

# **Towards a Euro- Mediterranean Energy Community**

**Moving from import-export  
to a new regional energy model**

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## ACRONYMS

<b>ADEREE</b>	National Agency for the Development of Renewable Energy and Energy Efficiency (Morocco)
<b>Bcm</b>	Billion cubic meter
<b>CCGT</b>	Combined Cycle Gas Turbine
<b>CDER</b>	Renewable Energy Development Centre (Moroccan organisation replaced by ADEREE in 2010)
<b>Comelec</b>	Maghreb Electricity Committee
<b>CSP</b>	Concentrated Solar Power
<b>ECSC</b>	European Coal and Steel Community
<b>EOR</b>	Enhanced Oil Recovery
<b>EU</b>	European Union
<b>EU ETS</b>	European Union exchange trading scheme
<b>GDP</b>	Gross Domestic Product
<b>GW</b>	Gigawatt (1 000 000 000 watt)
<b>IRENA</b>	International renewable energy agency
<b>LNG</b>	Liquefied Natural Gas
<b>LGP</b>	Liquefied Petroleum Gas
<b>Med-TSO</b>	Mediterranean transmission system operators
<b>Mtoe</b>	Million tonnes oil equivalent
<b>MW</b>	Megawatt (1 000 000 watt)
<b>NMC</b>	North Mediterranean Countries
<b>OMEL</b>	Spanish electricity market
<b>PV</b>	Photovoltaic
<b>REN</b>	Renewable Energy
<b>RTE</b>	Electricity transmission network
<b>SEMC</b>	South and East Mediterranean countries
<b>SME</b>	Small and Medium-sized Enterprises
<b>TICGN</b>	French domestic consumption tax on natural gas
<b>TICPE</b>	French domestic consumption tax on energy products (replaced the TIPP on 1 January 2012)
<b>TWh</b>	Terawatt hours: 1 000 000 000 000 watts/hour
<b>USD</b>	United States Dollars



## SUMMARY

BECAUSE OF A LACK of common vision, the energy interdependence that links countries on the south shore of the Mediterranean with those on the North shore is not, at present, governed by any regional strategy. The European Union is in favour of developing a European energy strategy, which is difficult to consider in a group of energy-dependent countries. Likewise, all of the countries in North Africa have established bilateral agreements with EU countries, without considering the energy policies adopted by their neighbours.

Yet a number of challenges lie ahead for countries in Europe and for South and East Mediterranean countries (SEMCs), notably that of energy transition.

European countries are committed to raising the share of energy consumption produced from renewable resources, improving energy efficiency and reducing CO<sub>2</sub> emissions by 2020. As they are increasingly energy dependent, they are also seeking to secure their hydrocarbon supplies. In the southern Mediterranean, the policies adopted by hydrocarbon-producing countries could lead to a reduction in the share of hydrocarbons exported to Europe. Likewise, the growth in energy demand, which could triple in SEMCs by 2030, calls for a significant increase in installed electricity production capacity. Whatever the energy policies in place, according to our estimations, increasing energy production capacities in SEMCs would require investments of between 310 and 350 billion US dollars by 2030.

The new global geopolitics of oil and gas, the drive to develop renewable and carbon-free energy sources, and the prospect of developing an energy sector that generates added value and creates new jobs on both sides of the Mediterranean are all factors that call for closer cooperation between countries in the Mediterranean region and for a new regional energy partnership.

There are several economic and geopolitical incentives for such an approach:

- Geographic proximity;
- The energy challenges faced by both North and South, and their complementary assets;
- The energy transition and, in particular, the development of renewable energy resources, which gives an advantage to SEMCs;
- The determination of SEMCs to be involved in the energy transition process, and their willingness to collaborate with other countries in this respect;
- The need to move beyond straightforward trade relations in the energy sector;
- The prospect of developing regional industries and thus creating jobs;
- The more favourable disposition of the western Mediterranean, which is now driving for greater integration.



This regional energy partnership, a new model that creates growth prospects for all the countries in the Mediterranean region and encourages the development of innovative strategies, is based on a shared vision; it is in keeping with the energy transition process, fostering the development of new, job-creating industries and engaging energy companies in the region in joint projects.

SEVERAL STRUCTURING actions could be taken to accomplish a Euro-Mediterranean Energy Community:

- Associate North and South in coordinating a common energy strategy;
- Harmonise standards (regulatory and technical standards);
- Promote energy efficiency policies;
- Strengthen trans-Mediterranean grid interconnections;
- Set up Euro-Mediterranean energy industries and partnerships;
- Build partnerships between production, training and research facilities across the Mediterranean region.



## EXECUTIVE SUMMARY

IN 2011, FOR THE FIRST TIME, the European Commission talked about an “EU-Southern Mediterranean Energy Community starting with the Maghreb countries and possibly expanding progressively to the Mashreq” (joint communication with the High Representative of the Union for Foreign Affairs and Security Policy, dated 8 March 2011). The European Coal and Steel Community (ECSC) launched in Europe in 1951 proved that the energy domain was capable of bringing about wide-scale regional integration. On a Euro-Mediterranean scale, the interdependence and complementary energy factors that link countries on both sides encourage thinking about more deep-seated regional cooperation. The challenges and opportunities currently facing Mediterranean countries call for urgent action involving the whole region, aimed at concrete results in the energy domain.

### The current energy situation in the North and South shores of the Mediterranean

#### The North

PRIMARY ENERGY PRODUCTION in European countries dropped from 1,185 Mtoe in 2000 to 1,041 Mtoe in 2010. This trend is likely to continue over the period 2010-2020. At the same time, primary energy consumption rose constantly over the period 2000-2010, and could continue increasing until at least 2020. Primary energy production in Europe is insufficient to meet energy demand in European countries. In the absence of new domestic energy resources, European countries’ energy independence (production/consumption ratio), which was 66% in 2000 and 56% in 2010, could continue dropping beyond 2020. The main hydrocarbon producers in the European Union (United Kingdom, Netherlands and Denmark) and on the European continent (Norway) have seen their fossil energy resources diminished over the last few years. (TABLE A)

To counteract the negative impacts of this situation, it is imperative that European Union countries:

- Take whatever measures are needed to meet the ‘20-20-20’ goals of the energy climate package adopted in 2008 (raise the share of EU energy consumption produced from renewable resources to 20%, reduce Co<sub>2</sub> emissions by 20% and improve energy efficiency by 20% by 2020);
- Diversify their energy partners: a European Commission communication on securing energy supply and international cooperation recommends that: “It is in the EU’s strategic interest to build stable and long-term partnerships with its key suppliers and new potential suppliers...”<sup>1</sup>;
- Adopt ambitious policies to save and use energy more efficiently in the housing, industrial and transport sectors;

1. COM (2011) 539 final.





**TABLE A.** Primary energy consumption and production in European countries (2000-2020)

	2000	2010	2020
Consumption in European countries (Mtoe)	1,791	1,829	1,860
Primary energy production in European countries (Mtoe)	1,185	1,041	988
Rate of energy independence as % (production/consumption)	66%	57%	53%

European countries = EU 27, Norway, Switzerland, Iceland

Eurostat (2012), European Commission (2011)

- Facilitate the expansion of renewable energy sources by organising competitive channels and defining financial incentive measures (buyback tariffs, tax credits, green certificates, etc.);
- Analyse the economic and environmental costs/benefits of exploiting non-conventional gases located on their territories.

### The South

PRIMARY ENERGY production in South and East Mediterranean countries (SEMCs) was 425 Mtoe in 2010. This figure is 24% higher than 2000 production levels. The rise in production could escalate by 2020 to respond to high growth in energy demand (+ 50% from 2010 to 2020). The presence of major hydrocarbon producers in the South (Algeria, Egypt, Libya) means that SEMCs taken as a whole have a high level of energy independence (129% in 2010), making them net exporting countries (although Morocco, a non-producing country, shows a much lower energy independence level). However, this energy independence dwindles over the period 2000-2020. The rise in energy demand is set to be more marked in the electricity sector: electricity demand could double by 2020, and even triple by 2030. Electricity production could thus go from 559 TWh in 2009 to 1,534 TWh in 2030 (OME conservative trend-based scenario). (TABLE B)

Installed electricity production capacity in SEMCs is likely to increase considerably over the next two decades. According to the Mediterranean Energy Observatory (OME), in a conservative scenario, 200 GW of additional electricity capacity would be required. In a proactive scenario (expansion of renewable energy and energy efficiency measures), 155 GW of additional electricity capacity would be sufficient, but would entail twice as many renewable energy power plants (wind and solar power) and a much bigger investment of around 40 to 50 billion US dollars. Whatever the scenario, according to our estimations, new energy production capacities in SEMCs would require investments of between 310 and 350 billion US dollars by 2030.

### North-South energy imports and exports

THE EUROPEAN UNION imports more energy than any other region in the world. In 2010, it imported 993 Mtoe, and by 2020 it could be buying 1,045 Mtoe a year. The EU imports over 60% of its gas and 80% of its oil. Its energy dependence (import/consumption ratio), which is set to rise from 53% in 2010 to over 60% in 2020, could be around 75% to 80% in 2030. The Russian Federation, which is the European Union's leading energy partner providing 32% of oil imports and 40% of gas imports, will benefit from this trend.

South and East Mediterranean countries taken as a whole are net exporters of fossil energies. In 2009, SEMCs exported 82 Mtoe of hydrocarbons

**TABLE B.** Primary energy consumption and production in SEMCs (2000-2020)

	2000	2010	2020
Consumption in SEMCs (Mtoe)	230	328	495
Primary energy production in SEMCs (Mtoe)	341	425	600
Rate of energy independence as % (production/consumption)	148%	129%	121%

OME (2011)

and could commercialise between 100 and 150 Mtoe in 2020. Depending on the energy directions pursued by producer countries in the South Mediterranean (e.g. use of renewable energy), the volume of exports could either drop considerably by 2030 to 33 Mtoe, or stabilise at around 150 Mtoe. This trend does not reflect the reality in all countries in the South: Morocco is 95% energy dependent and imports hydrocarbons from countries located outside the Mediterranean.

Regional energy exchanges between the North and South sides of the Mediterranean currently reveal that: 20% of the gas and 15% of the oil consumed in Europe comes from North Africa; 60% of oil exports and 84% of gas exports from North Africa are destined for Europe. Grid interconnections with Spain enabled Morocco to import 4.6 TWh in 2011. During the next few years, exports from hydrocarbon producer countries in the South toward North Mediterranean countries could diminish due to the steep growth in energy demand predicted in these countries. On the other hand, electricity transfers between the two sides of the Mediterranean should progressively increase due to the development of interconnections.

### The energy sector's role in creating national wealth and employment

THE ENERGY SECTOR generates significant added value in countries that produce hydrocarbons. On the other hand, it does not create jobs (in Algeria, the energy sector represents 36.7% of GDP, but it employs only 2 to 3% of the working population). In comparison, in France, the energy sector represents 1.7% of GDP and employs 0.5% of the working population. The energy transition offers countries in the Mediterranean region the prospect of developing new energy industries (e.g. wind power, photovoltaics, CSP, energy efficiency, etc.). In Germany, from 2000 to 2011, the number of jobs in renewable energy industries almost quadrupled (381,600 jobs in 2011).

## Arguments calling for energy integration between both sides of the Mediterranean

2. Joint communication from the High Representative of the European Union for Foreign Affairs and Security and the European Commission dated 25 May 2011, COM(2011) 303

**Regionalisation of globalisation: the pertinence of geographical proximity.** Major powers have a political and economic interest in their neighbours (e.g. United States and Japan). European countries, West Africa and the Sahel are becoming areas of strategic concern. The Arab Spring has obliged the European Union to propose “a new response to a changing neighbourhood”<sup>2</sup>. The political situation and the economic development of South Mediterranean countries have had the effect of stimulating North Mediterranean countries' interest in their neighbours.



**The third industrial revolution using renewable energy is underway and it benefits countries in the South.** The economist Jeremy Rifkin maintains that “a third industrial revolution must take over from our current system, which is spiralling into a dangerous endgame”. The solar potential of countries in the southern Mediterranean gives them an advantage in accomplishing this new industrial revolution. The cost of producing electricity generated by photovoltaic solar technology could be around 10 cents of a US dollar (7.8 €ct/kWh) in very sunny regions (to compare to the average market price of electricity in France, which was 4.69 €ct/kWh in 2012<sup>3</sup>).

**Countries in the South, both consumers and producers, want to take part in the energy transition.** The world is undergoing an energy transition from a fossil model to a non-carbon, non-fossil model. The energy transition responds to the priority climate targets of countries in the northern Mediterranean, creating an opportunity for countries in the South to develop new energy industries. Implementing this energy transition remains problematic for countries in the South, whose economic growth is highly dependent on the hydrocarbon sector. In exchange for the resources they supply, they want to be involved as partners in the energy transition. They would like to make this perspective part of their national, energy, industrial and technological strategies, and set up international partnerships to this end.

**North-South relations in the Mediterranean are now characterised by common energy challenges and complementary assets.** Countries in the northern Mediterranean have developed considerable know-how in the domain of renewable energy and energy efficiency in transport, buildings and the industrial sector. Several competitiveness clusters specialising in energy are developing skills and technologies. Some countries in the South possess significant reserves of hydrocarbons and all SEMCs have solar potential to develop. There is no competitive relationship between the two sides; each has something to offer the other. It is easier to build a community of interest between complementary countries than competing countries.

**North-South energy relations cannot be restricted to commercial relations, which have shown their limits in creating value and jobs in the South.** The energy exchanges developed between the two sides of the Mediterranean are restricted to simple commercial exchanges to the detriment of developing a dynamic energy sector that creates jobs in producer countries. Moreover, the rise of spot markets means that commercial relations tend to privilege the short term. It is, however, vital that European countries secure their supplies over the long term. This turnaround of perspective puts companies at the heart of regional energy strategies. Only a North-South relationship based on production and long-term cooperation can result in a durable relationship of trust and encourage the investment needed for energy transition in the region.

**An opportunity to establish regional job-creating industries.** Traditional energy industries (i.e. oil and gas) and new ones (i.e. renewable energy, energy efficiency, etc.) are being organised without any particular coherence between the two sides of the Mediterranean. Countries that produce hydrocarbons in the

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3. Source : RTE.



South cannot develop their activity downstream and deliver gas right to the end consumer in Europe, which does not encourage them to invest in new deposits. In addition, if they are to develop renewable energy industries, SEMCs will need to acquire the appropriate know-how. At the same time, European companies working in renewables (especially solar), faced with stiff competition, are unable to raise their experience curve and reach critical size. A move to organise North-South value chains in the renewable energy industries by creating segments with high added value on the South side would help transfer European know-how and create jobs.

**Several factors point to dynamic integration in the western Mediterranean, which could act as a testing ground for the whole region.** Given the strong complementary factors between countries on both sides of the Mediterranean when it comes to a requirements/resources balance, in particular between the Maghreb and Western Europe, and the strong fabric of cultural, historical and linguistic relations, the western Mediterranean seems to offer a suitable framework for starting up a new type of energy-based partnership.

## Potential action in view of a Euro-Mediterranean Energy Community (EMEC)

THE DYNAMICS AT WORK call for the definition of a “New Energy Partnership” in the region. This new partnership approach, based on a common vision of regional energy challenges and the desire to devise strategies that generate added value on both sides, should lead to a “Euro-Mediterranean Energy Community”. To accomplish this, several structuring actions could be initiated:

- Coordinate a common strategy: associate North and South in coordinating a common strategy through an equally balanced body bringing together stakeholders from both sides;
- Converge standards: update legislation and technical standards to encourage a partnership approach, and support cooperation between the electricity and gas regulators (Medreg network);
- Promote energy efficiency policies: develop common standards and reinforce the network of energy management agencies in the Mediterranean region (Medener);
- Strengthen interconnections to move towards a common area and ensure that the network remains fluid (support for Medgrid), and accompany the cooperation between Mediterranean electricity transmission system operators (support for Med-TSO network);
- Propose new industrial combinations of energy through co-production: set up Euro-Mediterranean energy industries, strategic partnerships and cross integration between national and international companies in the region;
- Build partnerships between industry, universities and research centres: encourage more interaction between stakeholders in new industries and research into innovative technologies (e.g. clusters, competitiveness clusters).



## Step-by-step plan

### Towards a Euro-Mediterranean approach

IN PARALLEL WITH THE DEBATES underway within member states on the European Energy Community project, Ipemed recommends opening up a Euro-Mediterranean component involving a Euro-Mediterranean Energy Community. This measure would provide a solution for an energy-focused Europe. By involving countries that produce hydrocarbons and solar energy in current European negotiations, it would be easier to reach a compromise between all partners in the region. At the same time, European energy dependence on Russian producers would diminish. This approach means:

- Involving those South Mediterranean countries that are interested in projects relating to the Euro-Mediterranean component of the European energy project;
- Setting up committees/networks of organisations to work on standards, interconnections and energy grids and markets at Euro-Mediterranean scale, some of which are already in operation.

In parallel with the process of integration through energy standards and markets, which is already occurring between the two sides of the Mediterranean, strategic energy partnerships designed to improve energy exchanges between countries in the region should be developed without delay.

### Western Mediterranean: the right geographical location for launching the EMEC project

IN THE SHORT TERM, the western Mediterranean appears to be a suitable geographical area for launching the first phase of the EMEC project. The first actions could be decided by the countries in the 5+5 Dialogue Group. As part of the European Union's reinforced cooperation procedure, several countries in southern Europe could also join forces to make propositions to Maghreb countries. It is by gradually building up a "Euro-Mediterranean Energy Community" (EMEC), with a strong production dimension, that energy will act as a driving force in Euro-Mediterranean economic integration.

## INTRODUCTION

EURO-MEDITERRANEAN interdependence has more strategic importance in the energy industry than in any other sector of the economy; also, the energy industry presents the greatest potential for cooperation between countries in the region. The Euro-Mediterranean countries are facing a number of tough challenges. But these challenges are also an opportunity to build solidarity.

The challenges and opportunities faced by Mediterranean countries in the energy domain call for urgent action involving the whole region and designed to achieve concrete results. Taking example from the European Coal and Steel Community (ECSC), which laid the groundwork for the joint production of two fundamental raw materials by six European countries (see explanatory note on the ECSC in **APPENDIX 1**), a “Euro-Mediterranean Energy Committee” (EMEC) could be set up to meet the need for greater cooperation and solidarity.

To this end, Ipemed (the Economic Forecasting Institute for the Mediterranean Region) has begun to discuss the energy cooperation framework that the countries in the Mediterranean basin could develop with a view to pursuing regional energy strategies. The Euro-Mediterranean Energy Committee (EMEC) proposed by Ipemed would operate on the basis of jointly-agreed strategic priorities and a set of common values (dialogue, durability, cooperation, sharing, trust, solidarity, etc.). The objective of this approach is to promote and to further deepen the energy interdependence and complementarity between countries in the Mediterranean basin.

Given the current changes in global energy geopolitics, the emergence of new energy production centres (rise in the production of shale oil and gas in the United States) and the development of major oil consumers (China, India, etc.), strengthening the energy relationship between Euro-Mediterranean countries is a necessary step. There are two approaches to global energy exchange at present: a short-term approach and a long-term approach. The short-term approach tends to focus on energy exchanges on the spot market, where natural gas is sold at competitive prices. The long-term approach fosters the development of trust between producing countries and consumer countries and, in most cases, leads to the establishment of long-term contracts. The long-term approach enables both producing countries and consumer countries to prepare for the energy transition. Sustainably promoting Euro-Mediterranean energy cooperation means fostering long-term relationships between the countries in the region. The EMEC project is in line with this perspective.

Ultimately, the EMEC could be called upon to develop a broad array of measures, including at least the following: diversify the energy mix through the greater use of renewable and carbon-free energy sources, build an integrated and intelligent grid, create a Mediterranean energy efficiency programme in the different consumption sectors, develop cross integration between countries on both sides and organise technological cooperation in order to create Euro-Mediterranean eco-technology industries. It is a decisive project



in terms of promoting the development of a sustainable energy policy and ensuring the energy transition to a low-carbon economy.

Such a Euro-Mediterranean energy policy, requiring the inclusion of the Mediterranean countries in European policy and a willingness in the South to meet European standards, will not come about overnight. It will take time to conduct the necessary talks. But given the current context and the growing state of urgency, we cannot afford to wait forever. This essential initiative could be based on the recent recommendations of the European Commission, which, in a communication<sup>4</sup> dated 8 March 2011, stated that “It is desirable to open a credible perspective for the integration of the southern Mediterranean in the EU internal energy market based on a differentiated and gradual approach. In the mid to long term, this would mean establishing a form of EU-southern Mediterranean ‘energy community’, starting with the Maghreb countries and possibly expanding progressively to the Mashreq”. A number of recent European publications address possible ways of building energy cooperation between the European Union and South Mediterranean countries (see **APPENDIX 2**, presentation of European publications issued since 2010, which include a section on energy in the Euro-Mediterranean region).

Likewise, the Parliamentary Assembly of the Mediterranean (PAM) recommends<sup>5</sup> “the establishment of a ‘Mediterranean Community of Energy’ in order to ensure coordination among the key actors concerned (parliaments, governments, industry, investors), as far as projects based on renewable energy, the reinforcement of national and regional transmission grids, as well as the promotion of investments and clear legal frameworks, are concerned”. Moreover, the Association of Mediterranean Regulators for Electricity and Gas (MEDREG) is working on the institutional, technical and economic aspects of integrating the electricity and gas markets in the Mediterranean region, with a view to creating a “Mediterranean Energy Community” by 2020.

Thus several institutions have pronounced themselves in favour of a regional energy community. However, they do not all share the same objective and the same approach. Ipemed believes that this ‘community’ should encompass all sources of energy and have a large productive dimension in order to generate added value on both sides of the Mediterranean<sup>6</sup>. A number of options are possible for the EMEC: it could either be the Euro-Mediterranean strand of the European Energy Community – which means that the decision to set it up would have to come from Europe – or it could be the Euro-Mediterranean counterpart of the European project, thus placing the decision-makers in the region’s energy sector on an equal footing.

This document constitutes the final report on the work carried out to date, which was done in two stages: firstly, in 2011, a working group composed of experts from both sides of the Mediterranean was set up, and a study was conducted by Samir Allal and Moncef Ben Abdallah; secondly, a complementary analysis was performed by Jacques Kappauf and Mourad Preure.

The report underlines the fact that South and North Mediterranean countries already have an interdependent energy relationship, but that they have failed to develop a common vision (**SECTION 1**). Yet countries on both sides of the Mediterranean will be confronted increasingly with energy challenges in the coming decades (**SECTION 2**). The countries in the region have much to gain from taking into consideration the position and the choices of their neigh-

4. COM (2011) 200 final, “Joint Communication to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: A Partnership for Democracy and Shared Prosperity with the Southern Mediterranean”, §7, pages 10-11.

5. Parliamentary Assembly of the Mediterranean, PAM Panel on External Trade and Investments in the Mediterranean, *Energy challenges in the Euro Mediterranean Region*, Ouarzazate, 14-15 September 2012.

6. Insofar as its productive and partnership dimensions are concerned, the ‘Euro-Mediterranean Energy Community’ is similar to President Hollande’s project for a ‘European Energy Community’: “Europe could - as it managed to do with coal and steel after the second world war and with its agricultural policy (...) decide to set up a European energy community. France and Germany will soon be celebrating the 50th anniversary of the Elysée treaty. They could lead the way by promoting cooperation between French and German energy companies, which could embark upon a number of joint projects”, *Speech by the President of France at the Environmental Conference* on 14 September 2012.

bours when developing their energy policies. Both northern and southern countries would benefit from implementing new, regional industrial energy strategies. Energy could act as a lever for Euro-Mediterranean cooperation (**SECTION 3**). Setting up a multi-sector regional energy strategy, which takes into account the resources and needs of each individual country in the Mediterranean and generates added value for all, requires the involvement of hydrocarbon-producing countries. Moving from a rentier model to the productive model used in producer countries would be beneficial for their entire economy and for all the countries in the region. Hydrocarbon-exporting countries, such as Algeria, have a role to play in helping the region to start the energy transition. The forces of change are already being felt in the electricity sector, which could play a driving role in regional cooperation. The deployment of renewable energy and of grid interconnections between Mediterranean countries is part of a new co-development trend. Therefore it is time to lay down the terms for a long-term cooperation that will secure energy supply and demand, as well as facilitate the move from a commercial energy import-export model to a new regional energy model. This report proposes defining the basic tenets of a common strategy and establishing a new Euro-Mediterranean energy partnership centred on companies (**SECTION 4**). It is in this perspective – and by increasing industrial and technological links – that the Euro-Mediterranean Energy Community should be built.

THE GEOGRAPHIC TERMS, used in this report have the following meanings:

**North shore countries**, also called ‘**North Mediterranean Countries**’ or ‘**NMCs**’: Portugal, Spain, France, Italy, Malta, Greece, Cyprus, Slovenia, Bosnia and Herzegovina, Croatia, Macedonia, Serbia and Albania;

**South Mediterranean countries**: Algeria, Egypt, Libya, Morocco and Tunisia;

**East Mediterranean countries**: Turkey, Israel, Jordan, Lebanon, Palestine and Syria;

**South and East Mediterranean countries**, also called ‘**SEMCs**’: countries on the southern and eastern shores of the Mediterranean;

**The Maghreb countries**<sup>7</sup>: Morocco, Algeria, Tunisia and Libya;

**The Mediterranean region** includes the countries of the Mediterranean rim<sup>8</sup>: Portugal, Spain, France, Italy, Malta, Greece, Cyprus, Slovenia, Bosnia and Herzegovina, Croatia, Macedonia, Serbia, Albania, Turkey, Israel, Jordan, Lebanon, Palestine, Syria, Algeria, Egypt, Libya, Morocco and Tunisia;

**Europe**: the 27 members of the European Union, along with other European countries<sup>9</sup> (Iceland, Switzerland, Norway);

**The Euro-Mediterranean region**: Europe and SEMCs.

7. Due to a lack of sufficient data, Mauritania is not included in the Maghreb countries in this report.

8. Definition preferred by the Mediterranean Energy Observatory (OME).

9. This excludes Turkey, as Turkey is included in the east shore countries in line with the data from the Mediterranean Energy Observatory, on which this report is based.





## 1

## The opportunity to define a common energy strategy

### Europe is not sufficiently united politically to conduct an energy strategy

ALTHOUGH ENERGY lays at the heart of European integration (the ECSC Treaty, which expired in 2002, and the Euratom Treaty, which concerns only nuclear energy), no European Union (EU) treaty offers a global legal basis enabling the member states to conduct a real common energy policy. Only Article 194 of the Lisbon Treaty deals with a common energy policy, its four mainstays being the working of the energy market; the security of energy supply within the EU; energy efficiency with energy savings and renewable energy; and lastly, grid interconnection. However, the decision-making process is slow and complicated, and the liberalisation of the energy market seems to be an end in itself.

The adoption in 2010 by the European Commission of the “European Energy Strategy for 2020<sup>10</sup>” and the presentation of the “Energy Roadmap 2050<sup>11</sup>” in autumn 2011 were the first elements defining the strategic objectives of the EU’s energy policy (all sectors combined). Energy portfolios can, however, vary greatly from one member state to another, and whilst some of them have fossil resources, others have few or none. Similarly, some member states are actively developing renewable energy (German, Spain, etc.), while others remain heavily reliant on fossil fuels (Poland) or on nuclear energy (France). Thus the energy policies implemented in different European countries reflect individual strategies which take little account of the energy decisions of their neighbours and are not always applied in accordance with European legislation. The European Union is doing its utmost to achieve the convergence of the energy policies of the member states towards the new directions defined in the different roadmaps.

Having regard to Europe’s increasing energy dependence in the coming decades (53% today, around 60% by 2030), the member states of the EU need to liaise more effectively and consolidate their relations with their traditional partners. Their regional proximity provides the opportunity to do this sustainably and concertedly.

### The South remains dispersed

ENERGY EXCHANGES between Maghreb countries (and more broadly South Mediterranean countries) and Europe have increased in the absence of any regional economic strategy. Each of the Maghreb countries has established bilateral agreements with European Union countries without considering the energy policies adopted by its neighbours, and has done so despite the proximity of their markets and the complementarities which might exist. If the Maghreb countries continue to follow individual policies (without considering the possible regional economies of scale in energy use), the economic growth rate will be lower and job creation insufficient<sup>12</sup>. Given the diversity and

10. COM (2010) 639 final, “Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – Energy 2020, Strategy for Competitive, Sustainable and Secure Energy”.

11. COM (2011) 885 final, “Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – Energy Roadmap 2050”.

12. Ghilès F., “Le défi énergétique en Méditerranée” (The Energy Challenge in the Mediterranean), IPEMED Notes, April 2010, IPEMED, Paris.

size of the energy resources to be found in Morocco, Algeria, Tunisia and Libya (hydrocarbons and/or solar and wind resources, depending on the country), energy could well be a key sector for integration in the Maghreb. Energy cooperation was, moreover, one of the priorities on the AMU's (Arab Maghreb Union's) agenda when it was created in 1989. However, despite the creation of the AMU, the Maghreb's economies have remained isolated from one another. The energy sector could play a more decisive role in the region's socio-economic development. It is emerging as an economic sector in which the Maghreb can present itself as an essential partner to the European Union in order to meet requirements on both sides of the Mediterranean over the long term. Closer relations between the countries of the Maghreb could speed up energy cooperation between these countries and Europe.

Beyond the Maghreb, energy could provide the entire Euro-Mediterranean region with a mechanism for productive integration.

**In the energy sector, Euro-Mediterranean countries are highly interdependent**

ENERGY IS THE SECTOR in which the interdependence between Euro-Mediterranean countries is the most marked and the most strategic: 20% of the gas and 15% of the oil consumed in Europe comes from North Africa, without counting the percentage that comes via Tunisia; and 60% of oil exports and 84% of gas exports from North Africa go to Europe. The North Mediterranean countries are net importers. Some South Mediterranean countries are exporters. They are all highly dependent on their energy exchanges, in some cases to balance their energy portfolio, in others because their energy exports are often essential to the creation of wealth. In addition to these commercial exchanges, this interdependence is also reflected in the security of supply, an issue both for European countries and for South and East Mediterranean countries that do not produce hydrocarbons. In Europe, more than half (54%) of the EU's gross domestic energy consumption is provided by suppliers outside the EU. At the same time, the hydrocarbon-producing countries on the southern side of the Mediterranean are seeking to secure their outlets.

A further aspect, Mediterranean countries are all concerned about rising temperatures. The Mediterranean region is one of the world's regions in which the impact of climate warming is going to be the most severe. Accordingly, the countries in this region need to make sustainable development a number one priority so as to reduce their energy consumption and their CO<sub>2</sub> emissions. The targets of the climate-energy package adopted in 2008 include an ambitious reduction in European energy consumption by 2020. SEMCs are also adopting environmental measures, although these are of a national nature and limited chiefly to the rapid development of renewable energy. Once the conditions of its application have been determined, Article 9 of the European REN Directive could become a major cooperation tool offering EU countries the possibility of including in their energy portfolios renewable energy produced outside the EU, notably in SEMCs. In its communication<sup>13</sup> of 6 June 2012, the European Commission announced that guidelines for more effective promotion of the cooperation mechanisms would be drawn up. These should provide for "specific measures designed to encourage trading in electricity of renewable origin under a future agreement with North African part-

13. COM (2012) 271 final, "Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – Renewable Energy: A Major Player in the European Energy Market", p.7.



ners, on the basis, for example, of specific negotiation mandates opening up the way to an EU-South Mediterranean energy community”.

Energy represents a huge industrial potential for the entire region. In the electrical sector alone, the Mediterranean Energy Observatory (OME) estimates that by 2030, without an ambitious energy policy, SEMCs need to have an additional capacity of 200 GW. This entails the development of new electricity grids and additional trans-Mediterranean lines for the implementation of the Mediterranean Solar Plan. The rapid development of gas production also entails the construction of gas pipelines or liquefaction plants. The OME estimates that between now and 2030, Mediterranean countries will need to invest 915 billion US dollars (715 billion euros in 2011) in the electrical sector. The cost of the Mediterranean Solar Plan amounts to some fifty billion US dollars. Major investments are also needed in the North Mediterranean countries, to replace their old power plants, finance the phase-out of nuclear power or develop segments of the renewable energy market.

This interdependence between Euro-Mediterranean countries in the energy sector requires a long-term commitment: multi-decennial gas contracts to mobilise the funds required for investment, the necessarily progressive shift to non-carbon energy sources, and the time required to plan profitable solar production or, in the South, to produce nuclear electricity. This interdependence is not governed by any regional strategy and short-term decisions could disorganise it.

### **The common priority given to energy security: security of supplies for customers versus security of outlets for suppliers**

IN TERMS OF ENERGY resources, Europe’s traditional sources are challenged today and will be even more challenged tomorrow by major energy consumers, that is to say China and India. Europe must therefore look carefully at its energy security not only in the short term but also, and mainly, in the long term, which will be far more problematical.

At the same time, the increased demand expected in South Mediterranean countries should absorb part of the flows intended for the North, irrespective of the energy efficiency gains achieved in the South. The traditional suppliers of European countries, which benefit from technological advances that reduce costs in the LNG chain, increase the size of methane carriers and shorten their routes, might also be tempted by economic models giving distant markets preference over nearer markets. In the short and medium terms, they can send their uncommitted volumes to these markets, while the methane carriers are available. If the Asian markets are going to be sought after by sources accessible overland, the producer countries of the South of the Mediterranean can do likewise and thus follow very closely the example of the international gas trade. Given the great uncertainty affecting Iranian sources and the sources around the Caspian, all of which are coveted by India and China, Europe might be worried about being supplied primarily by Russia and find itself in a showdown if caught with the Russian source. For Europe, there is a real risk of gas upheavals in the future due to scissor phenomena between the supply and demand curves which could be more especially marked as the volatility caused by the expected predominance of stock exchange dynamics will have a negative effect on the visibility of the players.

Since the European project is characterised by a liberal approach favouring the market and reducing the role of the states, the question of energy security in European countries is perceived in a strictly economic light and attaches little importance to the whole complexity of the subject. The deregulation process undertaken in the European Union from 1996, with EU directives 96/92/EC and 98/30/EC, fragmented the gas chain, which was originally integrated upstream and downstream and organised around a long-term relationship between the producer and the purchaser. This relationship, embodied in long-term contracts containing a take or pay clause, made it possible to share the volume risk, assumed by the customer, and the price risk, assumed by the producer.

In a context of gas-gas competition with short-term logic predominating, producer countries are finding themselves having to assume both the volume risk and the price risk, whereas they have no visibility and do not derive any profit from downstream margins. They will have to place their volumes on a speculative market governed by the stock exchange logic of the spot markets, fed by cargos of LNG. Producers will hesitate to commit to the major investments needed to meet future demand, which is expected to increase sharply, especially as European domestic sources in the North Sea are in an advanced state of decline, which will bring European gas dependence to a critical level of over 80% by 2030. The gas industry is a long-term industry that requires stability. When the chain between the supplier and the customer is broken, supplies become insecure. At Euro-Mediterranean level, the trust built up over several decades between traditional South Mediterranean suppliers and the EU countries could sooner or later weaken. The community solidarity measures provided for, in the event of a supply crisis in the gas market, in the European “Gas Supply Security” regulation of 2010<sup>14</sup> is an emergency mechanism which does not eliminate the risk for European consumer countries of a breakdown in the long term. Thus it would appear essential to restructure the long-term contracts between European countries and their traditional South shore suppliers at a time when the latter emphasise the fact that they are increasingly being approached by the Asian markets.

The security of both supplies and outlets is an issue requiring the right balance to be found between long-term agreements and the spot market. If the countries in the region want to do more than just grab opportunities as they arise, then it is important to preserve long-term commercial commitments which provide the visibility required for long-term planning.

### **Energy complementarity and cooperation between countries in the Mediterranean region, that doesn't come with convergent dynamics**

THE RÉGION has all the natural resources and all the necessary energy production technologies. The South has major energy resources (renewable energy, hydrocarbons) and is a key transit zone (Turkey); and the North has developed skills in renewable, low-carbon energies, which immediately places North-South relations on an equal footing (resources in the South, technologies in the North). This complementarity provides a firm basis for regional cooperation.

Several concrete energy cooperation projects are in progress in the region. One might point to the aim of the European Union to work towards Euro-

14. EU Regulation no. 994/2010 of the European Parliament and the Council of 20 October 2010 concerning the measures designed to ensure the security of supply of natural gas and abrogating Council Directive 2004/67/CE.



Mediterranean gas and electricity markets; the completion of the Mediterranean electrical loop (to be closed with the direct current connection of the last two opening points, Tunisia-Libya and Turkey-Syria); and the launch of the Mediterranean Solar Plan under the Union for the Mediterranean (with the aim of producing 20 GW of renewable energy by 2020 in South Mediterranean countries). The launch of the Desertec Industrial and Medgrid initiatives forms part of this cooperation. The number of forums for exchanges among professionals in the sector is increasing, their object being to support the harmonisation of regulations, the transfer of know-how, and the funding of electricity generation and transmission infrastructures (OME, Medelec, Medener, Medreg, Med-Enec, etc.). A number of these initiatives have the backing of the European Commission.

And yet energy has not really been of a structuring nature; nor has it given any impetus to a real Euro-Mediterranean partnership. The high density of strategic resource exchanges has not created any virtuous circles of diversified partnerships providing meaningful strategic opportunities, and does not yet appear able to do so. European policies are designed to meet energy requirements; not many of them fall within a regional logic or meet requirements in a perspective of Euro-Mediterranean co-development. There is still much distrust between producer countries and consumer countries, including South Mediterranean countries. Current initiatives are not converging towards upstream-downstream cross-integration involving energy companies on both shores in new value-creation processes. And yet that remains highly structuring.

A Euro-Mediterranean partnership in the spirit of Barcelona, which could have helped producer countries to diversify their economies and change them from rentier economies to production economies, seems to be more a pipe-dream than a concrete ambition embodied in concrete projects and reflecting a firm conviction on the part of North Mediterranean countries. The lofty ambitions of the Barcelona Process came up against the reality of complex situations in which indisputable complementarities and powerful historical and cultural affinities were unable to overcome the lack of vision and insufficient commitment of the players concerned. The part played by coal and steel was a decisive factor in recognising the importance of and the initial impetus given to the European project. Can energy do the same thing for the Euro-Mediterranean partnership? It seems that the possibility certainly exists and that the dynamic is under way. That does not mean that success is assured. On the contrary, the lack of vision of the decision makers concerned and the insufficient commitment shown by players on both sides of the Mediterranean may well put a damper on this dynamic<sup>15</sup>.

Any partnership between energy companies in the region needs to be such that the value chain is divided between both sides of the Mediterranean. Their geographical proximity gives every reason not only for heightening this cooperation in the case of hydrocarbons, gas in particular, but also in the implementation of the energy transition. Both gas and electricity would seem to be sectors conducive to highly effective regional cooperation, notably as regards new generating technologies and interconnections (South-South and South-North). The links between the European Union and its neighbouring countries

15. The EU's decision to diversify gas supply sources, giving preference to distant sources and initiating major infrastructure projects for this purpose: isn't this indicative of a communication gap?



are currently becoming stronger as a result of the increasing number of gas and electricity networks. This interdependence based on physical infrastructures is helping to reinforce cooperation, although this necessary condition is insufficient.

**Defining a Euro-Mediterranean strategy based on a common vision: the Euro-Mediterranean Energy Community**

TO SUCCESSFULLY IMPLEMENT new and sustainable regional energy strategies, both public- and private-sector initiatives need to be shared by the players in the Mediterranean region. Accordingly, regional energy integration requires the definition of a shared regional vision concerning production, consumption and energy resource management.

A common vision in the Mediterranean countries is essential for determining the framework within which energy exchanges will increase as time goes on. It is on this basis that the regulations to be introduced as regards electrical flows between the countries in the Mediterranean region or commercial gas transfer agreements can be decided on. It is also the basis on which the decision whether or not to develop industrial Euro-Mediterranean energy networks or more effectively organise technology transfers can be made. A vision shared by the players in the energy sector could lead to a better division of the added value between the two sides of the Mediterranean.

In 1951, with the creation of the ECSC, French and German production of two fundamental raw materials that underpinned the industry of two former enemy powers was brought together under a High Authority, thus fulfilling a joint Franco-German objective: to achieve a balanced development of the production and distribution of coal and steel, and the sharing of production between the member states at the highest possible level of productivity. This initiative was designed to promote Franco-German solidarity by means of the economy, foster economic expansion and generate employment in both countries.

In its communication of 8 March 2011<sup>16</sup>, the European Commission, jointly with the High Representative of the Union for Foreign Affairs and Security, expressed itself in favour of the creation of a “sort of energy community” between the EU and the southern Mediterranean. The question is whether this ‘community’ should, in the same spirit that motivated the ECSC project, help the Mediterranean countries to achieve a productive partnership going well beyond mere commercial energy exchanges.

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16. COM (2011) 200 final, “Joint Communication from the Commission and the High Representative of the Union for Foreign Affairs and Security to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – a Partnership for Democracy and Shared Prosperity with the Southern Mediterranean”, para. 7, pp. 10 & 11.



## 2

## Mediterranean countries facing energy challenges

HAVING REGARD to maintaining economic and demographic growth in SEMCs in the coming years, the chief challenge facing these countries is to maintain their economic growth without generating negative environmental and social impacts. The demand for energy is going to increase sharply in the southern Mediterranean and these countries, notably the hydrocarbon producers, need to optimise their production so as to continue to export and also satisfy growing domestic demand. It should be remembered that, as regards the organisation of both production and the current energy exchanges between the two sides of the Mediterranean, the added value generated in this sector is of no benefit to the countries in the South.

### The challenge of ensuring sustainable growth in the region

A RAPID ECONOMIC and demographic analysis of the three geographical entities defined by the Mediterranean Energy Observatory (OME) emphasises that:

- in the northern Mediterranean, the population is 216 million, with a per capita GDP of around 20,000 euros;
- in the southern Mediterranean, the population is 162 million, with a per capita GDP of around 4,800 euros;
- in the eastern Mediterranean, the population is 114 million, with a per capita GDP of around 6,350 euros.

Furthermore, South and East Mediterranean countries have a very young population. Indeed, one third of the population in these countries is under fifteen years of age. This age bracket comprises 81.5 million people out of a total population of some 275 million<sup>17</sup>. The average age is 41 in the North and 26 in the South.

The **TABLE 1** below summarises the economic and demographic data and assumptions underlying the OME's projected scenarios<sup>18</sup> on which our report is based. The economic and demographic situations are specific to each country. It will be seen, however, that South and East Mediterranean countries have on average a higher rate of economic and demographic growth than countries in the North.

The current economic crisis affects the GDP growth rate in both the short and the medium term, but as regards the long-term projections, the OME adopts the assumption that the dynamic of the years 1990-2009 will return to normal over the 2009-2030 period.

Between 2009 and 2030, it is believed that the population of SEMCs will increase from 276 to 354 million (+78 million) whilst that of NMCs will increase very little, from 216 to 228 million (+12 million).

17. Jolly C. (dir.), *“Tomorrow, The Mediterranean, Scenario and Projections to 2030”*, IPEMED, Paris, 2011.

18. OME Scenarios: two scenarios may be distinguished: the conservative scenario (CS), characterised by the continuation of past trends, policies and projects in progress, with no significant energy efficiency or demand-side management programmes; and the proactive scenario (PS), characterised by a strong political will to replace past trends with the implementation of far-reaching energy saving, demand-side management and renewable energy development programmes.

**TABLE 1.** GDP and population growth rate in Mediterranean countries

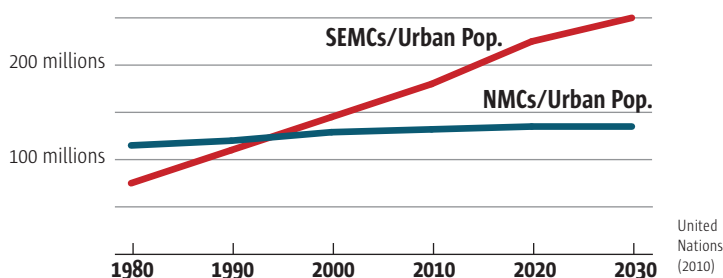
	Annual GDP growth rate		Annual population growth rate 2009-2030
	1990-2009	2009-2030	
North Mediterranean countries	1.7%	1.9%	0.3%
South Mediterranean countries	4%	4%	1.2%
East Mediterranean countries	3.7%	3.7%	1.2%

MEP 2011 (OME)

**TABLE 2.** Per capita GDP and growth between 2009 and 2030

	Per Capita GDP		Increase 2009-2030
	2009	2030	
North Mediterranean countries	20,000 €	27,800 €	+39%
South Mediterranean countries	4,800 €	8,500 €	+77%
East Mediterranean countries	6,350 €	10,500 €	+66%

MEP 2011 (OME)

**FIGURE 1.** Projected urban populations in the Mediterranean countries (in millions)

Similarly, the per capita GDP will more than double between 2009 and 2030 in South Mediterranean countries. In 2030, the per capita GDP is expected to be 27,800 euros in North Mediterranean countries, 8,500 euros in South Mediterranean countries and 10,500 euros in East Mediterranean countries (TABLE 2).

It emerges from the two tables above that, based on the assumption that the annual growth rate in the per capita GDP and the population of SEMCs is maintained, the population will increase by 29% and the standard of living (per capita GDP) by over 70%. Economic growth of this nature is only possible if the corresponding demand for energy, and more particularly electrical energy, can be satisfied; in other words, an economic sector unable to meet demand is a major constraint which at the very least slows down, or even prevents, economic growth and the satisfaction of the needs of all the inhabitants. A serious economic constraint, reflected in higher energy prices, stifles the development of employment and social wellbeing.

Moreover, to achieve sustainable growth in the Mediterranean region it is essential to anticipate and plan for urban growth in the towns and cities, particularly in South and East Mediterranean countries (FIGURE 1). The urban population is increasing rapidly in these regions and by 2030<sup>19</sup> should account for 70% of the total population of the Mediterranean Rim countries (some 380 million). This phenomenon of urbanisation, which will be found chiefly in the coastal areas, could, if not controlled, give rise to some serious environmental concerns (increased waste, increased demand for water and for urban and industrial wastewater disposal, greater pressure on arable lands and forest areas) and to increased air pollution and CO<sub>2</sub> emissions

19. The Blue Plan, "Mobility and Urban Growth in the Mediterranean Region", December 2007.





As regards the various initiatives introduced by these countries to reduce their CO<sub>2</sub> emissions, disparities can be found between the countries in the Euro-Mediterranean region. The road map for “eliminating carbon from the energy sector between now and 2050”, presented by Commissioner Oettinger and detailed by the European Commission in its communication of 15 December 2011, sets as its objective the reduction by at least 80% of EU countries’ CO<sub>2</sub> emissions by 2050. The energy sector accounts for 50% of CO<sub>2</sub> emissions in Europe. At present, however, no southern or eastern Mediterranean country has set a target for the reduction of emissions<sup>20</sup>.

And yet the reduction of CO<sub>2</sub> emissions by all the countries in the Mediterranean region is essential. According to the OME’s projections, CO<sub>2</sub> emissions in the region could increase by 40%, reaching 3000Mt by 2030 (the OME’s conservative scenario<sup>21</sup>). Were they to adopt “non-carbon” strategies, these countries could nevertheless limit this increase to 9% (proactive scenario), i.e. 600Mt less. The increase should be less marked in the South than in the North (between 1.6% and 3.1% in SEMCs, depending on the scenario).

A range of economic and regulatory incentives (market instruments, taxes, labels, standards, etc.) is needed to persuade producers and consumers to behave more responsibly. However, the price of CO<sub>2</sub> in the European carbon market (EU ETS) is far too low to encourage European manufacturers to invest in less polluting energy sources and more energy efficient technologies. A high CO<sub>2</sub> per tonne price is needed for there to be a real carbon price-signal effect on investment decisions. At the same time, and without taking into account the international commitments of the countries in the region, national green growth strategies, adapted in line with local characteristics, need to be introduced in each country in the Mediterranean region. These strategies call for a decisive commitment on the part of each country if the objectives established are to be achieved. Coordinated actions at Mediterranean level could well result in further benefits. At regional level, as has been said by the Centre for Mediterranean Integration (CMI), it is without doubt “time to go beyond the fruitful sharing of experiences and incorporate green growth into an action programme at Mediterranean level. The regional level is ideal for the intensive efforts which will be necessary within the framework of an integration process favourable to the development of the Mediterranean region in its entirety”<sup>22</sup>.

20. Boisgibault L., Mozas M., *Carbon Constraint in the Mediterranean – Differentiated Impacts and Policies for Carbon Reduction in the Euro-Mediterranean Region*, Construire la Méditerranée, IPAMED, 2012

21. The conservative scenario is based on the continuation of past trends.

22. CMI, “Vers une croissance verte en Méditerranée” (Towards Green Growth in the Mediterranean), MED Report 2012.

## Addressing the increasing energy demand

ENERGY DEMAND is far greater in South Mediterranean countries than in European countries. It increased sharply in SEMCs (+42%) between 2000 and 2010 and should continue to increase in the years to come (TABLE 3). This is a major challenge for SEMCs (TABLE 3).

### Energy demand in the Mediterranean region: the pre-eminence of hydrocarbons

WITH A POPULATION of nearly half a billion, the Mediterranean region consumes 1 billion toe (Mtoe), i.e. more than 8% of world energy demand. Approximately 80% of the Mediterranean region’s energy demand is met by

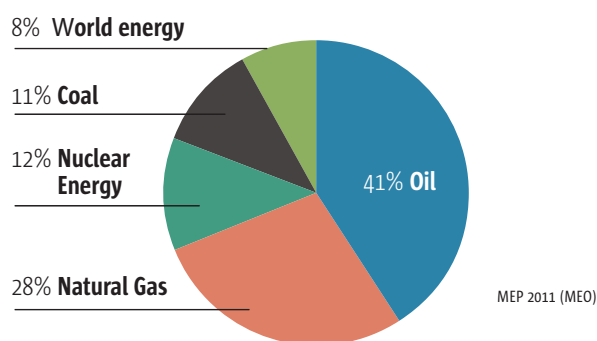
**TABLE 3.** Consumption of primary energy in European countries and SEMCs (2000 to 2020) (Mtoe)

	2000	2010	2020	Taux de variation	
				2000-2010	2010-2020
European Countries*	1,791	1,829	1,860	2%	1,7%
SEMCs	230	328	495	42%	51%

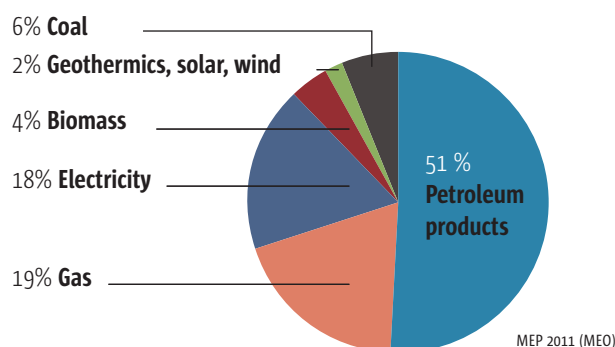
\* EU 27, Iceland, Norway, Switzerland

Eurostat, MEO (2011), European Commission (2009), BP Statistical review (2012)

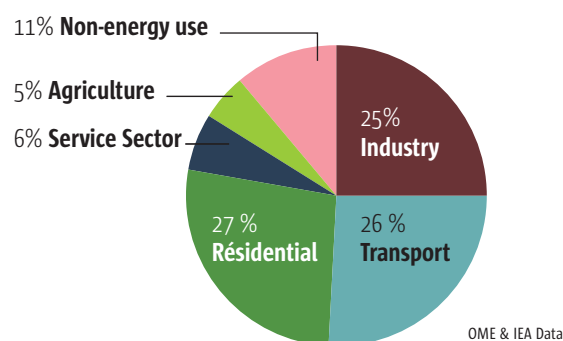
**FIGURE 2.** Primary energy consumption by product in the Mediterranean countries (2009)



**FIGURE 3.** Final energy consumption by product in SEMCs (2008)



**FIGURE 4.** Final energy consumption by sector in SEMCs (2008)



fossil fuels; this will continue to be the case up as far as 2030. Oil accounted for over 40% of primary energy consumption in 2009, and gas for nearly one third of regional consumption (FIGURE 2).

The breakdown of final energy consumption by product (2008) in SEMCs leads to the same conclusion: petroleum products are largely predominant (51%), followed by gas (19%) and electricity (18%), and well ahead of coal (6%), biomass (4%) and renewable geothermal, solar and wind energies (2%) (FIGURE 3). Final electricity demand will experience the greatest increase in the period 2009 to 2030. The increase should hold steady at 4.6% up until 2030.

Analysis of final consumption by sector in SEMCs (FIGURE 4) emphasises that the residential, transport and industrial sectors each account for around one quarter of final energy demand in these countries.

### Anticipating growth in demand

ENERGY DEMAND should increase four to five times faster in SEMCs than in NMCs. By 2030, demand in SEMCs could account for 47% of primary energy consumption in the Mediterranean region, as against the present 33%, with the NMCs' share dropping from 67% to 53%. At regional level, the share of gas is expected to increase to 36% by 2030, that of coal to around 10% over the



same period. The demand for gas should rise sharply and exceed the demand for oil in the next ten years. In 2030, the Mediterranean region could find itself obliged to import some 40% of its oil and 28% of its gas requirements.

The greater proportion of the Mediterranean region's primary energy demand will be in SEMCs, bringing total energy consumption to around 1,500 Mtoe in 2030, with an estimated average annual increase of 1.5%.

This increased demand could be contained if greater attention were paid to energy efficiency. The gains in energy efficiency, obtained by calculating the difference between the OME's conservative and proactive final energy demand scenarios<sup>23</sup> could amount to 168 Mtoe by 2030. The total electricity consumption savings potential in the region is estimated at 3800 TWh over the next twenty years, which is equivalent to 1.4 times the electricity consumption of the entire region by 2030 (in the conservative scenario) or to the southern Mediterranean's electricity production over the last ten years.

Whichever the scenario, sustained growth of the final energy demand (3.5% or 2.6% a year between now and 2030 according to the MED 2030 scenarios) will increase the dependence of SEMCs on fossil energies and make them much more vulnerable. Countries currently exporting energy, such as Algeria or Libya, will see their export capabilities and hence the financing of national economic activity reduced to meet domestic demand. As for energy importer countries, such as Tunisia and Morocco, their dependence is very likely to increase, as will their energy bills following the expected increase in supply costs caused by depletion of the reserves. The social and economic risks resulting from increased supply costs and their repercussions on the energy bills of countries, companies and households make a change of scale essential in demand-side management policies so as to consume better and less.

## Optimising production

THE ENERGY PRODUCTION capacities of European countries and of SEMCs follow different trends. Whereas energy production is expected to increase in SEMCs, at least until 2020, it is steadily decreasing in European countries. A comparison of the data in TABLES 3 and 4 reveals a gradual decrease in the energy independence of European countries between 2000 and 2010 (from 148% to 57%). It can also be seen that production in SEMCs does not increase as fast as primary energy consumption between 2010 and 2020.

As regards hydrocarbons and electricity, there will be significant variations in energy production in the countries in the Mediterranean region.

### Production of hydrocarbons

#### Oil

IN 2011, OIL PRODUCTION in producer SEMCs (Algeria, Egypt, Libya, Syria and Tunisia) amounted to 152 million tonnes (60 Mt less than in 2010 because of the events that shook these countries in 2011). Taking into account the production figures for North European countries (the UK, Denmark and Norway), European hydrocarbon production was greater than that achieved in SEMCs, namely 166 million tonnes.

23. The proactive scenario is based on a voluntary energy efficiency programme and a more diversified energy supply mix.

**TABLE 4.** Primary energy production in European countries and SEMCs, 2000 to 2020 (Mtep)

	2000	2010	2020	Variation	
				2000-2010	2010-2020
European countries*	1,185	1,041	988	-12%	-5%
SEMCs	341	425	600	24%	41%

\* EU 27, Iceland, Norway, Switzerland

OME (2008, 2011), Eurostat (2012), Norwegian Ministry of Oil and Energy (2010), European Commission (2009)

Given the oil reserves of SEMCs, estimated at 4.6% of the world's reserves, oil production could increase by 20% between now and 2030 in these countries, provided exploration is speeded up in the main oil producing countries on the southern side of the Mediterranean. However, the region's crude oil production should slow down after 2020. Production amounted to 5.1 million barrels a day in 2010, and should reach a peak of 6.4 mb/day in 2030.

In the refining sector, SEMCs produced 2.4 million barrels a day of refined products in 2011, whilst European countries produced 12.5 barrels a day (nearly half of which came from North Mediterranean countries – France, Spain and Italy). The shortage of oil refining capacity persists in South Mediterranean countries. Rising domestic demand is forcing them to increase their imports of petroleum products, of fuel in particular. Fuel imports in Algeria have increased sharply in recent years (up 77%), going from 1.3 million tonnes in 2010 to 2.3 million tonnes in 2011. In the same year, Sonatrach imported 1.3 million tonnes of fuel oil, 380,000 tonnes of petrol and 200,000 tonnes of bitumen for a price of two billion dollars. To meet rising domestic demand, the Sonatrach Group has launched a 10 million dollar investment programme for the construction of five new oil refineries, and a four billion programme for the renovation of the Skikda, Arzew and Algiers refineries so as to increase current refining capacity and produce petrol and diesel fuels to the relevant European standards.

Several SEMCs are anxious to make up for this delay in downstream production in order to start exporting refined products. In August 2012, SAMIR<sup>24</sup>, (Moroccan limited company in the refining industry) commissioned a new crude oil distillation unit with a capacity of 80,000 barrels a day, bringing total refining capacity to 200,000 barrels a day. The construction of a second refinery in Tunisia was due to start at the end of 2012. Unusually, this is a private refinery. The initial refining capacity of 120,000 barrels a day could increase to 250,000 barrels a day<sup>25</sup>. It will cost an estimated 1.5 billion euros.

## Gas

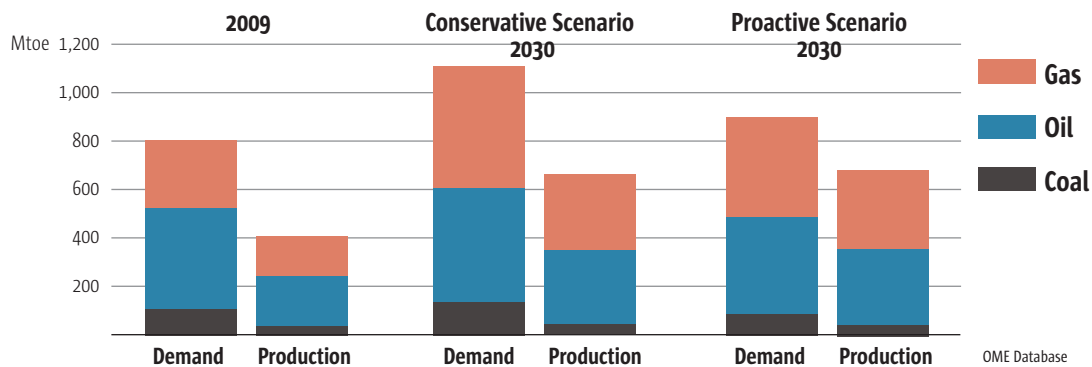
OF THE SEMCS, Algeria and Egypt are the two main gas-producing countries, ahead of Syria and Libya (the Libyan crisis of 2011 caused a sharp fall-off in production). In 2011, these four southern producer countries produced a total of 152 bcm (billion cubic meters). Of the North Mediterranean countries, only Italy is a gas producer (8 bcm). If we include gas production in North European countries, in 2011 the total volume of European gas production was distinctly higher than that of SEMCs, namely 247 bcm. This situation is set to change rapidly in the next few years, as European reserves are falling and will last less than 20 years.

24. Oxford Business Group, "Morocco: Investing in Hydrocarbons", 4 October 2012.

25. Investing in Tunisia, "Private Oil Refinery and 1,200 Jobs", 11 May 2012.



**FIGURE 5.** Projected hydrocarbon demand and production in the Mediterranean region



Gas production in SEMCs could increase significantly between now and 2030, from nearly 170 bcm in 2010 to some 364 bcm by 2030. One might ask what impact the recent discovery of gas resources in the eastern Mediterranean (Israel, Lebanon, Cyprus, Turkey) might have on regional energy geopolitics. The American geological institution, US Geological Survey, estimates that reserves in the Levant Basin could amount to 3,500 bcm, nearly as much as in Algeria (4,500 bcm). Disputes over maritime borders between Israel and Lebanon as well as between Cyprus and Lebanon, plus the claims put forward by Turkey, could, however, make it difficult to exploit these vast resources.

The total quantities of hydrocarbons produced in the Mediterranean region are insufficient to meet regional demand (FIGURE 5). The region is a net importer of oil and gas and is expected to remain so for the next twenty years.

## Electricity production in the Mediterranean region<sup>26</sup>

### Electricity production in the Mediterranean region

IN 2009, THE COUNTRIES in the Mediterranean region produced 1,873 TWh. It will be seen that 30% of this electricity was produced in SEMCs (FIGURE 6).

The electrical energy mix produced in the Mediterranean region varies from one shore to the other. In 2009, whilst fossil fuels accounted for 89.5% of electricity production in SEMCs, they accounted for only 45% in NMCs. Gas continues to predominate in electricity production in SEMCs, whereas North Mediterranean countries tend to prefer nuclear energy (FIGURES 7 and 8).

The sharp increase in electricity demand will require the installation of additional capacities, of 317 to 383 GW, depending on the scenario used, between now and 2030 and for the entire region. More than half of these will be installed in SEMCs. The gap between NMCs and SEMCs is expected to narrow between now and 2030, but electricity production will remain higher in the North.

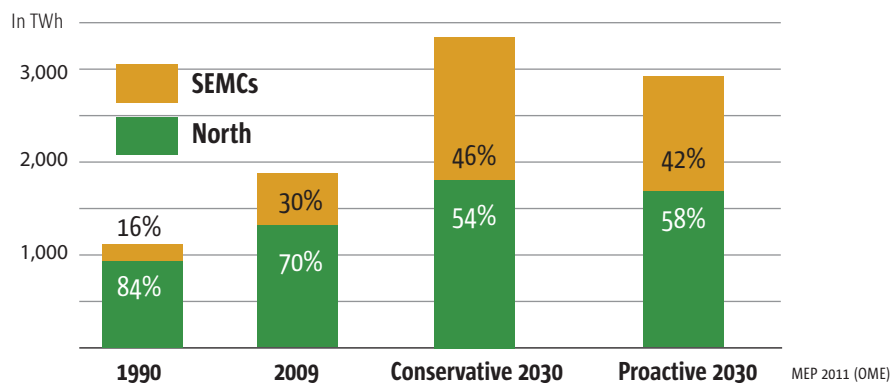
In a proactive scenario, in 2030, hydrocarbons would not account for more than 37% of total electricity production in the Mediterranean region (as against 58% in 2009) – as much as the total production of renewable energy.

### Renewable energy in electricity production

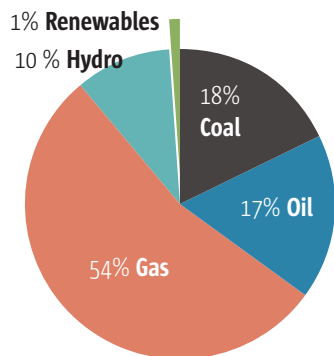
THE GENERATION OF ELECTRICITY FROM RENEWABLE SOURCES. Whilst the level of renewable electricity generation is higher in North Mediterranean

26. For further information on the electrical sector in the Mediterranean region, refer to chapter 3.2 “The driving role of electricity in regional cooperation”.

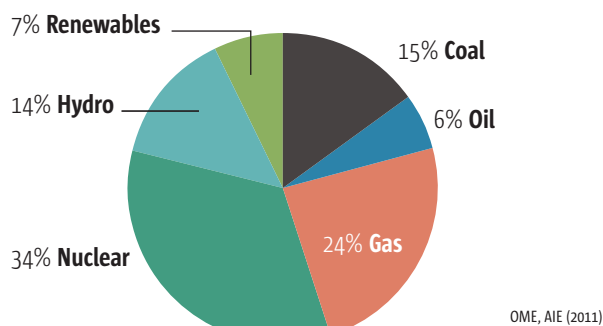
**FIGURE 6.** Electricity production in the Mediterranean region



**FIGURE 7.** Electricity production by product in SEMCs (2009)



**FIGURE 8.** Electricity production by product in NMCs (2009)



countries, it accounts for only a small part of the total electricity produced in these countries (wind energy 5%, solar energy 0.6%). The generation of electricity from renewable sources is even more insignificant in SEMCs. That said, the figures are continually improving and renewable electricity generation is expected to increase sharply between now and 2030, in both South and North Mediterranean countries (TABLE 5).

**RENEWABLE ENERGY PRODUCTION FACILITIES.** Most of the region’s renewable energy production facilities are located in European countries, where wind and solar (mainly photovoltaic) energy are enjoying a boom. The projections to 2030 indicate that the share of renewable energy (including hydraulic energy) in the Mediterranean region will reach 42% of total installed electricity capacity, according to the OME’s conservative scenario, and around 53% in the proactive scenario. Along with natural gas, in both scenarios, renewable energy is expected to be the main source of electricity production by 2030. These expectations reflect current trends in the Euro-Mediterranean region. Several European countries (Germany, Spain and France) and a number of South and East Mediterranean countries (among them Morocco, Tunisia and Jordan) have set themselves ambitious renewable energy development objectives. Of the technologies so far developed, solar energy is expected to achieve the highest growth rate. The use of photovoltaic solar energy, in particular, is expected to increase faster on the southern side of the Mediterranean, especially in Maghreb countries.

According to the European Wind Energy Association (EWEA), Europe’s installed wind capacity will exceed 100 GW by October 2012. Nearly half of

**TABLE 5.** Production of renewable energy in Mediterranean countries 2009 (TWh)

	Wind Energy	PV Solar Energy
South Mediterranean countries	1.6	0.02
East Mediterranean countries	1.5	0.02
North Mediterranean Countries	61	7.60

OME

**TABLE 6.** Installed renewable energy production capacity in Europe and in South and East Mediterranean countries, 2009 to 2011 (GW)

	Wind Energy	PV Solar Energy
South Mediterranean countries (Morocco, Algeria, Tunisia, Libya, Egypt)	0.8	0.011
East Mediterranean countries (Jordan, Israel, Palestine, Lebanon, Syria, Turkey)	0.8	0.013
North Mediterranean Countries (France, Spain, Portugal, Cyprus, Italy, Greece, Malta, Slovenia)	41.0	20.6
Spain's share	21.7	4.4
France's share	6.8	2.6
Italy's share	6.7	12.7
European Countries (EU 27)	94.0	51.7
Germany's share	29.0	24.7

OME (2009), EWEA (2011), EPIA (2011)

this capacity is located in North Mediterranean countries (41 GW). Germany is the driving force behind the deployment of renewable energy and remains the leading country as regards installed capacity for both wind energy (29 GW) and solar energy (24 GW). On the other hand, installed wind capacity is only about 1 GW in East Mediterranean countries. Solar energy production capacity is even lower in these countries (less than 0.02 GW in 2009). Major efforts are required over the next twenty years to meet the renewable energy development targets set by each of the Maghreb countries (Moroccan Solar Plan, Tunisian Solar Plan, the Algerian renewable energy development policy, and so on).

## The organisation of energy exchanges

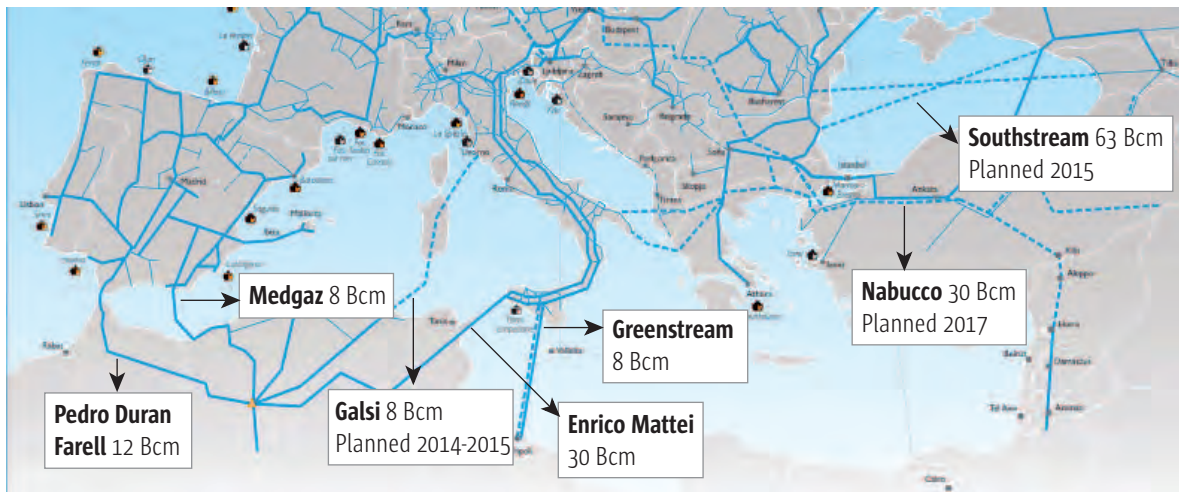
ENERGY EXCHANGES between countries in the Mediterranean region are chiefly organised on a South-North basis. Four of the South and East Mediterranean countries (Algeria, Egypt, Libya and Syria) export hydrocarbons and account for 22% of the oil and 35% of the gas imports throughout the Mediterranean region. All the other countries are net importers of primary energy. However, over the next twenty years, certain countries, such as Egypt and Algeria, which today are energy exporters may have to reduce their exports in order to meet rising domestic demand. Commercial electricity exchanges between South and North Mediterranean countries are still of a very limited nature (only Spain/Morocco), but this situation is expected to be remedied in the next few years thanks to the Mediterranean Solar Plan and the interconnection plan proposed under the Medgrid Initiative.

**FIGURE 9.** Oil shipments between North Africa, the Middle East and Europe in 2011



BP Statistical Review of World Energy (June 2012)

**FIGURE 10.** Trans-Mediterranean Gas Pipeline Networks (2010)



## Oil

THERE ARE TWO MAIN pipelines in the northern Mediterranean. The trans-alpine pipeline linking Italy (Port of Trieste) and Germany via Austria. It transports 0.7 million barrels a day (bpd). And the southern European pipeline, which starts from France (Fos-sur-Mer), and then runs through Switzerland to Germany; capacity 0.4 million bpd.

In the eastern Mediterranean, there are two pipelines that go through Turkey. The Iraq-Turkey pipeline running between the Kirkuk oilfield in Iraq and the port of Ceyhan in Turkey, capacity 1.6 million bpd. And the Baku-Tbilisi-Ceyhan (BTC) pipeline running between the Baku offshore installation in Azerbaijan and the port of Ceyhan in Turkey, via Georgia; capacity 1.2 million bpd.

The remaining trans-Mediterranean shipments are by sea. Over 70% of the hydrocarbon resources coming from South Mediterranean countries and the Middle East and intended for Europe are supplied by the Middle Eastern countries (FIGURE 9).

## Gas

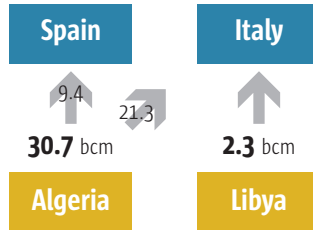
GAS COMING FROM SOUTH Mediterranean countries and intended for North Mediterranean countries is transported chiefly by gas pipelines. The main trans-Mediterranean pipelines currently in operation are shown below (FIGURE 10):

- The Enrico Mattei pipeline, capacity 30 bcm, linking Algeria (Hassi R'Mel) to Italy and Sardinia via Tunisia.
- The Pedro Duran Farell pipeline, capacity 12 bcm, linking Algeria (Hassi R'Mel) to Spain (Seville) and Portugal (Setubal) via Morocco.



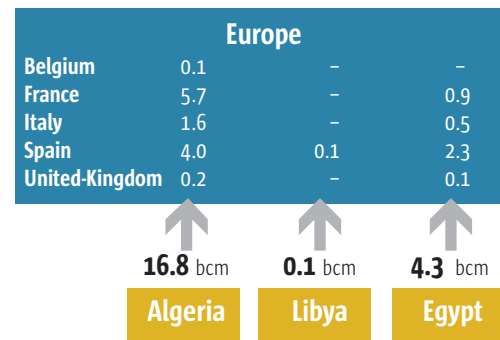


**FIGURE 11.** Gas transfers by pipeline from Algeria and Libya to Spain and Italy in 2011 (in bcm)



BP Statistical Review of World Energy (June 2012)

**FIGURE 12.** Transfers of LNG from Algeria, Libya and Egypt to European countries (in bcm)



- The Medgaz pipeline, the most recent installation, capacity 8 bcm, linking Algeria (Hassi R'Mel) to Spain (Almeria), in operation since April 2011. Unusually, it links the producer country directly to the consumer country without going through a third party transit country. It required an investment of one billion euros, half of which was financed by a loan from the EIB through the FEMIP. It belongs to a consortium of five international companies: the Algerian Sonatrach (36%), in charge of the project; the Spanish Iberdrola (20%), the Hispano-Emirati Cepsa (20%), the Hispano-Italian Endesa (12%) and the French GDF-Suez (12%).

- The Greenstream pipeline, capacity 8 Bcm, linking Libya and Italy.

The Galsi pipeline, capacity 8 to 10 bcm, due to link the southern Algerian gas fields to Italy (and possibly Corsica) via Sardinia was initially expected to come into operation in 2012, but this has been postponed until 2014. Construction is being delayed by technical and economic problems. Sonatrach is reluctant to invest in this project without long-term gas price guarantees.

The European strategy for diversification of its gas supply sources will also benefit from the upcoming construction of the Nabucco pipeline (scheduled for 2017) and the Southstream pipeline (2015), with respective capacities of 30 and 63 bcm. These should enable the EU countries to look further afield, to Central Asia (Russia, Iran and other countries in the Caspian region), although there are uncertainties regarding the volumes available, the routes and the transit countries.

The figures **FIGURES 11** and **12** show that the majority of gas transferred from SEMCs to European countries (mainly Italy and Spain) is shipped by pipeline. Thus in 2011, Algeria exported 32.8 bcm of gas by pipeline to Italy and Spain, and 16.8 bcm of LNG to five European countries (mainly Italy and Spain). In the long run, this distribution could be slightly modified in favour of LNG.

### Electricity

THERE ARE ONLY TWO (400 kV) commercial links in operation between the North and South shores of the Mediterranean; they are situated between Spain and Morocco. In 2012, 17% of the electricity consumed in Morocco came from Spain <sup>27</sup> (see **FIGURE 24**).

27. Energy News, August 2012.

**TABLE 7.** Added value and employment in the energy and mining sector in the Maghreb and in France

	Algeria (2010)	Morocco (2011)	Tunisia (2012)	France (2012)
Added value from the sector (Billions of USD)	69	7	4	44
Share of the sector in GDP	36.7%	7%	8.2%	1.7%
Population employed in the sector	226,500	80,000	37,600	144,000*
Share of total employment	3%	0.76%	1.17%	0.6%
Active population	9,735,000	10,500,000	3,207,000	25,000,000

\* Figures for energy only

Treasury Department (Algeria, 2011), Ministry of Ecology and Sustainable Development (France, 2011), Moroccan Department of Energy and Mining (2011), African Economic Outlook, Tunisia (2012), Tunisian National Institute of Statistics (2012), World Shore (2011)

## Added value, fiscal resources and employment (North-South)

THE ORGANISATION OF energy production and exchanges between countries in the Mediterranean region raises the question of how to apportion the added value and the income derived from the sale of energy products. Do production and processing generate as much value in the producer countries as they do in the consumer countries? Are the changes in the energy sector going to create as many jobs in the North as in the South?

### Added value: a comparison between France and the Maghreb

THE ENERGY SECTOR generates considerable added value in Algeria. However, compared with the other countries in the region, notably France, the creation of jobs in the sector is disproportional to the creation of wealth. Of the three Maghreb countries concerned, Algeria is distinguished by the weight of the sector as regards both GDP and employment, although it employs only 3% of the active population. As to the other two countries, the share of the energy sector in GDP is around 7 to 8%, and it is just as marginal as regards job creation. The share of the energy sector in Algeria's GDP is five times greater than that of its neighbours and twice as great as France's. It cannot be used as an efficiency benchmark. It characterises first and foremost a hydrocarbon-dependent economy, one whose aim today is to free itself from this dependence.

The **TABLE 7** compares added value and employment in the energy sector in the Maghreb and in France.

### Fiscal resources derived from petroleum products: a godsend for European countries

IN 2011, TAXES (TICPE AND TICGN)<sup>28</sup> received by the French government amounted to 25 billion euros. These taxes were essentially on oil, gas accounting for only 274 million euros<sup>29</sup>. They accounted for 57.1% of the price of Eurosuper petrol and 49.1% of the price of diesel. Only in the UK are the taxes on petroleum products higher than in France. The **TABLE 8** and **FIGURE 13** illustrate the major role played by taxes on petroleum and gas products in France and the European Union.

The general trend, which is particularly marked in the case of liquid hydrocarbons, is characterised by the predominant role played by taxes imposed in consumer countries. Hydrocarbon producer countries, in reality, obtain a lower advantage from their exports. Oil companies that commit financial

28. TICPE: Domestic Consumption Tax on Energy Products (replaces the TIPP); TICGN: Domestic Consumption Tax on Natural Gas.

29. Source: Oil Industry Newsletter (BIP).

**TABLE 8.** Percentage of taxes in consumer prices in France

	Eurosuper (SP95)	SP98	Diesel
2008	61.1%	59.9%	50.1%
2009	66.5%	65.2%	59.1%
2010	61.4%	60.2%	53.7%
2011	57.1%	56.1%	49.1%

BIP (Oil Industry Newsletter) from the DGEC (Department of Energy and Climate), France

**TABLE 9.** Tax on petroleum products in the European Union

	Super SP95			Diesel		
	Excl. Tax (€)	Incl. Tax (€)	% Tax	Excl. Tax (€)	Incl. Tax (€)	% Tax
Germany	81.61	175.00	45.63	84.14	156.10	46.1
Spain	81.92	151.26	45.84	83.83	142.28	41.08
Italy	81.72	187.01	56.3	83.65	175.92	52.45
United Kingdom	71.04	173.01	58.94	76.38	179.41	57.42
UE 27	<b>78.13</b>	<b>170.12</b>	<b>54.07</b>	<b>81.29</b>	<b>154.83</b>	<b>47.5</b>

BIP from the EC's Oil Newsletter (2011)

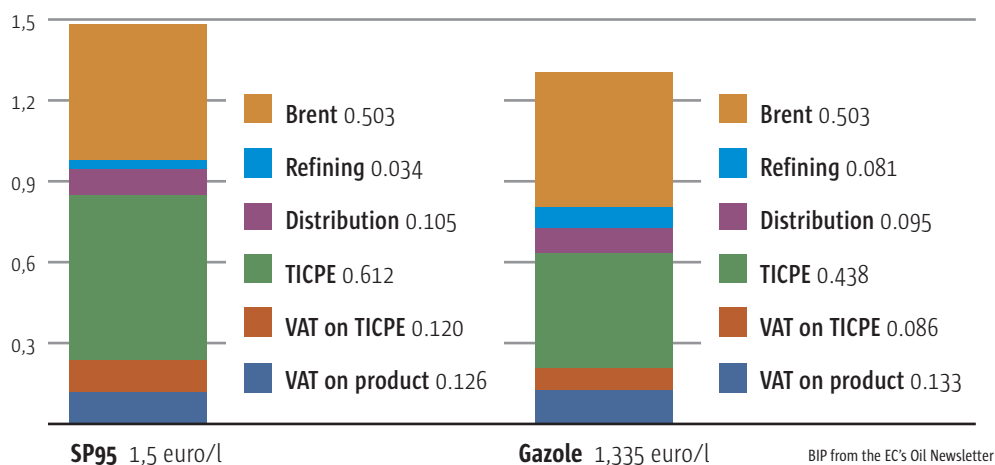
and technological resources run a geological, technical, financial and commercial risk, and even a political risk in some cases, and yet they derive the least benefit from the wealth created.

### Job creation: potential in both the North and the South

JOBS IN THE TRADITIONAL energy sectors (oil and gas) are not expected to undergo major changes in the next few years. On the other hand, the renewable energy sector will hopefully create new jobs, although this depends on developments in the world energy situation and on the will of the countries concerned to develop renewable energy.

The boom in renewables and the development of interconnections and smart grids, or of thermal efficiency and renovation in the building sector, are likely to create new jobs in the Mediterranean region. In the South, the fear remains that the expected structural changes will not result in the creation of local jobs. Care must be taken to ensure that changes in the energy sector are not limited to the installation abroad of foreign units producing solar and wind energy equipment without generating any transfer of know-how. Neither must they be limited to the purchase of European and Asian technologies, but rather, they should encourage the organisation of local research and development programmes. Last, but by no means least, it is essential that they mobilise the workforce of SEMCs.

Energy sector changes within SEMCs should, moreover, generate new jobs without doing away with any of the existing ones. The energy policies adopted by the countries in the region clearly entail the creation of jobs to meet growing local demand in the labour markets of SEMCs. That said, the continuing large share of fossil fuels in the primary energy mix between now and 2030, even using the proactive scenario, does not portend any profound changes in the traditional energy activities of the producer countries. The commitments made by the Maghreb countries in favour of renewable energy necessitate the creation of jobs, in order to achieve the renewable energy pro-

**FIGURE 13.** Breakdown of average pump prices in France in 2011 (in euros/litre)

duction objectives set by each of the SEMCs. According to a GIZ<sup>30</sup> report, 137,000 jobs could be created in the renewables sector by 2025. Similarly, in Morocco, Said Mouline, Managing Director of ADEREE (National Agency for the Development of Renewable Energies and Energy Efficiency) emphasises that the “15% renewables and 12% energy savings” targets for 2020 represent “a saving of some 21 billion dirhams between the reduction in the energy bill and the sale of carbon certificates, as well as 30,000 potential new jobs”.<sup>31</sup> The first studies presented by the Economic and Social Council of the Kingdom of Morocco<sup>32</sup> show that 100,000 new jobs could be created in Morocco between now and 2030 in four sectors involved in green policies (renewable energy, energy efficiency, wastewater and liquid effluent management, and the management of solid urban waste).

30. BMZ, GIZ, DEVED, MIPMEPI, SEQUA, “Promotion des jeunes et des femmes dans l'économie verte en Algérie” (Promotion of Young People and Women in the Green Economy in Algeria), DEVED, GIZ, 2012.

31. CDER (Renewable Energy Research Centre), 12<sup>th</sup> Board Meeting.

32. Report of the Moroccan Economic and Social Council, “Economie Verte, Opportunités de création de richesses et d'emploi” (Green Economy, Opportunities for the Creation of Wealth and Employment), Auto-saisine (“Self-referral”) no. 4/2012.



## 3

## Energy as a lever of Euro-Mediterranean cooperation

THE IDEA OF DEVELOPING a multi-sector regional energy strategy that includes the resources of each of the Mediterranean countries, meets their needs, both present and future, and generates added value for each of them, cannot be taken for granted. The economic growth of energy producing SEMCs is still too dependent on hydrocarbons to encourage them to develop a regional outlook shared with their Mediterranean neighbours. This is the case of Algeria. It can, however, be observed at the same time that a partnership dynamic is under way in the region's electrical sector. A number of complementarities are encouraging the countries in the Mediterranean region to develop common projects in this sector. If they are to play a structuring role at regional level, these must be cooperative projects. What sort of long-term Euro-Mediterranean energy cooperation is needed to ensure the security of energy supply and demand in all the countries in the region?

### Algeria: an exporter country facing huge challenges

THE DEVELOPMENT OF ENERGY cooperation in the Mediterranean region is too often seen through the prism of renewable energy alone. And yet it remains essential to include fossil energy in regional discussions in order to involve hydrocarbon producer countries in the definition of a regional strategy, relying at the same time on their ability to help achieve a regional energy transition. But how are the trends to be changed, and Dutch disease prevented? The best indicator is production potential and its management by the national players concerned. This potential is of course considered with reference to the major trends marking the industry in question, current technological upheavals and the challenges they mean for national energy operators, universities, research organisations, service companies and SMEs.

We have opted to use Algeria as an example, a textbook case which raises three questions:

- What long-term energy balances in hydrocarbon producer countries?
- Hydrocarbons in the national economy: how is Dutch disease to be overcome?<sup>33</sup>
- What are the challenges in terms of human resources, science and technology?

The European Commission is endeavouring to strengthen its partnerships with its main energy suppliers, which it feels should be “mutually advantageous and a reflection of their interdependence”. In its Energy Supply Security directive<sup>34</sup>, it points out that that “it is in the European Union's interest to attach greater importance to its cooperation with Algeria where energy is concerned. Both parties mean to complete as soon as possible their

33. Dutch disease, which appeared in the 1970s, refers to the difficulties encountered by the Dutch economy following the bringing into exploitation of the natural gas reserves in the Slochteren gas field in the 1960s. “This term refers to the astonishing contrast between a rather sluggish domestic economy and a largely surplus foreign balance”, Chevalier, J.M.; Geoffron, P.; “*Les nouveaux défis de l'énergie*” (New energy challenges), *Economica*, 2011.

34. Communication of 7 September 2011, COM(2011) 539 final, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, concerning Energy Supply Security and International Cooperation – *The EU's Energy Policy: Investment with Partners beyond our Borders*.

work on a draft energy agreement which would boost bilateral cooperation in this matter, over and above the usual questions of gas and oil commerce, and, more especially, be centred on cooperation in renewable energy development and commerce”.

## The major energy balances in perspective

### Overview of the oil and gas production chain

ALGERIAN OIL PRODUCTION is holding steady at 1.73 million barrels a day. Gas production, however, amounted to 78 billion cubic metres in 2011, 3% less than in 2010. This fall-off in production, in evidence since 2009, is due to the brake put on the development of Algerian upstream activities, itself the consequence of a lack of realism in the partnership policy and inappropriate changes in the regulations. As regards refining, the country is facing a sharp increase in domestic demand, obliging Sonatrach to update and increase its refining capacity, as well as import large volumes of fuel to meet urgent requirements. In August 2012, Sonatrach announced plans to import 2.5 million tonnes of fuel, including two million tonnes of diesel oil for 2012<sup>35</sup> (for further details, **APPENDIX 4**).

### Hydrocarbons in the major energy balances

THE HYDROCARBONS SECTOR, whilst it lies at the base of the major balances and profound dynamics of the Algerian economy, continued to decline in 2011. For the sixth consecutive year, the added value fell by 3.2%, i.e. 19.7% in six years.<sup>36</sup> However, in 2011, the upward trend in oil prices continued; the price of oil increased by 41%, the price of gas by 20.6%. This more than made up for the 4.8% fall-off in volumes. The country is no longer able to maintain its expansion in the hydrocarbons sector. Maintaining its export income depends on the upward variations in the price of oil. Whilst the Algerian mining sector remains uncertain, the inconsistencies marking the management of the energy sector over an entire decade have placed the country in a precarious situation as regards its external balances. This may have been made up for by the high level of the exchange reserves, amounting to some 190 billion dollars.

### Increased energy demand and energy efficiency programmes

NATIONAL ENERGY CONSUMPTION remains high: there has been an annual increase of 6% in electricity consumption since 2008. This is comfort consumption that creates no wealth. 60% of electricity is consumed by households, as against 10% by industry. The state spends 8 billion dollars a year subsidising electricity consumption and maintaining electricity prices well below economic costs.

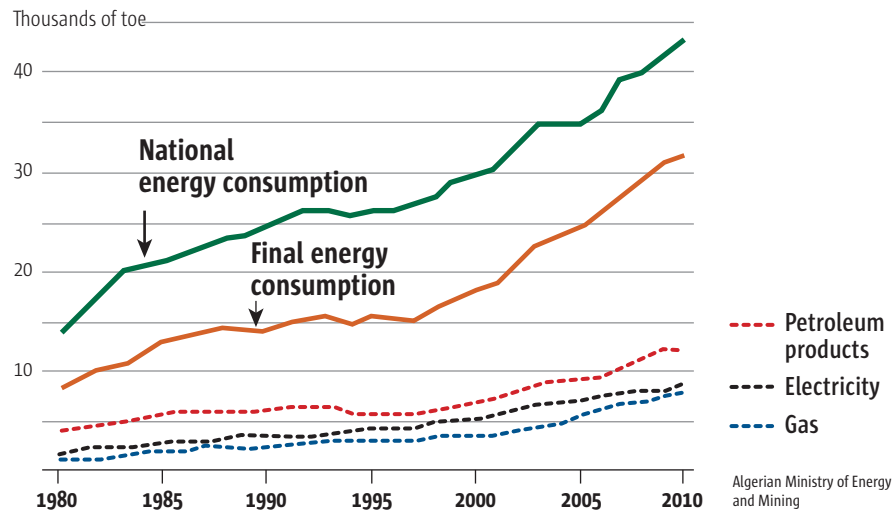
From 1980 to 2010, there was a sharp increase in national energy consumption, unrelated to economic growth. In this period, national electricity consumption increased threefold, final consumption by 3.7 times, the consumption of petroleum products threefold, gas consumption by 5.4 times and electricity consumption by 4.6. Algeria also saw an increase in domestic demand for fuels. According to the Algerian Ministry of Energy and Mining, the rate of growth in overall energy consumption is increasing. Elec-

35. L'Expression, "2,5 millions de tonnes de carburants importés, l'autre paradoxe algérien", (2.5 million tonnes of imported fuel, the other Algerian paradox), 4 August 2012.

36. Bank of Algeria Report 2011.



**FIGURE 14.**  
Algerian energy  
consumption  
(in millions  
of toe)



Electricity consumption is expected to increase by 14 to 18% and fuel consumption by 15 to 20% in the next few years<sup>37</sup>. Within ten years, these trends will give rise to a dramatic disruption of the supply/demand balance with a probable cessation of exports. The decision makers are well aware of this and have already introduced energy saving measures, although these are still inadequate and insufficiently applied.

A three-year (2011-2013) energy efficiency programme was adopted in February 2011; this includes the following measures:

- 42% reduction in consumption
- Thermal insulation of buildings (this sector accounts for 42% of final consumption)
- The promotion of energy efficiency in the industrial sector
- The systematic use of energy-saving lamps
- The introduction of the technical principles of solar air conditioning
- The inclusion of energy performance considerations in public lighting systems (sodium lamps)
- The promotion of LPG
- The promotion of LNG

This is an ambitious programme, although it is still insufficiently applied and its message remains indecisive.

The systematic use of air conditioning contravenes the energy efficiency objectives, and the transport sector is not sufficiently incorporated into the measures adopted.

### Prospective study of the supply and demand for primary energy in Algeria, 2020 and 2030<sup>38</sup>

THIS STUDY DOES NOT reveal the developments to be expected over the next twenty years. The economic projections have to be weighted by the potential discoveries of new deposits and the energy policies that might be adopted in the future. The scenarios developed by the OME have to be taken into account when identifying the cooperation policies best able to open up strategic perspectives for a producer country like Algeria, in a context where the goal is to shift from a rentier to a production economy and to harmonise northern and southern energy models.

37. [www.elwatan.com/economie/les-assurances-du-ministere-de-l-energie-18-10-2012-189298\\_III.php](http://www.elwatan.com/economie/les-assurances-du-ministere-de-l-energie-18-10-2012-189298_III.php)

38. Prospective study based partly on the two OME scenarios (CS and PS).

The conservative scenario follows past trends. The proactive scenario entails greater cooperation. The question is knowing which strategies are in operation today. Are there any real strategies? By that we mean coherent chains of decision based on a prospective analysis of internal strengths/weaknesses and of opportunities/threats in the international environment, in order to achieve a structural and positional energy balance in an increasingly uncertain and competitive world in which energy is a major lever of power. As a producer country, Algeria cannot confine itself to preserving its position as the exporter of what is an exhaustible resource at a time when the world – and its commercial outlets – have embarked on the transition from an energy consumption (and hence to some extent importation) model based almost exclusively on fossil energies to a non-carbon, non-fossil model.

Will the country be able to maintain its rate of exportation in the long term without putting pressure on domestic demand? That does not appear likely without turning to new resources. The European Commission for the Regulation of Electricity and Gas warns against the increasing demand for gas, which could, in the absence of major discoveries of new deposits, put an end to gas exports as early as 2020. The OME's projections to 2030 foresee an average annual increase of between 2.6% (proactive scenario) and 3.6% (conservative scenario). As a reminder, the average annual increase from 1990 to 2009 was 3.5%.

AS REGARDS the increase in supply, the prospects for oil, gas and renewables would appear to differ:

- As regards liquid hydrocarbons, the probability of finding huge deposits, as happened in the 90s, remains low. On the other hand, supply could increase considerably thanks to the “enhanced oil recovery” system (EOR)<sup>39</sup>. With this technology, Algeria's oil deposits offer useful potential, taking the depletion threshold beyond the 18.5 years estimated by the BP Statistical Review. In our view, considering also probable discoveries in the Northern Sahara and offshore locations, it is reasonable to believe that Algeria has resources enabling it to keep producing for another fifty years.

- As regards natural gas, the country still has large untapped reserves of conventional gas, as well as, more importantly, significant non-conventional gas potential: tight gas reservoirs such as the Hamra quartzites, as well as shale gases in the Berkine Basin, central Sahara, the Ahnet region and the Gourara (Timimoun) Basin in Western Sahara. These reserves could account for as much as four times the conventional gas reserves. However, they are located a long way from the infrastructures and would require at least five times more drilling equipment than Algeria has at present. The country is currently evaluating these reserves, but it seems obvious that they will come to replace the conventional resources, very probably to maintain Algeria's position in the gas market. Considering the untapped potential in conventional and, more importantly, non-conventional gas, Algeria may well have potential gas reserves of 20 trillion cubic meters. The future development of gas resources will require a stable and encouraging legal framework. By defining both the non-conventional hydrocarbons and the smaller deposits, and adopting the appropriate tax system in their regard, the amendments to the law on hydrocarbons are helping to achieve this. Whatever policy lines are

39. Enhanced oil recovery (EOR), which consists in increasing the quantity of hydrocarbons extracted from a deposit, plays a decisive role in the increase of production. Three methods of enhanced recovery are used: the thermal method, which uses the injection of steam to heat the oil, thereby fluidising it and making it easier to produce; chemical recovery, which uses viscosifiers and/or surfactants; and CO<sub>2</sub> injection, as a means both of increasing the yield of the deposit and of storing the CO<sub>2</sub> as part of the fight against climate change (source: French Institute of Oil and New Energies [IFPEN]).





adopted, hydrocarbons in Algeria are going to become more costly and more complex. Algeria is expected to adopt fresh partnership approaches involving risk sharing, the encouragement of foreign investment and the international development of industrialisation and research. A greater emphasis should also be placed on national initiative. The partnership with Europe would appear to be a useful means of furthering this. The new geopolitics of energy are prompting the country to move away from the strictly nationalistic logic of the 70's and turn to approaches more in tune with an interdependent world in which technology is the key to a competitive advantage.

- At the end of the decade, renewables could provide a very effective means not only of balancing the national energy portfolio but also of exporting electricity by transcontinental cable to the North shore of the Mediterranean. There is clearly a new awareness on the part of both the state and civil society of the views in favour of renewable energy. As regards legislation, there would seem to be a minimum requirement for the development of renewable energy (the Act governing Energy Management, the Act governing Electricity and Public Gas Supply, the Act governing Renewable Energy and its Role in Sustainable Development, the National Fund for Energy Management, the Executive Order concerning the Costs of Diversification, the Indicative Programme on Means of Production Requirements, and so on).

IT APPEARS POSSIBLE to reach a point where renewable energy make up 40 to 50% of the electricity mix, if a change of mindset can be achieved. There should also be (but is this possible, given the general mood following the political upheavals in the Arab world?) a return to prices more in line with economic reality. Does the state have to continue to subsidise electricity consumption to the tune of 8 billion dollars? Does it have to subsidise the price of imported diesel?

It seems that energy supply in the country could increase well above the 2.6 to 3.6% indicated in the two OME scenarios. That appears probable in the case of hydrocarbons, given the state's fresh viewpoint and the legal adjustments in progress. Beyond 2020, Algeria could achieve and even exceed the target of 85 bcm of gas exports and for a long time maintain an oil export objective of 1.5 mbd.

### **What should Algeria's priorities be?**

COMPETITION between suppliers is going to become increasingly ferocious in the European gas market. The suppliers will have to preserve the competitiveness of gas in the face of competing energy resources at the same time as protecting their share of the market. This will mean lower prices, but also volatility and more speculation. Price perspectives will remain uncertain in Europe with gas surpluses in the United States due to the production of non-conventional gases enabling this country to export gas. It is essential that Algeria be ready for this to avoid being marginalised. The Wood Mackenzie study commissioned by the Gas Exporter Countries Forum in 2011 concluded as follows: "Algeria will suffer increasing competition in Southern Europe, especially in Italy where major contracts are due to expire and other exporters are pushing to get market share. We expect this will drive a shift



towards more LNG exports thus increasing Algeria's flexibility to capture more market opportunities"<sup>40</sup>.

1. The primary need is to contain and reorient domestic demand and improve energy efficiency.
2. Secondly, supply needs to be given a boost:
  - By relaunching the development of national upstream activities, which have suffered from a decade of problems, notably legal instability and inappropriate and discouraging legislation;
  - By committing to a realistic renewable energy programme, which could include the private sector and provide the opportunity for building a real public/private partnership.
3. Thirdly, technological development needs to be seen as the keystone of the national energy policy.

ALGERIA'S CONCERN as regards pressure on national energy demand and maintaining its position in the gas market vis-à-vis North Mediterranean countries may be seen within the framework of a Euro-Mediterranean partnership. If it commits to a common regional strategy to save energy and create new industrial links in the gas and renewable sectors, Algeria could learn from the experience of neighbouring countries and forge some profitable industrial partnerships. This opportunity falls well within the projected creation of a Euro-Mediterranean energy community.

The Franco-Algerian partnership for the supply of water in Algiers is, all things considered, an example to follow. Moreover, Algeria is suffering from a water shortage (600 litres of water per person, compared to the 1,000 litres needed). An ever-greater share of the energy consumed will be required in order to satisfy water requirements. Renewables, together with desalination or water treatment, constitute a technological theme of the future for a Euro-Mediterranean partnership.

Lastly, the Act governing Hydrocarbons is currently being amended to eliminate inconsistencies in the legislation introduced in 2005-2006, which discouraged foreign exploration and exploitation partnerships. A further purpose of the new provisions is to encourage the exploration and exploitation of Algeria's very considerable non-conventional hydrocarbon reserves.

### **Hydrocarbons in the national economy: how is Dutch disease to be overcome?**

#### **Hydrocarbons in the major economic balances**

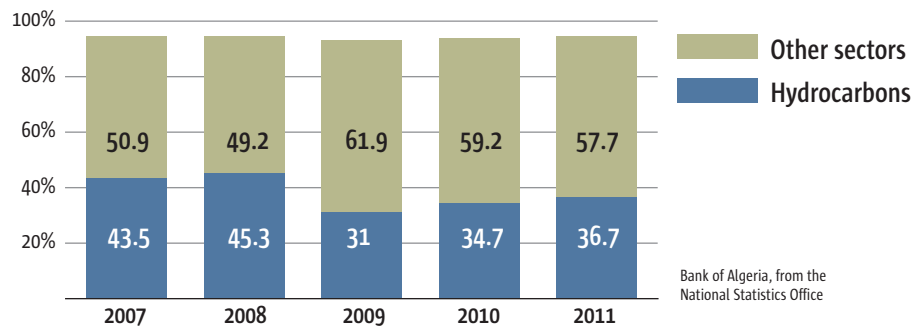
ECONOMIC GROWTH in Algeria is still too heavily reliant on the hydrocarbons sector. Growth in the economic sector depends on the hydrocarbons sector, and hence on the uncertainties of the oil market. The general public industrial production index (up by 0.4% in 2011) is still below the 2009 level. Growth in the non-hydrocarbon sectors, (of the order of 2.4%) is due to two sectors: agri-food (21%) and energy (8.2%). The recession marking all the other sectors varies from 3.2% to 13%. Manufacturing production continues to decline (down 5.4% in 2010 and 1.2% in 2011). The productive capacity utilisation rate varies from 75% in the private sector to 77% in the public sector<sup>41</sup>.

40. Wood Mackenzie, "Global Gas Service", April 2011, page 18.

41. Algerian National Statistics Office.



**FIGURE 15.**  
The share of hydrocarbons in Algeria's GDP



Thus it emerges that the country is increasingly dependent on the hydrocarbons sector. The Dutch disease phenomenon is typical. The imports made possible by hydrocarbon exports inhibit the national productive – mainly industrial – system. The hydrocarbon sector is paying for the errors of management made over an entire decade and which led to cessation of the development of the oil-gas upstream activities. With the pressure on volumes, the increased value of exports is due solely to rising oil prices.

Hydrocarbons are virtually the country's sole exports. In 2011, they accounted for 98% of Algeria's exports (the same level as in 2007). In the same period, the income derived from the export of hydrocarbons amounted to 71 billion dollars. Hydrocarbons accounted for 36.7% of GDP in 2011, compared with 43.5% in 2007 (FIGURE 15). They also accounted for 70% of the state's budgetary income. Despite their small share of GDP, this dependence on hydrocarbons does not appear to be lessening and may still be regarded as a structural trend (see APPENDIX 5 for a detailed breakdown of the share of hydrocarbons in the Algerian economy).

As regards export, liquid hydrocarbons predominate, hence Algeria appears to be not so much a gas country as an oil country. The vast reserves discovered in the last decade are oil reserves.

Are the industrialisation effects of these hydrocarbons a myth or a reality?

In the dynamics at work, there is nothing that points to an early change in Algeria's position as virtually a single-product exporter. Not only do hydrocarbons dominate the country's exports, they also profoundly influence structural developments in the national productive system. We are dealing here with a classic case of Dutch disease. Industry dawdles, accounting for less than 5% of the GDP, whilst ordinary manufactured consumer goods dominate goods and services imports (FIGURE 16).

At the same time, the investment trend is down in relation to final consumption (FIGURE 17).

### Human resources, science and technology: What are the challenges?

THE ENERGY AND MINING sector employs 226,500 people. Sonatrach has a permanent workforce of 47,900. However, whilst the sector accounts for 36.7% of the GDP, it employs only 3% of the population. The sector needs to develop new skills so as to anticipate the emergence of the renewable energy and energy efficiency segments. The country's universities seem incapable of adapting to change and using the full range of their scientific skills to function in an organisational relationship with energy companies and commit to

FIGURE 16.

Variations in industry's share, excluding hydrocarbons, of the GDP (%)

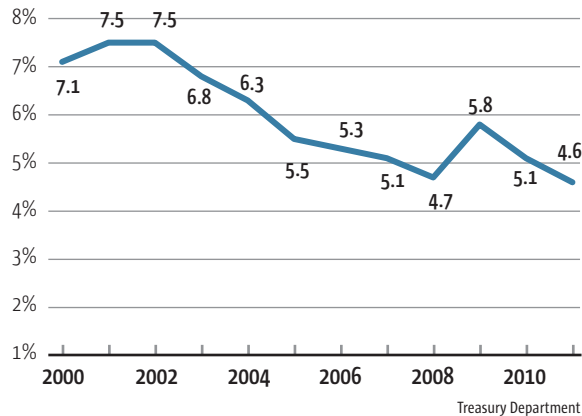
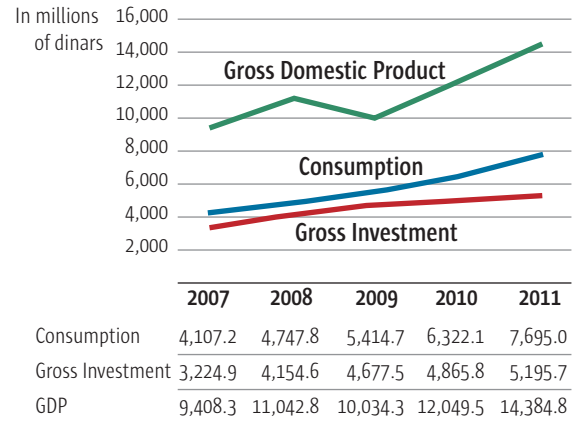


FIGURE 17.

Major aggregates of the GDP (2007-2011)



Bank of Algeria

a virtuous cycle of cross-fertilisation. The crisis in Algeria's university system (one of the more conspicuous aspects of which is the shortage of research staff, with the best people seeking employment abroad) is depriving operational processes – including engineering, heavy maintenance and development – of the scientific support needed to turn a company into a learning organisation and a source of knowledge creation. Hence these processes are incapable of collecting and producing knowledge, as they are not themselves rooted in fundamental scientific disciplines. The natural driving force of the hydrocarbons industry is, surprisingly, neutralised<sup>42</sup>.

Moreover, it appears that the Algerian companies concerned do not capitalise on experience to the same extent as foreign companies. Algeria is a pioneer in natural gas liquefaction and also, which tends to be forgotten, in the laying and management of deep-water pipes. The first project of this type was the gas pipeline linking Algeria and Italy via the Strait of Messina. The Italian Methane Pipeline Company (SNAM) built a pipe-laying vessel, thereby acquiring unique know-how. Sonatrach, its Algerian counterpart, also invested in it, but without deriving any significant technological benefit. Algerian engineering and construction companies are under-represented. Engineering, which is the repository so to speak of all industrial processes and the meeting point of the associated operational activities, is insufficiently developed in Algeria.

A partnership with the European players in the sector could initiate a virtuous circle of knowledge building and innovation. Any such a partnership should seek to develop innovative processes across the entire industrial fabric (including energy champions and SMEs), and to bridge the gap between industry and higher education by significantly raising the standard of universities. Therein lies the theme of a structuring partnership between energy players on both shores. To disseminate innovative processes, the partnership must focus on engineering and include universities on both sides of the Mediterranean, which should play a driving role in the dynamics at work (see APPENDIX 6 for details of employment, skills and training in this sector in Algeria).

42. Oil operations in the North Sea have given a decisive boost to science and technology in the Scottish universities of Aberdeen, Edinburgh and Herriot-Watt, which have become benchmarks in the geosciences and offshore oil technologies, as well as to the scientific and academic community in Bergen (Norway) and the Norwegian university fabric in general. At the same time, a whole host of oil and offshore production SMEs have sprung up. Nothing like this has happened in Algeria: the universities and the SMEs give the impression of not being part of a country with a flourishing oil and gas industry.



### Conclusion

WITH BOTH FOSSIL and renewable energies, there are sufficient resources to warrant a long-term partnership with European companies. That said, there is a need for meaningful, innovative projects embodying the approach, the vision and the procedures required; innovative partnership concepts which can take root and engender a dynamic of change. Algeria, through its energy companies – and considering the growing demand for gas across the world<sup>43</sup> – has all the characteristics it needs to be a key player in the energy transition process.

Among other things, Algeria has unique experience and expertise in gas chain management, including and above all the liquefaction of natural gas, considerable non-conventional gas potential, and two other important features: sunshine and gas reserves, which are more than sufficient to make it a leader in hybrid gas-solar power generation, which today offers an optimum cost per kWh.

From the case study of Algeria there emerge a number of arguments encouraging hydrocarbon producers on the south shore to expand their energy mix and enhance energy efficiency through the implementation of dynamics of innovation and technological development. Moreover, this example shows that these countries have assets on which they can lay emphasis vis-à-vis their neighbours and their European partners so as to create structuring projects and assist with the transformation of universities and specialised schools in the energy sector.

## The driving role of electricity in regional cooperation

ELECTRICITY IS THE FIRST industrial sector in which cooperative links have been created between several European countries. Since the 20s, a number of cross-border links have been being established in Europe (France, Italy, Switzerland), In 1951, even before the ECSC was founded, the Union for the Coordination of the Production and Transport of Electricity (UCPTE) was established in order to build a large interconnected network in Western Europe. The development of interconnections between European countries has enabled the creation of energy solidarity mechanisms and the initiation of regional integration by the networks. The same approach should be prioritised between South Mediterranean countries so as to promote, with the support of COMELEC (the Maghreb Electricity Committee), electricity cooperation in the Maghreb. There are major challenges to be met in the electricity sector, on both sides of the Mediterranean.

Complementary issues in both the North and the South provide the opportunity to take the initiative and immediately implement a change of direction for the production and consumption of electrical energy at regional level. Even if Medgrid and the Mediterranean Solar Plan set objectives for 2020, these must not go only as far as 2020 (or 2030), which is not that far away. A long-term vision, up as far as 2050, is needed, in line with the perspective adopted by the European Commission and the International Energy Agency. If the Mediterranean countries can be persuaded to pursue a common long-term electricity production strategy, the countries on both shores would reap the benefits.

43. According to the IEA, world demand for natural gas should increase by an annual 1.7%, greater than the energy demand's 1.4%. World LNG trade is growing at a rate of 4.5%, i.e. more than twice growth in gas production (2.1%) and should more than double between 2007 and 2030.

Looking ahead to 2050 will, however, necessitate medium-term objectives: how many electricity production plants and what North-South inter-connection infrastructures will need to be installed in the Mediterranean region between now and 2030?

### **Requirements of South and East Mediterranean countries: meeting a demand heightened by economic and demographic growth**

ELECTRICITY DEMAND in South Mediterranean countries is expected to increase sharply between now and 2030. This will be felt mainly in the industrial and residential sectors; and it requires South Mediterranean countries to immediately implement policies for energy management and for the development of their electricity production capacities. Renewable energy provides the opportunity to help satisfy this increased demand.

In the OME's conservative scenario, renewable energy would still play a marginal role and in 2030 would account for only 5% of electricity consumption. There would then be very marked exposure to the negative effects of the risk of fossil fuel price peaks.

In the OME's proactive scenario (PS), diversification of the means of production is expected to be intensified, particularly in the South with the introduction of nuclear energy and a significant increase in the use of renewable, mainly wind and solar, energy. Renewable energy would then account for 14% of electricity consumption by 2030. However, this is only the first strategic step towards the energy transition and the development of North to South electricity exports.

Compared with the conservative scenario up to 2030, the proactive scenario would mean a 14% reduction in primary energy consumption across the region; a saving of 87 Mtoe (i.e. around 75% of the primary energy consumption of SEMCs in 2009, see [APPENDIX 7](#)).

### **Installed electrical capacity in SEMCs**

TO MEET THE REGION'S increasing demand for electrical energy, some major initiatives need to be introduced by the different countries in the region, chiefly by SEMCs, to increase their production capacity. According to the OME's conservative scenario, electricity production in the South will increase three-fold between 2009 and 2030, and almost double between now and 2020. In the proactive scenario, on the other hand, demand in SEMCs will only double between now and 2030, as it takes into account demand-side management programmes.

Whatever the scenario, installed production capacity in SEMCs is going to increase considerably in the next two decades ([TABLE 10](#)). But what increases may be expected in electricity production between now and 2030? And what will be the share of renewable energy in the total installed production base?

### **Installed electricity production capacity in South Mediterranean countries**

IN 2009, ELECTRICITY was mainly being produced in South Mediterranean countries from gas, with gas power plants accounting for 50% (58 GW) of total electricity production, followed by hydraulic electricity production

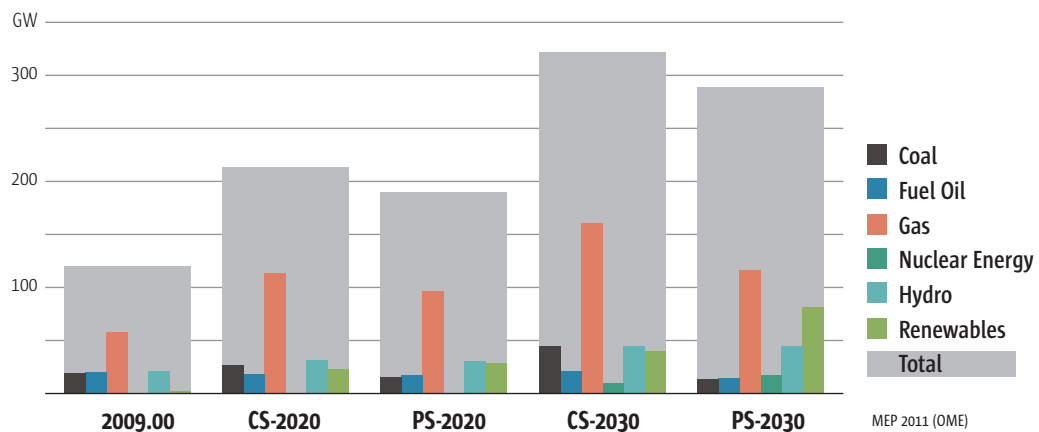


**TABLE 10.** Electricity production (in TWh) in the conservative and proactive scenarios (CS & PS)

	2009	CS 2020	PS 2020	CS 2030	PS 2030
Mediterranean Region (NMCs & SEMCs)	1,873	2,642	2,455	3,353	2,916
SEMCs	559	1,014	827	1,534	1,229
SEMCs' Share	30%	38%	33.5%	46%	42%

MEP 2011 (OME)

**FIGURE 18.** Installed electricity production capacity in South Mediterranean countries



MEP 2011 (OME)

See **APPENDIX 7** for details of installed electricity production capacities for each of the SEMCs.

(21 GW). Renewable (wind, solar) energy accounted for only 2 GW out of a total installed capacity of 120 GW. (**FIGURE 18**)

It emerges from the analysis of the conservative scenario to 2030, which extends past trends, comparing it with the 2009 situation, that without a far-reaching energy economy and energy management programme:

- Coal-burning capacities would increase by a factor of 2.3, accounting for 14% of total installed capacity by 2030;
- Fuel oil capacities would remain stable at 6.5% of the total;
- Gas-burning capacities would increase by a factor of 2.8 and account for 50% of total installed capacity;
- Hydro power generation would increase by a factor of 2, accounting for 4% of the total;
- Renewable energy would increase by a factor of 20, but would account for only 12% of total installed capacity (1% of the 2009 installed capacity);
- Nuclear energy capacity, nil in 2009, would account for 3% of total installed capacity by 2030.

#### Renewable energy capacity and production in SEMCs

IN 2009, RENEWABLE ENERGY production on the south shore (excluding major hydraulic plants) was still marginal: 1,804 MW for all SEMCs. Wind energy accounted for most of the installed renewable energy capacity (90%). In both scenarios, by 2030, installed wind capacity will account for more than double the installed solar capacity, as the investment costs are well below solar costs (around 2,000 USD/kW for wind compared with 4,300 USD/kW for

**TABLE 11.**  
Installed renewables production capacity in South Mediterranean countries (in MW)

	Wind	PV	Other	Total
2009	1,620	25	159	1,804
CS 2020	17,000	5,354	568	24,726
PS 2020	19,800	8,000	750	28,550
CS 2030	29,000	10,400	1,000	40,400
PS 2030	54,700	25,200	2,000	81,900

Other: geothermal energy, biomass, tidal energy

MEP 2011 (OME)

**TABLE 12.**  
Renewables production in SEMCs (in TWh)

En TWh	Wind	PV	Other	Total
2009	3	0.04	0.8	4
CS 2020	35	9	2	46
PS 2020	41	14	3	58
CS 2030	65	18	4	77
PS 2030	125	44	9	178

Other: geothermal energy, biomass, tidal energy

MEP 2011 (OME)

See **APPENDIX 8** for a breakdown of renewable energy capacity and production in South and East Mediterranean countries.

**TABLE 13.** Share of renewables in the electricity production mix in SEMCs

	PS 2030	CS 2030
% of Installed capacity	82 GW/ 289 GW = 28%	40 GW/ 322 GW = 12%
% of Energy produced	178 TWh/1229TWh = 14%	77 TWh/ 1534 TWh = 5%

MEP 2011 (OME)

solar power<sup>44</sup>). Solar power will be chiefly photovoltaic (PV), although concentrating solar power (CSP) projects are on the increase<sup>45</sup>; similarly, wind power will initially be onshore. Provided ambitious energy programmes are implemented in SEMCs, installed renewables production capacity in 2030 could be double the installed capacity indicated by the conservative scenario, i.e. 81,900 MW (**TABLE 11**).

Renewable energy generation between 2009 and 2020 is expected to increase sharply, whichever scenario is used. Wind energy is predominant in the production of renewable energy, and in both scenarios, wind power production is three times higher than solar power production. (**TABLE 12**)

This analysis goes to show that a proactive policy in favour of renewable energy (PS) could help increase the share of renewable energy to one-third of electricity production in the South (28%). That would represent 14% of total electricity production. (**TABLE 13**).

However, any decision to encourage the development of renewable energy depends on the investment cost: if it continues to remain higher than that of fossil energies, it could nevertheless rapidly become competitive. Successive investments in regional electricity grid infrastructures could also work in favour of renewable energy.

### Estimated costs of investment in electricity production in SEMCs

THE ESTIMATES GIVEN in this report are indicative. They provide an order of magnitude and a 'warning' as to the level of additional investments required, hence they use simplifying assumptions which nonetheless give pertinent results. It is assumed that existing facilities will still be operating in 2030; the cost of replacing power plants is not taken into account.

The estimates are based on the standardised costs published by the OECD in its study *Projected costs of generating Electricity*<sup>46</sup>, published in 2010, and on

44. IRENA (2012), *Renewables energy technologies : cost analysis series*, vol. 1 : Power sector, n°4, 5.

45. According to the OME's scenarios, installed concentrating solar capacity accounts for 4 to 6.55% of total renewable energy capacity (excluding hydro), whereas PV solar energy accounts for around 30% in both scenarios.

46. OECD/Nuclear Energy Agency, *Projected Costs of Generating Electricity* 2010, OECD Publishing, 2010.



**TABLE 14.** Installation costs by energy source of electricity production

	Nuclear	Gas (CCGT)	Coal	Coal + CO <sub>2</sub> Capture	Wind (onshore)	PV Solar	CSP (Concentrating solar parabolic / no storage)
Capacity MW	1,400	480	750	474	45	1	1
Overnight costs* USD/kW (OCDE)	4,101	1,069	2,133	3,837	2,349	6,006	
Costs USD/kW (IRENA)					1,800-2,200 Average Cost: 2,000	3,600-5,000 Average Cost: 4,300	4,600

\* : the overnight costs (capital investment) include sponsor and construction costs, less interest during the construction phase. 1 USD 2008=0.684 €.

OCDE (2010), IRENA (2012)

the *International Renewable Energy Agency's* renewable energy cost analysis<sup>47</sup> published in June 2012. A comparison of the OECD's figures with those of IRENA shows that renewable energy installation costs are continually decreasing. It also reveals a difference of about 30% between the two sets of figures on the solar energy sector. The costs of concentrating solar power (CSP) are given as a guideline.

**TABLE 14** shows the installation cost for different types of electricity generating plants with different capacities (MW). It does not include operating and maintenance costs.

### What are the choices in terms of investment in electricity production means for the period 2020 to 2030?

TO SHOW THAT A CHANGE of direction is financially and technically feasible, let us compare a conservative scenario characterised by the continuation of past trends with a proactive scenario in which a policy of sustainable development is adopted to meet future electricity demand, using the scenarios created by the OME:

- **Conservative Scenario (CS).** In South Mediterranean countries, future production follows past trends; the South continues to invest mainly in conventional means of production, burning greenhouse gas fossil fuels, with renewable energy marginalised and accounting for only 5% of electricity consumption in 2030. This scenario "ignores" the potential for renewable primary energy in the South and does not predict any significant development in this area in the future. It does not prepare the electricity sector for the long transition towards low-carbon energy, or for the depletion of fossil fuels. Each national electricity grid continues to function individually, with minimal interaction with its neighbours (cooperation in the event of incidents, little in the way of commercial exchanges). The South's electricity network is not ready to export electricity to the North. Regional cooperation is still essentially limited to traditional exchanges of know-how, experience and training. Commercial electricity exchanges are limited to specific links, such as the Morocco-Spain link, for example, and the future Tunisia-Italy link. The additional electricity production capacity would be 178 GW (200 GW including hydro), requiring an investment of some 308 billion US dollars (238 billion euros).

47. IRENA, *Renewables energy technologies : cost analysis series*, vol. 1 : Power sector, n° 4, 5, 2012.

- **Proactive Scenario (PS).** Future demand is satisfied but with energy saving measures and a meaningful change of direction in the structure of

**TABLE 15.** CS-PS Comparison of additional capacity and estimated costs in SEMCs

	Additional capacity CS 2030		Costs CS 2030 Billions of USD	Additional capacity PS 2030		Costs PS 2030 Billions of USD
Nuclear	9.6 GW		39	17 GW		69,7
Coal	26 GW		55	-		-
Gas (CCGT <sup>50</sup> )	103 GW		110	58 GW		62
Wind	29 GW	Average coast: 59* (53.6 - 63.8)		54,7 GW	Average coast: 111* (101 - 120)	
PV Solar	10.4 GW	Average coast: 45* (37.4 - 52)		25,2 GW	Average coast: 108* (90.7 - 126)	
TOTAL (USD)	178 GW	Average coast: 308 (295 - 320)		154,9 GW	Average coast: 350 (323.4 - 377.7)	
TOTAL (€)	238 billions €			317 billions €		

The additional capacities from the other renewable sources (hydro, waste, biomass, etc.) have not been included in our calculations because of the lack of standardised figures. Their volumes, which are the same in both scenarios, do not basically change either the order of magnitude or the differences between them. For the sake of simplicity, the cost of onshore wind farms and PV solar plants has been used for macroeconomic estimation of these installations, despite the existence of CSP and offshore farm projects; they, too, do not affect the order of magnitude of the projected investments.

OCDE (2010),  
\*IRENA (2012)

the installed production base during the period 2020 to 2030, with renewables accounting for 28% of total installed capacity by 2030. In the proactive scenario, 350 billion dollars (317.3 billion euros) would be invested to increase installed capacity by an additional 154 GW (170 GW including hydro). The cost is 42 billion dollars higher than in the conservative scenario, due mainly to a twofold increase in renewable production capacity. Taking a ten-year period, the overall cost in the PS is 13.6% higher than in the CS, 1.3% on an annual basis. Looking further ahead to 2050, this investment would need to be continued throughout the entire period. This would in fact be sufficient to enable 14% of electricity consumption in SEMCs to be met by renewable energy in around twenty years' time. This is not dissimilar to the situation in Germany, where in 2010 renewable energy accounted for 17% of electricity consumption under a sustainable development programme launched in 1990.

This very reasonable additional cost is warranted by the development of renewable energy in SEMCs at a rate which the German experience has shown to be achievable, with positive repercussions on employment (500,000 jobs by 2050), on municipal income (from taxes), on the reduction of greenhouse gas emissions, and on fossil fuel economies. The French government is following a similar renewable energy development strategy, aiming at the creation of 30,000 "sustainable" jobs in the renewable energy sector by 2020 (Grenelle Environment Forum). Morocco<sup>48</sup> expects 30,000 jobs to be created in this sector between now and 2025; and a report on Algeria<sup>49</sup> estimates that 137,000 jobs could be created in that country in the same sector over the same period.

The investments shown in **TABLE 15** may be compared with the GDP of all the South Mediterranean countries for 2030, an estimated 4,147 billion US dollars. They account for 7.4% to 8.4% of the South's GDP, depending on the scenario used (the estimated investment costs for wind farms and PV solar plants are based on IRENA data). These estimates may also be compared with the sums invested by development funding institutions in the energy sector in SEMCs (e.g. EIB/FEMIP: 5.1 billion euros between 2002 and 2011). To be able to finance these sizeable investments, SEMCs are going to be obliged to make every effort and explore every available source of funding.

48. Moroccan Economic and Social Council, "Economie verte: Opportunités de création de richesses et d'emploi" (Green Economy: Opportunities for the Creation of Wealth and Employment), 2012.

49. BMZ, GIZ, DEVED, MIPMEPI, SEQUA, "Promotion des jeunes et des femmes dans l'économie verte en Algérie" (Promotion of Young People and Women in the Green Economy in Algeria), 2012.

50. CCGT: Combined Cycle Gas Turbine.



### **INSERT.** Estimated costs of investment in electricity networks in SEMCs and in Europe

► Egypt should increase its production capacity by around 47 GW (conservative scenario) between now and 2030. The cost of network development is an estimated 3.8 billion dollars over the next ten years, and a total investment of 20 billion dollars would be needed to build the networks required by 2030<sup>51</sup>. It might be estimated that investments amounting to some 80 billion dollars would be needed to connect up 200 additional GW in SEMCs, excluding the cost of interconnections with Europe.

► In Europe, 3,400 TWh/year are transported over the network. The European Network of Transmission System Operators for Electricity (ENTSO-E) estimates that 42,000 km of new lines would be needed; these would cost from 29 to 32 billion dollars over the period between 2011 and 2015 in order to ensure:

- Security of supply (26,000 km)
- Integration of renewables (20,000 km)
- Development of the single market (28,500 km)

Certain lines are participating in several objectives.

### **Investment costs of electricity grid infrastructures**

RENEWABLE ENERGY has to be converted into electrical energy if it is to be sold and delivered to consumer countries around the Mediterranean: thus the development of renewable energy depends very largely on the development of interconnection, transport and distribution infrastructures.

New transport infrastructures will be required in order to connect new production capacities to the 170 GW (PS) or 200 GW (PS) network. Similarly, to supply 78 million additional consumers and meet a higher per capita consumption will require new distribution networks. The costs of transport and distribution infrastructures will depend mainly on:

- the distances between the production plants and the places of consumption;
- the type of current used (direct or alternating);
- the voltage level (400 kV, 225 kV, etc.).

Investment in new transport and distribution technologies, e.g. smart grids, is bound to optimise the capacity of future infrastructures as well as renovating and increasing the transport capacity of existing infrastructures.

It is not in fact easy to estimate required levels of investment in electricity networks over the long term, in the absence of data on the places concerned. The insert below shows forecasted estimates and gives a few values. The **INSERT** shows forecasted estimates and gives a few values. Investments amounting to some 80 billion dollars could be required to develop the electricity networks on the south shore.

### **The potential of SEMCs: renewable primary energy in abundance**

THE SOUTH MEDITERRANEAN countries have abundant energy sources, mainly solar energy, and, to a lesser extent, wind energy. They receive solar radiation equivalent to between 1,700 and 2,600 kWh/m<sup>2</sup>/year<sup>52</sup>, compared with 880 to 1,800 kWh/m<sup>2</sup>/year in Europe. The energy from the solar radiation received per km<sup>2</sup> is equivalent to that of 1.5 million barrels of oil or 300,000 tonnes of coal<sup>53</sup>.

51. OME, MEP Égypt study (2011).

52. MED-CSP SOLEMI data (2008).

53. DII- Desertec Industrial Initiative.

At present, average consumption per person is 2,030 kWh in the South and 6,036 kWh in the North<sup>54</sup>. However, by 2030, average consumption in the South is expected to have at least doubled, to 4,300 kWh/year.

According to the MEDRING Update Study, Vol. 3 (MED EMIP)<sup>55</sup>, the average amount of power per unit of area could be 40 MW/km<sup>2</sup> with CSP and PV solar power, and 7 to 15 MW/km<sup>2</sup> with wind power on both sides of the Mediterranean. 125,000 km<sup>2</sup> (i.e a square measuring 350 km on each side) of solar production would be sufficient to meet the 2030 demand of the European Union (4,400 Twh) and SEMCs (1,100 Twh). This area is only a small fraction of the area of the deserts in South Mediterranean countries (some 36 million km<sup>2</sup>).

Moreover, the use of land for electricity generation is not in competition with other traditional uses such as agriculture, housing, mining or the exploitation of primary fossil energy sources, environmental reserves or even military activities.

All the figures point to the colossal renewable energy potential in the South. The fact remains, however, that the exploitation of this potential depends on its economic profitability and the policies adopted. This potential is a means of meeting demand in both South and North Mediterranean countries, and exploring the complementarities between the two shores.

## Requirements of North Mediterranean countries

IN 2009, THE EUROPEAN Parliament and the European Council established ambitious and demanding objectives for 2020, known as “20-20-20”: the reduction by at least 20% of the 1990 level of greenhouse gas emissions; a 20% share of renewable energy in final energy consumption in the European Union; and a 20% reduction in energy consumption to be achieved, essentially, by improving energy efficiency.

Renewable energy will on average have a 34% share in total electricity consumption under the EU countries’ national action plans for renewable energy. Ambitious objectives are planned for the coming decades, in line with scenarios in which climate warming is limited to 2°C by 2050.

The European Parliament and the European Council seek to reduce the 1990 level of greenhouse gas emissions by 80 to 95% by 2050 (by 40% in the period to 2030). Thus the European Union is maintaining its course towards a non-carbon energy system based on the development of renewable energy and a greater use of electricity in industry, heating and air conditioning, and transport.

According to the European Commission<sup>56</sup>, by 2050 renewables should be meeting the greater part of European energy consumption needs, and the European power supply system should to a great extent be non-carbon based.

After 2020, renewable energy technologies will move forward from the production phase to the mass production and large-scale deployment phase; they will move on from being burgeoning technologies reliant on economic support mechanisms to being competitive, mature technologies that no longer need to be subsidised. The unit costs of renewable energy have already dropped thanks to economies of scale and technological advances, and should continue to do so<sup>57</sup>.

54. OME, *Mediterranean Energy Perspectives*, 2011.

55. MED EMIP Medring update study, Vol. III, *Market potential and financial impact of solar power generation in Mediterranean partner countries*, 2010.

56. Communication from the Commission of 15 December 2011, COM (2011) 885 final, entitled “Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – Energy Roadmap 2050”.

57. European Commission, “Impact assessment”, Commission staff working paper COM (2012).



The EU must meet several key challenges to ensure its energy security at an affordable cost and also continue to reduce its greenhouse gas emissions. It must remedy:

- The deterioration in supply security;
- The low diversity of supply: there are only a few supplier countries, Russia, Algeria and Norway, accounting between them for 75% of gas imports and 50% of crude oil imports, a situation that exposes the EU to the risks of price volatility and increases;
- Low competitiveness: dependence on fossil fuels is pushing prices up;
- Climate change due to greenhouse gases: global warming should be limited to 2°C to prevent dangerous impacts. Although the EU has reduced its greenhouse gas emissions in the last twenty years, these reductions do not appear sufficient to prevent temperatures below 2°C from rising<sup>58</sup>.

Measures are in the course of preparation to get these various aspects back on track. The majority of EU countries are agreed on the usefulness of pursuing the policy of cooperation with neighbouring countries in the renewable energy sector, and on giving the policy a further boost through plans to import renewable energy on a large scale in the long term. This will to cooperate is embodied in particular in Article 9 of the Renewable Energies Directive<sup>59</sup> (energy-climate package), which establishes the feasibility of importing renewable energy into Europe. The terms and conditions of this transfer of renewable energy from a third-party country have still to be determined.

### **Complementarities and convergences between North-South and South-South interests**

SEMCS HAVE AN ABUNDANT renewable energy potential able, over the long term, both to meet their energy demand and provide a major source of export income [81.4 billion US dollars (63 million euros) a year by 2050 from the export of 1000 TWh according to a Desertec Industrial Initiative scenario], provided that adequate technologies and funding are available. A number of South Mediterranean countries are thinking of initiating the energy transition by gradually increasing the share of renewables in the production of electrical energy, and they are looking for the necessary partners.

European countries are expressly seeking to increase the share of renewable electrical energy in their energy consumption in order to ensure security of supply and maintain their development. They already have maturing technologies and are able to find the required financial resources. They are committed to energy transition and their experience will be of use to South and East Mediterranean countries.

There are several complementarities between the countries in the Mediterranean region:

- commercial complementarity between a south shore offering by 2050 a potential renewable production surplus and a North shore anxious to purchase these green products;
- technical complementarity between a south shore looking to rapidly acquire renewable energy technologies and a more technically advanced North shore;

58. As above, page 8.

59. European Parliament and Council Directive 2009/28/EC of 23 April 2009 concerning Promotion of the Use of Energy from Renewable Sources.

- financial complementarity between south shore partners seeking the appropriate funding for highly capital-intensive infrastructure projects with a long-term return on investment and North and South shore partners able to provide the necessary financing (investment funds, operators, etc.).

Moreover, the objectives of countries on both sides of the Mediterranean are convergent in terms of economic factors and energy policies designed to:

- Utilise sustainable sources of employment in the renewable energy sector;
- Ensure the transition to non-carbon energy sources, thereby obviating the risks of fossil fuel price spikes and variability;
- Diversify energy supply sources;
- Ensure the co-production of renewable energy and improve supply security through the development of interconnections;
- Reduce production costs and make savings on the fossil fuels replaced by renewable sources.

Thought must be given today to the technologies and fuels to be used to build additional capacity in the South: the choices for 2020-2030 will be determined by both past trends and the energy vision for 2050. Past trends make it necessary to create 200 GW of additional production capacity; and the energy vision for 2050 entails orienting the means of production towards a future energy mix in which renewable energy should play a major role. Thus this decision-making period provides a good opportunity to promote a proactive scenario for renewable electricity, one of the driving factors in North-South cooperation.

### **Synergies of interconnected systems with a large share of variable renewable production**

THE FOLLOWING SYNERGIES would be generated by a large interconnected North-South system with a large share of variable renewable production on both the North and the South shores:

#### **Mega-regionalisation ensures better control of the immediate production-consumption balance**

CONVENTIONAL ENERGY production is controllable and can always be adjusted to meet variable demand. Renewable energy production is variable, more or less randomly. The regionalisation of variable production and demand avoids having to halt renewable energy production when production is higher than demand in the relatively limited locally controlled zone, and enables the surplus to be sent to another interconnected zone which, as a result, is able to economise on fossil fuels and reduce its CO<sub>2</sub> emissions. If the interconnections are congested, making transfer impossible, either renewable energy production is halted (incurring stopping and restarting costs), or the market price becomes negative to encourage customers in the zone with the surplus to consume (as in Denmark, where at certain times of the day the customer is paid to consume – a market aberration).



### The wealth of new energy production plants enables production to be smoothed out, making it less variable and hence easier to control

THE PRODUCTION OF an isolated wind turbine is very uncertain, making production forecasts somewhat unreliable. But the production of a wind farm is less variable and renewable energy production forecasting is more reliable. Likewise, it is easier to reduce production variability and improve forecasting reliability when the system operator is working in several wind farm zones with complementary wind patterns: the wind does not suddenly die down everywhere at the same time. The best renewable energy production forecasts enable the system operator to optimise its energy reserve requirements and avoid situations in which it has unexpectedly to turn to other, more costly means of production.

### Complementarity between sources and demand

SOLAR ENERGY IS relatively stable in the South throughout the year, whereas in the North it is less available in winter and wind energy is plentiful. The consumption peak occurs in winter in the North and in summer in the South. Furthermore, the difference in load curves due to the time difference and public holidays enables the means of production to be optimised and their costs reduced.

### The cost-benefit performance of renewable energy

ACCORDING TO THE OECD'S standardised costs<sup>60</sup> and the IRENA studies<sup>61</sup>, the investment costs per kW of photovoltaic solar energy are approximately four times higher than those of gas-burning plants, twice as high as those of wind power and coal-burning installations, and almost the same as those of nuclear plants (TABLE 14). Wind and coal power are approximately twice as costly as gas, but twice as cheap as nuclear power. However, any decision to invest in renewable energy must be based on the average levelised cost of the electricity generated (LCOE), which includes investment costs, operating and maintenance costs, the output of the system throughout the life of the installation(s) and funding costs. On this basis, wind power, although capital-intensive, emerges for the moment at least as the most profitable form of renewable energy. TABLE 16 shows the standardised costs per kWh produced by nuclear power, gas and coal according to OECD data, with a 10% discount rate, and the cost per kWh produced by onshore wind farms, photovoltaic (PV) solar power and concentrating solar power (CSP) according to the IRENA data.

The cost per kWh of solar power remains high, but is expected to fall sharply in the next few decades, by around 40% by 2020. In very sunny areas, however, solar energy is sometimes already competitive (around 10 cents USD). In the EU, the cost of renewables is funded by support mechanisms such as feed-in-tariffs (FIT), emission quotas and the CO<sub>2</sub> market or green certificates, tax incentives and loans at favourable interest rates for investments.

The benefits to be considered are external to the projects themselves:

- The cost of fossil fuels is avoided thanks to the production of renewables;
- The cost of damage to the environment, health and the climate are avoided;

60. OECD/Nuclear Energy Agency, *Projected Costs of Generating Electricity* 2010, OECD Publishing, 2010.

61. IRENA, *Renewables energy technologies : cost analysis series*, vol. 1 : Power sector, n° 4, 5, 2012

**TABLE 16.** Standardised costs per kWh

	Nuclear power	Gas (CCGT)	Coal	Onshore wind farms	PV solar power	Concentrating solar power (CSP)
USD/kWh	0.098	0.092	0.089	0.06 – 0.14*	0.22 -0.27*	0.17- 0.36*
Life times in years	60	30	40	25	25	25

OCDE (2008), \*IRENA (2012)

- A fall in the market price, as, under the merit-order principle, less use is made of gas- and coal-burning plants with high marginal costs;
- The creation of jobs, thus generating income for households and the economy;
- Additional income for the local authorities from business rates.

Germany provides a striking example: although it has major reserves of coal and very probably non-conventional gas, the Federal Government is pursuing a course towards even more renewable energy and has set itself ambitious development objectives in this respect, despite the fact that the costs of renewable energy are expected to remain higher than those of fossil fuels for a few years yet. The German government believes that the development of renewables will enhance social wellbeing and that the long-term results will be positive.

### The case of Germany<sup>62</sup>

IN THE 1980's, in the wake of the Chernobyl disaster and under pressure from environmental associations, the idea began to form of developing the production of electricity from renewable sources. In 1991, a law was voted in whereby energy suppliers were obliged to purchase electricity generated by renewable sources at a price fixed by law. A project to phase out nuclear-generated energy in the medium term was outlined, and major efforts were made to improve both energy efficiency and renewable energy. The aim of this new policy was to increase energy security and combat climate change. It also embodied Germany's strategic industrial decision to make the country a world leader in green technologies and renewable energy. In 2000, Germany's installed wind power capacity was already higher than 6,000 MW (as against only 68 MW in France in the same year, see **FIGURES 19** and **20**).

This energy policy has also enabled Germany to build one of the most important sectors of its economy and create a great many jobs. In 2004, renewables accounted for 160,400 jobs; by 2010, this had risen to 267,400 jobs, including 120,000 jobs in solar energy and 96,000 in wind energy in the areas of manufacture, planning and installation, operating and maintenance. In the space of ten years, the number of jobs increased almost fourfold and is expected to reach 500,000 by 2020. In 2009, the sector's turnover (investment and operations) amounted to 33.4 billion euros, of which exports accounted for 9 billion euros (**FIGURE 21**).

In 2011, the Federal Government decided to stop using nuclear energy definitively by 2020. It set the following targets for the share of renewables in electricity consumption: 35% by 2020, 50% by 2030 and

80% by 2050. It also set the following consumption reduction targets:- 10% by 2020 and 25% by 2030.

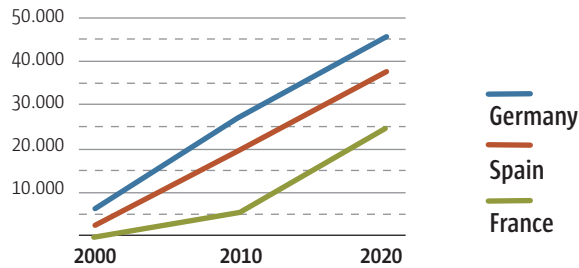
In 2007, according to Germany's Renewable Energy Agency (AEE), the prevention of damage to health, the climate and the environment meant a

62. BMU, the Federal Ministry of the Environment, the Preservation of Nature and Nuclear Safety - [www.bmu.de/english](http://www.bmu.de/english); AEE, the German Renewable Energy Agency.

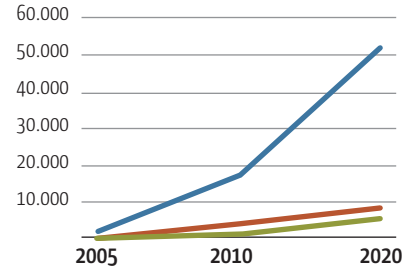




**FIGURE 19.** Installed wind power capacity in Germany, Spain and France, 2000-2020 (MW)

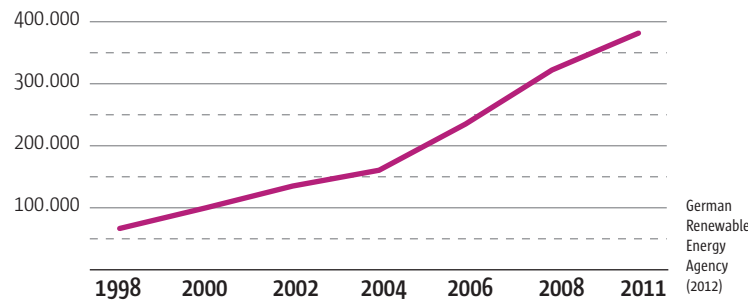


**FIGURE 20.** Installed photovoltaic capacity in Germany, Spain and France, 2000-2020 (MW)



Eurobserv'ER, EPIA (2011), Syndicat des énergies renouvelables (2011), National Renewable Energy Action Plans (2010)

**FIGURE 21.** Number of jobs created in Germany in renewable energy



German Renewable Energy Agency (2012)

saving of 8 billion euros (an estimated €70 per tonne of non-used CO<sub>2</sub>). Ceasing to use gas- and coal-burning plants has reduced the market price and resulted in a saving of 5 billion euros.

Ceasing to use nuclear energy and the concomitant upsurge in the use of renewable energy have, however, meant a major cost for the country. In 2010, investments in renewables amounted to 26.6 billion euros, including 19.5 billion in PV solar energy and 2.5 billion in wind power. In the last ten years, investment in the development of renewable energy has cost the country an annual average of over 10 billion euros. The cost of the energy transition (to achieve the 2022 targets) could increase this annual average to 20 billion euros (additional capacities and new networks)<sup>63</sup>. Germany has the highest average cost of domestic electricity (around 25 euro cts/100kWh). At present, the consumer pays a surtax of 3.5 cts/kWh; this could increase to 5 cents in 2013, so the decision to develop renewable energy calls for serious efforts in the short-to-medium term.

But the situation remains positive. Among the key factors for the success of Germany's transition to renewable energy, we might mention the following:

- A strong, unwavering political will since 1990, which considerably reduces the risk of regulation and reassures the investors;
- An effective support mechanism for both R&D and the production of renewable energy (FIT);
- A market mechanism at European level;
- An electricity network interconnected with neighbouring countries, plus the development of future interconnections in coordination with ENTSO-E to integrate the production of renewables on a large scale and further develop the European single market;
- Positive repercussions on employment and the local authorities<sup>64</sup>.

63. Vattenfall Europe.

64. A recent study conducted in several European countries shows that wind energy generates more added value per MWh produced than gas (CCGT). In Spain, for example, MWh produced by wind energy can generate an added value of €56 compared with the €16 produced by CCGTs. This is because gas is to a large extent imported by European countries and generates little income for their national economies (Ernst & Young Report, Analysis of Value Creation Potential of Wind Energy Policies, July 2012).

This policy commitment could, however, find itself undermined in future years. The increasing use of schist gas in the United States has led to the replacement of coal by gas for electricity generation in that country. The coal goes to European countries, where it is sold cheaply. This situation is leading European, particularly German, electricity companies to step up operations in their coal-burning plants and shut down their gas-burning plants, which are in fact less polluting. Consequently, the objective to reduce CO<sub>2</sub> emissions through the increasing use of renewable could be largely undermined in the short to medium term by what could be an enduring situation.

For the record, Germany's total installed electricity capacity is 160.5 GW, including 54.2 GW from renewable sources: the penetration rate of renewable energy is 33.7%, to be compared with the 28% penetration rate for South Mediterranean countries in the proactive scenario to 2030.

The purpose of North-South cooperation in the electricity and renewables sectors is to successfully duplicate the achievements of one country at a more complex region-wide level. The key factors mentioned above militate in favour of cooperation enabling the creation of a technically viable regional international system (based on renewable production + conventional production + interconnected networks + European single market) with positive repercussions on economic activities and on employment in the Euro-Mediterranean region.

The International Energy Agency, however, does emphasise the fact that the rapid upsurge in the worldwide use of renewable energy (according to the IEA, by 2015 renewable energy will be the second largest source of electricity production in the world, after coal), is dependent not only on "lower technological costs, higher fossil fuel and carbon prices, but also, and above all, on continuation of the subsidies"<sup>65</sup>. The profound changes in the energy sector in the United States (by around 2020 the USA is expected to become the world's largest oil producer), the use of conventional gases, which could maintain gas at a moderate price, the reluctance of the countries concerned to adopt a new international framework for the reduction of CO<sub>2</sub> emissions, or indeed the budget crises in one or another European country: these are all factors that must not be overlooked when estimating the future costs of renewable energy.

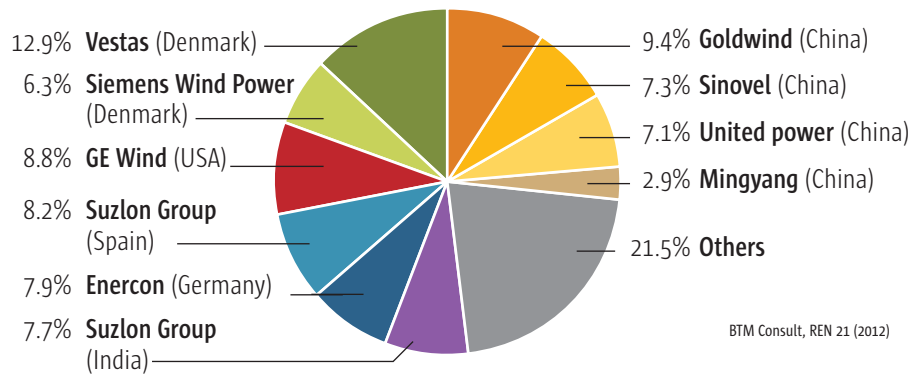
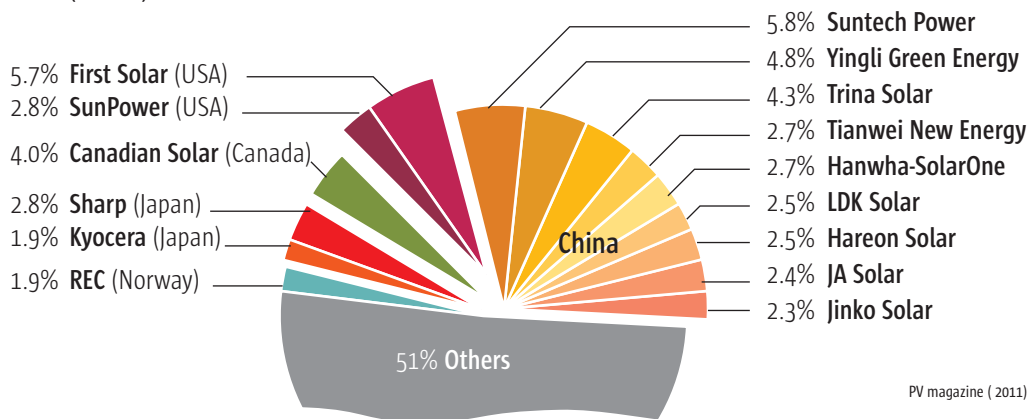
### **The opportunity to create Euro-Mediterranean industrial sectors**

TO CREATE A REAL SOURCE of added value for the countries in the Mediterranean region, increasing the number of renewable energy installations requires major industrial development in these new renewable energy sectors, which remain nonetheless exposed to international competition. In the Maghreb, there is no industrial group of international dimensions in these sectors. There is a whole value chain that remains to be developed in the wind, photovoltaic and concentrating solar power sectors. Whilst the solar radiation received by South Mediterranean countries offers advantageous perspectives for the production of solar power, SEMCs will themselves be required to contribute to this dynamic by gradually developing upstream and downstream activities in these sectors. Development perspectives need to be established with the transfer of the know-how and technologies of neighbouring European

<sup>65</sup> IEA (2012), *World Energy Outlook*.

**FIGURE 22.**

Market shares of the 10 largest wind power developers (2011)

**FIGURE 23.** Market shares of the world's leading developers of photovoltaic solar modules (2011)

companies which have the necessary innovation capacities but which are unable to grow.

In 2011, there were four European companies among the largest world-wide developers, particularly in the wind power sector (**FIGURE 22**).

In the rapidly expanding photovoltaic solar power sector, European companies are increasingly threatened by competition from Asia and are finding it hard to remain competitive. Although the European Union had nearly three-quarters of the world's installed photovoltaic solar power capacity in 2011, the European photovoltaic industry is losing major shares of the markets. Some international companies have gone bankrupt (among them Q-Cells and Solar Millennium). There were no EU countries among the fifteen leading producers of photovoltaic modules in 2011 (**FIGURE 23**). The same applies to the production of photovoltaic cells. Consequently, the European photovoltaic industry needs to redefine its entire strategy if it is to survive and invest in new technologies.

The situation in the concentrating solar power sector, which is less developed with a world installed capacity of less than 2 GW, is very different. In 2011, Spain led the world, in terms of both installed capacity (65% of world capacity) and the industrial production of concentrating solar power (CSP). Industry in this sector is integrated vertically with companies operating at different levels of the chain (R&D, design, project exploitation, ownership, etc.). The economic crisis affecting the country is, however, leading to sharply reduced subsidies and higher taxes in the sector, hence the Spanish companies are

being encouraged to seek new markets in South Africa, the USA and, more generally in Morocco and other North African countries.

Given the high solar potential of South Mediterranean countries and the job creation objectives set in the renewable energy sector by the Maghreb countries, there is a need to develop partnerships, initially Euro-Maghreb and then Euro-Mediterranean. These partnerships would derive mutual benefit in the industrial sectors on both sides of the Mediterranean, and they would also be a major component of the Euro-Mediterranean Community's energy project.

### Interconnection infrastructures

THE ELECTRICITY NETWORKS of the Mediterranean countries form a complete loop which nevertheless remains open at two points: between Tunisia and Libya; and between Turkey and Syria (FIGURE 24).

Two main distinct zones are organised around the Mediterranean Basin, within which the national networks are interconnected by alternating current:

- The first zone comprises the networks of three Maghreb countries (Tunisia, Algeria and Morocco), interconnected since 1997 with the south west European network (comprising Spain, France, Italy, the Balkan states, Greece and Bulgaria), which is itself connected to the Turkish network for which the connection tests begun in 2010 are expected to be completed by the end of 2012.
- The second zone comprises the networks of Libya, Egypt, Jordan, the Palestinian Territories, Lebanon and Syria, which have been interconnected since the mid-1990's. (Israel's electricity network is not connected to those of its neighbours.)

However, to close the loop of Mediterranean electricity networks and enable exchanges of electricity between technically incompatible regional networks, a high voltage direct current electricity transmission system will be required. This solution consists in installing, at two cut-off points, links comprising back-to-back conversion stations. The investment cost of a 500 MW back-to-back direct current link would amount to around 125 million dollars<sup>66</sup>.

The advantage of exchanges between the North and South shores has already been demonstrated by the Morocco-Spain interconnection (700 MW). These exchanges, mainly from Spain to Morocco, have enabled Morocco to make substantial savings: in 2011, Spain sold 4,582,000 MWh for 243,660,000 euros on the Spanish electricity market (OMEL). If this electricity had been produced from gas, it would have cost Morocco 320,740,000 euros<sup>67</sup>. Thus Morocco saved some 77 million euros. Cooperation of this sort means a new opening for the large-scale development of renewable energy in the southern Mediterranean, with part of it exported to the North. Ultimately, Morocco could be exporting electricity to Spain. The development of renewables for export is based on the upsurge in energy transition in South Mediterranean countries, which will help to create economies of scale faster, accompanied by the faster initiation of a virtuous circle of lower unit costs.

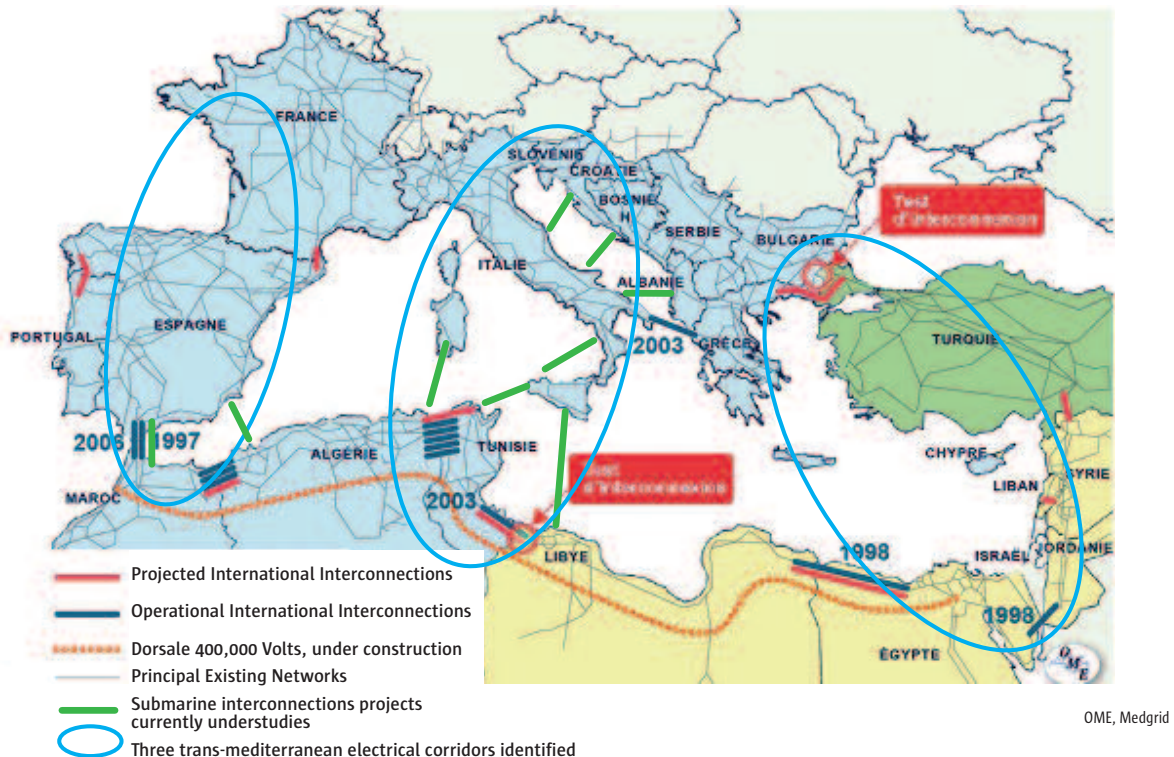
Every means of optimisation needs to be found so as to reduce the already high level of investment. South-South cooperation should also continue to increase with the closing of the Mediterranean electricity loop and the creation

66. ETN.

67. On the basis of 92.11 USD/MWh, OECD unit cost; and an exchange rate of 1USD to 0.76 euros.



FIGURE 24. Electrical interconnections in the Mediterranean region



of new trans-Mediterranean interconnections. More significant exchanges would probably result in considerable economic gains, reducing or deferring investments in the means of production: thus, for example, the 220 kV Tunisia-Libya interconnection would have a cost/benefits ratio of 12.7; and the 400 kV Turkey-Greece interconnection a ratio of 3:6 according to the Medring Update Study (MED-EMIP Project)<sup>68</sup>.

Just as the proactive scenario is a possible first step towards a significant increase in renewable production, the creation of infrastructures capable of exporting 5 GW of electricity from the south to the North shore of the Mediterranean by 2020 is a first step in regard to interconnections (cf. the EU's Mediterranean Solar Plan). Assuming that exports are made on the basis of 2,000 hours a year, 10 TWh would be exported by 2020, i.e. 1% of the potential foreseeable by certain industrial partners for 2050 (Morocco currently imports 4.5 TWh from Spain). Studies for the development of a new interconnection capacity of 5 GW are being conducted by the Medgrid consortium<sup>69</sup>. Three trans-Mediterranean, subsea corridors for the transfer of electricity have been identified: in the West, in the centre and in the East (FIGURE 24).

Medgrid is a consortium of industrial partners, launched in mid-2010 and created officially at the beginning of 2011, the purpose of which is to promote and facilitate the development of a trans-Mediterranean interconnected electrical grid which would be consistent with the ambitions of the Mediterranean Solar Plan. The aim is to integrate the electricity networks on both sides of the Mediterranean to enable exchanges of electricity in either direction depending on requirements. This is part of a real co-development initiative between the two shores. Today, the partners comprise twenty-one companies of various profiles from both sides of the Mediterranean, which have a shared

68. MED EMIP, Medring update study, Vol. 1, "Overview of the power systems of the Mediterranean basin", 2010

69. www.medgrid-psm.com.

belief in the future of renewable energy in SEMCs, as well as in the need to develop the Mediterranean electrical interconnection network. Additionally, Medgrid works closely with a number of institutions in the Mediterranean countries, the European Commission, the major government or non-government agencies, various banking institutions, etc. (APPENDIX 8). Since the creation of Med-TSO in 2012, Medgrid has also been working with the new Euro-Mediterranean network of transmission system operators.

Today, all the arguments are in favour of developing a Euro-Mediterranean electricity network: the advantages of being able to make the best use of energy resources; exploitation of the renewable energy production potential, particularly solar energy, in SEMCs; increased security of supply for both North and South Mediterranean countries; the regional integration factor, and so on. Medgrid studies in progress show that it would initially be a case of the North Mediterranean countries transferring their electricity to SEMCs, given their increasingly growing requirements<sup>70</sup>. Under the EU's energy policy, and more particularly under the Mediterranean Solar plan, Medgrid is aiming to promote and facilitate the development of this network, pointing to its feasibility and emphasising the benefits it would bring, and, ultimately, to create conditions favourable to the launching of renewable production and interconnection projects, which it does not doubt will be established.

All these regional structuring initiatives provide opportunities for promoting a proactive scenario favourable to the development of renewable electricity and making it one of the driving factors in North-South cooperation.

## What form of long-term Euro-Mediterranean energy cooperation is required to ensure energy supply and demand security?

THE ECONOMIC EXCHANGE model developed between the countries in the Mediterranean region emphasises the distortions at work. The energy and economic challenges facing the Mediterranean countries in the coming decades require new North-South relations to be defined. Another model, offering a growth potential for all the countries in the region, together with innovative strategies within the present context of a severe economic crisis, needs to be found. Forces are at work in the region. A new Euro-Mediterranean paradigm is in preparation. The energy transition may provide the framework on which a new regional energy partnership will be built.

There are a number of economic and geopolitical reasons in favour of energy integration between North, South and East Mediterranean countries:

### **Their geographical proximity strengthens the regionalisation of globalisation:**

THE MAJOR POWERS are evincing a growing interest in the region. In addition to the North American Free Trade Agreement (NAFTA), in 2005 the North American countries launched the Partnership for Security and Prosperity (PSP), of which one of the actions aimed at regional energy integration. Japan has strengthened its economic relations with East Asia. Moreover, West Africa and the Sahel are becoming areas of increasing strategic interest to European countries. At the same time, the Arab Spring pushed the European Union

70. RTE.



into proposing “a new strategy in regard to an area in the process of change”<sup>71</sup>. The political situation and the economic development of South Mediterranean countries is arousing fresh interest on the part of North Mediterranean countries in their neighbours.

**The third industrial revolution, renewable energy, has begun and is a plus for South Mediterranean countries.**

“A THIRD INDUSTRIAL revolution must take over from our current system, which is spiralling into a dangerous endgame”, emphasises economist Jeremy Rifkin. According to him, every economic era is rooted in a combination of a new mode of communication and a new source of energy. He believes that the third industrial revolution, based on the development of green energy and information technologies, has already begun. The solar potential of South Mediterranean countries gives them an advantage in accomplishing this new industrial revolution. The countries in the Mediterranean region do not, however, have similar technological capacities and opportunities for entering into this new industrial era. SEMCs need the support of the North Mediterranean countries.

**Countries in the South, both consumers and producers, want to take part in the energy transition and are ready for international collaboration in this field.**

THE WORLD IS undergoing an energy transition from a fossil model to a non-carbon, non-fossil model. The energy transition responds to the priority climate targets of countries in the northern Mediterranean (which have committed to reduce their CO<sub>2</sub> emissions under the Kyoto Protocol). It also provides countries in the South with an opportunity to grow their economies by developing new energy industries. Implementing this energy transition remains problematic for countries in the South, whose economic growth is highly dependent on the hydrocarbon sector. The fossil energy producing countries do not wish to be left behind once the new energy order has been established. In exchange for the resources they supply, they want to be involved as partners in the energy transition. They would like to make this perspective part of their national, energy, industrial and technological strategies, and set up international partnerships to this end.

**North-South relations in the Mediterranean are now characterised by common energy challenges and complementary assets**

COUNTRIES IN THE NORTHERN Mediterranean have developed considerable know-how in the domain of renewable energy and energy efficiency in transport, buildings and the industrial sector.

Several competitiveness clusters specialising in energy are developing skills and technologies. Some countries in the South possess significant reserves of hydrocarbons and all SEMCs have solar potential to develop. There is no competitive relationship between the two sides; each has something to offer the other. It is easier to build a community of interest between complementary countries than between competing energy-dependent countries.

<sup>71</sup> Joint Communication of 25 May 2011 from the High Representative of the Union for Foreign Affairs and Security Policy and the European Commission, COM(2011) 303.

**North-South energy relations cannot be restricted to commercial relations, which have shown their limits in creating value and jobs in the South**

THE ENERGY EXCHANGES developed between countries in the Mediterranean region have been restricted to simple commercial exchanges, to an import/export relationship. This has not encouraged the development of a dynamic energy sector that creates jobs in producer countries (in Algeria, for example, the energy sector accounted for 36.7% of GDP in 2011 but employed only 3% of the active population). Moreover, the rise of spot markets means that commercial relations tend to privilege the short term. European countries are being encouraged to turn to the spot market to import gas at a competitive price. It is, however, vital that they also secure their supplies over the long term, which could be achieved through a structuring partnership with SEMCs. As for producer countries, they should go from being energy sources to industrial energy players. This turnaround of perspective puts companies at the heart of regional energy strategies. Additionally, by putting the emphasis on long-term relations, both producer and consumer countries in the Euro-Mediterranean region could build lasting relationships of trust and regional energy cooperation. Only a relationship based on production and long-term cooperation can encourage the investment needed for energy transition and for a new industrial revolution in the Euro-Mediterranean region.

**An opportunity to establish regional job-creating industries**

TRADITIONAL ENERGY industries (i.e. oil and gas) and new ones (i.e. renewable energy, energy efficiency, etc.) are being organised without any particular coherence between the two sides of the Mediterranean. Countries that produce hydrocarbons in the South cannot develop their activity downstream and deliver gas right to the end consumer in Europe, which does not encourage them to invest in new deposits. In addition, if they are to develop renewable energy industries, SEMCs will need to acquire the appropriate know-how. At the same time, European companies, which are facing stiff competition, are unable to maintain their position in the top fifteen producers of photovoltaic modules, despite the know-how they have acquired. A move to organise North-South value chains in the renewable energy industries by creating segments with high added value on the south side would help transfer European know-how and create jobs. In just ten years, Germany has multiplied by four the number of jobs in the renewable energy sector.

**In the last few years, the western Mediterranean has undergone a real process of dynamic integration, and could well act as a testing ground for the whole region**

IN THE MEDITERRANEAN region, there are two geopolitical areas which follow different, even divergent, paths in terms of geostrategic issues, resources and the role of the players concerned. The eastern Mediterranean extends beyond the Bosphorus as far as the Indian Ocean and is subject to the disturbances in this area, which is characterised by a high entropic load. The western Mediterranean extends from the Maghreb to Western Europe and has a large North-South integration potential. These factors must be taken into account when developing the Euro-Mediterranean partnership; and the two





geopolitical areas should be seen through the prism of two separate but convergent integration processes.

Given the strong complementary factors between the Maghreb countries and Western Europe when it comes to a requirements/resources balance, and the strong fabric of cultural, historical and linguistic relations that has been woven, the western Mediterranean seems to offer a suitable framework for starting up a new type of energy-based partnership. The EU-South Mediterranean “Energy Community” project envisaged by the European Commission adopts the same approach: “[a community] starting with the Maghreb countries and possibly expanding progressively to the Mashreq”<sup>72</sup>.

Energy may well be the ideal means of integration in the western Mediterranean. It remains to embody this fact in intelligent projects that ensure a positive future for the entire region. It also remains to convince all those concerned, and that is probably the hardest part.

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72. COM (2011) 200 final, “Joint Communication from the Commission and the High Representative of the Union for Security and Foreign Affairs to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – a Partnership for Democracy and Prosperity shared with the South of the Mediterranean”.

## 4 Towards an energy community

THE DYNAMICS AT WORK call for the definition of a ‘New Energy Partnership’ in the region. The purpose of this partnership is to guide the energy sector towards a ‘Euro-Mediterranean Energy Community’, i.e. a community with a common destiny, uniting public- and private-sector decision-makers and players in the Mediterranean energy sector around a common goal. To come into effect, such a partnership must be based on a joint strategy and on a set of concrete actions.

### Defining a joint strategy

#### A strategy based on shared values

THE REDEFINITION of energy cooperation in the Mediterranean basin calls for a new approach from all those involved in the sector, based on a common vision. To successfully implement new, sustainable energy strategies on a regional scale, the joint, region-wide measures taken must be rooted in shared principles and values.

Establishing a new energy partnership means, first and foremost, encouraging a dialogue between all the decision-makers in the energy sector and in other business sectors that impact on energy consumption. Euro-Mediterranean energy strategies should be discussed in an open and equitable manner, between stakeholders on both sides of the Mediterranean.

Moreover, the new partnership cannot be built solely on the individual interests of each country in the region. The high level of energy interdependence that links the countries in the region, in terms of both energy flows and infrastructure, must be governed by a more effective joint approach focusing on the long term rather than the short term. Thus it is important to adopt common objectives in the following areas: production, resource management, consumption and the organisation of the value chain between different Mediterranean countries.

In addition, the exploitation of energy resources and the production, distribution and consumption of energy must be managed in accordance with sustainable development principles. Sustainably managing energy resources in the Mediterranean basin means carrying out a regional energy transition that leads to energy savings, improves energy efficiency across all energy consumption sectors and increases the share of low-carbon energy sources.

The purpose of regional cooperation in the energy sector – an idea which deserves wider support – is to promote and develop projects of regional interest.

Technical, financial and regulatory cooperation between all the stakeholders in the Mediterranean region's energy sector is vital.

As is ensuring the long-term sustainability of the new Euro-Mediterranean energy partnership by building a relationship of trust between the busi-



nesses in the sector and making sure that they fulfil their commitments to each other. This bond of trust – which is essential to the proper implementation of a regional energy strategy by the Mediterranean countries and to successful business dealings between the operators in the region – must exist between North and South, and within the South itself.

It can only be maintained through the mutual fulfilment of contractual obligations, the unimpeded transit of energy across national territories for the benefit of other countries, the development of long-term gas contracts and, ultimately, a commitment to signing an investment securitisation treaty. Such a relationship of trust also means establishing rules of access to networks in neighbouring countries and adopting common safety and security standards in the production, exploitation and distribution of energy resources.

Lastly, all of the countries in the region are seeking to secure their energy supply and to adjust supply to meet demand in their domestic market. The development of Euro-Mediterranean electricity and gas networks is strengthening solidarity between the Mediterranean countries as well as between consumers.

To satisfy domestic energy demand and to increase the share of renewables in line with objectives, each country in the region, according to its capacity, is required to provide its neighbours with all or part of the energy they need by building its transfer capacity. The energy supply security needed by European and South Mediterranean countries alike must be ensured both ways.

### **The strategic objective: establish a new regional energy partnership that will lead to the development of a Euro-Mediterranean Energy Community**

THE NEW ENERGY PARTNERSHIP proposed by Ipemed provides structural solutions to recurring problems and distortions on both sides of the Mediterranean. This multidimensional process can create a fresh climate of economic prosperity between the countries in the Mediterranean region. It is a long-term process, in keeping with the energy transition.

### **The energy transition: a structuring framework for the new Euro-Mediterranean energy partnership**

IT IS ESSENTIAL that southern countries, within the framework of this partnership, are actively involved in the major structural changes currently occurring in the international energy sector as it shifts from a fossil fuel model to a non-carbon, non-fossil model. While the exploitation and exportation of hydrocarbons will constitute one element of the North-South partnership, it will no longer be the only one since, through this partnership, countries in the South – including hydrocarbon-producing countries – will be confirming their commitment to the energy transition.

Hence the North and the South will be engaged in a multidimensional partnership based on strong complementary factors: the North is powerful but facing stiff competition from the new centres of global growth, while the South has a young and fast-growing economy, vast fossil and renewable energy resources, and is an engine of innovation and wealth creation.

The energy transition meets the different requirements of the North and the South by (i) supporting the development of renewable energy industries and low-carbon technologies and (ii) contributing to the economic development of the countries involved. Hence it provides a global framework for the new Euro-Mediterranean energy partnership.

### **First and foremost, a partnership between businesses in the Euro-Mediterranean region: companies at the heart of the new energy partnership**

EVEN THOUGH this partnership is primarily state-run, there must be room for corporate initiative. The heightened communication between companies and universities on both sides of the Mediterranean, and the resulting climate of trust, should encourage innovative forms of partnership including North/South and also South/South capital links.

In the face of Asian competition, the characteristic syndrome of European companies is the following. To borrow Marc Giget's 'competence tree' concept<sup>73</sup>, European companies have their roots in a rich body of fundamental scientific disciplines; their production processes, i.e. the trunk of the competence tree, are efficient and innovative, as they are continuously fed with knowledge and are capable of bringing about technological breakthroughs that overturn the rules of competition. Their vulnerability lies in the branches of the tree, i.e. in the relationship between product and market. Unbridled competition from their Asian rivals prevents them from raising their experience curve and reaching critical size. The reverse engineering (copying) practised by their Asian competitors, combined with vastly oversized markets, doom European companies either to disappear or to be taken over by their Asian rivals. This is especially true of the renewable energy industry.

The regional partnership will put European companies back on the offensive. It will help them to reach critical size, thanks primarily to the exceptionally sunny climate and the presence of gas deposits large enough to very substantially boost the profitability of solar power stations through the implementation of hybrid solutions; from an industrial and technological perspective, it will put them back in the number one position. Ultimately, the Maghreb could become Europe's power supply, while creating a virtuous circle including companies and universities on both sides of the Mediterranean. Energy would be a more powerful lever for regional integration than coal and steel were for the European Community.

### **The development of co-production will be reflected in upstream/downstream – North/South integration partnerships in the Mediterranean energy industry**

THESE PARTNERSHIPS will enable risk sharing throughout the chain between customers and sellers, and will give sellers access to revenue from the downstream side. National companies will be able to sell gas and kilowatt hours directly to the end-customer in Europe. They will have access to downstream profits and, by controlling the market risk, will be able to offset the volume risk that they are taking in developing the upstream side of gas supply chains. They will reverse their strategic position by directly opposing their competitors, particularly in the Middle East. They will no longer regard the volumes produced

73. Giget, M., *La dynamique stratégique de l'entreprise* (Corporate Strategy Dynamics), Dunod, Paris, 1998.



by their competitors as a threat, but as an opportunity. In exchange, European energy companies will be able to strengthen their position in the upstream activities of producing countries and thus – under similar technical and economic conditions – will have an advantage over their competitors located outside of the Mediterranean region.

Real upstream-downstream energy chains will emerge, enabling power producers on both sides to expand their strategic possibilities. The partnership could be extended to include capital links. The development of national companies could also come about within a South-South framework, the aim being to create powerful energy production and supply channels comprising energy companies on both sides of the Mediterranean. The value chain must be divided between the North and the South, including intellectually-intensive activities. This will create new opportunities for European SMEs, through partnerships with companies in the South. Such partnerships will give companies in the North a competitive edge over their Asian counterparts.

Original solutions for the Maghreb should perhaps be sought too, enabling market leaders like Sonatrach to get involved in the downstream gas supply chain and in electrical power generation in neighbouring Maghreb countries, and to sell gas and kilowatt-hours to the end customer. This could help them reach the critical size needed to be competitive, and strengthen their positions in other markets. Failing this, it is hard to imagine hydrocarbon producers in the South distributing large volumes to their immediate neighbours, when their market shares in Europe are being threatened by newcomers. This threat is all the more serious because the industry is going through a period of upheaval due to the emergence of non-conventional gases and to the global economic downturn. In this respect, regional joint ventures would seem to be a viable option. This could be a fast track to success for the Maghreb project which, like the European coal and steel project, will be reliant on the corporate sector. Such solutions are in keeping with the European project and could even inject new life into it, as they stem from the same philosophy. They will interact strongly with the dynamics at work in the western Mediterranean, ultimately creating a single drive towards a Euro-Mediterranean partnership and Maghreb integration.

### **This partnership will create political stability in producing and transit countries**

THE STABILITY ITSELF will result from shared prosperity and therefore successful regional integration. This brings us back to the fundamental principles of the Barcelona Declaration, which are still of current interest. The goal is to create a virtuous circle that will turn the Maghreb into a ‘strip of prosperity’<sup>74</sup> capable, subsequently, of spreading prosperity along a North/South corridor. This could contain the deep disorder that extends across the Maghreb from its southernmost boundary, with the Sahel becoming the southern border not only of the Maghreb but also of Europe.

74. J.L. Levet and M. Preure, *France – Algérie. Le grand malentendu*, (France - Algeria. The great misunderstanding). L’Archipel, Paris, 2012. Page 29 et seq.

### **A partnership based on scientific and technological cooperation**

IT IS ESSENTIAL THAT SEMCS have a good command of science and technology, and that they are able to create innovative processes. This could be accomplished with the help of universities in different Mediterranean countries and

through the identification of new forms of cooperation between universities and businesses. Cross-fertilisation between research and industry will be encouraged by the joint development of technology parks, which will provide a framework for the partnership between companies on both sides of the Mediterranean. For universities in the Maghreb, this is a historic opportunity to grow. Innovative European companies could really stride ahead in the technology of photovoltaic, wind power and, above all, hybrid solar-gas power plants. Renewable energy could really take off within the framework of this new Euro-Mediterranean energy partnership. The solar potential of Algeria and Libya, coupled with existing gas reserves, could lead to the development of unique technological expertise and excellence in hybrid gas-solar power generation. This would justify the creation of industrial champions consisting of companies, universities and research centres in SEMCs and North Mediterranean countries.

### **The nuclear power industry could be placed under a technology watch**

EVEN THOUGH THE NUCLEAR industry accounts for only 6% of the world's energy supply and it has not yet recovered from the after-effects of Fukushima, it is still an important source of energy and will become even more important in the second half of this century with the introduction of fourth-generation reactors. When this time comes, the new energy paradigm will require new energy systems in the Mediterranean region, which will have to include nuclear power. It will also require new forms of partnership, which will take responsibility for the electricity needs, safety constraints and geopolitical concerns associated with non-proliferation. New partnerships could be established to conduct research into low- and medium-capacity reactors (300 to 500 MW), coupled with sea water desalination plants. Nuclear power could be the best means of addressing the serious problem of water stress on the southern edge of the Mediterranean. As for the recurring issue of uranium enrichment, the beginnings of a solution could be found in sharing the responsibility for enrichment activities and developing the whole fuel cycle process within the framework of a very long-term and forward-looking partnership.

THANKS TO THIS 'STRUCTURED' complementarity, the development of a Euro-Mediterranean energy project based on the optimal use of energy resources is possible. It should encourage fossil energy producers to diversify their portfolio of activities and skills and hence to develop the production of renewable energy – and ultimately, perhaps, nuclear energy – all within the framework of North-South partnerships.

Meeting this long-term objective demands that a certain number of prerequisites are met:

- The convergence of economic dynamics between SEMCs and NMCs, and between SEMCs themselves. Such convergence implies a certain degree of sub-regional integration on each side of the Mediterranean;
- A strengthening of the partnership between energy companies and businesses that operate in the energy sector as sub-contractors or equipment manufacturers;
- A real partnership between universities;



- Discussions on the design, implementation and adjustment of energy policies;
- The sharing of best practices;
- Equivalent energy efficiency norms and standards. Europe, which is a long way ahead as far as energy efficiency is concerned, will have to assist the southern countries in bringing their standards up to par. At the same time, local engineering methods in SEMCs (for example, raw earth construction) must be rehabilitated, as they provide solutions to the chaotic growth in energy consumption. North Mediterranean countries must be wary of imposing their ideas without taking into consideration the traditional technological potential available in SEMCs, which could make European companies more competitive;
- Structural measures to inform and raise the awareness of consumers, in order to bring consumption patterns into line with energy efficiency standards. The goal is to encourage new consumption habits in populations which, over the last few generations, have seen the use of commercial energy become increasingly widespread. Adjusting consumption habits is an important means of saving energy, including in producing countries.

## Priority actions for an energy community

SEVERAL CONCRETE actions must be taken as a matter of priority, in order to establish the new energy partnership and show that it will generate added value for the region. These projects could provide the foundations for the Euro-Mediterranean Energy Community.

### Setting up structure-building energy projects in the region

THE ENERGY PROJECTS proposed in this section are structure-building, cross-disciplinary and multidimensional. They should not be confused with the pilot projects presented below, which are shorter, serve an instructive purpose, and are designed for the purpose of exploring and defining new approaches. Several priority projects have been identified.

#### I. Involve both North and South in coordinating the joint strategy

A STEERING COMMITTEE must be set up to ensure that both North and South are equally involved in managing the joint strategy. The Secretariat of the Union for the Mediterranean could play an instrumental role in this undertaking. The most practical way to proceed would be to start off with bilateral projects and then move on to integration between the 5+5 dialogue countries in the western Mediterranean, followed by proposals encompassing the entire Euro-Mediterranean region. The feedback could then be used to define innovative new approaches on a Euro-Mediterranean scale. The steering committee would be composed of ministers or of high-ranking representatives of the energy ministries in the countries concerned, along with public- and private-sector figures from the energy industry and representatives of professional networks in the Mediterranean region.



The purpose of the steering committee would be to help build a new energy partnership that is comprehensible and acceptable to both sides of the Mediterranean. The debate between the different players in the region's energy sector must be monitored in order to pinpoint areas of concern and of convergence. This flexible organisation could identify priority actions, facilitate cross-integration between North and South, and support regional initiatives and pilot projects in favour of the new partnership. It would be the first building block in the development of the Euro-Mediterranean Energy Community.

## **2. Update legislation and technical standards to encourage a partnership approach**

NATIONAL GOVERNMENTS in the region must support this process by updating their legislation in order to facilitate the development of a partnership approach:

- Encouragement of FDI (single point of contact, transfer of profits, land-use problems, securitisation of investments, etc.);
- Support for public-private partnerships across the whole chain;
- Support for innovative initiatives (venture capital, tax credits, etc.) and for co-production;
- Strengthening of the Association of Mediterranean Regulators for Electricity and Gas (Medreg).

## **3. Promote energy efficiency policies**

IT IS ESSENTIAL to encourage countries in the South to implement and monitor demand side management programmes (potential energy savings of around 30%, according to experts):

- Develop common energy efficiency standards and norms in construction, transport and industry;
- Reinforce the network of energy management agencies in the Mediterranean region (Medener), so that it can help introduce ambitious energy efficiency policies.

## **4. Strengthen grid interconnections to move towards a common area and ensure network fluidity**

- In 2013-2014, finalise the technical and economic master plan for a trans-Mediterranean network capable of exporting around 5 GW to Europe by 2020 (coordinated by the industrial initiative Medgrid);
- Strengthen technical and technological cooperation between NMCs and SEMCs through trans-Mediterranean grid connection projects;
- Regularly survey the needs and projects of each country in order to have global information on the development of Mediterranean networks (Med-TSO network).

## **5. Propose new industrial links in the energy sector through co-production and the development of Euro-Mediterranean channels (cross-integration)**

THE HYDROCARBON INDUSTRY is a long-term, capital-intensive, international and vertically-integrated industry. If the 'take or pay' principle in gas contracts comes under threat from the rival spot market and, at the same time, hydrocarbon companies in the South are not allowed to access the ups-





tream market in the North, they will no longer be able to invest the funds needed to supply enough gas to meet future demand.

Sonatrach, which is an international company, does not intend to open its capital to foreign investors but it does aspire to be one of the top ten hydrocarbon companies in the world. It aims to operate across the entire value chain, right to the end customer, and to develop its renewable energy offering. It is not in opposition with European energy companies; on the contrary, a partnership could create synergies. Such a partnership could lead to the creation of joint subsidiaries between southern and European companies across the entire energy supply chain from the upstream to the downstream end, in both the fossil fuel and the renewable energy sectors.

THUS THE EURO-MEDITERRANEAN Energy Community would be a source of new opportunities for companies. It should help SEMCs to develop a real productive system, in tandem with that of European countries.

This project involves taking several measures:

- Involve national governments in the Euro-Mediterranean region in bringing energy market players closer together and encouraging corporate initiatives;
- Study the energy sectors in the Mediterranean countries and develop regional industrial channels;
- Identify the potential for industrial champions and SMEs in the energy sector in both SEMCs and Europe, pending the definition of partnership-based solutions to their development problems;
- Cross-integrate national and international companies in the region and explore strategic partnership possibilities (joint ventures, jointly-owned subsidiaries, co-location, etc.);
- Create B-to-B websites and forums allowing industrial companies and SMEs to discuss their needs, the sharing of information on industrial and commercial legislation, and networking between entities that have decided to build partnerships with their Mediterranean counterparts.

## **6. Build partnerships between industry, universities and research centres**

ENERGY COMPANIES, universities and SMEs in the southern Mediterranean are not sufficiently involved in the development of renewable energy, new technologies or indeed nuclear power (for the longer term).

The following four energy sectors provide opportunities for international partnerships between the industrial, academic and research communities:

- Hydrocarbons: Algerian energy companies aim to become major fossil fuel seekers and to enhance the recovery of deposits in Algeria; in addition, they aspire to become technological leaders in emerging fields such as natural gas liquefaction and non-conventional gases;
- Renewable energy: industrial companies in the North Mediterranean wish to maintain their technological leadership position in the renewable energy sector; those in the south Mediterranean wish to develop their expertise in this sector, and also become leading players in the hybrid solar-gas power industry (in gas-producing countries);



- Nuclear power: operators in SEMCs and NMCs are monitoring developments in the nuclear sector (small- and medium-sized reactors coupled with sea water desalination plants);
- Energy efficiency: a great deal of awareness-raising still needs to be done. Regional energy efficiency standards in construction, transport and industry must be established.

A regional dynamic must be created, in which all those who work in the energy sector and in affiliated fields in universities and research centres know each other and share their knowledge and skills. A regional impetus is needed.

TO ACCOMPLISH these priority tasks, governments must encourage corporate initiatives. However, companies must make sure that they stay at the leading edge of their field by exploring new avenues, maintaining a technology watch and showing initiative and imagination in everything from customer/supplier relations to strategic partnerships and indeed capital links. This approach should already be apparent in the invitations to tender for public contracts issued in SEMCs, and should foster the development of co-location projects.

### **Pilot projects proposed to further the state of knowledge and promote cross integration**

**LPG in Corsica:** consumers in Corsica are unhappy with the delays in the Galsi gas pipeline project. Corsica's electricity supply comes from two obsolete diesel-fired power plants. Yet Algeria produces a surplus of LPG and could supply Corsica. Regasification is not a valid option for Corsica, as the cost would be too high compared with the size of the market. But propane islands could be set up to supply homes and an electric power station with LPG. Such a project would encourage the development of partnerships with regions with similar energy supply set-ups (isolated and mountainous regions with low population densities, etc.).

**Development of hybrid solar-gas power plants:** the hydrocarbon sector could create a virtuous circle that would enable solar power to develop. A project could be developed based on an industrial partnership between an Algerian energy company and a European energy company, and involving SMEs and universities on both sides of the Mediterranean. This partnership would transfer technological expertise to the South and would stimulate the growth of research centres and companies in Europe and the Maghreb.

**GDF-Suez / Sonatrach partnership:** extend the upstream partnership (based on the Touat gas field in south-west Algeria) through a downstream partnership in the French market, based on the creation of a jointly-owned subsidiary able to operate as an independent power producer (IPP).

**Organisation of competition between SMEs specialising in energy-efficient buildings:** competitions should be organised to encourage the creation of joint ventures or partnerships. The competitions would be open to SMEs and universities and would lead to the development of benchmark projects on energy



efficiency in the construction sector. An energy efficiency award could be created to reward innovation, excellence and initiatives aiming to strengthen North-South development. It is vital to combine Europe's technological know-how in this field with the ancestral practices of the South, in order to create a regional engineering community capable of implementing new approaches in the building sector.

**Disseminated/decentralised system, wind power, photovoltaic, solar water heaters:** If, for example, 50% of Algerians were to produce 10% of their own electricity, energy consumption would drop by 5%. A network of micro-enterprises should be set up to produce solar water heaters, PV equipment and low-capacity wind turbines. Such an approach would promote the creation of green jobs. It could culminate in the mobilization of savings and jobs for the unemployed which, in turn, would lead to greater wealth and a carbon-free energy supply. By bringing together project sponsors to create these small-scale systems, we could establish an environment in which innovative companies working in partnership with a university are subsidised to develop renewable energy production equipment or a material with outstanding heat insulation properties, the end goal being to make these innovations available in the public domain. Micro-enterprises operating in this field should be assisted rather than obligated to buy patents. There are a lot of innovative SMEs in Europe and the Maghreb that deserve such support.

#### **Transfer of knowledge and technology to the South (training, R&D)**

THE NEW PARTNERSHIP should encompass the establishment of a Euro-Mediterranean Energy Institute. Based on already existing centres in the region, this institute would act as a melting pot of regional experience and know-how. It should facilitate the transfer of knowledge and technology from the North to the South. A possible first step towards this could be to bring together the French Institute of Petroleum and Renewable Energies (IFPEN) and Sonatrach in a strategic partnership focusing on fast-expanding energy sectors, such as the production of natural gas (conventional and non-conventional), gas liquefaction, hybrid power generation, solar power stations, etc. The partnership would potentially grow to encompass the whole of the Maghreb.

The institute would focus on four areas: rational energy use and sustainable development; hydrocarbons; electricity, renewable energy, electrical networks; nuclear technology watching and sea water desalination.

Each of these areas could be developed in a special centre set up in a selected country. The institute's activities would include: documentation, training, research, engineering.

It could bring together existing capacities in the different countries concerned, and incorporate them into a network. It could also pool initiatives and structuring actions, thus enhancing the capitalisation of experience. It would interact closely with the universities and energy companies in the countries concerned, and would accelerate their development.

## The sequential approach

THE PROJECT TO ESTABLISH a Euro-Mediterranean Energy Community is a long-term project. Action must be taken on two levels at the same time: the Euro-Mediterranean level and the western Mediterranean level, which is much easier to mobilise and which could act as a testing ground for the whole region.

### Towards a Euro-Mediterranean approach

IN PARALLEL WITH THE EU debates on the European Energy Community project, Ipemed recommends considering the possibility of a Euro-Mediterranean Energy Community. Doing this would not add further complications, but would be a new source of opportunity for Europe on the energy front. By incorporating countries that produce hydrocarbons and solar energy into the current negotiations, it would be easier to reach a compromise between all partners in the region. In addition, it would reduce Europe's dependence on a single energy producer.

This approach means:

- Involving interested southern Mediterranean countries in projects relating to the Euro-Mediterranean component of the European energy project;
- Setting up organising committees to work on standards, interconnections and energy networks and markets at Euro-Mediterranean scale, some of which are already in operation.

In parallel with the process of integration through energy standards and markets, which is already occurring between the two sides of the Mediterranean, strategic energy partnerships designed to improve energy exchanges between countries in the region should be developed without delay.

### The western Mediterranean is easy to mobilise

IN THE SHORT TERM, the western Mediterranean appears to be a suitable geographical area for launching the first phase of the EMEC project. The first actions could be decided by the countries in the 5+5 Dialogue Group. As part of the European Union's reinforced cooperation procedure, several countries in southern Europe could also join forces to make propositions to Maghreb countries. Like the Franco-German initiative that was behind the establishment of the ECSC in 1950, an approach driven by two or three countries on each side of the Mediterranean would get the EMEC project off the ground in the western Mediterranean region.



## CONCLUSION

### Energy, a driving role in Euro-Mediterranean economic integration

WHEN THE ECSC TREATY was signed in 1951, each of the six member countries possessed its own coal and iron reserves, so they were all participating in the project on an equal footing. Nowadays, NMCs and SEMCs do not all have the same resources and the same energy requirements. However, they each possess different assets, which highlight the mutual gain that could be achieved through a structured and complementary partnership between countries on both sides of the Mediterranean.

Both sides could benefit substantially from a new energy partnership that is accepted by all the Mediterranean countries and puts the focus on the corporate sector: security of energy supply and demand, development of the industrial base, more jobs in the energy sector and in affiliated sectors, more competitive companies, economic benefits through economies of scale and a reduced environmental impact. Energy plays a huge role in regional integration:

- Through networks (electricity grids and gas pipelines);
- Through cross partnerships between business and industry on both sides of the Mediterranean;
- Through joint research and technological innovation programmes;
- Through the harmonisation of standards.

The development of concrete actions based on this new energy partnership – ensuring, above all, that both North and South are involved in coordinating joint strategy – will ultimately result in a Euro-Mediterranean Energy Community. The countries in the region have a large number of energy-related challenges to tackle and they, as well as the operators in the region, must be willing to move forward from an import-export model to a new regional energy model. Mediterranean countries that are ready to adopt the same productive, sustainable and united approach, and operators on both sides that are looking to enter into win-win partnerships, are invited to take the requisite decisions. Ipemed advises that:

- Mediterranean countries interested in developing a common strategy, and western Mediterranean countries in particular, should organise a 5+5 energy summit in order to define a regional approach and joint objectives regarding energy efficiency, the development of energy infrastructures (in accordance with the master plan drawn up by Medgrid), the development of renewable energy and the reorganization of gas supply agreements. This summit would be an opportunity to discuss the possibility of setting up a steering committee composed of representatives of the energy ministries in the countries concerned, along with public- and private-sector figures from the energy industry and representatives of professional networks in the Mediterranean region.

- Large companies and SMEs in the energy sector investigate the different types of partnership that they could set up with their counterparts in the South or the North, but also with competitiveness clusters, universities and research centres. Companies must get involved in this Community project, just as they did in the ECSC. However, they will not be able to do so unless they have very strong government support. They can contribute to the project by adopting an approach based on co-production and co-development.
- Professional and institutional networks in the energy sector continue to share their experiences and work more closely together in their respective fields (energy management, regulation, electricity, gas, etc.) in order to identify priority measures and define a common energy strategy.

In view of the ministerial conference on energy, which the Union for the Mediterranean has scheduled for the end of 2013 in Brussels and which will be preceded by a Mediterranean summit on energy affairs, Ipemed proposes to define – with the support of all those in favour of a new energy partnership – the founding principles of the Euro-Mediterranean Energy Community, in order to mobilise the region's decision-makers.

Beforehand, Ipemed will invite European energy ministers to pledge their support for a Euro-Mediterranean Energy Community Initiative – based on a productive Euro-Mediterranean partnership – at the European energy summit in May 2013.

Work is underway to step up integration and energy solidarity between the populations on both sides of the Mediterranean, with the full support of Ipemed and the OME.



# APPENDIXES



## APPENDIX 1 Explanatory note on the ECSC

THE EUROPEAN COAL and Steel Community (ECSC), initiated by the Schuman Declaration of 9 May 1950 (9 May is still Europe Day) and established by the Treaty of Paris signed by France, the FRG, Italy, Belgium, the Netherlands and Luxembourg on 18 April 1951, was the first ever European Community. Its purpose was to create a common market for the production and sale of French and German coal and steel, under the authority of a supranational organisation. According to its founders, this project would prevent further outbreaks of war in Europe and lay the foundations for a much more deep-rooted European Community. It paved the way for a rapprochement between France and Germany – an essential prerequisite to European construction – and laid the groundwork for supranational integration in Europe.

### History

**BACKGROUND.** The ECSC was created, first and foremost, to address the organisational problems inherent in primary industry in Western Europe at the start of 1950, in particular coal (which was the main source of energy at the time) and steel (a raw material essential to the arms industry). The problems were as follows:

- The United Nations Economic Commission for Europe warned of a risk of overproduction, as each country had developed its own production base without coordinating with its neighbours.
- The ‘Monnet Plan’ for the modernisation and economic development of France, which was financed by the Marshall Plan, was closely linked to the coal and steel resources in the Ruhr.
- In the FRG, the Allies capped steel production and established the International Authority for the Ruhr to regulate the distribution of German coal and steel in both the domestic and export markets, including France. But the FRG did not want to be the only country under international control and suggested extending it to include industries in neighbouring countries.
- The Americans and the British, due to the Cold War and the outbreak of the Korean war on 25 June 1950, wanted to make better use of Germany's potential and to raise the ceiling on steel production in the Ruhr.
- At the end of the war, the Allies had decided to break up the big industrial cartels in the Ruhr, as they had been feeding German imperialism since the end of the 19<sup>th</sup> century. The growing American demand for German steel was likely to result in a revival of the cartels.





Given the situation, the possibility of integrating certain sectors of European industry was quite frequently discussed in the late 1940s.

**THE BIRTH OF THE ECSC.** Because of all these difficulties, Robert Schuman, the French Minister of Foreign Affairs, was looking for a way to bring about a rapprochement between France and Germany. He was pressured by the need to respond to Adenauer's overtures, to come to some decision about the control of the Ruhr and Saar regions, and to draft a set of proposals to the American Secretary of State, Dean Acheson, about the organisation of Western Europe. At the end of April 1950, Jean Monnet, Commissioner General for the Modernisation and Development Plan, presented to Schuman an ambitious project to pool coal and steel production under a supranational authority. Schuman adopted it immediately, and took political responsibility for it. Instead of going through diplomatic channels, Schuman, who already had Adenauer's approval, made the French proposal public on 9 May, at a press conference designed to influence public opinion.

In his declaration, Robert Schuman explained that:

- Europe [...] will be built through concrete achievements which first create a de facto solidarity
- The coming together of the nations of Europe requires the elimination of the age-old opposition of France and Germany.
- The pooling of coal and steel production should immediately provide for the setting up of common foundations for economic development as a first step in the federation of Europe.
- The solidarity in production thus established will make it plain that any war between France and Germany becomes not merely unthinkable, but materially impossible.
- By pooling basic production and by instituting a new High Authority, [the ECSC] will lead to the realisation of the first concrete foundation of a European federation indispensable to the preservation of peace.

The common High Authority would not be composed of government representatives, but of independent figures. It would have the duty – and the power – to set up and run the common coal and steel market. The plan to establish a supranational authority was a major institutional innovation. To prevent it from being watered down during negotiations, Schuman asked the governments concerned to agree to it in advance.

Public opinion was favourable to the French initiative, and Germany, Italy, Luxembourg, the Netherlands and Belgium quickly adhered to the project.

### Content of the Treaty of Paris

**OBJECTIVES:** the role of the ECSC was to contribute to economic expansion, the growth of employment and the improvement of the standard of living in the member states, by establishing a common market for coal and steel. To do this, it had to progressively establish conditions which would in themselves ensure the most rational distribution of production at the highest possible level of productivity, while safeguarding the continuity of employment. The project provided for:

- The removal of barriers to trade (customs duties and quota restrictions);

- The elimination of discriminations in transport rates (through the establishment of direct international rates);
- The establishment of competition rules (publication of price scales and banning of cartels).

**DEVELOPMENT AND ENFORCEMENT OF THE TREATY:** immediately after the declaration on 9 May, lawyer Paul Reuter set up a committee of lawyers to identify areas of convergence and draw up a draft agreement: this would protect the progress made so far, and prevent it from being jeopardized by unresolved issues. This progress, as described in the Reuter Memorandum of 5 August, would provide the foundations of the future ECSC institutions (principles, governance). The negotiations on the project (the Schuman Plan Conference) involved France, Germany, Italy and the Benelux countries, and took place from 20 June 1950 to 18 April 1951 (10 months). On 18 April 1951, a detailed treaty was signed in Paris, instituting the ECSC for a period of 50 years. The treaty came into force on 23 July 1952, after being ratified by France. The common market was set up very quickly: it was opened on 10 February 1953 for coal and on 1<sup>st</sup> May 1953 for iron ore and scrap iron.

**THE LEGAL ACTS OF THE ECSC:** in international relations, the ECSC had the legal capacity needed to exercise its responsibilities and fulfil its objectives. The High Authority had three legal instruments at its disposal to carry out its tasks:

- Decisions, which were fully binding in their entirety;
- Recommendations, which were binding as to the aims to be pursued, but left the decision as to how to achieve these aims to the member countries;
- Opinions, which had no binding force.

## Governance

**INSTITUTIONAL ARCHITECTURE.** The Treaty of Paris established a supranational High Authority, as well as other bodies intended to provide a counterweight to the High Authority (a Special Council of Ministers, an Assembly representing the national parliaments, a Consultative Committee and a Court of Justice).

**THE FINANCIAL FRAMEWORK.** The ECSC had its own resources and was thus financially independent. These resources derived from a levy on the turnover of coal and steel undertakings. The High Authority could also contract loans and lend funds to companies in the member countries to develop their productivity and improve social conditions (reclassification of workers and building of housing).

## The achievements of the ECSC

OVER A FIVE-YEAR TRANSITION period, the High Authority, under the significant impetus of presidents Jean Monnet (1952-1955) and René Mayer (1955-1957) completed the difficult task of opening the Common Market. The opening of the common market had a number of positive effects:



- Increase in trade
- Greater market transparency
- Price stability
- Largely positive social and economic impact

But the ECSC then ran into difficulties:

- The High Authority was unable to completely eradicate secret price agreements between producers
- As of 1958, the High Authority suffered from the weakness of its presidents
- The Treaty of Rome, which established the EEC and Euratom in 1957, pushed the ECSC into the background
- In the early 1960s, the slump in sales of European coal (growing use of oil and competition from cheaper American coal) resulted in a serious structural crisis which put pressure on the High Authority (France, Germany and Italy all refused to lower their output).

IN 1967, THE MERGER TREATY (or Brussels Treaty), which combined the executive bodies of the three European Communities (EEC, ECSC and Euratom), came into force and established the European Commission instead of the High Authority. The ECSC Treaty expired on 23 July 2002.

## APPENDIX 2 European publications that address the subject of energy in the Euro-Mediterranean region (since 2010)

**European Commission, Communication COM (2010) 639 final of 10 November 2010**, entitled Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – *Energy 2020 A strategy for competitive, sustainable and secure energy*:

- “In this context, 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, in particular in the Mediterranean region and with transit countries such as Ukraine and Turkey”. Priority 5, page 22
- “Proposals will also be made to set the required regulatory framework between the EU and third countries to develop strategic routes from new suppliers, notably around the southern corridor and the southern Mediterranean. Supply issues, including network development and possibly grouped supply arrangements as well as regulatory aspects, notably concerning the freedom of transit and investment security, will be covered”. Priority 5, page 22

**The European Commission and the High Representative of the Union for Foreign Affairs and Security Policy, Joint Communication COM (2011) 200 final of 8 March 2011**, entitled Joint Communication to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – *A partnership for democracy and shared prosperity with the southern Mediterranean*:

- “Establish an EU-South Mediterranean Energy Community”, §7, page 10
- “It is desirable to open a credible perspective for the integration of the southern Mediterranean in the EU internal energy market based on a differentiated and gradual approach. In the mid to long term, this would mean establishing a form of EU-Southern Mediterranean 'energy community', starting with the Maghreb countries and possibly expanding progressively to the Mashreq”. §7, pages 10-11

**European Economic and Social Committee, Opinion TEN/443 CESE 541/2011 of 15 March 2011** on “Energy supply: What kind of neighbourhood policy do we need to ensure security of supply for the EU?”

- “The (European) Union should propose a specific energy community involving the countries of the southern Mediterranean. Completion of the Med-ring electricity grid, projects in the pipeline such as Desertec, the Medi-



terranean Solar Plan, and Mediterranean cooperation itself should lead us to step up cooperation, in the Maghreb for example, in the areas of energy efficiency, renewable sources, transmission, grid interconnection, and the upgrading of generation and distribution systems”, § 4.6.2 page 9

**The High Representative of the Union for Foreign Affairs and Security Policy and the European Commission, Joint Communication COM(2011)**

**303 of 25 May 2011**, entitled Joint Communication to the European

Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – *A new response to a changing Neighbourhood*:

- “Energy cooperation will be stepped up through increased energy policy dialogue aiming at further market integration, improved energy security based on converging regulatory frameworks, including on safety and environmental standards, the development of new partnerships on renewable energy sources and energy efficiency, and nuclear safety. In the medium term this could lead to extending the Energy Community Treaty to neighbours not yet party to it or, building on its experience, establishing a complementary ‘EU-Southern Mediterranean Energy Community’”, § 2.3 page 12

**European Commission Communication COM(2011) 539 final of 7 September**

**2011**, entitled Communication from the Commission to the European

Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on security of energy supply and international cooperation – *The EU energy policy: engaging with partners beyond our borders*.

- “In the future, a similar approach could be considered to set up a framework providing an appropriate legal and political basis for the import of renewable electricity from the southern Mediterranean”. § 1.1, page 5
- “The importance of the Mediterranean region in EU energy supplies is growing, both for fossil fuels and potentially for electricity from renewable sources. The EU should therefore be more actively engaged in promoting the development of energy infrastructure in this region”. § 1.2, page 6
- “Promote cooperation on renewable energy projects with the South Mediterranean countries, notably in the framework of the Mediterranean Solar Plan, with the launching of pilot solar plant projects in 2011-2012”. page 6
- “The energy situation in the southern Mediterranean calls for special ambition. Energy demand in the region is expected to double from the current level by 2020. Urgent market reform is needed to stimulate investments in clean and efficient energy and low-carbon energy technologies. As a first step, the EU is ready to work on developing a ‘EU-southern Mediterranean energy partnership’ focussed primarily on the development of renewable energy”. § 1.3, page 8
- “Future EU-Libya energy cooperation could encompass a wide range of topics including also renewable energy, electricity and energy market management, and endeavour to facilitate Libya’s full integration in regional and EU-Mediterranean energy cooperation structures. Furthermore, the EU will support European companies’ efforts to help restore the country’s potential for the export of oil and gas supplies”. § 2.1, page 11
- “Create a forum with interested partners in the Mediterranean for actively promoting the highest offshore oil and gas safety standards in the region”. § 2.4, page 16

**Conclusions of the European Council 17615/11 of 24 November 2011**, on strengthening the external dimension of the EU energy policy:

- “Efforts should be intensified with a view to: enhancing energy security (...) notably through: (...) proposing to Mediterranean countries a partnership initially focused on electricity and renewable energy, under the Union for the Mediterranean and building on the Mediterranean Solar Plan”. § 3. c) page 7

**European Commission, Communication COM (2011) 885 final of 15 December 2011**, entitled Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – *Energy roadmap 2050*.

- “The EU will continue encouraging and facilitating the development of renewable and low-emission sources of energy in the southern Mediterranean and interconnections with European distribution networks”. b) page 12
- “To exploit renewable electricity from the North Sea and the Mediterranean, significant additional infrastructure, notably subsea, will be needed”. b) page 18

**European Commission, Communication COM (2012) 271 final of 06 June 2012**, entitled Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – *Renewable energy: A major player in the European energy market*:

- Projects under development that could use cooperation mechanisms include the 'Helios' solar power project of Greece, common projects or support schemes in the Northern Seas, and similar initiatives in the southern Mediterranean and in the European Neighbourhood Policy area more broadly”. §3, page 6
- “the Commission (...) will facilitate international cooperation on renewable energy development by both enabling full use of the cooperation mechanisms which could develop renewables in the southern Mediterranean and, in the context of strengthening EU-southern Mediterranean policy dialogue on climate change, seek a mandate for the negotiation of bilateral/multilateral agreements(s) to allow for the use of credits from renewable energy projects in the southern Mediterranean”. a) p 6-7
- “propose specific measures aiming at encouraging trade of electricity from renewable sources in the framework of a future agreement with North African partners, e.g. on the basis of specific negotiating mandates, paving the way towards an EU-southern Mediterranean energy community”. b) p 7

**The High Representative of the Union for Foreign Affairs and Security Policy and the European Commission, Joint Communication JOIN(2013) 4 final of 20 March 2013**, entitled Joint Communication to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – *European Neighbourhood Policy: Working towards a stronger partnership*:

- “The EU and its Mediterranean partners made limited progress towards setting up a Mediterranean Energy Community in the future”.



## APPENDIX 3 Oil and gas production capacities in South and East Mediterranean countries and in Europe

**TABLE 17.** Oil production and refining capacities in SEMCs

	Production (Mt)		Refinery Barrels/day (in thousands)	
	2010	2011	2010	2011
Algeria	75.5	74.3	NC	500
Egypt	35.0	35.2	NC	747
Libya	77.4	22.4	1 770	510
Morocco	0.0	0.0	NC	80
Syria	19.1	16.5	NC	–
Tunisia	3.8	3.7	NC	30
<b>TOTAL</b>	<b>210.8</b>	<b>152.1</b>		<b>≈ 1.987</b>
Turkey	–	–	613	613
<b>TOTAL (2)</b>	<b>210.8</b>	<b>152.1</b>	<b>NC</b>	<b>2.480</b>

BP Statistical Review of World Energy (June 2012), Oxford Business Group, Rapport Sénat 2012, Ubifrance

**TABLE 18.** Oil production and refining capacities in European countries

	Production (Mt)		Refinery Barrels/day (in thousands)	
	2010	2011	2010	2011
Germany	–	–	2.091	2.077
Belgium	–	–	813	823
Denmark	12.2	10.9	–	–
Spain	–	–	1.427	1.467
France	–	–	1.702	1.610
Greece	–	–	440	498
Italy	5.1	5.3	2.396	2.331
Norway	98.6	93.4	310	310
Netherlands	–	–	1.274	1.276
Roumania	4.3	4.2	–	–
United Kingdom	63.0	52	1.757	1.757
Sweden	–	–	422	434
<b>TOTAL NMCs*</b>	<b>5.1</b>	<b>5.3</b>	<b>5.965</b>	<b>5.906</b>
<b>TOTAL</b>	<b>183.2</b>	<b>165.8</b>	<b>12.632</b>	<b>1.2583</b>

\* North Mediterranean Countries.

BP Statistical Review of World Energy (June 2012).

**TABLE 19.** Gas production in SEMCs in billions of cubic meters and in Toe

	Production 2010	Production 2011
	In bcm	
Algeria	80.4	78.0
Egypt	61.3	61.3
Libya	16.8	4.1
Syria	7.7	8.3
<b>TOTAL</b>	<b>166.2</b>	<b>151.7</b>
	In Mtoe	
<b>TOTAL</b>	<b>149.6</b>	<b>136.5</b>

BP Statistical Review of World Energy (June 2012)

**TABLE 20.** Gas production in European countries in billions of cubic meters and in Toe

	Production 2010	Production 2011
	In bcm	
Germany	10.6	10.0
Denmark	8.2	7.1
Italy	7.6	7.7
Norway	106.4	101.4
The Netherlands	70.5	64.2
Roumania	10.9	11
United Kingdom	57.1	45.2
Total NMCs	7.6	7.7
<b>Total</b>	<b>271.3</b>	<b>246.6</b>
	Mtoe	
<b>TOTAL</b>	<b>192.8</b>	<b>181.3</b>

BP Statistical Review of World Energy (June 2012)



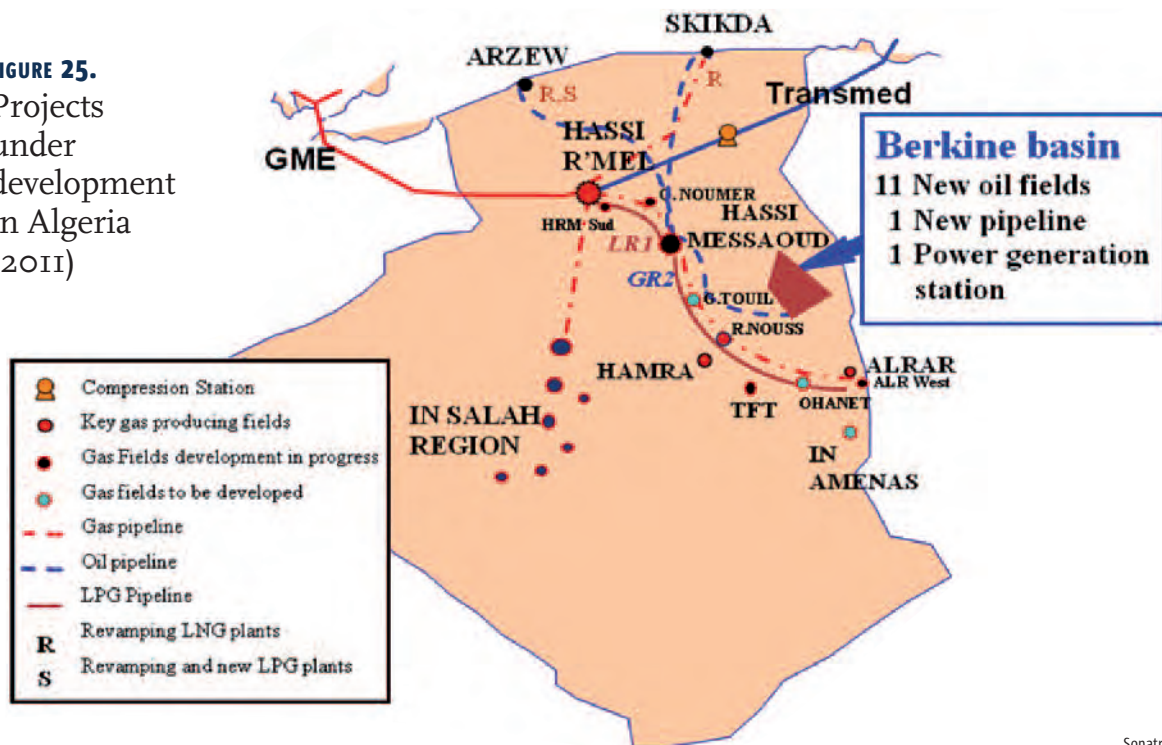


## APPENDIX 4 Presentation and appraisal of the oil and gas production chain in Algeria

### Exploration

ALGERIA'S OIL and gas potential is high and is regarded as prospective for exploration. Nevertheless, it is still under-explored. The mining area stretches over 1.5 million sq. kilometres, only half of which has been prospected. The drilling density is low, with only 14 wells per 10,000 sq. kilometres (as opposed to 100 worldwide). The highest drilling density is in the Berkine Basin in the Sahara (57 wells/10,000 sq. kilometres).

**FIGURE 25.**  
Projects  
under  
development  
in Algeria  
(2011)



Sonatrach

### Hydrocarbon production

OIL DEVELOPMENT is based on the oil fields in Hassi Messaoud and the Berkine Basin. Algerian oil production remains at a steady level of 1.729 million barrels per day. The Hassi Messaoud oil field and its peripheral area account for over one third of production, followed by the Berkine Basin and Tin Fouye Tabankort oil fields in south east Algeria.

The Hassi R'Mel gas field accounts for 60% of the national production of natural gas. Gas development is continuing, based on the gas fields currently under development. Gas production amounted to 78 billion cubic meters (bcm) in 2011, 3% less than in 2010. This fall-off in production, in evi-

**TABLE 21.** Trend in Algerian hydrocarbon production

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2011/2010
Oil (m b/d)	1.652	1.680	1.852	1.946	2.015	2.003	2.016	1.993	1.816	1.762	1.729	-1.6%
Gas (bcm)	78.2	80.4	82.8	82	88.2	84.5	84.8	85.8	79.6	80.4	78	-3%

BP Statistical Review of World Energy (June 2012)

dence since 2009, is due to the brake put on the development of Algerian upstream activities in the last decade, itself the consequence of a lack of realism in the partnership policy and inappropriate changes in the regulations. This trend does not appear to be structural, considering the substantial potential of the Algerian subsoil in terms of both conventional and non-conventional hydrocarbons. The exploitation of new oil fields (GassiTouil, Quartzites de Hamra, El Merk, South West Oilfields – Timimoun, Ahnet, Touat, Reggane, etc.) should offset this downward trend in the short term. In the medium and long terms, upstream development should start again as a result of a new, more realistic approach allowing for international partnerships between energy sector operators and for the exploitation of non-conventional gas potential, which is estimated to be comparable with American reserves. The outcome should be substantial production volumes able to keep the supply curve high over a long period of time. (TABLE 21)

### Refining capacity

SONATRACH is facing a significant increase in domestic demand and is therefore having to update and increase its refining capacity, as well as import large volumes of fuel to meet urgent requirements. In August 2012, Sonatrach announced that it was planning to import 2.5 million tonnes of fuel, including 2 million tonnes of diesel oil for 2012<sup>75</sup>.

Sonatrach has a refining capacity of 21.9 million tonnes per annum (mta), broken down as follows:

- Algiers refinery (2.7 mta)
- Skikda refinery (15 mta)
- Arzew refinery (2.5 mta)
- Hassi Messaoud refinery (1.1 mta)
- Adrar refinery (600,000 ta)

It is also worth mentioning the Skikda Condensate Topping refinery, which has a production capacity of 5 million tonnes and processed 4.66 million tonnes in 2010. The Skikda refinery is currently being rehabilitated and updated, at a total cost of two billion US dollars. This will increase its production capacity by 10%, bringing it up to 16.6 million tonnes/annum, including 4.7 million tonnes of diesel oil and 2 million tonnes of petrol. The Algiers refinery will follow, and will see its capacity climb by 35% to 3.64 million tonnes. These rehabilitation programmes will also bring Algeria's refineries into line with the new European environmental standards, in terms of product quality. In addition, the Minister for Energy and Mining announced in spring 2012 that Algeria would be investing 10 billion US dollars in five new refineries, thus bringing its refining capacity up to 30 mta.

75. L'Expression, "2,5 millions de tonnes de carburants importés, l'autre paradoxe algérien" (2.5 million tonnes of imported fuel, the other Algerian paradox), 4 August 2012.



## Transport network

THE HYDROCARBON transport network stretches over 14,000 km. It also includes complementary infrastructure:

- 81 pumping and compression stations;
- Crude oil and condensate storage facilities, comprising 118 tanks with a design capacity of 3.8 million cubic meters;
- A sea port loading capacity of almost 210 mta;
- A maintenance and repair infrastructure based on three principle maintenance facilities and three regional facilities;
- A national gas dispatch centre (CNDG) in Hassi R'Mel;
- A liquid hydrocarbon dispatch centre (CDHL) in Haoud El Hamra (near Hassi Messaoud).

The transport network is extended beyond the Mediterranean area by three trans-continental pipelines (see **FIGURE 10**) :

- The Enrico Mattei pipeline, which has a capacity of 30 bcm and links Hassi R'Mel to Italy and Sardinia via Tunisia.
- The Pedro Duran Farell pipeline, which has a capacity of 8 bcm and links Hassi R'Mel to Seville (Spain) and Setubal (Portugal) via Morocco.
- The Medgaz pipeline, which has a capacity of 8 bcm and links Hassi R'Mel to Almeria in Spain.

## LNG terminals

THE LIQUEFACTION capacity is 26.7 billion cubic meters per annum. The new LNG trains in Skikda and Arzew will provide an additional 14 billion cubic meters per annum in 2013. Four LNG plants have been built in Algeria:

- GL1K/GL2K (Skikda) : 4 Bcm ;
- GL1Z (Bethioua) : 10,5 Bcm ;
- GL2Z (Bethioua) : 10,5 cm ;
- GL4Z (Arzew) : 1,7 Bcm.

## LPG separation

ALGERIA IS ALSO a major producer of LPG. Almost 85% of the LPG produced derives from the gas treatment units in the fields. There are two LPG (butane-propane) separation facilities – with a total capacity of 8.6 million tonnes – in the industrial area of Arzew (GP1Z and GP2Z). The setting into operation of the new separation plant in Arzew, with a capacity of 3 million tonnes per annum, will bring the total volume of LPG available for export to 11.6 million tonnes per annum.

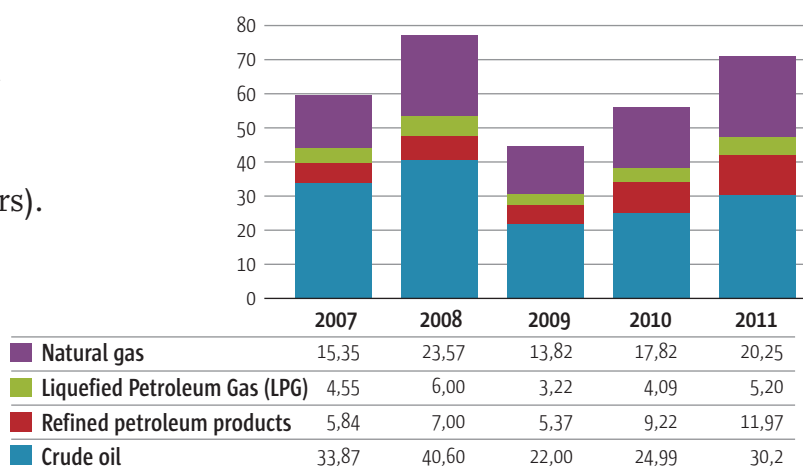
## APPENDIX 5 Hydrocarbons in Algeria's national economy

**TABLE 22.** Revenue from Algeria's hydrocarbon exports (in billions of US dollars)

	2007	2008	2009	2010	2011
Hydrocarbon exports	59.61	77.19	44.42	56.12	71.66
Exports excluding hydrocarbons	0.98	1.4	0.77	0.97	1.22

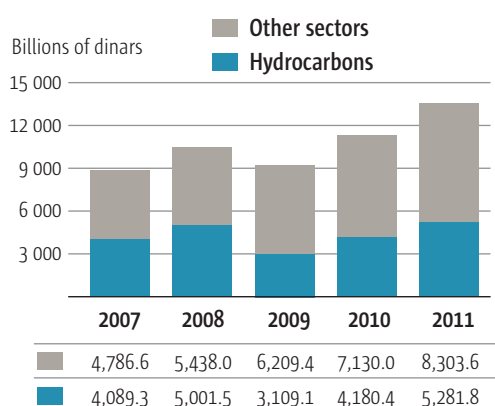
Bank of Algeria, from the National Statistics Office and the Directorate-General of the Algerian Treasury

**FIGURE 26.** Exports per product (in billions of US dollars).

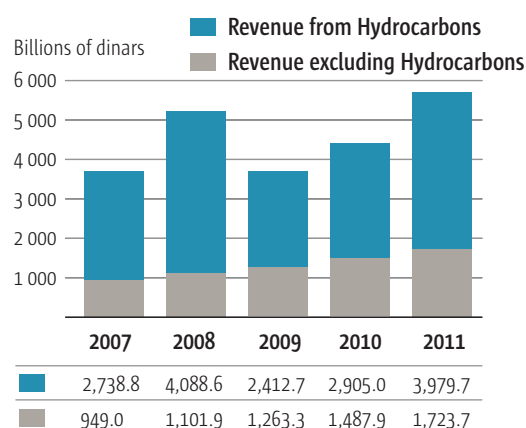


Ministry of Energy and Mining

**FIGURE 27.** Share of hydrocarbons in Algeria's GDP<sup>76</sup>



**FIGURE 28.** Hydrocarbons in budgetary revenue (2007-2011)



Bank of Algeria, from the National Statistics Office and the Directorate-General of the Algerian Treasury

76. Dinar exchange rate:  
[http://ec.europa.eu/budget/contracts\\_grants/info\\_contracts/infoeuro/infoeuro\\_en.cfm](http://ec.europa.eu/budget/contracts_grants/info_contracts/infoeuro/infoeuro_en.cfm)



## APPENDIX 6 Human resources, science and technology: What challenges in Algeria?

### Jobs in the energy sector and related industries (petrochemicals) in Algeria

THE ENERGY AND MINING sector employs 226,549 people. SONATRACH has a permanent headcount of 47,963 people, broken down as follows: 55% in its core businesses, 23% in logistics functions and 22% in support functions. SONEGAS, which is in charge of electricity and natural gas distribution, employs 52,637 people in all.

Sonatrach's main subsidiaries have a bigger total headcount (67,693 people) than the parent company:

- The petroleum product distribution company NAFTAL alone employs 29,380 people;
- The well engineering company ENTP employs 6,939 people;
- The large-scale petroleum engineering company ENGTP employs 7,000 people;
- The ENSP group, which provides specialised services to the petroleum industry, employs 2,700 people;
- The civil engineering and construction company GCB employs 6,500 people;
- The national drilling company ENAFOR employs 5,000 people;
- The national geophysics company ENAGEO employs 5,154 people;
- The national pipeline engineering company ENAC employs 2,574 people;
- The national petrochemicals company ENIP employs 2,446 people.

### The national skills base

#### Scientific and technological universities, sector-specific training centres and institutes

SOME UNIVERSITIES in Algeria have the potential to support the Algerian energy sector. Generally speaking, they have helped to train most of the executives working in the sector. However, their biggest drawback is their inability to adapt to change and to use the full range of their scientific skills to function in an organisational relationship with energy companies and commit to a virtuous cycle of cross-fertilisation. A three-way partnership with universities and energy companies in Europe could provide the structural basis needed for them to engage in such a process. The following Algerian universities and schools specialise in the energy sector:

- The University of Science and Technology Houari Boumediene in Algiers (USTHB): Schools of Mathematics, (ii) Civil Engineering, (iii) Mechanical and Process Engineering, Faculty of Physics, (iv) Electronics and Computing, (v) Chemistry;
- The University of Science and Technology of Oran M'hamed Boudiaf (USTO) offers the same subjects as USTHB;
- The National Polytechnic School of Algiers: Departments: (i) Automatics, (ii) Electrical engineering, Electronics, (iii) Plant engineering, (iv) Chemical engineering, (v) Civil engineering, (vi) Environmental engineering, (vii) Mechanical engineering, (viii) Mining engineering, (ix) Metallurgy;
- The University M'Hamed Bougara of Boumerdès was established in 1998 by grouping together six national institutes founded in the 60s, 70s and 80s [National Institute of Hydrocarbons (INH), National Institute of Electrical and Electronic Engineering (INELEC), National Institute of Mechanical Engineering (INGM), National Institute of Construction Materials (INMC), National Institute of Manufacturing Industries (INIM) and National Institute of Food-Manufacturing Industries (INIA)].

THE ENERGY SECTOR has set up several training establishments, including:

- The Algerian Petroleum Institute (IAP-CU) (School of Boumerdes and Oran): Specialised, post-graduate courses in geoscience, upstream and downstream petroleum technologies, liquefied natural gas, economics, HSE (operators, supervisors, technicians, advanced technicians, systems engineers, specialised and post-graduate state-certified engineers). Provision of services (studies, analyses and expert appraisals);
- Sonatrach's corporate training centre (CPE): Management, finance, marketing, computing, QHSE, technology;
- NAFTOGAZ in Hassi Messaoud: Basic and advanced technical training in drilling, well control, production, exploitation, computing and management;
- The Electricity and Gas Training Institute (IFEG), which has three specialised training centres: Blida, Ain M'Lila and Ben Aknoun. Training in technical fields such as electricity generation, transmission and distribution, and new and renewable energy sources.
- Sonelgaz's Technical School of Blida: Electricity and gas-related training courses. The production, transport and distribution of electricity, gas, and new and renewable energy sources.

**National organisations in the face of current technological challenges: EOR, geoscience, shale gas, renewables, nuclear electricity generation coupled with desalination, etc.**

THERE ARE SEVERAL research and engineering companies that encompass the whole spectrum of scientific disciplines from hydrocarbons to nuclear energy (with two small reactors for research purposes). Regrettably, however, Algeria is not a technologically aggressive country. Sonatrach's research centre in Boumerdès focuses much more on conducting everyday laboratory activities and on supporting upstream activities. Likewise, research into renewable energy sources is lagging behind the rest of the world.



The crisis in Algeria's university system (one of the more conspicuous aspects of which is the shortage of research staff, with the best people seeking employment abroad) is depriving operational processes – including engineering, heavy maintenance and development – of the scientific support needed to turn a company into a learning organisation and a source of knowledge creation. Hence these processes are incapable of collecting and producing knowledge, as they are not themselves rooted in fundamental scientific disciplines. At best, it is foreign companies that capitalise on the knowledge gained from experience. Engineering, which is the repository so to speak of all industrial processes and the meeting point of the associated operational activities, is virtually inexistent in Algeria.

Therefore, partnering with European companies could be the best way to achieve a virtuous circle of knowledge creation and innovation. Any such a partnership should seek to develop innovative processes across the entire industrial fabric (including energy champions and SMEs), and to bridge the gap between industry and higher education by significantly raising the standard of universities. To achieve this, the partnership must focus on engineering and include universities on both sides of the Mediterranean, which should play a driving role in the dynamics at work.

## APPENDIX 7 Power supply system in SEMCs

### The primary energy consumption of the power supply system and installed capacity in South and East Mediterranean countries

**TABLE 23.** Primary energy consumption of the power supply system (production inputs)

In Mtoe	2009	CS 2020	CS 2030	PS 2020	PS 2030
Region total	396	512	612	468	525
SEMC total	118	196	277	155	210
Share of SEMCs	30%	38%	45%	33%	40%

MEP 2011 (OME)

**TABLE 24.** Installed capacity of electrical power plants in the southern Mediterranean

In MW	Coal	Fuel oil	Gas	Nuclear	Hydroelectric	Renewables	Total
2009	1,785	9,712	34,230	0	5,029	828	51,585
CS 2030	3,446	7,892	92,036	3,500	5,457	15,657	127,988
PS 2030	1,035	6,693	60,531	6,000	5,457	39,247	119,563
CS 2020	2,489	8,119	66,976	0	5,330	9,314	92,228
PS 2020	2,213	7,829	60,099	1,033	5,330	19,930	96,658

**TABLE 25.** Installed capacity of electrical power plants in the eastern Mediterranean

In MW	Coal	Fuel oil	Gas	Nuclear	Hydroelectric	Renewables	Total
2009	17,168	10,296	23,930	0	15,959	975	68,328
CS 2030	41,149	12,855	69,209	6,100	39,090	24,796	193,199
PS 2030	13,048	8,164	55,631	11,100	39,030	42,147	169,181
CS 2020	24,233	10,447	46,458	0	26,821	13,416	121,465
PS 2020	14,985	9,244	43,248	0	26,821	20,951	115,248

IF WE COMPARE the power plant population in the southern and eastern regions, we can see that there are some similarities in respect of the development of renewable energy by 2030. However, the comparison also reveals continuing differences in energy use. For example, coal and hydroelectric power play a bigger role in the south-east.

In the conservative scenario for 2030, renewable energy accounts for 12% of the total installed capacity of power plants in the South, while it accounts for 33% in the proactive scenario. Gas accounts for 72% of capacity in the CS and 50% in the PS (TABLE 20). Renewable energy accounts for 13% of total installed capacity in the CS for 2030 and for 25% in the PS. Gas accounts for 36% of capacity in the CS and 33% in the PS (TABLE 21).

At present, the installed coal power capacity in the East is ten times bigger than that in the South. It should be noted that, for both regions, the installed coal power capacity predicted for 2030 in the proactive scenario is three times smaller than that predicted in the conservative scenario. Furthermore, the share of renewable energy in total installed power production capacity is similar in both groups of South Mediterranean countries (between 33% and 36%). It is also worth pointing out that the renewable energy production capacity will derive primarily from wind power.





## APPENDIX 8 Renewable energy capacity and generation in South and East Mediterranean countries

**TABLE 26.** Renewable energy production capacity in South Mediterranean countries

In MW	Wind power	Solar power	Others	Total
2009	817	11.6	0	828.6
CS 2020	6,987	2,327	0	9,314
PS 2020	13,986	5,944	225	20,155
CS 2030	11,955	3,702	0	15,657
PS 2030	27,007	12,240	600	39,847

**TABLE 27.** Renewable energy production capacity in East Mediterranean countries

In MW	Wind power	Solar power	Others	Total
2009	803	13.4	159	1,804
CS 2020	10,013	3,027	568	24,726
PS 2020	5,814	2,056	525	28,550
CS 2030	17,045	6,698	1,000	40,400
PS 2030	27,693	12,960	1,400	81,900

**TABLE 28.** Renewable energy production in South Mediterranean countries

In TWh	Wind power	PV	Others	Total
2009	1.6	0.02	0	1.62
CS 2020	15	4	0	20
PS 2020	31	10	1	42
CS 2030	29	7	0	36
PS 2030	67	22	3	92

**TABLE 29.** Renewable energy production in East Mediterranean countries

In TWh	Wind power	PV	Others	Total
2009	1.4	0.02	0.8	2.22
CS 2020	20	5	2	27
PS 2020	10	4	2	16
CS 2030	36	11	4	51
PS 2030	58	22	6	86



## APPENDIX 9 Presentation of Medgrid

MEDGRID IS COMPOSED of 22 companies or organisations from different backgrounds on both sides of the Mediterranean, all of which share the same belief in the future of renewable energy sources in SEMCs and in the need to develop the Mediterranean network of grid interconnections (Medgrid's members include electricity and gas network operators, electricity production companies, suppliers of equipment for renewable and non-renewable energy generation, electrical equipment manufacturers, computing service suppliers, cable manufacturers, financial establishments and investors).

### Medgrid's missions

MEDGRID'S ACTIVITIES can be broken down into four elements:

- Draw up a technical and economic master plan for a trans-Mediterranean grid capable of exporting around 5 GW to Europe by 2020;
- Promote a regulatory framework that is conducive to investment and to the profitability of investments, and that opens up the European single market to renewable energy producers in the South;
- Analyse the benefits of infrastructure investments and energy exchanges in terms of growth, economic activity and employment;
- Develop technical and technological cooperation with the South, based on trans-Mediterranean interconnection projects.

### Medgrid's work programme

TO PROMOTE THE DEVELOPMENT of a Mediterranean interconnected electrical grid, Medgrid will show how such a grid will enable the exportation of renewable electricity generated in SEMCs and the optimal use of power plants across the entire Euro-Mediterranean region, thus providing significant economic benefits and reducing CO<sub>2</sub> emissions. It will compare these benefits with the investment cost of the grid (it is estimated that the cost of creating the interconnections between SEMCs to enable the transit of 5 GW of electricity could be as much as €6 billion). Medgrid will propose the regulatory changes needed to build the grid and to use it for two-way energy exchanges between North and South, and will identify the technological developments required. The aim is to help create a climate that is favourable to investment not only in the grid but also in power generation facilities (since potential investors will be informed on the technical feasibility and the cost of transporting energy).

Medgrid's work can be broken down into five parts, each of which is managed by a dedicated team made up of shareholder representatives:

- The technical feasibility of developing the grid,



**FIGURE 29.** Depth of the Mediterranean sea



- Economic analysis,
- Financing conditions,
- Regulatory aspects,
- Technological aspects.

At the same time, Medgrid must publish the results of its investigations and take whatever steps are necessary to ensure that its recommendations regarding regulations and financing are taken into consideration.

#### **Grid development activities**

THE GOAL IS TO define the structure and ensure the technical consistency of the grid, so that it is commensurate with the volume of renewable energy exports specified in the Mediterranean Solar Plan and with economically-justified exchanges of conventional electricity by 2020/2025. This means identifying technically feasible solutions – bearing in mind both technical and cost considerations – and calculating optimal exchanges between different power supply systems based on the cost of production and on consumption requirements.

As some segments will be under the sea, the exact route of electrical interconnections will be determined essentially by the possibility of laying subsea cables which, in the medium term at least, cannot be laid at a depth of more than 2,000 m. Looking at the map below, which shows the Mediterranean seabed, we can see that Medgrid is investigating three possible interconnection routes:

- Sea and land routes from Morocco and Algeria to France and beyond, via Spain and possibly Portugal,
- Sea and land routes from Algeria, Tunisia and Libya to countries bordering Italy, via Italy and possibly Sardinia and Corsica,
- Land routes from Libya to Europe via Egypt, Jordan, Syria and Turkey (and Lebanon, Palestine and Israel): east corridor (possible alternative sea routes via Cyprus).

As for calculating optimal exchanges between power supply systems, simulation methods are used to select a power plant that is available and operates at the lowest comparable cost in order to meet the rise in consumption. This process is repeated throughout the year, according to a given schedule.

**FIGURE 30.** Laying of subsea cables



Technip

Simulations are performed a great number of times to take into account fluctuations in consumption and in the generation of conventional and renewable energy. Based on existing or potential exchange capacity, it is possible to define the optimal capacity of interconnection lines, above which investments in the grid will not be offset by savings on supply costs.

The tools are now very well-known and have been adapted for renewable energy generation, which is intrinsically more random. The main drawbacks of simulations are the lack of information on the random nature of renewable energy generation and the restricted access to commercially-sensitive information. These factors must be borne in mind when exploiting the results.

### **Economic analysis**

BESIDES ANALYSING the grid, simulations can be used to calculate the benefits of each interconnection line: overall savings on supply costs, drop in CO<sub>2</sub> emissions, reduction in renewable energy dumping, etc. It is also possible to calculate the amount of energy that passes through an interconnection line and hence the transport rate that would ensure a return on the investment. Uncertainty regarding production costs and the rate of development of green energy sources will also be taken into account by developing alternative scenarios and thus evaluating the reliability of the results obtained.

### **Financing models**

IT IS IMPORTANT to analyse how financing models and subsidies impact on grid investment and – as pointed out above – the cost of transporting electricity, which may influence production investment. Medgrid will study the variants and its findings will be taken into consideration in the economic analysis.

### **Regulations**

IN SEMCS AND THE EU, the regulations governing electricity generation and supply must be updated to enable infrastructure development and energy exchanges between power supply systems. The regulations as they stand are



quite different and the aim is not to harmonise them but to introduce minimal changes. The modifications needed to enable exchanges between SEMCs and the EU – as provided for in Article 9 of EU Directive 2009/28/EC – are obviously a priority matter, which Medgrid is currently investigating through a real-life export situation. Transport-related questions – rates and capacity development - are also being discussed, as well as the price for using subsea interconnection lines.

### **Technological aspects**

ONE OF THE SPECIFIC features of the trans-Mediterranean network is that it requires subsea links and therefore the use of direct current technology. At present, we are seeing a rapid expansion in the use of these technologies across the world and the feasibility of trans-Mediterranean links is no longer in question, insofar as we know how to identify routes that are not at great depth, as we saw above. Nonetheless, these technologies, driven by the emergence of several new markets, are still changing fast and it is Medgrid's duty to inform its members on the latest developments in energy transport techniques. In addition, it must offer to investigate any developments that will make interconnection lines easier and cheaper to build.

Trans-Mediterranean projects entail the laying of cables at great depth, unlike North Sea projects for example, where many interconnection lines have or will be installed at relatively shallow depths. It is therefore in this area that MedGrid is likely to push for new developments. Conversely, direct current technology – direct current conversion, switchgear and networks, direct current network meshing – is progressing thanks to ongoing projects all over the world (notably in Asia), and Mediterranean projects will also benefit from these projects.

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