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The Maghreb Energy Sector: Situation and Perspectives

MUSTAPHA FAÏD

The Maghreb energy situation is characterized by several dynamic factors that suggest, at the same time, serious potential for instability and great opportunity for cooperation. Energy consumption is highly disparate among Maghreb countries and far below that in the countries of the northern Mediterranean; that said, consumption is projected to increase rapidly, linked to Maghreb population growth. Energy concerns dominate the countries' external trade balances, though energy trading among them is almost totally absent, but potential for intraregional trade is high. With genuine and balanced cooperation among players, the Union for the Mediterranean could contribute to creating an integrated economic entity in the Maghreb with energy playing the lead role.

Energy Situation

The five Maghreb countries differ from one another in several ways with respect to energy, particularly the type of energy used, the level of energy consumption, and the availability of hydrocarbon resources.

Mustapha Faïd is president of SPTEC Conseil, a Paris-based consulting firm specializing in oil and gas issues. He was general manager of Observatoire Méditerranéen de l'Energie from February 2007 to June 2008.

Table 9.1 Consumption of primary energy in the Maghreb, selected years (million tons of oil equivalent)

Country	1971	1980	1990	2000	2006
Algeria	3.7	12.2	23.9	29.3	34.0
Libya	1.7	7.2	11.5	17.0	18.7
Mauritania	0.2	0.4	0.6	1.0	1.3
Morocco	2.4	4.8	6.7	9.8	12.6
Tunisia	2.0	3.8	5.5	7.6	8.9
Total	10.0	28.3	48.2	64.6	75.4

Source: Observatoire Méditerranéen de l'Energie.

Table 9.2 Primary energy consumption in the Maghreb, 2006

Country	Consumption (million tons of oil equivalent)	Population (millions)	Per capita consumption (tons of oil equivalent)
Algeria	34.0	33.3	1.0
Libya	18.7	6.0	3.1
Mauritania	1.3	3.1	0.4
Morocco	12.6	30.5	0.4
Tunisia	8.9	10.1	0.9
Total/average	75.4	83.0	0.9

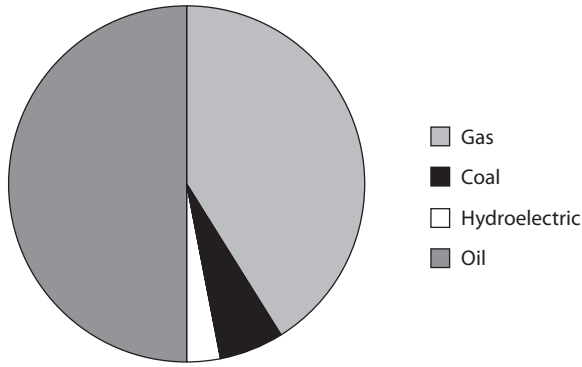
Source: Observatoire Méditerranéen de l'Energie.

Energy Consumption

The Maghreb countries' energy consumption reached 75 million tons of oil equivalent (mtoe) in 2006, up from less than 10 mtoe in 1971, an annual growth rate of nearly 6 percent over the period (table 9.1). Algeria consumes the largest share with 44 percent (34 mtoe), followed by Libya with 25 percent (19 mtoe), Morocco with 17 percent (13 mtoe), Tunisia with 12 percent (9 mtoe), and Mauritania with 2 percent (1 mtoe). Annual energy consumption per capita varies considerably from country to country (table 9.2): more than 3 tons of oil equivalent (toe) per capita in Libya but only about 1 toe in Algeria and Tunisia and barely 0.4 toe in Morocco and Mauritania.

Average primary energy consumption per capita amounts to 0.9 toe in the Maghreb; by comparison, consumption is over three times larger for the northern Mediterranean countries at 3.2 toe per capita. This discrepancy underlines the importance of energy issues to the development of the Maghreb countries, individually and as a group.

Figure 9.1 Consumption of primary energy in the Maghreb by energy type, 2006 (percent)



Source: Observatoire Méditerranéen de l'Energie.

Table 9.3 Oil consumption in the Maghreb, 1971–2006 (millions of tons)

Country	1971	1980	1990	2000	2006
Algeria	2.3	5.5	9.7	10.0	11.6
Libya	0.7	4.6	7.4	12.7	13.2
Mauritania	0.2	0.2	0.3	0.5	1.0
Morocco	1.8	3.9	5.1	6.6	7.6
Tunisia	1.3	2.5	3.2	3.8	4.0
Total	6.2	16.8	25.7	33.6	37.4

Sources: Observatoire Méditerranéen de l'Energie; BP Statistical Review of World Energy 2007.

Fossil fuels are the dominant form of energy used in the Maghreb, representing 97 percent of total energy consumption (figure 9.1).

Oil

In 2006 oil consumption stood at almost 38 mtoe, half of total primary energy consumption. Because of their large hydrocarbon resources, Libya and Algeria are the largest oil consumers in the region, at over 13 million tons and nearly 12 million tons, respectively. Consumption totaled less than 8 million tons in Morocco, 4 million tons in Tunisia, and only 1 million tons in Mauritania (table 9.3).

Table 9.4 Consumption of natural gas in the Maghreb, 1971–2006 (million tons of oil equivalent)

Country	1971	1980	1990	2000	2006
Algeria	1.2	6.5	13.5	18.7	21.6
Libya	0.9	2.5	4.1	4.2	5.3
Mauritania	n.a.	n.a.	n.a.	n.a.	n.a.
Morocco	n.a.	n.a.	n.a.	n.a.	0.5
Tunisia	0.0	0.4	1.2	2.7	3.7
Total	2.1	9.3	18.8	25.6	31.1

n.a. = not available

Sources: Observatoire Méditerranéen de l'Energie; CEDIGAZ.

Natural Gas

In 2006 consumption of natural gas reached 31 mtoe—34 billion cubic meters (Gm^3)—41 percent of total primary energy consumption in the Maghreb. Algeria, Libya, and Tunisia have all created transport and distribution networks for natural gas and consume, respectively, 21.6 mtoe, 5.3 mtoe, and 3.7 mtoe (table 9.4).

The distribution network in Algeria supplies more than 2.2 million customers, a coverage rate of 38 percent at the end of 2006. Libya consumes 5.9 Gm^3 and is developing its national pipeline network while continuing to convert power stations to natural gas. Tunisia's consumption for 2006 was 4 Gm^3. Increased capacity of the Enrico Matteï pipeline, which transports Algerian gas to Italy and Slovenia, also increased the availability of natural gas on Tunisia's local market. Morocco has only been using natural gas since January 2005. Consumption is now up to 0.6 Gm^3 of Algerian gas thanks to the first combined-cycle power plant in Tahaddart (near Tangiers).

Coal

Coal consumption is only 4.3 mtoe in the Maghreb, roughly 6 percent of total primary energy consumption (table 9.5). Morocco is the main consumer of coal in the region. However, production is in sharp decline in the Jerada coal mines in the west of the country and Morocco has to import most of the coal it uses to produce electricity. Algeria and Tunisia consume very little coal, less than 1 mtoe combined.

Table 9.5 Coal consumption in the Maghreb, 1971–2006
(million tons of oil equivalent)

Country	1971	1990	2000	2006
Algeria	0.2	0.6	0.5	0.8
Libya	n.a.	n.a.	n.a.	n.a.
Mauritania	n.a.	n.a.	n.a.	n.a.
Morocco	0.3	10.1	2.6	3.4
Tunisia	0.1	0.1	0.1	0.1
Total	0.6	10.8	3.2	4.3

n.a. = not available

Sources: International Energy Agency; Observatoire Méditerranéen de l'Energie.

Table 9.6 Consumption of renewable energies, 1971–2006
(million tons of oil equivalent)

Country	1971	1980	1990	2000	2006
Algeria	0.01	0.01	0.02	0.08	0.08
Libya	0.10	0.13	0.13	0.14	0.17
Mauritania	0.05	0.16	0.24	0.53	0.25
Morocco	0.13	0.26	0.32	0.44	0.47
Tunisia	0.67	0.82	1.04	0.94	1.00
Total	0.96	1.38	1.75	2.13	1.96

Source: Observatoire Méditerranéen de l'Energie.

Renewable Energy

Consumption of renewable energies is very low, less than 2 mtoe in 2006, of which half is consumed by Tunisia (table 9.6).

Electricity

Electricity consumption reached 91.4 terawatt hours (TWh) in 2006 (table 9.7). Average annual growth in electricity consumption exceeded 8 percent between 1971 and 2006. The share of electricity consumption for each of the Maghreb countries is as follows: 38 percent for Algeria (34.4 TWh), 26 per-

Table 9.7 Electricity consumption in the Maghreb, 1971–2006
(terawatt hours)

Country	1971	1980	1990	2000	2006
Algeria	2.2	7.1	16.1	25.4	34.4
Libya	0.5	4.8	10.2	15.5	24.0
Mauritania	0.1	0.1	0.2	0.3	0.4
Morocco	2.3	5.3	9.6	13.7	19.2
Tunisia	0.9	2.9	5.8	10.6	13.5
Total	6.0	20.2	41.9	65.5	91.4

Source: Comité Maghrébin de l'Electricité (COMELEC).

cent for Libya (24.0 TWh), 21 percent for Morocco (19.2 TWh), 15 percent for Tunisia (13.5 TWh), and less than 1 percent for Mauritania (0.4 TWh).

Energy Resources

The Maghreb is clearly rich in natural resources—particularly oil and natural gas reserves—but those resources are not spread evenly among the region's countries.

Oil and Natural Gas

Hydrocarbon reserves in the Maghreb amount to more than 7 billion tons of oil and nearly 6,000 Gm^3 of natural gas. In 2006 the Maghreb countries produced a little over 175 million tons of oil and 102 Gm^3 of natural gas (table 9.8). At current levels of production, the Maghreb has 40 years of oil reserves and 58 years of natural gas reserves remaining. These resources are mostly concentrated in Algeria and Libya. Libya has the largest reserves of oil with 5.4 billion tons, while Algeria only has 1.5 billion tons—18 years of production at the current rate. However, Algeria dominates natural gas reserves with 4,500 Gm^3 against 1,300 Gm^3 in Libya. Algeria and Libya combined hold 87 percent of oil reserves and 71 percent of natural gas reserves for the entire Mediterranean region. Together with Egypt, which holds 23 percent of the Mediterranean gas reserves, the three countries control 93 percent of such reserves.

Renewable Energy

Maghreb countries benefit from significant renewable energy resources, in particular solar and wind power. Sunshine hours vary between 2,650 and 3,400 hours per year. Average annual irradiation varies from 1,300

Table 9.8 Oil and natural gas reserves and production, 2006

	Oil				Natural gas			
	Reserves		Production	Reserves/ production	Reserves		Production	Reserves/ production
Country	Millions of tons	Percent	(millions of tons)	(years)	Gm^3	Percent	(Gm^3)	(years)
Algeria	1,545	19	86	18	4,504	54	85	53
Libya	5,399	67	86	63	1,316	16	15	89
Tunisia	90	1	3	27	70	1	3	28
Maghreb total	7,034	87	175	40	5,890	71	102	58
Rest of the Mediterranean	1,032	13	60	17	2,390	29	61	39
Total for the Mediterranean	8,066	100	235	34	8,280	100	163	51

Gm^3 = billion cubic meters

Sources: BP Statistical Review of World Energy 2007; CEDIGAZ; Observatoire Mediterranéen de l'Energie.

kilowatt hours per square meter per year (kWh/m^2/year) on the coastal zones to 3,200 kWh/m^2/year in the south and desert zones. Average wind speed in the region fluctuates between 6 and 11 meters per second.

The potential for harnessing solar and wind energies is significant in the region—6,000 megawatts in Morocco, for instance—but it is not yet exploited. Despite political support for renewable energy in most Maghreb countries and wide recognition of the benefits, many institutional, regulatory, and financial obstacles remain.

Energy Trading

Energy trading among Maghreb countries remains extremely weak considering the countries' needs, availability of resources, and proximity.

Oil and Petroleum

Table 9.9 summarizes the trade of oil and petroleum products among Maghreb countries in 2005. The most striking feature is the negligible level of intra-Maghreb trade in the oil sector: only 1.8 million tons, under 3 percent of the total of 70 million tons traded to and from the region. One could think that the countries of the Maghreb deliberately ignore each other.

Algeria does not sell any of its oil to its neighbors and exports only 1 million tons of liquefied petroleum gas to Morocco, 4.6 percent of total Algerian exports of petroleum products. Morocco imports only 10.6 percent of the petroleum products it needs from Algeria and brings in the remaining 6.7 million tons from outside the Maghreb. Tunisia imports around 0.8 million tons of oil from Libya, just 18.3 percent of total Tunisian imports and less than 2 percent of total Libyan exports. Tunisia exports more than 1.3 million tons of petroleum products to countries outside the Maghreb.

Natural Gas

Tunisia and Morocco are transit countries for Algerian pipelines to Italy and Spain, and for this service they are able to levy a share. In 2006 the share amounted to 1.8 Gm^3, or 2.9 percent of the total gas exported by Algeria.

In Tunisia the Enrico Matteï gas pipeline, which was brought into service in 1983, will have its capacity increased to 32 Gm^3 a year. As the transit levy is 5 percent, Tunisia will benefit by up to 1.6 Gm^3 a year. Furthermore, the Tunisian company STEG has a contract to buy 0.5 Gm^3 of Algerian gas a year.

In Morocco the Pedro Duran Farell (Maghreb-Europe) gas pipeline, which came into service in 1997 to supply Spain and Portugal, has a ca-

Table 9.9 Oil flows between Maghreb countries, 2005 (million tons of oil equivalent)

	Exporter							
Importer	**Algeria**	**Libya**	**Morocco**	**Tunisia**	**Total Maghreb**	**Rest of the Mediterranean**	**Rest of the world**	**Total**
Algeria		0	0	0	0	402	450	852
Libya	0		0	0	0	0	29	29
Morocco	975	37		0	1,012	490	6,167	7,669
Mauritania	0	0	0	0	0	0	0	0
Tunisia	0	779	12		791	191	3,278	4,260
Total Maghreb	975	816	12	0	1,803	n.a.	n.a.	n.a.
Rest of the Mediterranean	20,159	45,372	0	1,317	66,848		n.a.	n.a.
Rest of the world	140	779	0	0	919	n.a.		n.a.
Total	21,274	46,967	12	1,317	69,569	n.a.	n.a.	

n.a. = not available

Sources: International Energy Agency; BP Statistical Review of World Energy 2005.

Table 9.10 Electric interconnections between Maghreb countries, 2006

Interconnection	Voltage (kilovolts)	Year of commissioning
Ghazaouet, Algeria ↔ Oujda, Morocco	225	1988
Tlemcen, Algeria ↔ Oujda, Morocco	225	1988
Djebel Onk, Algeria ↔ Metlaoui, Tunisia	150	1984
El Aouinet, Algeria ↔ Tajerouine, Tunisia	225	1984
El Aouinet, Algeria ↔ Tajerouine, Tunisia	90	1952
El Kala, Algeria ↔ Fernana, Tunisia	90	1956
Mellousa, Morocco ↔ Tarifa, Spain	400	1996/2006
Medenine, Tunisia ↔ Abukamash, Libya	220	2003
Tobruk, Libya ↔ Saloum, Egypt	220	1998

Source: Comité Maghrébin de l'Electricité.

Table 9.11 Electricity flows between Maghreb countries, 2006
(gigawatt hour)

	Exporter						
Importer	**Algeria**	**Libya**	**Morocco**	**Tunisia**	**Egypt**	**Spain**	**Total**
Algeria		n.a.	136	135	n.a.	n.a.	271
Libya	n.a.		n.a.	n.a.	123	n.a.	123
Morocco	159	n.a.		n.a.	n.a.	1,899	2,058
Tunisia	141	n.a.	n.a.		n.a.	n.a.	141
Egypt	n.a.	91	n.a.	n.a.		n.a.	91
Spain	n.a.	n.a.	27	n.a.	n.a.		27
Total	300	91	163	135	123	1,899	2,710

n.a. = not available

Source: Comité Maghrébin de l'Electricité; Observatoire Méditerranéen de l'Energie.

pacity of 12.7 Gm^3 a year. The transit charge is 7 percent, so Moroccan levies can claim up to 0.9 Gm^3 a year. Morocco only recently decided to use gas in its new combined-cycle power plant at Tahaddart, which requires 0.6 Gm^3 a year.

Electricity

Tables 9.10 and 9.11 show electricity trading among the Maghreb countries for 2006. Flows remain extremely low—only 0.7 TWh, less than 1 percent of the total electricity consumption of these countries. Electricity interconnections developed in the Maghreb remain vastly inferior to the potential

of the region because the lines were intended for zero-sum two-way transactions over a period of time, essentially to meet emergency needs. Even though construction of the interconnection line between Tunisia and Libya was completed in 2003, there has not yet been any trade between the two countries. The only significant trading relation is between Morocco and Spain. Morocco imports 1.9 TWh from Spain, around 10 percent of its needs and nearly 12 times the amount it buys from Algeria (table 9.11).

Summary

Intra-Maghreb energy trade is very low, mostly due to a lack of trust among the region's countries. Algeria sells very little energy to its neighbors. It exports only 1 million tons of petroleum products to Morocco, around 5 percent of its oil exports. It sells 0.5 Gm^3 of natural gas a year to the Maghreb generally, less than 1 percent of its natural gas sales. Finally, it trades less than 0.6 TWh of electricity with its immediate neighbors, less than 2 percent of its production. Libya exports less than 1 million tons of oil—less than 2 percent of its energy trade—to Tunisia and does not export any natural gas there. Morocco's energy trade with Maghreb neighbors amounts to only 1 million tons, or 11 percent of its total energy trade. Tunisia's trade with other Maghreb countries represents barely 14 percent of its total energy trade.

Socioeconomic Data

Developments in the Maghreb's energy sector occur in the context of economic growth that is not quite keeping pace with the region's rising population. Domestic demand for energy is likely to increase, putting more pressure on each country's external trade balance.

Population

In 2006 the population of the Maghreb totaled 83 million inhabitants (table 9.12). Algeria is the most highly populated country (over 33 million), closely followed by Morocco (31 million). Together they represent nearly 77 percent of the Maghreb's population. Table 9.12 outlines the region's population growth from 1971 to 2020. Numbers more than doubled between 1971 and 2006, from 38 million to 83 million. The largest increases occurred in Algeria (more than 19 million) and Morocco (15 million).

The population of the Maghreb is young and numbers are expected to exceed 100 million by 2020, an annual rate of increase of 1.3 percent over the period. This will inevitably entail a large increase in energy consumption, especially electricity.

Table 9.12 Population growth in Maghreb countries, 1971–2020 (millions)

Country	1971	1980	1990	2000	2002	2004	2006	2010p	2020p
Algeria	14.2	18.8	25.3	30.5	31.4	32.4	33.3	35.2	39.9
Libya	2.1	3.0	4.3	5.3	5.5	5.7	6.0	6.7	8.2
Mauritania	1.3	1.6	2.0	2.6	2.8	3.0	3.1	3.6	4.5
Morocco	15.4	19.3	23.9	27.8	28.5	29.1	30.5	32.3	36.8
Tunisia	5.2	6.4	8.2	9.6	9.8	9.9	10.1	10.7	12.1
Total	38.1	49.1	63.7	75.8	78.0	80.1	83.0	88.5	101.5

p = projection

Sources: World Bank, *World Development Indicators 2007*; UNCTAD, *Trade and Development Report*, 2007.

Economic Growth

As table 9.13 shows, in 2006 the GNP of the five countries totaled nearly $200 billion. Algeria accounted for the largest share (36 percent), followed by Morocco (26 percent), Libya (24 percent), Tunisia (13 percent), and Mauritania (less than 1 percent).

GNP growth rates for Maghreb countries are mediocre. For 2007 the estimates are 3.1 percent for Algeria and 2.3 percent for Morocco. Tunisia and Libya did much better, with rates of 6.3 and 6.8 percent, respectively. In 2008 the GNP growth rate for Libya is expected to reach 9 percent. The rest of the Maghreb countries will maintain modest rates.

Over the longer term, the GNP of the Maghreb should reach around $324 billion (constant dollars) in 2020 while the population is expected to increase by 20 million inhabitants. Average annual GNP growth rates are projected at between 3.5 and 4.0 percent for Maghreb countries over the next 15 years, which is relatively modest in the context of population growth of 1.3 percent per year. Energy needs are likely to rise sharply even with modest economic growth, as the increase in population will be a considerable factor. In addition, the energy intensity record—the amount of energy consumed (mtoe) to produce one unit of GNP at current dollars—is particularly high for Algeria (0.48) and Libya (0.39). The average energy intensity for the Maghreb is 0.39.

The Place of Energy in Trade Balances

Merchandise trade balances for Maghreb countries differ widely. Algeria and Libya exhibit surpluses, in large part due to hydrocarbon exports. Morocco, Tunisia, and Mauritania incur large deficits.

Table 9.14 reports the Algerian merchandise trade balance. Hydrocarbon exports account for almost 98 percent of Algeria's total exports, signaling

Table 9.13 Gross national product figures and projections, 1970–2020 (billions of current dollars)

Country	1970	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007e	2008p	2010p	2020p
Algeria	4.9	42.3	62.0	54.8	56.2	58.9	62.9	66.2	69.6	70.8	73.0	76.6	87.7	127.7
Libya	4.0	35.5	28.9	34.5	36.0	37.2	40.6	42.7	45.3	47.7	50.9	55.4	53.3	67.3
Mauritania	0.2	0.7	1.0	1.1	1.1	1.1	1.2	1.2	1.3	1.4	1.5	1.5	1.6	2.1
Morocco	4.0	21.0	28.9	37.1	39.4	40.7	42.9	45.1	46.2	49.9	51.0	54.1	59.5	80.6
Tunisia	1.4	8.7	12.3	19.4	20.4	20.7	21.9	23.2	24.1	25.5	27.1	28.6	30.9	45.9
Total	14.0	108.0	133.0	147.0	153.0	159.0	170.0	178.0	187.0	195.0	204.0	216.0	233.0	323.6

e = estimate; p = projection

Source: World Bank, *World Development Indicators 2007*.

Table 9.14 Algerian merchandise trade balance, 2007

Category	Exports		Imports		Balance (millions of dollars)
	Millions of dollars	Percent	Millions of dollars	Percent	
Consumption goods	33	0.1	4,009	14.6	–3,976
Energy	55,705	97.7	313	1.1	55,392
Equipment goods	46	0.1	10,097	36.8	–10,051
Food products	87	0.2	4,827	17.6	–4,740
Primary products	170	0.3	1,277	4.7	–1,107
Semifinished products	978	1.7	6,919	25.2	–5,941
Total	57,019	100	27,441	100	29,577

Source: Agence Nationale de Promotion des Exportations, www.promex.dz.

Table 9.15 Moroccan merchandise trade balance, 2007

Category	Exports		Imports		Balance (millions of dollars)
	Millions of dollars	Percent	Millions of dollars	Percent	
Consumption goods	4,106	30.1	5,525	18.9	–1,419
Energy	288	2.1	5,833	20.0	–5,545
Equipment goods	1,572	11.5	6,377	21.8	–4,805
Food products	2,463	18.1	3,005	10.3	–542
Primary products	1,425	10.4	1,776	6.1	–351
Semifinished products	3,783	27.7	6,719	23.0	–2,936
Total	13,638	100.0	29,235	1.0	–15,598

Source: Centre Marocain de Promotion des Exportations, www.cmpe.org.ma.

an extreme dependence on oil and natural gas. The share of food in total imports is almost 18 percent, around $5 billion of food products annually.

Morocco's merchandise trade deficit totaled $16 billion in 2007 (table 9.15). Energy imports amounted to over $5 billion, 20 percent of total imports and around 35 percent of the trade deficit.

Tunisia's merchandise trade deficit was around $4 billion in 2007 (table 9.16). The share of energy in total imports was about 12 percent, somewhat less than the share for Morocco. However, thanks to local resources, Tunisia manages a slight surplus in energy trade. Food exports represent only 6 percent of total exports and do not entirely balance food imports.

Libya's merchandise trade balance in 2005 exhibited a surplus of $21 billion (table 9.17). Libya is very similar to Algeria in that hydrocarbon exports represent more than 95 percent of total exports. This raises the same

Table 9.16 Tunisian merchandise trade balance, 2007

Category	Exports		Imports		Balance (millions of dollars)
	Millions of dollars	Percent	Millions of dollars	Percent	
Consumption goods	5,568	37.3	1,936	10.3	3,632
Energy	2,416	16.2	2,311	12.3	105
Equipment goods	2,103	14.1	5,001	26.6	–2,898
Food products	896	6.0	1,323	7.0	-427
Primary products	1,038	6.9	375	2.0	664
Semifinished products	2,924	19.6	7,871	41.8	–4,947
Total	14,945	100.0	18,818	100.0	–3,872

Source: Institut National de Statistique.

Table 9.17 Libyan merchandise trade balance, 2007

Category	Exports		Imports		Balance (millions of dollars)
	Millions of dollars	Percent	Millions of dollars	Percent	
Energy	27,526	95.3	55	1.0	27,471
Food products	29	0.1	1,319	17.0	–1,290
Manufactured goods	1,242	4.3	6,369	81.0	–5,127
Chemical products	751	2.6	322	4.0	429
Machinery and transport equipment	29	0.1	3,612	46.0	–3,583
Other manufactured products	462	1.6	2,277	29.0	–1,815
Metals and mining	58	0.2	71	1.0	–13
Primary agricultural products	29	0.1	47	1.0	–18
Total	28,884	100.0	7,853	100.0	21,031

Source: UNCTAD, *Trade and Development Report*, 2007.

concern as for Algeria: an extreme dependence on hydrocarbons. The proportion of food imports is also large, almost 17 percent of total imports or around $1.3 billion of food products annually.

Mauritania had a merchandise trade deficit of around $1 billion in 2005 (table 9.18). Energy imports are small and account for 10 percent of total imports.

The Maghreb as a whole is an important trading region; merchandise transactions amount to $200 billion a year, of which 43 percent relate to

Table 9.18 Mauritanian merchandise trade balance, 2005

Category	Exports		Imports		Balance (millions of dollars)
	Millions of dollars	Percent	Millions of dollars	Percent	
Energy	n.a.	n.a.	132	10.0	–132
Food products	324	47.0	135	10.0	189
Manufactured products	16	2.4	1,050	79.0	–1 033
Chemical products	1	0.1	32	2.0	–31
Machinery and transportation equipment	6	0.9	891	67.0	–885
Other manufactured products	10	1.5	128	10.0	–118
Metals and mining	344	50.0	3	0.2	342
Primary agricultural products	2	0.3	3	0.2	–1
Total	687	100.0	1,324	100.0	–637

n.a. = not available

Source: UNCTAD, *Trade and Development Report,* 2007.

hydrocarbons. Total exports reached nearly $115 billion in 2006. Algeria and Libya together accounted for nearly 75 percent of regional exports. Tunisia accounted for some 13 percent of total exports and Morocco for 12 percent. Maghreb imports reached around $85 billion, with Morocco representing nearly 35 percent of the regional total, followed by Algeria (32 percent), Tunisia (22 percent), Libya (9 percent), and Mauritania (less than 2 percent).

Scenarios and Perspectives in the Mediterranean Context

The projected rise in energy demand throughout the Maghreb underlines the need for extra capacity in the region. It also emphasizes the complementarities in resources and needs throughout the region, and thus the benefits of efficient trade flows between the countries.

Energy Demand Projections

Table 9.19 shows growth projections for each type of energy in the Maghreb through 2020. Considerable growth in energy consumption is predicted between 2006 and 2020, from 75 mtoe to 128 mtoe. This is mostly linked to the development of electricity generation, which will consume

Table 9.19 Demand for energy in the Maghreb, 2006–20

	Primary energy (mtoe)			Oil (million tons)			Natural gas (mtoe)			Renewable energy (mtoe)			Coal (mtoe)			Electricity (TWh)		
Country	**2006**	**2010p**	**2020p**	**2006**	**2010p**	**2020p**	**2006**	**2010p**	**2020p**	**2006**	**2010p**	**2020p**	**2006**	**2010p**	**2020p**	**2006**	**2010p**	**2020p**
Algeria	34.0	40.0	61.8	11.7	13.0	15.0	21.5	26.0	45.5	0.1	0.1	0.4	0.7	0.8	0.9	34.4	46.1	85.5
Libya	18.7	23.5	28.5	13.2	12.3	13.3	5.3	11.0	15.0	0.2	0.2	0.2	0.0	0.0	0.0	24.0	35.0	48.3
Mauritania	1.2	1.4	1.7	1.0	1.2	1.2	0.0	0.0	0.0	0.3	0.3	0.4	n.a.	n.a.	n.a.	0.4	0.5	0.7
Morocco	12.6	16.6	20.0	7.6	8.4	9.5	0.6	2.3	5.2	0.5	0.6	0.7	3.4	4.0	4.2	19.2	27.4	37.3
Tunisia	8.9	12.6	16.1	4.0	6.8	7.6	3.7	4.5	7.0	1.0	1.2	1.4	0.1	0.1	0.1	13.5	16.3	28.4
Total	75.4	94.1	128.1	37.4	41.7	46.6	31.1	43.8	72.7	2.0	2.4	3.2	4.3	4.9	5.3	91.4	125.3	200.1

p = projection
mtoe = million tons of oil equivalent
TWh = terrawatt hours

Sources: International Energy Agency; BP Statistical Review of World Energy 2007; Observatoire Méditerranéen de l'Energie; CEDIGAZ; and authors' estimates.

31 mtoe in fossil fuels (coal, oil, and gas)—nearly 40 percent of primary energy demand in the Maghreb in 2020. Oil consumption in the Maghreb will increase somewhat, from 38 million tons in 2006 to nearly 47 million tons in 2020. Consumption of natural gas should increase sharply between 2006 and 2020, from 34 Gm^3 (31.1 mtoe) to 80 Gm^3 (72.7 mtoe). Requirements for electricity generation will double between now and 2020, from 17 to 34 Gm^3. Consumption of renewable energy is projected to increase from 2.0 mtoe to only 3.2 mtoe between 2006 and 2020. Important sources of renewable energy exist in the region, but they are likely to remain poorly exploited unless there is a big push from the Union for the Mediterranean. Demand for coal, which is mainly used to generate electricity, should increase from 4.3 mtoe in 2006 to 5.2 mtoe in 2020. This increase is concentrated in Morocco, where consumption will rise from 3.4 mtoe in 2006 to 4.2 mtoe in 2020.

As is noted above, demand for electricity is expected to rise very steeply. According to national companies, total electricity generation in the Maghreb countries should rise by 8 percent per year to reach 200 TWh by 2020. The largest increase is expected in Algeria, where capacity should more than double over the same period. An increase in capacity of more than 24 TWh is expected in Libya and 18 TWh in Morocco. The increase in Tunisia will be around 15 TWh. To accommodate electricity needs in the region, the Maghreb will need to develop additional capacity of over 23,000 MW. Almost 50 new units, each with a capacity of 500 MW, will need to be built—on average, three new power stations per year. From now until 2020, Maghreb countries will need to invest between 15 billion and 20 billion euros to construct and renovate power stations. The investment is considerable at a time when the oil, gas, and electricity industries are all experiencing higher costs for engineering and construction and a significant shortage of skilled manpower.

By using interconnections among countries and increasing intra-Maghreb electricity trade, the region can help satisfy its increased demand and better guarantee the reliability of networks. Better use of existing electric interconnections and gas infrastructure can be a start in promoting energy trade among Maghreb countries and establishing, over the long term, an integrated regional market. A cooperative approach will optimize investment and reduce the financing demands for new capacity.

Energy Trade Potential

The following sections present estimates of intra-Maghreb energy flow increases that could easily be achieved either with existing infrastructures (perhaps renovated) or through projects already under construction or planned.

Algeria-Morocco

Energy trade between Algeria and Morocco could be increased rapidly and significantly. Morocco could import between 35 and 40 percent of its petroleum needs from Algeria. The two countries could trade 3.5 million tons by 2020 using coastal shipping or, preferably, a multiproduct pipeline constructed between the frontier storage facilities at Remchi in Algeria and Oujda in Morocco. Algeria could increase its imports of lubricants from Morocco. Oil transactions could be multiplied by three to four times in 10 years.

Existing natural gas infrastructure between the two countries already allows Morocco to collect 0.9 Gm^3 of gas annually as a transit charge on deliveries sent to Spain and Portugal. The capacity of the gas pipeline could be increased by adding a 5-to-6 Gm^3 compression station, which would respond to increased demand both in Morocco and elsewhere. This would allow Morocco to increase the size of its service fee levy to 1.25 Gm^3. In addition, Morocco could contract a further 2 to 3 Gm^3 of Algerian gas, or 50 percent of its estimated additional needs, by 2020. Morocco would then receive 3 to 4 Gm^3 of gas from Algeria, 50 to 70 percent of its estimated needs for 2020.

Regarding electricity, the third interconnection line being developed between Morocco and Algeria, as well as the 400 kilovolt project throughout the Maghreb, should easily allow an increase of transactions to 4 TWh.

Algeria-Tunisia

Tunisia could import up to 50 percent of its natural gas needs from Algeria, tripling the amount currently imported to 3.5 Gm^3 a year. A levy of up to 1.5 Gm^3 could be collected as transit charges. A further 2 Gm^3 could be imported as part of a contract. The remaining demand could be met through national production and imports from Libya. Gas infrastructure between Tunisia and Algeria already exists; progress on the Libya-Tunisia project, which has been pending for some time, could be accelerated. Tunisia could also satisfy 20 to 30 percent of its oil requirements by importing from Algeria (1.5 to 2 million tons).

Regarding electricity, a fifth interconnection line is being built between Tunisia and Algeria. The ELTAM line along the Maghreb is being upgraded to 400 kilovolt, which will allow transactions to the level of 6 TWh.

To summarize, more than 18 mtoe could be traded between the Maghreb countries by 2020, representing 15 percent of the total energy requirements of the region: petroleum products in the amount of 8.5 million tons (18 percent of total Maghreb oil needs, namely 47 million tons); natural gas in the amount of 9.5 Gm^3 (12 percent of Maghreb natural gas

needs, namely 80 Gm^3); and electricity in the amount of 15 TWh (7.5 percent of total demand in the Maghreb, namely 200 TWh).

Sustainable Development

Sustainable development in the Mediterranean requires implementing vigorous policies to conserve energy and better exploit renewable energy. Two collaborative regionwide projects need to be considered: an integrated solar project and applying the Kyoto Protocol's Clean Development Mechanism (CDM).

Integrated Solar Project

An integrated solar project would focus on developing a large number of sites across the Maghreb to produce electricity from solar power (photovoltaic and solar concentrator) and locally manufacturing solar panels, solar concentrators, and other equipment and accessories. On a large enough scale, this project would satisfy both cost criteria and conditions for financing. Such an initiative would benefit from the expertise of northern Mediterranean companies and from the Maghreb's human and technical resources.

The project would affect the economic and social development of rural zones substantially, improving technology for pumping water and thus irrigation for agriculture; it would also establish small units of transformation, storage, and refrigeration that could increase the tourist appeal of these semideserted regions. Finally, it would help Maghreb countries better retain their rural populations, reduce urban concentrations, and diminish tensions over energy sources and the environment.

Clean Development Mechanism

Sustainable development would help fight pollution, which affects all large cities in the Maghreb, and climate change, to which the region is extremely vulnerable. Applying the CDM of the Kyoto Protocol could contribute to financing efficient renewable energy projects. Unfortunately, unlike other regions—Latin America, China, and India—the Mediterranean has been slow to take advantage of this mechanism.

To benefit from the CDM, a regional carbon fund could be set up with the collaboration of northern Mediterranean energy companies. This fund would invest in CDM projects and encourage an energy policy adapted to the Maghreb, while simultaneously helping the northern Mediterranean countries to reach their targets for reducing greenhouse gas emissions in line with the Kyoto Protocol and its successor agreement.

Diversifying Energy Supply in the Maghreb: The Nuclear Option

The pressure of energy demand means that no option should be ignored. Renewable energy forms should obviously be used to the maximum, but they will not be sufficient to replace thermal production methods in the electricity sector. The nuclear option is being considered seriously in the Maghreb. Morocco, Algeria, Tunisia, and Libya are all separately studying the possibility of including nuclear power in their energy choices and are elaborating protocols of cooperation with several other countries.

Nuclear power development is a complex field that is particularly sensitive to issues of security. It requires massive investment that cannot be achieved without close cooperation with international companies that have the requisite technology and expertise, notably to handle radioactive waste. Developing nuclear power to generate electricity should take place in a regional context, allowing Maghreb countries to pool their human, technical, and financial capabilities and at the same time benefit from the expertise of their partners.

Training and Research and Development

Efficient and lasting partnerships will not exist without investing in training and research and development. It is essential to plan for specialized training institutes and joint research centers. Several regional institutes should be set up to train engineers and technicians in fields related to hydrocarbon, electricity, and nuclear industries, as well as renewable energy and sustainable development sectors. Instructors and specialists should come from every country and the diplomas delivered by training courses should be recognized across the entire Euro-Mediterranean region. Maghreb institutes should be publicly supported to develop research programs in subjects of common interest.

The Challenge for the Union for the Mediterranean

Twelve years after the start of the Barcelona Process, the gap between European countries and the developing countries of the southern Mediterranean is as large as ever. This calls for a fresh spur to cooperation between the Mediterranean's northern and southern shores. One of the greatest challenges facing the creation of a Euro-Mediterranean partnership will be to alter fundamentally the European perception of North African countries as simply suppliers of raw materials or as market opportunities. Meanwhile, Maghreb countries should not stick to old individualistic attitudes but consider the advantages of a regional approach, not only from geostrategic and economic points of view, but also in terms of the strong workforce formed by a young population.

The question arises regarding whether the energy sector could act as a catalyst to initiate the process toward an integrated economy with a high and sustainable level of growth and more widespread cooperation around the Mediterranean. The uneven division of energy resources among Mediterranean countries suggests a basis for well thought out and acceptable forms of interdependence.

Recommendations

Based on the above figures, recommendations for the Maghreb consist of developing energy trading generally within the region and specifically building power stations to service both the Maghreb and European countries.

Developing Energy Trading

Above all else, the development of energy trade is essential. The potential is enormous if countries can find the political will and are prepared to encourage business in the right direction. The following paragraphs suggest measures that could be achieved realistically in the short term.

Multiproduct pipelines—liquefied petroleum gas, gasoline, and diesel—could be constructed to connect the storage and distribution facilities on either side of the borders between Algeria and Tunisia and between Algeria and Morocco. This initiative would not only meet the growing needs of the border regions, but also end the considerable informal trade in petroleum products across the borders. Natural gas consumption could be increased, in particular in Morocco, in the electricity, tertiary, and domestic sectors. A gas pipeline already runs through Moroccan territory and branches could be created that connect it to large urban centers. Constraints on electricity could be eased by maximizing the use of existing electric interconnections between countries and by upgrading them to increase transactions both within the Maghreb and with Europe. In addition, a 400 kilovolt line running from Morocco to Egypt would reinforce electricity networks efficiently across North Africa.

Direct undersea north-south connections could be constructed between Morocco and Spain, between Algeria and Spain via the Medgaz pipeline, between Algeria and Italy via the Galsi pipeline, between Tunisia and Italy, and even between Libya and Italy. These connections would allow partners to use complementary supply and demand situations better and optimize investments at a regionwide level, reducing costs for individual countries. The connections would also provide more reliable and secure supplies of electricity to Maghreb countries.

Partnerships for Building Power Stations

Despite the important progress in rural electrification that Maghreb countries have made in recent years, access to electric power is still not universal and much remains to be done. The difference in production capacity between the southern and northern Mediterranean countries demonstrates the level of effort still required. Maghreb countries should eventually enjoy the same amount of secure power per capita that the European Union does.

The anticipated development of both electric generation capacity and transport networks will require total investment of about 15 billion to 20 billion euros for the Maghreb countries by 2020. The question is whether Maghreb countries can raise such sums given their economic situation, the small amount of public funds available, the lack of creditworthiness, and the country risk premiums that lenders demand.

All North African countries from Morocco to Egypt should establish a global plan to build electricity power stations with joint-venture companies. This is one of the most crucial challenges facing the Mediterranean. Fortunately, natural gas is widely available. Reforms enacted over recent years in several countries have opened energy markets to the private sector. This should allow them to enter into partnership projects. Mediterranean cooperation would improve the institutional and financial conditions needed to finance local energy projects. Nuclear power also remains an option. Some power stations could be coupled with desalination plants, as the desalination of seawater is crucial for the future of North Africa. Other power stations could be dedicated, in part, to exporting electricity.

The main goal should be universal access to reliable electric power. Improvement of interconnections should be a priority, as it will allow better exploitation of complementary relations, not only among the Maghreb countries, but also between North Africa and the European market. Power projects should not only seek to optimize production and availability in the Maghreb, but also exploit opportunities to export gas and electricity to the north.

Conclusion

The grand idea is for Maghreb countries to agree on a global plan, based on their mutual interests, for building power plants, refineries, and transport and distribution infrastructure, as well as developing wind and solar power. Growth in demand for energy in the Maghreb—particularly electricity—will be considerable over the next 15 years. This will be one of the key factors affecting the economic and social development of Maghreb countries. However, growth runs the danger of being slowed by problems in financing the necessary infrastructure.

A global plan would be based on joint-venture companies bringing together operators in Maghreb countries and European players, both to develop integrated projects that would respond more efficiently to energy needs and to export gas, electricity, and other petrochemical products to Europe and other markets. Reforms enacted independently by various Maghreb countries over recent years have encouraged the opening of energy markets to the private sector; these should be extended to attract more firms to the energy sector.

Cooperation on a Mediterranean scale would facilitate the establishment of appropriate institutional structures and adequate finance. In the context of balanced cooperation, the Union for the Mediterranean could make a major contribution to economic integration. Discordant voices have already been raised, notably in Algeria, where the project is criticized for not being a political agreement. But the project remains important and it is imperative to make the correct strategic, economic, and political choices. Without a doubt, the energy sector could be a driving force for establishing the Union for the Mediterranean, based on complementary supply and demand, a balance of relationships, and a regard for solidarity.

Given the inequalities between the Mediterranean's north and south, the scale of investment needed, and the human and technical resources to be mobilized, cooperation is necessary and desirable in the Maghreb's energy sector. The economic policies of the Maghreb countries should be formed with a long-term vision of regional solidarity and cooperation; otherwise the region will remain prey to numerous contradictions that foment instability.