Energy Infrastructures in the Mediterranean: Fine Accomplishments but No Global Vision

Abdelnour Keramane[1]
Director and Founder
MedEnergie **Journal, Paris**

A Strong Energy Interdependence

The Mediterranean Basin today is home to 7% of the world's population and represents 10% of the word's GDP and over 8% of global energy demand. The region has 4.7% of the planet's natural gas reserves and 4.6% of oil reserves (though probably underestimated), concentrated in four countries that supply 22% of oil exports and 35% of gas exports to the ensemble of the Mediterranean Basin. There is a strong North-South interdependence: supply security for the former, funding of economic and social development for the latter.

Insofar as future perspectives, according to the Observatoire méditerranéen de l'énergie (OME, the Mediterranean Energy Observatory),[2] if the current trend continues, it will lead to a rise in demand of over 40% by 2030, with equivalent effects regarding CO_2 emissions. The OME has also drawn up a proactive scenario with greater energy efficiency and more renewable energy, in which demand would increase less quickly (23% by 2030). The energy mix will continue to be dominated by hydrocarbons (nearly 80% of demand by 2030), above all natural gas.

The electricity sector will continue expanding, with the installation of over 320 GW of new capacity by 2030, more than half of it in the South, and a less carbon-based electricity mix (less than 45% fossil fuels, of which 28% will be natural gas; and over 50% renewable energy, a third of which will be hydroelectric). Renewable energy is taking the lion's share, with the different national plans underway in Southern and Eastern Mediterranean Countries (SEMCs), the 20 GW Mediterranean Solar Plan (MSP) and the Desertec initiative.

Since the energy resources are concentrated in the South while the greatest consumption is in the North, export flows move in a South to North direction, which requires heavy infrastructure. Also required in addition to production units are facilities designed for transport and distribution. Hence, considerable sums have been invested in developing various energy infrastructures around the Mediterranean Basin.

Important Energy Infrastructures

The Enrico Mattei Gas Pipeline, the first pipeline to cross the Mediterranean Sea, transports Algerian natural gas from Hassi R'mel to the terminal in Mazzara del Vallo (Sicily), after crossing Tunisian territory. Inaugurated in its first stage in August 1983, its capacity for transport was doubled to 24 Gm^3/year as of 1995, then raised to 32 Gm^3/year after bolstering the existing transport facilities in the Algerian and Tunisian sections. In 2012, the

[1] A Qualified Engineer, Abdelnour Keramane received his degree from the École nationale des ponts et chaussées (Paris Tech, civil engineering school), then served as Director General of the Algerian state electricity and gas company, Société algérienne de l'électricité et du gaz (Sonelgaz). A founding member and chairman of the Maghreb Electric Energy Committee (Comité maghrébin de l'énergie électrique, Comelec) and the Algerian Committee to the World Energy Conference and vice-president of the Algerian Gas Union (Union algérienne du gaz), he later became Algerian Minister of Industry and Mining and then Managing Director of the Trans-Mediterranean Pipeline Company (Milan). At present, he is the director of *MedEnergie*, a journal of his creation.

[2] *The Mediterranean Energy Perspectives 2011* report presents an in-depth analysis of the energy situation in the Mediterranean Region and perspectives for the 2030 horizon.

Insofar as future perspectives, if the current trend continues, it will lead to a rise in demand of over 40% by 2030, with equivalent effects regarding CO_2 emissions

Enrico Mattei Gas Pipeline transported 20.6 Gm^3, i.e. approximately a third of Italy's natural gas imports.
The Pere Duran Farell Gas Pipeline connects the natural gas fields of Hassi R'Mel in Algeria to Morocco, Spain and Portugal. Its initial capacity was 8 Gm^3/year, with the first natural gas supply reaching Spain and Portugal in November 1996. The pipeline's current capacity is 12 Gm^3/year and could reach 18 to 20 Gm^3/year with the installation of additional compression stations. Nearly 11 Gm^3 were transported in 2007 (8.8 Gm^3 to Spain, 1.4 Gm^3 to Portugal and 0.5 Gm^3 to Morocco).
The Medgas Pipeline is the second Algerian natural gas pipeline to Europe via Spain, but this one does not traverse Morocco. With a capacity of 8 Gm^3/year, it began operating in May 2011. In 2012, the volumes transported were 10.2 Gm^3 for Spain through the two natural gas pipelines, 1.4 Gm^3 for Portugal and 0.5 Gm^3 for Morocco.
The GreenStream Pipeline links the Libyan natural gas fields of Bouri (offshore) and Wafa (onshore) to Sicily across the Mediterranean. It began operating in October 2004 with a capacity of 8 Gm^3/year. The GreenStream delivered 9.2 Gm^3 of Libyan natural gas to Italy in 2007, but only 6.5 in 2012 due to the 2011 political events.
In 2012, the overall volume of natural gas supplied to Europe via these pipelines totalled 39.3 Gm^3 over a total capacity of 58 Gm^3, that is, a utilisation rate of 68%.

Liquefaction Factories

Algeria has two enormous liquefied natural gas (LNG) complexes at Arzew and Skikda, comprised of several liquefaction units that exported 25 Gm^3 to Europe and Asia in 2007. With the recent creation of two new liquefaction trains in Skikda (4.5 Mt/year) and another in Arzew (4.7 Mt/year), the total export capacity for LNG is 38 billion m^3/year. In 2012, Algeria exported 14.4 Gm^3 of LNG to Europe and 15.3 in total, with an overall capacity of 30. Thus, the utilisation rate was approximately 50%.
In Egypt, there are two LNG plants manufacturing for export: the Spanish Egyptian Gas Company, with a liquefaction train having a capacity of 7.5 Gm^3 per year, and Egyptian LNG in Idku, with two trains having a total capacity of 10 Gm^3 per year. The total amount supplied in 2007 was 15 Gm^3, of which eight went to Mediterranean countries. In 2012, Egypt supplied 6.7 Gm^3 of LNG, of which 2.4 went to Europe.
Libya likewise has a liquefaction plant in Marsat Brega, with a capacity of 1 Gm^3/year. In 2011, it supplied 340 million m^3 of LNG to Spain.
Hence in total, according to these figures, less than 50% of LNG export capacity is being used.

The Maghreb-Europe Electricity Interconnection

The Maghreb's electricity grids, which are interconnected, are also connected to European grids via two 400-kV, alternating-current submarine cables between Morocco (Ferdioua) and Spain (Tarifa) running through the Strait of Gibraltar (with a length of 26 km and at a maximum depth of 660 m) with a 1,400-MW capacity, the first of which began operating in October 1997 and the second in June 2006. During the first years, this 400-kV AC interconnection, which functioned from North to South, allowed an energy flow from Spain to Morocco of an amount equivalent to 20% of the production by Morocco's Office National de l'Électricité (ONE). Within the framework of the perspectives of increased exchange and the preparation of the Maghreb market's integration into the European market, a 400-kV Spain-Morocco-Algeria-Tunisia electricity highway is being developed, with internal grids stepped up to 400 kV and an increase in the physical capacity of the Morocco-Algeria connection from 400 to 1000 MW. The strengthening of North-South and East-West electricity interconnections is considered a goal with multiple beneficial effects for the region. The same is true of the colossal project electricity companies of the Mediterranean Basin have been painstakingly implementing for nearly two decades now, which consists of connecting all electricity grids of the countries along the Mediterranean seaboard, from Spain to Morocco and across 8,000 km covering

the Maghreb, Mashreq and Turkey in the South and East, and Greece, Italy, France in the North, the final goal of this unprecedented construction project being the establishment of Euro-Mediterranean electricity and natural gas markets.

The development of renewable energy – energy sources considered intermittent – poses new problems for grid managers and operators. This will require strengthening of electricity grids and interconnections, not only to stabilise grids but also to allow green electricity to be exported from South to North under Article 9 of EU Energy Directive 2009/28/EC. The Medgrid consortium is working precisely on a simplified system facilitating the transfer of renewable-source electricity via submarine cables at a number of corridors across the Mediterranean, through third countries to the EU within the framework of Article 9.

Assessment: Lack of Global Vision

On the geostrategic level, the major works projects constituted by the natural gas pipelines and submarine electricity cables are certainly the result of excellent regional-scale cooperation and greatly contribute to strengthening ties between the North and South shores of the Mediterranean. Nonetheless, the fact remains that, since these are sophisticated technical systems subject to contingencies and natural hazards, they must be the object of controls and attentive surveillance, not only insofar as the principles of supply security but also with regard to the imperatives of sustainable development: sustainable management of energy resources under acceptable economic conditions and in a manner limiting the effects of climate change, i.e. through the use of the appropriate, most environmentally-friendly forms of production and transport.

To this end, it is essential to establish appropriate regulatory and control mechanisms making it obligatory for owners and/or operators of these works to periodically publish detailed assessments and precise, transparent reports not only on their technical and commercial performance, but also on their state with regard to environmental impact.

From the standpoint of reliability and risks, natural gas pipelines have been operating for several decades and have not experienced any major technical incidents. This means their operation is reliable. The precious data accumulated on the state of the conduits and that of the seabed and its environment have contributed a great deal to both the hydrographic and maritime communities and specialised research institutions.

With regard to the environment, the financial, economic and social crisis, the energy crisis, supply security concerns and the need to make transitions towards low-carbon economies in order to adapt to a context of climate change only accentuate the need for and the interest in a change of scale in the implementation of complementary policies of energy efficiency and conservation in the region, both in the North and the South. This complementarity could be extended to include in-depth cooperation not only in energy conservation and renewable energy, but also insofar as infrastructures and matters of common energy policy. It would also be appropriate to effect an energy assessment and a carbon assessment as well as an economic assessment before carrying out a project.

On the economic level, with the stagnation or reduction of the global energy demand, the works carried out are not being used to their full capacity, whether they be natural gas pipelines or liquefaction facilities. The question thus arises of whether, before undertaking certain projects as for instance, Medgaz, it would not be more economic to saturate the existing facilities and infrastructures, then proceed to their extension before considering new sites and routes. This would, moreover, allow environmental impact (soil deterioration, pollution, disturbance of wildlife, etc.) to be minimised. The existence of a long-term master plan for cross-Mediterranean energy highways would facilitate such an approach.

On the industrial level, in order to attain shared prosperity between North and South, it must be ensured that the projects carried out foster technology transfer and industrial partnership: stepping up research, construction, maintenance and operational capacities in countries of the South through the effective establishment of technology transfer systems allowing the development of local electricity facility engineering and a local electricity facility industry, which are practically nonexistent today.