Building trust can take the form of investment

ENERGY
AND
REGIONAL
INTEGRATION

in the Western Mediterranean

The Mediterranean
in a multipolar
World up to 2030

CIDOB

COLECCIÓN **MONOGRAFÍAS**

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In view of the challenges which confront the Western Mediterranean world in the years ahead, the Barcelona Centre for International Affairs is committed to building scenarios that highlight its potential as an area of growth and innovation and fosters a better future for the people who inhabit its northern and southern shores. With that purpose in mind, and under the general title of "The Mediterranean in a multipolar world up to 2030", CIDOB is working on a three year research program (2010-2012) whose aim is to analyse how countries in the area might overcome their differences and imagine a common future.

The research program, carried out in partnership with OCP Foundation in Rabat, brings together internationally recognised experts. It has opened three lines of research devoted to analysing and making proposals on issues critical to the future of the region. The focus of our research in 2010 is role played by energy in developing downstream industries and reinforcing regional integration, which would allow the Western Mediterranean to be an actor in its own right on the world stage. We will then focus, in 2011, on the idea of the Western Mediterranean as a laboratory where the future of the Euro-African space could be mapped out. The third focus, during the last year of the research program, will be on the economic governance of Western Mediterranean countries, and how this might impact on the region's future.

With the final purpose of building a comprehensive understanding of the region's future, CIDOB's Western Mediterranean research project has adopted a prospective methodology offering a platform for analysis, information exchange, and the sharing of views – in other words, a laboratory of ideas- that could offer insights and practical tools for decision makers, be it at a political, economic or private level. The program is also building a network of experts drawn form the region and beyond.

As a result of the initial phase of the research, which focused on energy and regional integration in the Western Mediterranean, we are presenting a first report which include 5 comprehensive papers written by analysts and authors who are well acquainted with energy issues and who have taken stock of the current state of play in the Western Mediterranean: the need for the region to reinvent itself energy-wise, the industrial potential of linking phosphates extraction in Morocco with gas supply from Algeria or the promising possibilities of solar energy, with a close look at a case study linking the latter with water desalination.

With the aim of exploring future scenarios and bringing fresh ideas for action in the region, these background papers were circulated and discussed by the participants at a specialised seminar that was held in CIDOB's headquarters in Barcelona, in early July 2010. Under the title of "Building Trust can take the form of Investment", Francis Ghilès, CIDOB's senior research fellow and director of the research program proposes, as a conclusion, some concrete ideas to add to a faster growth in the Maghreb, drawn from the enriching discussions.

The region has a lot of potential that has been wasted for too long, and it is high time to surmount the complexities and move ahead. As Francis Ghilès writes in his paper, on the region "there is no shortage of capital, and if capital is fleeing the region it is precisely because the regional leaders – in the Maghreb but also in southern Europe - seem unable to think out of a box […]. Now is the time to practice a little economic *realpolitik*, discuss some really new ideas, face up to the role energy and other minerals could play as facilitators or basic enablers in helping to anchor the Western Mediterranean firmly in the new world economic map".

If we are earnestly committed to looking ahead to 2030 with a degree of optimism, we have to start putting together the building blocks of a better future today. This publication aims to provide some serious ideas for action.

PHOSPHATES, ENERGY AND THE REST: THE ALCHEMY OF THE MAGHREB

Amar DRISSI

Amar DRISSI

Executive Director, Office Chérifien des Phosphates (OCP)[1]

"If we don't do the impossible,
we shall be faced with the unthinkable"

Petra Kelly

Introduction

The usual rhetoric about the Maghreb is rather tired and thread bare. Full of outdated clichés, straight banalities or trite simplifications, it keeps oscillating between trivia or grand designs with a healthy dose of posturing, wishful thinking and pointless sloganeering. How to say something new about the Maghreb, that alluring but faceless oxymoron? How to say something new about regional integration, industrial synergies, something new that may get us out of the well-trodden paths, something that shakes the old patterns, and forces us to think out of the box?

The economic and global crisis in the Maghreb may be primarily a crisis of ideas, a crisis of representations, a crisis of analysis, a crisis of thought and decision process, a crisis of perceptions. While we tend to over-focus on economic results, outcomes, which are actually only the consequence and the end result of various processes at work, things may seem intractable. Therefore, if we want to change, we have to change twice: change the reality of our situation and change our perception of reality[2].

As is usually the case, we are flooded with a lot of information but little knowledge. Navigating the challenges of the Maghreb development and industrial integration will require some hard facts, analysis, recommendations for action with a healthy dose of creative thinking. Food for thought more than dogmatic stances will help us frame vital questions. In so doing, we may provide more questions than answers.

Instead of just repeating all that has been said about the cost of non-Maghreb[3], we will try to go for some real stuff and build some practical meaningful cases and proposals which are concrete, tangible and make economic sense. Along this line, there may be small nudges[4], a lot of muddling through with questions, surprises and incomplete ideas which may force us to think.

1. The article expresses the personal view of the author and does not reflect the position of OCP
2. De Brabandere Luc : The forgotten half of change, Dearborn, 2005
3. International Crisis Group
4. Thaler &Sunstein : Nudges, Penguin, 2008

Current context and long term trends in world chemical industry

There is a powerful economic trend which has been with us for more than a decade and will continue relentlessly: the migration of chemical industries form the northern part of Europe to the southern hemisphere. Specialty chemicals (such as vitamins, colouring agents, industrial dyes…) have massively left Continental Europe to China[5] and other parts of the world. The European specialty chemical industry which was active and innovative in the fifties has been in retreat since most of the scientific patents have started to fall into the public domain and can thus be easily copied all over the world[6]. In a ten-year time frame, the Gulf has built a powerful petrochemical industry which is best exemplified by SABIC in Saudi Arabia.The rationale behind these new value levers is major shifts in demand, supply, cost competitiveness and attractive long term margins that will further re-shape the whole industry.

As far as petrochemicals are concerned, they will go through several upheavals that will shake and remodel the whole landscape over the next 10-15 years:

- Continued focus on social prioritization: Middle East is likely to add capacity downstream for purpose of job creation (even at expense of return on investment[7])
- Relentless globalization: Asia/ME still continue to become the demand and supply centers
- Powerful buyers looking upstream
- Continuous technological innovation: Gas to olefins, Coal to olefins, Biotech, U.S. natural gas developments (shale gas)
- Industrial learning curves: China/India are making major advances in capex/opex efficiency gains

Depth and length of the downturn will vary by "product" with low cost being the key competitive advantage[8].

- Though Europe and non-China Asia will likely feel the most pain, exposures among players vary greatly based on location and end-use mix of their portfolios, and their financial exposures
- Chemicals will suffer the downturn in differentiated ways, based especially on their exposure to the hard-hit automotive and construction sectors
- As far as the ethylene chain is concerned:
  - We should witness pain in petrochemicals over the next few years, particularly for naphtha crackers
  - If no additional closures are initiated, ethylene (cracker) utilizations will fall to the lowest levels ever since globalization surfaced in the past 20 years
  - Ethane crackers in the U.S. and propane crackers across regions benefit from "excess NGL" conditions and low natural gas prices
- Recovery, once it comes, is bound to generate very strong demand growth

5. As an example, China capex savings vs. typical western levels (green-field)in polyester plants could fetch up to 60-70%
6. What will stay is core R&D in specific segments such as pharmacy, agro chemistry, specialties
7. Source: SRI, CMAI, ICIS, interviews, McKinsey Chemicals in the Middle East Initiative
8. Scott Andre,Alexander Vogel: Industry Perspective on Petrochemicals 10-15 Years Out, Mc Kinsey

The chemical migration to North Africa: still in limbos

The whole traditional European chemical landscape is vanishing, and is in the process of being remodeled in a radical way. This means opportunities for countries who can boldly take advantage of it. A recent study by Mc Kinsey demonstrates that there are many opportunities available to skilled players to take advantage of long term trends

- *"Seek low cost feedstocks in ME, Russia, or other stranded locations.*
- *For ME feedstocks, create advantaged proposals by bringing ways to create down-stream jobs (e.g., partner with fabricators)*
- *Develop relationships to access coal in China if CO_2 issues will not impact those assets for many years*
- *Investigate outlook for strongly advantaged U.S. ethane costs and, if confirmed, identify economical changes to existing crackers or potential new investments*
- *Identify energy-intensive chemicals in the U.S. that will be advantaged in a low natural gas price scenario*
- *Apply, to the extent possible, the capex advantages/techniques that China can achieve to investments in other regions"*[9].

With regard to this process, it is clear that Northern Africa (Algeria, Libya) still lags behind: this relocation process could spread and get more impetus provided more rational conditions could prevail. Algeria could still set up a full-fledged petrochemical industry[10] which is still in limbos. As for Morocco, chemicals were NOT[11] part of its ambitious industrial scheme called EMERGENCE launched in 2006: the rationale was that the chemical fabric was tiny, fragmented with small actors and subcritical size which pointed to an inward-looking sector with few competitive factors[12] and hence a small potential for attracting outsourcing. Still Morocco could take advantage of some relocation by fully leveraging its scientific and technical workforce provided a serious upgrading effort. In any case, and this may be the lesson which can be drawn from the Gulf experience, a deliberate approach embodied in a strong State engagement is needed to attract and achieve any significant industrial relocation process[13].

JORF PHOSPHATE HUB (JPH): The Moroccan FDI as an example of chemical relocation strategy

Due to high agricultural demand for efficiency and productivity coupled with a relentless world food increase in consumption, the market for fertilizers will be rapidly growing over the next decades.

Within this context, the JPH program is a case in point of such a deliberate strategy to attract foreign direct investments (FDI) in this specific chemical sector. Opening downstream value chain to direct Investors thru plug & play industrial plots would be tantamount to offering them a virtual upstream integration to the mine at most competitive cost. OCP clearly enjoys a competitive advantage which is access to a top-quality rock along geological reserves available for more than 500 years at current cost.

9. Industry perspectives: Petrochemicals, 6th Annual Global Petrochemicals Conference Vienna, 10 February 2010
10. In spite of high cost of capital and country risk considerations
11. There is some talk today to expand the scope and reach of EMERGENCE much as was done by Egypt which now boasts 15 industrial sectors. The risk is clear: diluting the much needed state effort
12. The cost differential is huge as compared to China: 3 to 1. The sector survives thanks to tariff barriers and a privileged access to public markets (on the fringes of cartelism)
13. Spain has been more or less in a situation comparable to that of Eastern Europe with a massive investment flux from France in the motor industry in addition to European agricultural subsidies. This begs the question as to whether Spain had any industry at all to relocate in Morocco! A neighbor could also be a competitor.

More specifically, the FDI will benefit from competitive and reliable rock sourcing with transparent pricing mechanisms thru:

a. Significant additional mining capacity by 2015 (+26m tons/year mainly in Khouribga).
b. Massive improvement of cost position mainly through shift in the logistic system (from train to slurry pipeline), a fully integrated chain supply platform (mine-to-port), access to pooled world class infrastructure & services, environmental facilities at highest standards.
c. "One-stop-shop": OCP will remain the sole rock supplier and service provider through JPH on the whole chemical platform.

The main industrial features[14] of the 18 ha-based JPH program will be:

- 10 new fertilizer manufacturing plants by 2020, with each a production capacity of 450 KT P_2O_5 per year[15],
- each plant will contain :
  - a sulphuric acid unit: 1 350 KT /year
  - a power plant: ≈58 MW
  - a phosphoric acid unit: 450 KT P_2O_5/year
  - one or several fertilizer units: 920 KT DAP/year
  - several storage units for feedstock, utilities and finished products

Energy for industry: a win-win scenario in Maghreb

Gas capacity and availability is present. A major gas pipeline built in 1992 supplies gas from Algeria to Spain through the Moroccan territory. It has a current capacity of 12 BCM with a planned extension to 18 and eventually to 24 BCM. The planned extension actually was not carried out because in the meantime Algeria preferred to engage in another gas route with an undersea pipe linking directly Algeria (Ain Temouchent) to Spain (Almeria). Started in 2006, the pipe was completed at the end of 2009 with a theoretical capacity of 8 BCM. Though the project looked excellent at that time (favored by tensions between Russian Gazprom and European consumers plus the possibility to export LNG to North American clients), today the whole picture has been radically altered[16] especially by 2 sets of factors.

a. The first one is purely economic: it seems that the Spanish market will never be able to absorb 12+ 8 bcm which is the total quantity theoretical available through the two pipes which link it to Algeria even if the Spanish economic growth comes back.
a. The second one is the emergence of a technological revolution called **shale gas**. Against this grim backdrop, it makes quite sense for Algeria to consider Morocco as a real commercial opportunity: out the 12 bcm theoretically sold to Spain, only 7 are actually sold which leaves about one third capacity idle (3 bcm).

Thus Algeria which was over-courted by Europeans went from a most favorable situation to a structurally depressed gas market where most European countries, fearing for dependency, actively search for complementary and alternative solutions.

14. Upstream and downstream infrastructural facilities will comprise :
Water conveyors to supply the mine with 45 millions de m3 / year from the Ait Messaoud dam
Opening of 3 new mines and construction of 3 new washeries allowing Khouribga to rise from 20 to 44 MT/year
Construction of a pipe carrying 44 MT/year
Construction of sea water desalination plants Jorf with a capacity of 60 M m3 /year
Extension of Jorf Lasfar port facilities

15. With an input of 1,600 KT of phosphate rock since 3.6 T rock= 1T P_2O_5

16. In 2009, the USA have become the 1st world gas producer (624 bcm) with an increase of 3,7 % compared to the previous year (ahead of Russian production that decreased by 12,4 %, to 582,3 bcm).

Hence the attractiveness for Algeria of a new market within arm's reach. From a purely commercial perspective[17], Algeria could sell 3 bcm without any major infrastructure investment (except maybe just an access connection linking it to Jorf Lasfar chemical facilities). Even in case of a Spanish economic revival and a possible revving up of its economy, still Algeria could just extend the capacity by adding some compression stations along the pipe. This was actually the way followed in the case of the Algerian-Tunisian pipe which, thanks to a proper negotiation process[18], was further extended to 30 bcm and thus prevented and strongly deterred the planned but still virtual direct pipe between Algeria and Italy. Such additional capacity would be finely suit Morocco's current electrical needs in clean energy and would especially mesh with 2 power plants coming into operation (Tahaddart and Ain Beni Mathar). Most realistic figures quoted by specialists are about 2 bcm immediately (1+1) with a full throttle fetching up to 5 bcm.

It is a bit ironic to see Morocco still operating its power plants with coal while gas has clearly become the # 1 clean energy source and that its territory is crossed by a major gas pipe[19]. Ideally, and if confidence prevailed, Morocco could even forgo all its power plants and rely solely on gas supply from Algeria, saving billions of dollars in power investment. Energy cooperation could make a viable industrial Maghreb emerge.

Such a commercial rerouting make many of industrial projects profitable while today they are hampered by the high cost of industrial electricity: Morocco 9.6 cent € KW as compared to Tunisia 7.3, Algeria 3.5, South Africa 1.6.

Case for a chemical Maghreb

Algeria is a major producer of gas and Morocco is a major producer of phosphates present on the three segments of the value chain (phosphate rock, phosphoric acid and fertilizers especially DAP). In 2009, OCP has produced around 2MT of nitrogenous fertilizers (ie DAP and MAP) which have required about 450,00T of ammonia[20] mainly imported from the Gulf and Trinidad…

A chemical Maghreb concept could be translated into different feasible schemes taking into account different issues (the gas price, financial and economic profitability, state perspective, economic operator perspective etc.). A competitive joint ammonia plant could be one among others.

A global package will have to be elaborated so as to keep the whole project in economic balance. Logistic considerations have to carefully weighed. The DAP granulation plant could be erected in Morocco and so might the phosphoric acid unit (since phosphoric acid would require special vessels for transportation). Ammonia is not easily transported so it should be best optimized by having its set-up on Jorf platform. In the case of a partnership with Libya, because of the lack of gas connection, it might be better to manufacture ammonia in Libya itself. OCP right now consumes about 450 KT of ammonia per year for DAP/MAP granulation[21], to which we should add future requirements: other OCP direct investments in DAP production such as 2 new granulation lines (needed:

17. Historically, Spain and Portugal bought all gas while Morocco was counting on the phase II extension which was actually bypassed by the decision to build another pipe directly to Spain.

18. A whole re-negotiation package would have to de-emphasize the royalties amount and put full weight on gas usage itself not to mention the need to elaborate a purchase contract wit Algeria

19. Though obviously this pipe was not made for Morocco

20. 1T of DAP Di-Ammonium Phosphate)= .25T Ammonia (N) + .46 T Phosphoric Acid (P or rather P_2O_5)+ ballast

21. The ambitious 2010 DAP production program aims at 3 MT which would request 750 KT of ammonia

500 KT of ammonia) plus an integrated fertilizer plant (ODI)[22] requiring a further 250 KT. All in all, we could realistically consider a 1,200 KT capacity size to be set up[23]. Such a deal would find an easy financing since it could already claim a firm commercial contract.

Such a partnership with a privileged access to gas (for Morocco) and a privileged access to phosphate(for Algeria) would of course have to balance the respectively privileged prices of both materials (against international prices) within a win-win profit-sharing scheme depending on respective contributions of each partner. Such joint ventures have already been successfully initiated in the past by OCP with diverse partners such as Indians (Imacid), Pakistanis (PMP), Germans (Emaphos), Belgians (Prayon), and most recently Brazilians (Bunge). JPH scheme could also be a possible formula for such a partnership. Possible candidates here are not only Algeria but possibly other countries in the region such as Libya, Jordan or Qatar. Diversification and upstream integration are among the major advantages of such partnerships in addition to the purely financial profit.

Though small by international standards, the agriculture of these countries also could be significantly enhanced in terms of productivity by using top quality fertilizers from Morocco not to mention the access to OCP world-class expertise and service in this field. Platforms and distribution hubs can also be considered in some countries depending on their favorable network location.

China as the conduit to an integrated Maghreb?

China will develop Africa. China will build the Maghreb. This may sound a bit provocative but should be considered. It is easy to find fault with certain recent Chinese economic behaviour in Africa[24]. Blame for economic plundering is becoming quite common and it may be quite easy to pinpoint some faulty patterns here and there. However this does not have to be an inevitable fatality. The way China treats Sub-Saharan Africa may not be the same as it accommodates the Maghreb. Of course this will depend on the Maghreb itself. Even in Africa other voices are rising to call for a more responsible and pro-active stance from the Africans themselves. At the China-Africa summit in Egypt held in November 2009, Paul Kagame, president of Rwanda, said:

> *"The onus is on us leaders, government and the private sector especially to fully engage at every stage and articulate our development priorities in this partnership"*

Likewise, in the Maghreb, the onus of proof must lie with us. If we want to be on a par with Chinese ambitions, we should stretch ourselves and come up with creative schemes and proposals. We should devise our own development plans to fully leverage China capabilities and thus frame a high level engagement with China as a long term strategic partner. Within this framework, Europe who was too shy to go by itself could find ways to boldly engage in some kind of triangular perspective.

China is basically viewing Africa as a reservoir of natural resources (oil and minerals), a source of arable land as well as a lucrative market for

22. Including phosphoric acid and sulphuric acid facilities

23. Not to speak of future developments: the JPH program aims at 10 granulation units which would fetch some 250 KT x 10= 2,500 KT within a 2020 horizon

24. Mr Wen told a press conference: *"There have been allegations for a long time that China has come to Africa to plunder its resources and practice neo-colonialism. This allegation in my view is totally untenable"*…Trade between China and Africa jumped 45 per cent to $107bn in 2008, a tenfold increase since 2000, and the new loans are likely to sustain the expansion. But Beijing has drawn criticism that Chinese finance, which comes without political conditions, props up unsavoury regimes in Zimbabwe and Sudan and fuels corruption. Mr Wen said eight new policy measures were *"more focused on improving people's livelihoods"* than a 2006 package, underlining what he called Beijing's "selfless" engagement in Africa. China pledges $10bn in loans to Africa: Barney Jopson, FT, November 8 2009

building and civil engineering works. Therefore, China will undoubtedly become the # 1 commercial partner. Along this line, the Tangiers-Med port is a natural gate to Asia as its transshipment facilities will contribute to accelerate the flux of goods coming from the Asian factories and to be sold on European and African markets. Proximity to Europe is bound to make Morocco a major platform for re-export to Europe. This is a starting point.

Against this backdrop, it may be wishful thinking to believe that China will engage in setting up heavy manufacturing in Africa[25]. However, this generic strategy may be twisted somehow depending of course on the political and economic will and assertiveness of its Maghrebi counterparts. As far as phosphates are concerned, China may be one of the largest world producers but mainly for its domestic consumption. Nobody actually knows for sure whether its resources are sufficient and for how long. Neither do we know the exact level of its reserves. As to its phosphates, the landscape is quiet fragmented with a lot of small players which makes it difficult to spot the right interlocutor. More intriguing is the issue whether China behavior in Africa is just proceeding by *fait accompli* or is it a well thought out strategy. Nonetheless, it makes quite sense to try to engage China in some kind of high-level FDI and in that case, phosphates and JPH (Jorf Phosphate Hub) could turn out to be a robust and ambitious conduit for a Chinese-Maghrebi partnership. In any case, whether China could turn out to be a disruptive factor in the rather nice and quite African rent system or whether it will just cave in nicely to a new neo-colonial division of labour is still largely an open question. But undoubtedly we can have a say in it.

More generally, if we put things into perspective, we cannot but raise the pressing and fascinating question: The Maghreb as a Chinese hinterland? Is a new emerging **ChinAfrica** in the making?

Eastern Europe as a thriving German Neo-Maghreb

Eastern Europe[26] was clearly the showcase of a strong German economic integration, something which was a successful example of what the Northern Mediterranean countries clearly might and should have done vis à vis their Maghrebi counterpart[27].

Germany boosted its own economic development by opening up to its hinterland: Eastern Europe, lies quite close geographically and culturally. According to Eurostat, in 2006, more than 50 % of secondary school students learn German (64 % in Poland and 72 % in Slovakia). With a cheap and well trained workforce, these countries offer Germany a favourable production space. By heavily investing in industrial sites in East, and fully leveraging its comparative advantages, Germany made it a « **verlängerte Werkbank » (a workshop extended to East**), which explains why German exports are faring so well. Just to give a sense of this strong economic integration, suffice it to say that the bodywork and equipment of the famous *Porsche Cayenne*, one of the most sold SUV in USA originates from the Bratislava Volkswagen (VW) factory where also 100% of the *Touareg* is manufactured. The engine of the *Cayenne* is manufactured in Porsche main factory in Stuttgart- Zuffenhausen and

25. "Chinese officials and academics have been debating in recent months proposals to use the country's vast foreign exchange reserves_to try to stimulate demand in developing countries – ideas sometimes referred to as "China's Marshall Plan"…But any plan to shift production to Africa that goes beyond the symbolic is likely to meet resistance. Beijing has opposed growing international pressure to appreciate its currency partly because of fears of job losses in export industries. Provincial governments in the interior of China are also desperate to attract jobs to their areas as labor costs in the coastal regions increase. Moreover, the prime motivation of the Chinese Marshall Plan has been to find ways to create new sources of demand for Chinese factories, not to shift their output elsewhere". China eyes industrial bases in Africa, James Lamont & Geoff Dyer, FT, December 3 2009

26. It actually stretched as far as Southern Eastern Europe and Turkey in a lesser extent. China and India were the main beneficiaries of this massive outsourcing outflow

27. It would be interesting to look at the way within NAFTA framework, the US chemical industry engaged in any meaningful outsourcing towards Mexico.

then integrated in the bodywork supplied by VW within the new Leipzig Porsche factory. It is quite clear that without the outsourcing of part of the value-added to external entities (whether be in Germany or outside), or the offshoring to subsidiaries outside the country, the German motor industry would have not been able to keep its world-class positioning. It did so by heavy direct investment: according to Eurostat, the capital stock invested in Eastern Europe by Germany was about 29 billion Euros in 2003 reaching by end of 2007 more than 50 billion Euros[28]. Germany made an industrial and geostrategic bet: it did work and if today it can bear the crisis better than its European counterparts, it is thanks to the economic hinterland it built and which is helping it cushion the most severe blows of the current economic crisis.

The case for major unifying projects within the Maghreb

It is now well-recognized that the Barcelona process launched in 1995, which emphasized free trade more than development, has reached its limits. If the Barcelona process[29] is dead, its postmortem itself still awaits a rigorous evaluation. However, some lessons can already been drawn. While security considerations have gradually become more central to the whole exercise, it fundamentally lacked the critical masses of investment to allow any serious attempt to take off. Not to speak of the cumbersome and bureaucratic fund allocation and disbursement mechanisms that slowed down the whole process. As a result, except in some limited instances in Tunisia, the economic and corporate upgrading (**mise à niveau**) never materialized and development never happened. The whole process gradually drifted and shifted away from the initial Barcelona spirit and stayed aloof from new emerging economic realities thus making it more and more irrelevant. Meanwhile, most countries of the region have favoured their bilateral relations at the expense of their horizontal ones.

This trend should be reversed especially if we want the new **Union pour la Méditerranée** (UPM)[30], to start gaining some credibility. Major industrial projects carrying mutual interest for North-African countries could carry a lot of weight. They could be a showcase of Maghrebi regional integration and multiply economic integrative effect. For example, unifying projects in infrastructures in transportation (high speed train and highway linking the major Maghrebi cities) and energy (electricity and gas) could contribute to maximum impact and visibility within the region. As far as energy is concerned, all should be done to avoid each country going its own way: thus, a major industrial platform in refined products[31] could be set up along the Mediterranean coast to supply all major North African cities, somehow like Rotterdam irrigating through pipelines all major European cities with refined petroleum products.

Even if these projects could take place under private financing and P/P schemes [32](BOT…), multinational entities such as the World Bank and the European Union could provide incentives to such unifying projects by providing feasibility studies, technical assistance and even some kind of economic, financial or political "conditionality". Their role as catalyst could also be further enhanced by establishing triangular exemption from custom duties.

28. Hans Brodersen: Le "modèle allemand" à l'exportation : pourquoi l'Allemagne exporte-t-elle tant? CERFA 57/IFRI/Robert Bosch Foundation, November 2008

29. Moisseron JY: vers la fin du processus de Barcelone, Confluences, No 55, automne 2005

30. Set up in July 2008 under the initiative of Pesident Sarkozy

31. Likewise, a steel Maghreb could make quite sense

32. Concessions de service public

Conclusion

The perspective is quite clear: rise to the level of a globalized world or collapse into irrelevance. The challenge is to make the south-south ambition operational. Adversity is there but levers are plentiful. In 1992, the building of a pipeline between Algeria and Spain crossing Morocco demonstrates that at a bilateral level, things can get done without political prerequisites having a deterrent effect. New insiders into the region such as China could help change the rules of the rent game provided that national economic players become more assertive and take the lead. Coming in place of the Barcelona process that sank into purely security considerations, UPM is facing a tough existential choice: being an empty shell or contributing to re-think the whole Mediterranean project with strong vision, critical cash, and credible engagement at a par with what Germany did in its Eastern Europe hinterland. The onus lies also on the emerging of real Maghrebian counterparts who should position themselves as real partners able to frame counterproposals and counter projects. Some major bold CHEMICAL INITIATIVE should be taken: for instance developing a massive HR vocational and scientific training including a heavy R&D component. This could boost and enhance a whole part of the chemical migration process to Northern Africa.

As Hannibal said, we will either find a way or make one. But beware: The world is possible without us.

THE WESTERN MEDITERRANEAN REGION MUST REINVENT ITSELF

Abderrahmane Hadj Nacer

THE WESTERN MEDITERRANEAN REGION MUST REINVENT ITSELF

Abderrahmane Hadj Nacer

Former Governor of the Central Bank of Algeria

Modern history suggests that finding the means to finance wars has never been an insurmountable problem. Even since oil became a major means of industrialisation and transport in the late 19th century, controlling oil fields has been the subject of intense rivalry between major powers. When the First Lord of the Admiralty Winston Churchill decided in 1907 to switch the British Royal Navy, then the most powerful fleet in the world, from coal to oil, he ushered in a phase of history which is still very much with us today.

History further suggests that finding the means to finance wars has never been an insurmountable problem. Even since oil became a major means of industrialisation and transport in the late 19th century, controlling oil fields has been the subject of intense rivalry between major powers. When the First Lord of the Admiralty Winston Churchill decided in 1907 to switch the British Royal Navy, then the most powerful fleet in the world, from coal to oil, he ushered in a phase of history which is still very much with us today.

Access to the major sources of energy (oil and nuclear until the 1960s, to which gas was added in the 1980s and renewable sources of energy, notably solar, will be in the future) or control of its transport from producer to end user define the way major powers conduct their foreign policy. They offer a prism through which international affairs can be clearly understood – the latest developments in Russia's relations with Ukraine combining as it does navy bases and gas underlines the strategic role of energy.

The founder of Cambridge Energy Associates, Daniel Yergin, published *The Prize, the Epic Quest for Oil, Money & Power* in 1993. The book offers keys to understanding the history of the 20th century which are even more relevant in the turbulent times we live in. The only new element to factor in is climate change which adds to the complexity of the overall issue. The race to control the Azerbaijan oil fields in both world wars, the redrafting of the first map of Iraq after the First World War to ensure the Kurdish oil fields were denied to Turkey are the stuff of his-

tory. We are today living with the consequences of the successful ousting of the moderate Iranian nationalist leader Mossadegh in 1952 by a coalition of American and British interests. The discovery of oil in Algeria in the 1950s complicated the process of decolonisation from France.

What is deemed by many in the West to be the threat of Iran acquiring nuclear weapons dominates the policy agenda of the major powers today. The ambition policy pursued by China and India as they seek to ensure reliable long term sources of oil and gas for their fast growing economies helps shape some of the attitudes towards both countries in the US and Europe. Recent events in Niger suggest that controlling a major source of uranium can bring together an unlikely coalition of Algeria, France and the United States. The advent of solar energy is unlikely to change the behaviour of major powers and will probably fuel further conflicts - at the least it could aggravate those which exist already in the Sahel region of the Sahara today, which is host to any number of semi failed states, trafficking of human being and billions of dollars worth of illegal cocaine flows.

The question which needs to be asked is: should major sources of energy, mineral resources and future solar power in the world in the Western Mediterranean region be considered a commonwealth of all neighbouring nations? This question must be set in the broader context of relations between Europe and North Africa. What threatens Europe today is not some unlikely though widely touted alliance of all Muslims against the west, some Islamic *Jihad* dressed up in the faded finery of an unlikely *Al Quaeda Maghreb* but an exacerbation of nationalist ambitions manipulated by major powers from outside the region. Such conflicts are easy to fuel if one considers that military expenditure in southern rim Mediterranean countries, as a percentage of GDP, are the highest in the world.

So long as the control of major sources of energy is deemed an essential prerequisite to great power status, the situation can only get worse considering that we live in an ever more multipolar world, a world where natural resources are not evenly spread across countries and regions. Attempting to secure medium and long term supplies of different forms of oil, gas and key mineral resources such a phosphates and uranium will fuel more conflicts and thereby increase the list of failing or failed states in the region and worldwide. Many smaller countries will simply fall prey to more powerful neighbours or major outside powers. The combination of the race for natural resources, criminal networks linked to smuggling of weapons, human beings and drugs and terrorism is the real challenges this region faces in the decades ahead.

Resources such as oil, gas and phosphates have fed insecurity- insecurity among those who own them and who depend on their export to finance their needs, insecurity among those who buy them and who are often apprehensive that their security of supply, as they see it will, be jeopardised. Figures forecasting the level of future supplies of oil and gas, projections regarding peak oil or gas feed a growing anxiety, of eventual shortages in the West. Recent rumours, relayed in serious western publications of a future shortage of phosphate rock are a case in point. Meanwhile oil and gas producers are worried because they are incapable

of planning the level of production and export levels needed over the medium term. For those countries which are rich in energy resources, oil and gas have produced a 20-21st century version of the curse of gold and silver which blighted the Spanish economy for three centuries after the conquest of America. This curse has modern counterparts both in Europe - Holland and the United Kingdom, and in North Africa.

The challenge we face today is how we can turn this curse into a blessing? How might we build in the Western Mediterranean a community of nations loosely inspired by the principles which allowed the European Coal and Steal Community to be set up over half a century ago? How can we ensure that access to the vast energy and mineral resources the West Mediterranean region boasts be opened up to all people - in North Africa, in Europe and beyond. A further twist to that already difficult question has been added by the crisis of the Euro: are Europe's Mediterranean countries in the same economic league as Germany and northern European states? Does the fault line in the region really run between Muslims and Europeans? Between Islam and Christianity? Or does it run through Europe? For the purpose of our discussion today it maybe worth returning to the 5+ 5 framework to which we would naturally add Germany and the United Kingdom – where energy, not least solar and petrochemical industries, notably fertilisers are concerned, these two major countries are essential players in the West Mediterranean.

If we are to stand any chance of building stronger links in the Western Mediterranean region, certain conditions would have to be met which would ensure a more rational development of resources which are either finite or very expensive to develop.

1. If we consider oil and gas, it would be to Algeria's advantage to ensure that the rate at which such resources are extracted is conducted in such a way as to prolong the life of these fields over as long a period as possible. The model to follow is that of Norway, not that of the United Kingdom.
2. The rate of extraction must imperatively take into account the producer country's capacity to make good use of the money it earns by exporting its resources. In other words accumulating vast hard currency reserves is of minimal interest. The focus should be on building up added value to manufacturing capacity in the country and providing opportunities for skilled employment. In the case of Algeria this suggests a policy of developing the upstream and downstream use of oil and gas. Upstream includes drilling technology, downstream includes chemical and pharmaceutical industries.
   Nor must we forget that a certain number of key parameters of economic activity are changing fast. First of all, water can be brought to people rather than the latter having to move to water resources – desalination has the potential to change the way whole regions, hitherto short of water can be developed. If skilfully used, such techniques offer the opportunity to put a brake on migrations. They could also if combined with greater use of fertilizers help boost farming in regions too dry to support major crops such a southern Algeria, Morocco and Tunisia. Are we, in North Africa, going to allow the Chinese to buy our land as they have in Sudan and Madagascar?

3. It is here that finance – and new financial tools which we have yet to invent, come into play. Their aim would be to enhance human resources and skills, to promote a network of small and medium size enterprises in any number of fields – to quote but two – developing small oil and gas wells and building small transport units etc. The aim would be to build a series of incubators of economic activity which would create jobs, enhance skills and help avoid the rush to the coast which is a major threat to the political, social and environmental future of North Africa.

It is with these factors in mind that the proposal to set up a new Mediterranean bank can be set in context. There will never be any shortage of funds for large projects but for the type of small ventures we suggest a new framework of guarantees and support will be required; incubators which are an even more important factor across the world in developing a network of innovating small enterprises would benefit from the creation of such an institution whose structures and mandate would have to be tailored to allow it to enact such policies. The role of such a new institution would be to lead the improvement in skills needed in the region and promote training in North Africa itself. Its objective would also be to encourage private and state actors, both in North Africa, Europe and beyond to work together.

Such an ambitious policy has no chance of succeeding without some bold initiative aimed at building confidence in a region marred by national rivalries. One could imagine the capital of the Moroccan *Office Chérifien des Phosphates* (OCP) being opened to the state oil and gas company of Algeria, *Sonatrach*. The latter would be encouraged to acquire a minority stake in the Moroccan company. The capital of a major Algerian bank like the *Caisse Populaire d'Algérie* (CPA) could be opened to a Moroccan private bank. The capital of two or three major European companies such *Suez EDF, Enel* and *Gas Natural* could be opened to minority stakes from *Sonatrach, OCP* and the *Tunisian Phosphate company.*

Libya could well be a partner is such cross shareholdings and where solar energy is concerned, German companies might be interested, British oil and gas companies might be solicited. Such a bold policy would also spell greater access for European companies to North Africa's natural resources and a willingness on the part of Europeans to allow some of the scientific research and the manufacturing of equipment needed to develop these resources on the southern shores of the West Mediterranean region. New industries will develop such as building materials, new farming methods more respectful of the environment and would offer ample opportunities for investors and proof to the local population that the Western Mediterranean can be turned into a successful joint venture between the two rims of the *mare nostrum* and beyond.

WATER DESALINATION AND SOLAR IN THE MEDITERRANEAN REGION

HOUDA BEN JANNET ALLAL

WATER DESALINATION AND SOLAR IN THE MEDITERRANEAN REGION[1]

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Context

The Southern Mediterranean countries (from Morocco to Turkey) (SMCs) are following the same path of production and consumption patterns as the North Mediterranean countries. The target is to close the gap and to join the group of industrialised countries. This, of course, leads to increasing needs and also related expected tensions in particular as it is taking place in a relatively difficult context, with the rise of serious concerns over resources, environment and climate change.

In this context, water resources are an important issue for all Mediterranean countries. Most countries are likely to face drinking water shortages in the decades ahead, some already face this situation. With the population growing quickly in the southern Mediterranean region, natural water resources will not be sufficient to satisfy total expected demand.

Moreover, water will always be intrinsic to economic and social development, and water shortages may cause serious tensions in the coming decades. On this basis, current trends do indeed look unsustainable. So, the future requirements are clear: provide water for all in a sufficient but efficient way but never forget the environmental dimension of the question. This cannot and will not be achieved easily and rapidly.

The scarcity of water in the Mediterranean region

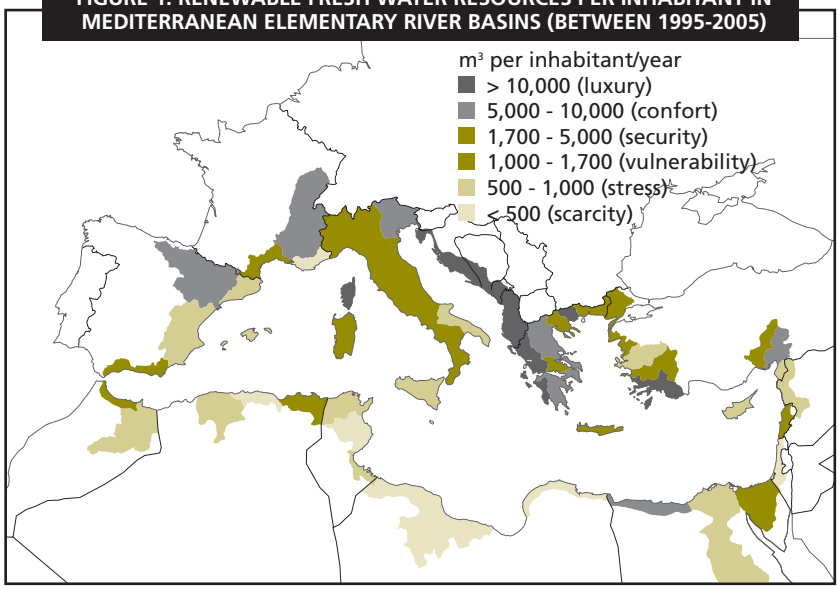
Water in the Mediterranean region is a rare and unevenly distributed resource, which makes it an important issue for all countries. Climate change and decline in rainfall means that what is a difficult situation can only worsen over years.

1. The paper is largely based on the results of the ongoing EC-FP7 MED-CSD Project "Combined solar power and desalination plants: techno-economic potential in Mediterranean Partners Countries", coordinated by OME and conducted by a Euro-Mediterranean consortium of 13 partners.

Water demand in the region doubled in the second half of the 20th century. The agriculture sector remains the main consumer of water, but the municipal and industrial sectors will become important consumers in the future due to the high population and socio-economic growth in southern countries. In many countries in the region, water withdrawal is approaching the limits of available resources.

Most of the countries are likely to face shortages of drinking water in the decades ahead, some are already facing this situation, mainly due to limited resources and an increase of population and needs. For many years, water shortages, which are cyclical or structural, have been observed. According to the Plan Bleu, in the Mediterranean in 2025, the number of "poor" water population (i.e. countries with less than 1,000 m^3/habitant/year[2]) will amount to 250 million, 80 million of whom will have "scarce" water (i.e. countries with less than 500 m^3/habitant/year). In 2008, the Mediterranean region accounted for 60% of the population of the world's "water-poor" countries (figure 1.). In addition, 20 million Mediterranean inhabitants, mainly in rural areas, have no access to drinking water (Plan Bleu 2008).

FIGURE 1. RENEWABLE FRESH WATER RESOURCES PER INHABITANT IN MEDITERRANEAN ELEMENTARY RIVER BASINS (BETWEEN 1995-2005)



Source: Blue plan from national resources

Water supplies are vulnerable in most of these countries for two reasons - because of an overexploitation of the renewable groundwater and the exploitation of non-renewable resources (fossil water). Moreover, degradation and pollution by man have added to the tensions on natural resources. These human actions alter the water system and quality, which limits the possibilities of various uses. These stresses on water will lead to greater health risks, conflicts of use between users, sectors, countries and vulnerability of supplies due to increased costs (particularly for water treatment). Alternative solutions are needed to prevent such a situation.

2. World Bank definition.

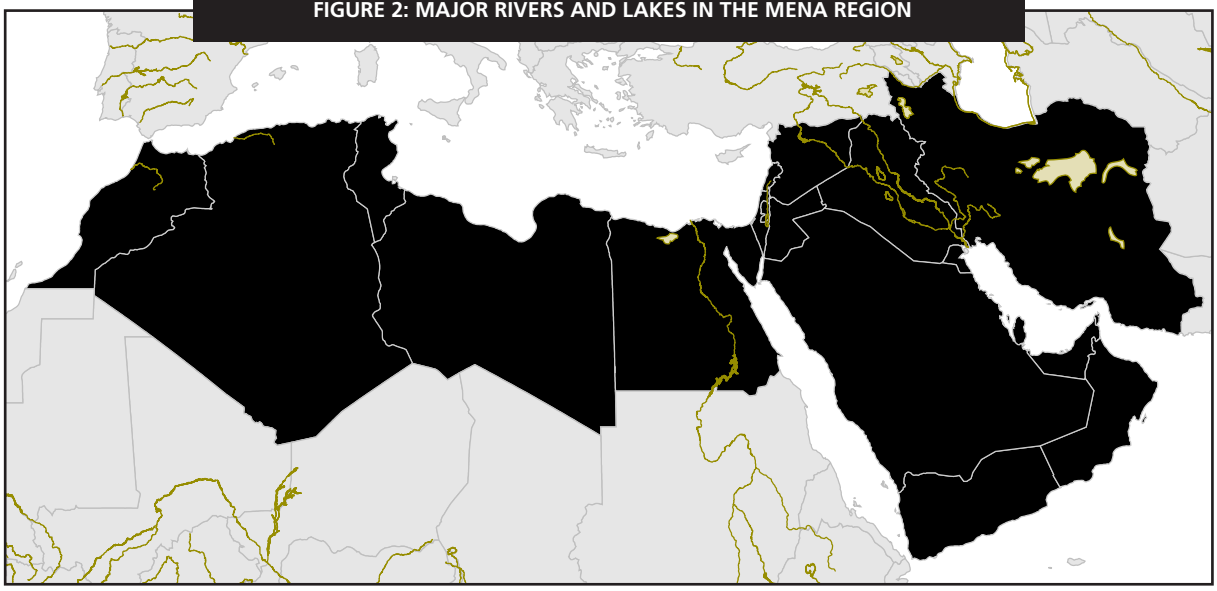
An overview of fresh water resources in the Mediterranean Region

Basically, the natural resources of fresh water are rainfall, rivers, lakes and groundwater sheds. A detailed definition of the different resources is given in "*Review of World Water Resources by Country*" (FAO, 2003).

There is a lot of rainfall in the north of the Middle East and North Africa (MENA) region, with an annual precipitation of more than 300 mm/y, but these are mainly restricted to coastal areas. According to the FAO, the annual average precipitation in the Maghreb region is about 86 mm/y, which equals 495 Bm^3/y^3, while in north-eastern Africa the annual average of rainfall is around 306 mm/y or 1,275 Bm^3/y.[3]

In the South Mediterranean region, there are only few major perennial rivers and lakes. More precisely, in MPCs, there are few rivers and lakes, namely the Nile and Lake Nasser in Egypt, and small rivers in Morocco as well as in Cyprus (Figure 2).

FIGURE 2: MAJOR RIVERS AND LAKES IN THE MENA REGION

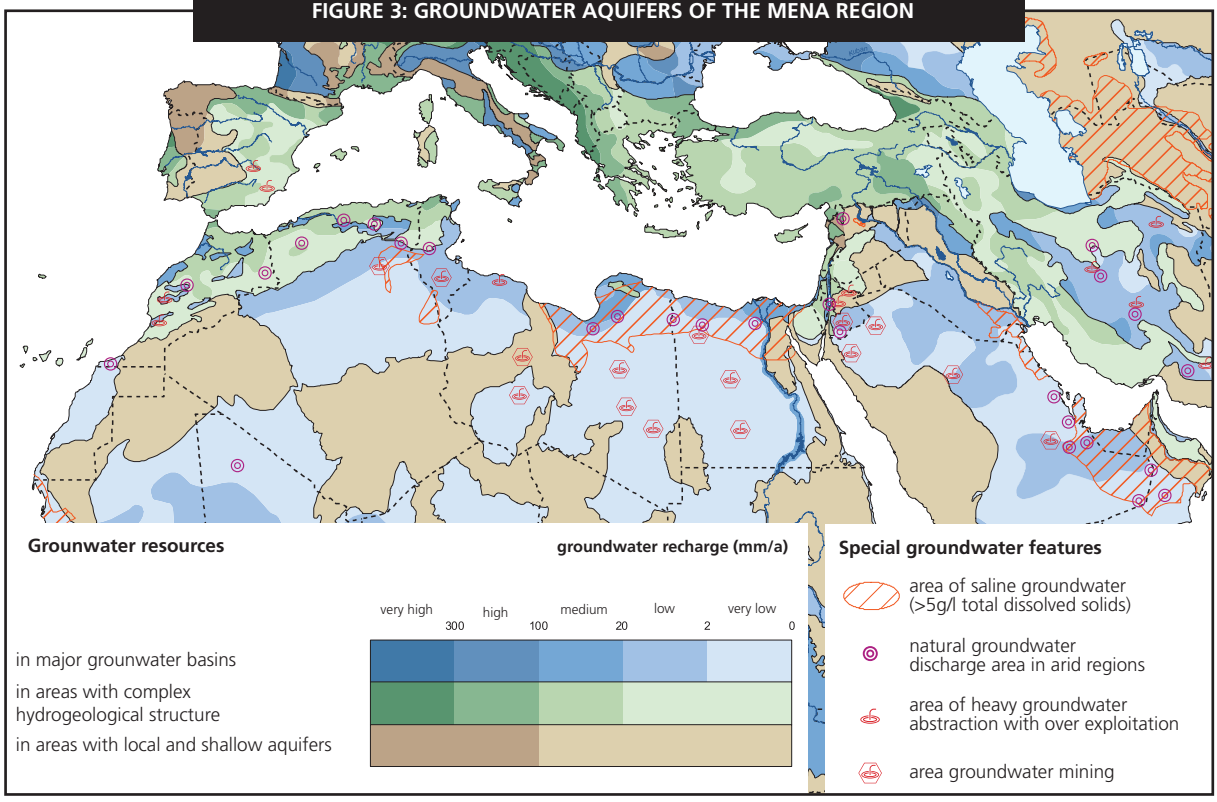


Source: World Bank 2007

There are very large groundwater aquifers in the MENA region that are re-charged by rainfall and by incoming rivers (Figure 3). However, most of the water contained in those subterranean basins, is fossil water that is not renewed on an annual basis (BGR, 2008).

3. 1 Bm^3 = 1 000 000 000 m^3

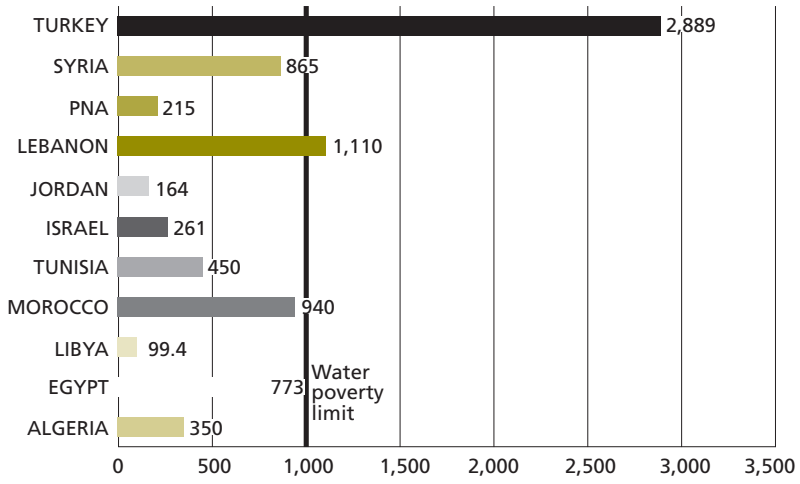
FIGURE 3: GROUNDWATER AQUIFERS OF THE MENA REGION



Source: BGR 2008

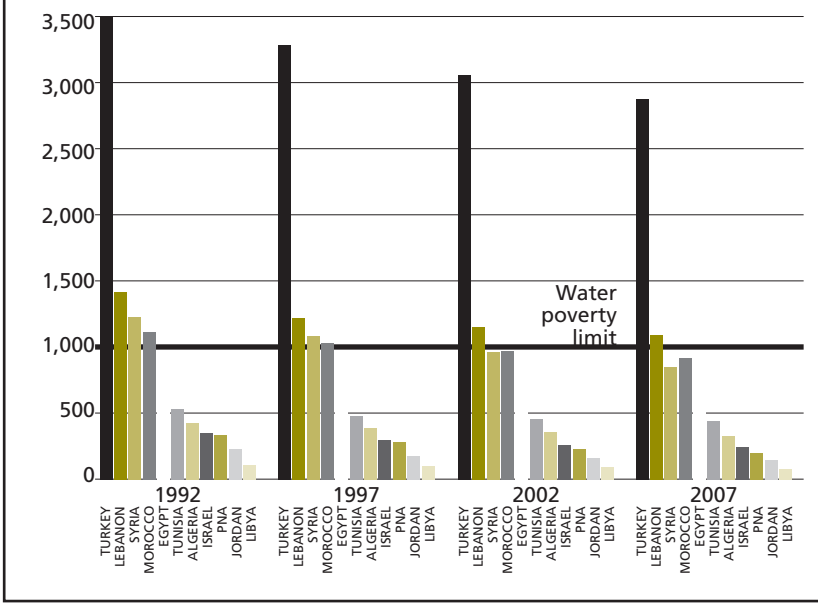
Among the South Mediterranean countries, only two – Turkey, and to a lesser extent, Lebanon- are not considered water-poor countries (Figure 4). Recent MED-CSD results confirm that MPCs can still be considered to be water-poor, except for Italy which has 3,226 m^3/cap/y, but it is unevenly distributed across the land. Indeed, some regions in the south and the islands (such as Sicily) are facing a severe shortage of water, mainly during summertime because of an increase in population during this period. Cyprus and the Italian islands are having to confront the same problem regarding the variability of water demand during the summer. Morocco and Cyprus, respectively with 940 and 922 m^3/cap/y, are on the verge of water poverty, and the situation is expected to worsen. Indeed, since the 1990s, the total renewable water per capita rapidly decreased in all countries (Figure 5).

FIGURE 4: TOTAL RENEWABLE WATER PER INHABITANT (M³/CAP/Y) IN SMCS AND MPCs in 2007



Source: OME based on data from FAO 2007

FIGURE 5: TOTAL RENEWABLE WATER PER INHABITANT (M³/CAP/Y) IN SMCS AND MPCS, 1992-2007



Source: OME based on data from FAO 2007

Prospects for water demand in the Mediterranean region: threats of deficit and tension confirmed

As part of the MED-CSD Project, and with the aim of assessing the techno-economic potential of CSP for electricity and desalination in MPCs, OME – with the support of DLR and the national partners of the project (Cyprus Institute, NREA, Techint, ONEP, PEC) – conducted a prospective analysis of water demand in the region up until 2050 by considering 3 different scenarios: the first assumes a 'Business as usual' trend, and thus relatively low efficiency gains (LE), the second is more optimistic (MEDCSD scenario) and the last takes into account extreme efficiency gains (EE). The prospective exercise also considers two socio-economic scenarios: one based on Business as usual (BaU) the other one on closing the gap (CG)[4].

In the **BaU scenario**, the demand for fresh water in the South Mediterranean is expected to grow more or less proportionally to the population in the case of low efficiency, which could be interpreted as the growth of population being the only driving force for water demand development. In the case of better improvement of uses and efficiency, water demand will grow less than population (Table 1). This demonstrates the crucial role of water management and efficiency distribution and end use. However, this also shows that these measures alone will not be enough to cover future demand in the South Mediterranean region, especially if the current demand is already over-using the available natural fresh water resources. Thus, this scenario reflects the influence of enhanced water management, policies and efficiencies which are the highest priority for a sustainable water future in the South Mediterranean region, but which are limited by the slow economic growth within this scenario.

TABLE 1: POPULATION GROWTH COMPARED TO WATER DEMAND GROWTH BY 2050 IN THE BAU SCENARIO

	2000	2010	2020	2030	2040	2050
Pop growth	1.8	1.7	1.3	0.9	0.7	0.5
Water demand SM CS growth rate-LE	1.4	1.7	1.2	0.9	0.8	0.6
Water demand SM CS growth rate-MEDCSD	1.0	1.4	0.9	0.7	0.5	0.3
Water demand SM CS growth rate-EE	0.5	1.0	0.6	0.4	0.3	0.1

Source : OME

In the **CG scenario**, the demand for freshwater in the South Mediterranean is expected to grow more than in the other scenario, due to a higher growth rate of the GDP. As a consequence, municipal and industrial water demands will be higher in all scenarios and will represent an important driving force for water demand. Water demand growth will be higher than population growth, even with high efficiency gains (Table 2). This scenario also reflects the marked influence of enhanced water management, policies and efficiencies, thus highlighting the importance of making them the highest priority for a sustainable water future in the South Mediterranean region.

TABLE 2: POPULATION GROWTH COMPARED TO WATER DEMAND GROWTH BY 2050 IN THE CG SCENARIO						
	2000	2010	2020	2030	2040	2050
Pop growth	1.8	1.7	1.3	0.9	0.7	0.5
Water demand SM CS growth rate-LE	1.4	2.0	1.7	1.5	1.4	1.4
Water demand SM CS growth rate-MEDCSD	1.0	1.7	1.3	1.2	1.1	1.1
Water demand SM CS growth rate-EE	0.5	1.3	1.0	0.9	0.9	0.9

Source : OME

The model shows that by 2050, water demand will be more than 200 Bm^3/y in almost all scenarios and could reach 337 Bm^3/y in case of high GDP growth and low efficiency gain (Table 3). However, even with high GDP growth rate, if policies and measures were taken in order to have high efficiency gain this total of 337 Bm^3/y could be reduced to 246 Bm^3/y (-27%). With efficiency gains that are achievable within a reasonable timeframe (i.e. MEDCSD scenario) the total demand will reach 288 Bm^3/y within the Closing the Gap scenario (according to high growth of GDP and the high growth of population in South Mediterranean region). In all cases, such amount of freshwater demand will exert significant pressure on the scarce water reserves of this mainly arid region.

TABLE 3: TOTAL WATER DEMAND (BM^3/Y) IN SOUTH MEDITERRANEAN REGION BY 2050							
BM^3/y	2000	Ba U 2050			GC 2050		
		LE	MEDCSD	EE	LE	MEDCSD	EE
Total SM Cs Demand	157	269	233	199	337	288	246
Total SWM Cs Demand	94	158	140	121	208	180	156
Total SEM Cs Demand	63	110	93	78	129	108	90

SWMCs: South West Mediterranean Countries SEMCS: South East Mediterranean Countries
Source : OME

The water demand in the South Mediterranean region in the year 2000 consists of 82 % agricultural use, 11 % municipal use and 7 % industrial use. While the water demand of the agricultural sector will be stagnating in the BaU scenario (tends to decrease very low), in the CG scenario it will decrease strongly to reach less than 63%, due to the high GDP which leads to increasing water demand in municipal and industrial sectors.

The model shows that in the BaU scenario, the deficit of 2050 can be reduced from 85 Bm^3/y (Low Efficiency scenario) to 63 Bm^3/y (MEDCSD scenario), and even to 41 Bm^3/y under the "Extreme Efficiency" scenario. The difference between the two extreme scenarios is approximately 50%. Water reduction deficit is higher in the CG scenario, and could be reduced from 125 Bm^3/y to 50 Bm^3/y by 2050 if measures are taken in favour of high efficiency in water management and uses. In this scenario, even with relatively good efficiency (as in the MEDCSD scenario), the deficit will remain very high and will continue to be a major concern for the South Mediterranean Countries.

The "Low Efficiency" scenario clearly indicates that a strategy following current paths would lead to an unsustainable situation for the region, and even the "Closing the Gap" scenario would lead to severe environmental and socio-economical impacts. With high efficiency gains, the deficit in the region will be reduced by 50% with relatively low growth rate of GDP, and by 60% with high GDP growth rate.

4. The **"Business as usual"** scenario (BaU) uses the figures from the futures of global interdependence (FUGI) global modelling system and from the International Monetary Fund (IMF) for GDP forecasts until 2030. For GDP forecasts from 2030 to 2040, we made a hypothesis of a lower GDP growth rate than the 2030 level. The same hypothesis has been made for the 2040-2050 period as compared to the period 2030-2040. The **"Closing the Gap"** scenario (CG) assumes that the relative distance between the actual average (2007) of per capita GDP in North Mediterranean countries and the respective countries of SMCs will be reduced by 50% in 2050. To calculate this scenario - and not forecast- the average annual per capita GDP growth rate of 1.35% for NMCs has been used as the reference.

TABLE 4: TOTAL WATER DEFICIT (BM³/Y) IN SOUTH MEDITERRANEAN REGION BY 2050							
BM³/y	2000	Ba U 2050			GC 2050		
		LE	MEDCSD	EE	LE	MEDCSD	EE
Total SMCs Deficit	19.44	85.2	63.4	41.4	124.7	83.0	49.9
Total SWMCs Deficit	19.25	73.7	57.2	40.9	102.9	71.2	46.9
Total SEMCs Deficit	0.19	11.5	6.3	0.5	21.9	11.8	3.0

Source : OME

Egypt, Libya and Syria are the countries with the largest expected deficits. The Egyptian deficit in 2050 would amount to more than 35 Bm³/y in the best case and about 90 Bm³/y in the worst case, which represents around 75% to 80% of the regional deficit. Egypt will be the country most seriously affected by scarcity of water.

South East Mediterranean countries are not very much affected by water scarcity, and the deficit in 2050 is expected to range between 1 and 22 Bm³/y (according to the different scenarios). Most of this deficit will be concentrated in Syria, but in some cases Israel, Jordan and PNA will have shortages of fresh water, in particular in case of high GDP growth and low efficiency gain in water uses.

The MEDCSD scenario reflects a compromise between two extremes, with efficiency gains that are achievable within a reasonable timeframe. This scenario indicates that a well balanced approach of increasing efficiencies of water extraction, distribution and end-use, improved water management and increased seawater desalination powered by renewable energy sources (mainly solar energy), will lead to a more sustainable path for water supply and demand for the South Mediterranean region.

Past studies (Plan Bleu, DLR, …) and MED-CSD results show that increasing supply, which was the main response of water policies in Mediterranean countries, has reached its limit. In view of this situation, management of water demand could be an effective way to reduce losses, irrational uses (waste, etc) and to improve the efficiency of resource uses.

So far, the proposed solutions to this situation have been dominated by a call for policies and measures such as better water management, measures to increase efficiency, higher and unsubsidised water tariffs, increased accountability, re-use of wastewater and better management of groundwater. Some of the countries that possessed the energy and financial means to do so also took into consideration seawater desalination, using for this purpose their abundant fossil energy resources (World Bank, 2007).

However, groundwater resources are already being over-used, fuel for desalination is becoming very expensive, and there is simply not enough water available, no matter whether it is well-managed or not. Of course, the above-mentioned measures make a lot of sense and should be implemented as soon as possible. They will effectively stretch existing resources and delay a possible collapse. But they will not be able to prevent a collapse of water supply in the long term if no additional new sources for fresh water are found and activated in time. As a consequence of scarcity, some places in these countries have already been abandoned, and migration induced by water scarcity is increasing, which solves nothing but instead creates similar problems in other regions.

As a consequence, in addition to efficient water management, water desalination is a second option to reduce tensions. However, desalination using renewable energy resources is the most sustainable solution as desalination is a heavy energy consumer. This can help to supply a share of water needs in a sustainable manner.

These goals, compared to conventional approaches, are "win-win": they improve security of water supply, limit the environmental impacts, risks of conflict and cost of access to water, and they have the potential to enhance economic growth and stability in the region.

TABLE 5: RESULTS OF THE WATER DEMAND SCENARIO IN MEDITERRANEAN REGION (CG-MEDCSD SCENARIO)

Year		2000	2010	2020	2030	2040	2050
CG-MEDCSD							
Total South West							
Exploitable Water	Bm³/y	81.86	81.86	81.86	81.86	81.86	81.86
Agricultural Use	Bm³/y	79.69	90.65	101.47	109.65	115.32	118.26
Municipal Use	Bm³/y	8.84	11.08	15.68	21.59	29.07	38.51
Industrial Use	Bm³/y	5.40	6.76	9.55	13.12	17.61	23.19
Wastewater reused	Bm³/y	3.08	4.76	8.22	13.33	20.64	30.85
Total Demand	Bm³/y	93.93	108.50	126.70	144.36	162.00	179.96
Deficit	Bm³/y	19.25	30.89	43.63	54.57	63.96	71.24
Sustainable Water	Bm³/y	74.68	77.60	83.06	89.79	98.04	108.72
Total South East							
Exploitable Water	Bm³/y	138.04	138.04	138.04	138.04	138.04	138.04
Agricultural Use	Bm³/y	48.93	54.98	59.01	61.81	63.07	62.90
Municipal Use	Bm³/y	9.30	11.30	14.72	18.93	23.93	29.88
Industrial Use	Bm³/y	4.89	6.04	7.85	10.05	12.61	15.57
Wastewater reused	Bm³/y	0.87	2.42	5.24	9.38	15.10	22.73
Total Demand	Bm³/y	63.12	72.31	81.58	90.80	99.61	108.36
Deficit	Bm³/y	0.19	0.57	3.29	6.59	9.42	11.78
Sustainable Water	Bm³/y	62.93	71.74	78.29	84.21	90.19	96.58
Total South Med							
Exploitable Water	Bm³/y	219.89	219.89	219.89	219.89	219.89	219.89
Agricultural Use	Bm³/y	128.62	145.63	160.47	171.46	178.38	181.16
Municipal Use	Bm³/y	18.13	22.39	30.40	40.52	53.01	68.39
Industrial Use	Bm³/y	10.29	12.80	17.41	23.17	30.22	38.77
Wastewater reused	Bm³/y	3.95	7.19	13.46	22.71	35.74	53.58
Total Demand	Bm³/y	157.04	180.81	208.28	235.15	261.61	288.32
Deficit	Bm³/y	19.44	31.47	46.92	61.16	73.38	83.02
Sustainable Water	Bm³/y	137.60	149.34	161.35	173.99	188.23	205.31

Source : OME

Water desalination using solar technology: a green and sustainable solution

Implementation of large-scale concentrating solar-powered desalination systems have been identified as a promising solution that addresses water needs in an efficient and sustainable manner. In particular, the AQUA-CSP study conducted by DLR[5] highlighted the following advantages of such an option, and which are still current:

5. The AQUA-CSP study analysed the potential for concentrating solar thermal power technology for large scale seawater desalination for the urban centres in the Middle East and North Africa (MENA).

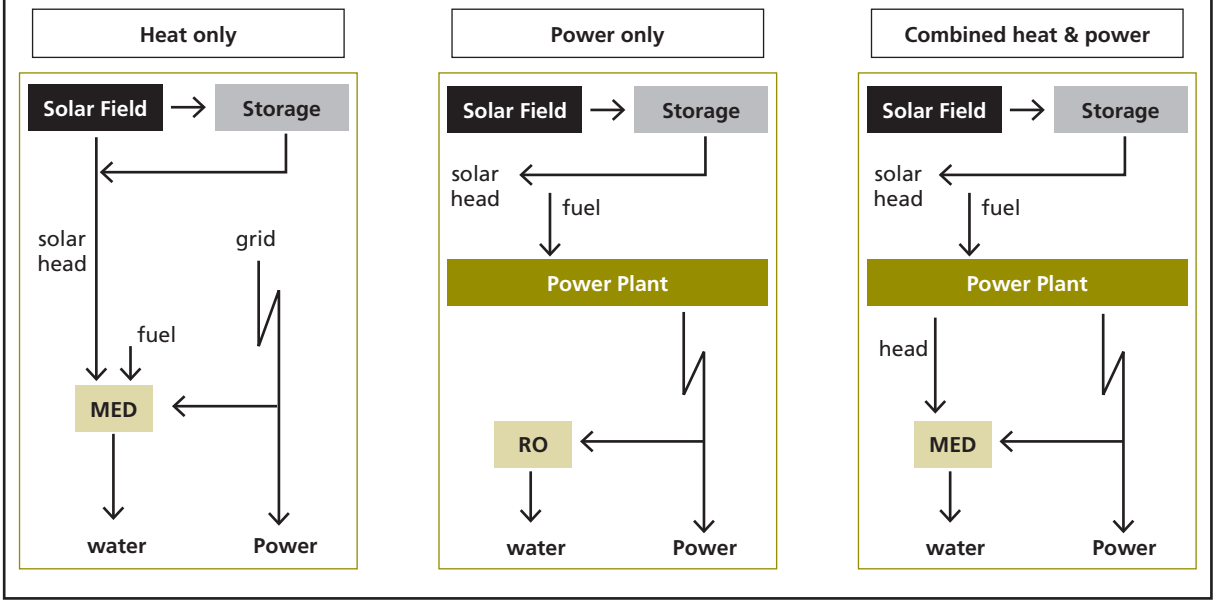
- Due to energy storage and hybrid operation with (bio)fuel, concentrating solar power plants can provide round-the-clock reliable capacity that is suitable for large-scale desalination either by thermal or membrane processes.
- CSP desalination plants can be deployed in very large units, up to several 100,000 m³/day.
- The huge solar energy potential of the South Mediterranean region can easily produce the energy necessary to prevent the threatening fresh water deficit that would otherwise increase, as noted in the previous section.
- Within two decades, energy from solar thermal power plants will become the least costly option for electricity (below 4 ct/kWh) and desalted water (below 0.4 €/m³).
- Management and efficient use of water, enhanced distribution and irrigation systems, re-use of waste water and better accountability are important measures for sustainability, but will only be able to prevent about 50 % of the long-term deficit of the region.
- Combining efficient use of water and large-scale solar desalination, and overexploitation of groundwater in the region can - and must - be ended by around 2030.
- Advanced solar-powered desalination with horizontal drain seabed-intake and nano-filtration will prevent most environmental impacts from desalination occurring today.
- With support from Europe, the South Mediterranean countries should immediately start to establish favourable political and legal frame conditions for the market introduction of concentrating solar power technology for electricity and seawater desalination.

As part of the MED-CSD Project, a technology review has been conducted which provides a review of the present state-of-the-art desalination and concentrating solar power technologies, and presents the main options for a combination of both technologies for large-scale solar-powered seawater desalination[6].

Three different technical mainstreams were addressed (Figure 6): small-scale decentralised desalination plants directly powered by concentrating solar thermal collectors, concentrating solar power stations providing electricity for reverse osmosis membrane desalination (CSP/RO), and combined generation of electricity and heat for thermal multi-effect desalination systems (CSP/MED). Multi-Stage Flash (MSF) desalination, although it currently provides the core of desalted water in the MENA region, has not been considered as a viable future option for solar-powered desalination, due to the high energy consumption of the MSF process.

6. Source: MED-CSD 2009: Trieb F., Sharfe J., Tomasek M.L., Kern J., Niesor Th., Cottret N., Glukstern P., Technology Review and Selection of CSP and Desalination Configurations adapted for Application in the Southern and Eastern Mediterranean Region. The full report is available at http://www.med-csd-ec.eu

FIGURE 6: DIFFERENT CONFIGURATIONS FOR DESALINATION BY CONCENTRATED SOLAR POWER*



Source: MED-CSD, WP1
*Left: Concentrating solar collector field with thermal energy storage directly producing heat for thermal multi-effect desalination.
Center: Power generation for reverse osmosis (CSP/RO).
Right: Combined generation of electricity and heat for multi effect desalination (CSP/MED)

Two options of combining CSP with seawater desalination have been investigated within the MED-CSD project:

Case 1: Reverse Osmosis Powered by Electricity from a CSP Plant (CSP/RO)

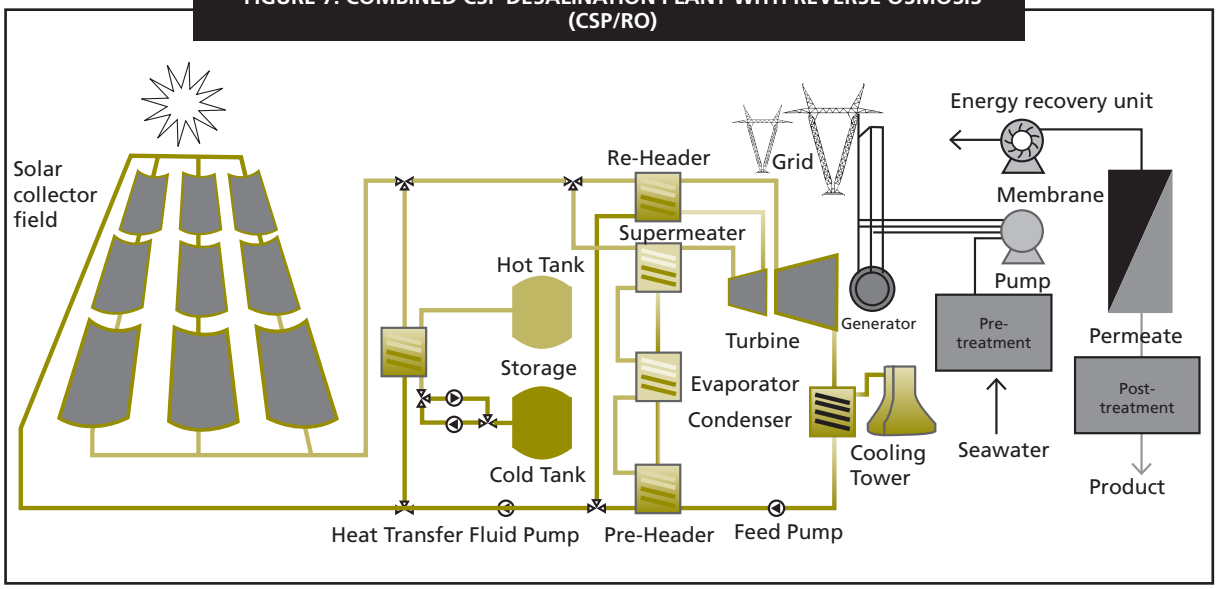
The plant configuration of the ANDASOL 1 plant can be considered the status quo of a modern CSP installation. The plant uses the modern European parabolic trough collector design SKAL-ET and the new receiver tube Schott Solar PTR-70 for its solar field. The heat transfer fluid used to transfer the solar heat to the power block is synthetic oil Monsanto VP-1, operating between 292 °C and 386 °C. The collector field has an aperture area of 510,000 m² and requires about 2 km² of land. The total outlay is about 310 million Euro.

The plant uses two large tanks containing 28,500 tonnes of molten nitrate salts (60% NaNO3 + 40% KNO3) to store solar energy received during the day for night-time operation of the turbine. The tanks are 14 metres high and have a diameter of 38.5 metres. The molten salt can store an amount of heat of 1010 MWh which is sufficient for 7.5 hours of full load operation of the turbine, with a charging capacity of 131 MWth and a discharging capacity of 119 MWth. The heat from the solar field is transferred to the molten salt tanks via HTF/salt heat exchangers and from the solar field and the storage to the power cycle via a HTF steam generator. The power cycle is comprised of a 50 MW steam turbine SST-700RH from Siemens operating with superheated steam at a pressure of 100 bar and a temperature of 377 °C. A condenser cooled by a wet cooling tower rejects the heat from the power cycle.

The plant has a gas-fired backup system (HTF Heater) to provide a maximum of 15% of the required heat when no solar energy is available. It will be used to prevent transients from clouds and to support start-up in the morning. Under the solar irradiation conditions given at the plant site in Spain, Andasol 1 will produce about 180 GWh of electricity per year. The plant was built by ACS Cobra and engineered by Grupo SENER, both well-known Spanish companies.

The ANDASOL plant configuration is very well applicable to a CSP/RO concept, producing maximum electricity during the day for RO operation and for surplus power delivered to the grid, while during night-time the plant will operate in part load and only serve the RO system which will be operated continuously during 24 hours. A configuration with an RO input power capacity of about 30% of the turbine output capacity should fit well to the ANDASOL configuration. This must still be confirmed by hourly time series modelling of plant performance under the specific conditions for the sites under consideration. The following pictures give some examples of the equipment that may be used in this configuration:

FIGURE 7: COMBINED CSP DESALINATION PLANT WITH REVERSE OSMOSIS (CSP/RO)



Source: MED-CSD, WP1

FIGURE 8: SKALET PARABOLIC TROUGH COLLECTOR WITH 150 METRES LENGTH

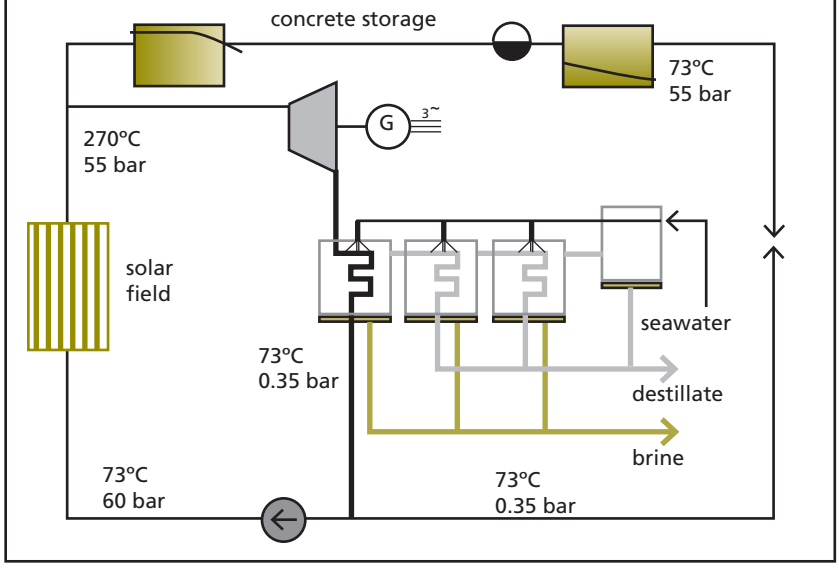
Source: MED-CSD, WP1

Case 2: Multi-Effect Desalination Using Heat & Power from a CSP Plant (CSP/MED)

An appropriate concept for such a plant must still be developed. A possible configuration could use a linear Fresnel collector field directly generating saturated steam at 270 °C, 55 bar. An intermediate heat transfer fluid and respective heat exchangers are not required in that case. A saturated back-pressure steam turbine would be used for power generation. Heat storage would consist of a concrete block with a high temperature and a low temperature section. The high temperature section would serve to store heat at around 270-250°C for saturated steam generation for the turbine, while the low temperature section would serve to store heat at around 250-75 °C for low temperature steam generation for the MED plant.

During daytime, excess steam from the oversized solar field that is not required for the turbine is used to heat up the concrete storage. While passing through the storage, the saturated steam entering at 270°C is condensed in the hot section of the storage. The condensate then enters the cold section of the storage and leaves ideally at about 73°C. The pressure of the condensate is then reduced to the backpressure of the steam turbine via a throttle valve. Then it is mixed with the condensate from the MED header and returned to the solar field by the feed pump of the power cycle.

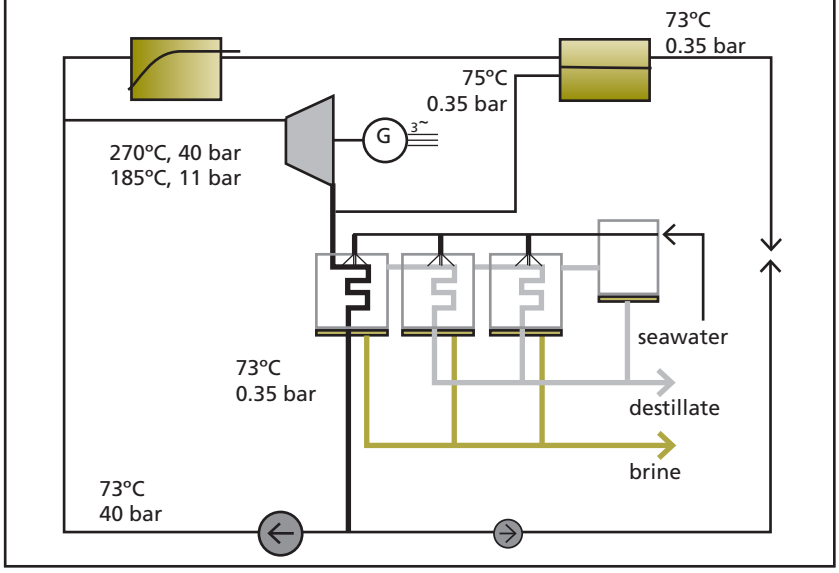
FIGURE 9: CSP/MED PLANT DURING DAYTIME OPERATION



Source: MED-CSD, WP1

During night-time, the solar field is by-passed and the condensate directly enters the cold end of the hot section of the concrete storage. There, its temperature is increased to the evaporation temperature which will be lower than at daytime of about 250 °C at a pressure of 40 bar. During discharge, pressure may be reduced to as low as 11 bar, 185°C. Passing through the hot section of the storage, the water evaporates and is then used to drive the turbine. During the night, only the amount of electricity required for the parasitic power demand of the power block and the power for the MED pumps will be produced. Therefore, the turbine will be operating in partial load, thus not generating enough steam for the MED process. The difference will be taken from condensate pumped through the low temperature storage section and evaporating at backpressure level, which will be added to the steam from the turbine. For reasons of security and control, this addition will take place through intermediate heat exchangers between the power cycle and the desalination cycle (not displayed here for reasons of simplicity). After condensation in the MED header, the condensate will be fed back to the high-temperature and to the low temperature storage.

FIGURE 10: CSP/MED PLANT DURING NIGHT TIME OPERATION



Source: MED-CSD, WP1

A possible advantage of this configuration is the independent control of power generation and seawater desalination, which allows for a certain load-following of the power generator while maintaining constant desalination capacity. Another advantage is the simplicity both of the components and of the configuration, which may help to reduce costs of electricity and water. There also seem to be several options for heat integration and efficiency enhancement that must still be exploited.

This must still be confirmed by a more detailed plant design and by hourly time series modelling of plant performance under the specific conditions for the sites under consideration. A general advantage of this configuration is that the lower operation temperature within the solar field will yield higher thermal collector efficiency. On the other hand, the efficiency of power generation will be lower than in Case 1.

To conclude, CSP and desalination technology is a promising option for the Mediterranean region particularly, and the CSP industry is developing fast. Many new stakeholders have appeared during recent years (technology providers, project developers, industry, etc.) and the economic conditions are quickly changing due to several factors (financial crisis, environmental concerns, availability of resources, etc.). But several constraints still need to be overcome in order for this option to play a substantial role in addressing water needs in the region and in a sustainable manner.

Massive changes will be needed: "focused" Euro-Mediterranean partnership, the win-win-win solution

Avoiding Preventing or facing tensions related to water scarcity in the region require a transition that will involve massive changes in technology and also in political and social awareness. Not only technology (and solar is an option) is needed but also skills in order to redefine core competencies in the coming decades to take into account these challenges and threats. In this context, technology transfer, research and education have a fundamental role to play. Technologies and capabilities are prerequisite. Adapted financial resources are of course also needed. Transfer of technology needs to be promoted between the region's northern and southern shores and regional research and development programmes need to be developed in order to accelerate the development and deployment of adapted technologies. This must be accompanied by the adaptation of education and capacity-building activities so that capabilities and required skills will be available in the region to effectively allow the required changes to take place and also to be sustained. What the region is short of today is the capacity to bring resources, capital and technology together in ways that are sustainable. This needs to be changed.

The region has no other choice than to evolve from a region of hydrocarbon dependency to a combination of the use of hydrocarbon and alternative energies. As for water, there is no other choice than efficient use and management of resources and promotion of sustainable water production technologies. In this context, solar energy can play a substantial role, considering the huge solar potential the region is endowed with.

Regional cooperation has an important role to play and the North and South Mediterranean countries have a common interest to build together a sustainable future in the region because of their interdependency. This implies a strengthened euro-Mediterranean partnership primarily devoted to the sustainable development of the region.

It is unlikely that a new paradigm for development will be developed over the short-term, and fortunately there are many ways forward to approach sustainable development in the Mediterranean region, though certain parameters are clear. What is needed is foresight, followed by action, adaptation and innovation. The response must be integrated, it must be regional and it must be balanced in terms of social, economic and environmental solutions.

The financial (and now economic and social) crisis, the energy crisis (despite the very temporary fall in oil prices), concerns related to security of supply and the need to move towards low-carbon economies to adapt to climate change, have only served to underline the need for an interest in rationalisation and the launch of complementary policies geared towards energy efficiency and energy sobriety within the region. This complementarity could be expanded to include intensive cooperation, not only in respect to energy savings and renewable energy, but also to infrastructure and issues relating to a common energy policy. The same applies to water.

The Mediterranean countries are today faced with the need to jointly forge a "green New Deal" in the Mediterranean which hinges on water and energy sobriety, to pave the way for a radical change in modes of consumption and production, thereby enabling all citizens within the region to live a different and better life. Is this a utopian vision? Not at all. It is rather the most realistic option – one which calculates the risks not so as to acknowledge our powerlessness, but instead to tailor our responses to the nature of the challenges which face us. The Barcelona Process has laid the groundwork for greater dialogue and cooperation. It must now evolve further to achieve full integration. The Euro-Mediterranean partnership needs to show, through means and actions, its commitment to sustainable development. This may be seen as an opportunity for leadership and innovation. No doubt the competitive advantage will go to those who can anticipate the pace and breadth of the changes implied by sustainable development. Otherwise, sustainable development raises issues which, if ignored for long enough, have the potential to destroy development.

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THE IMPORTANCE OF ENERGY ISSUES IN INTRA-MAGHREB RELATIONS AND IN THE RELATIONSHIPS BETWEEN THE MAGHREB AND EUROPE

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Introduction

Badly-managed imbalances and great inequalities have always been the source of misunderstandings between partners. The case of the Western Mediterranean area is instructive, among the Maghreb countries themselves, or between the Maghreb and its northern coastal neighbours. If only a common approach for an integrated and interdependent regional development could be considered, important potentialities and complementarities could exist in many sectors. But the constraints, differences and contrasts remain significant. They seem to be here to stay, if not getting worse - and this is so in every field. Energy issue is no exception. Indeed, one cannot help but notice the numerous discrepancies the region continues to face, where a sustained dialogue, mutual understanding and cooperation could succeed in getting rid of many constraints in the energy field.

Energy would have been not only the main factor in the integration that the Maghreb countries set themselves as a goal more than twenty years ago, in 1989, but also the driving force behind the economic development and international cooperation in the area, as envisaged by the Barcelona Process, since its inception in 1995. Some progress has certainly been made. But it has had limited results, lacking ambition, considering the potential and the needs in the region. In particular, it has not been the result of an approach based on complementarities and interdependencies.

In order to appreciate the constraints it is necessary to point to some general facts –social-economic as well as commercial – which will not be without consequence to future energy availability and to the development of the whole region. We will then examine the prevailing and expected energy situation in the Maghreb countries, highlighting the assets of the region as well as the challenges it has been facing, in terms of needs, infrastructure, finances and regulation.

Finally, we will attempt to list a few guidelines and/or projects, which –within the framework of a genuine and balanced cooperation – could contribute in a major way to the construction, in term, of an economic integrated area that is likely to meet the aspirations of the populations in the Maghreb countries and in Southern Europe.

Some major facts

– Firstly, concerning **demography**. Unlike the North, the population in the South is growing too fast, creating requirements in terms of development that are so heavy that the question remains as to the Maghreb countries' capability to mobilize the necessary means to face them.

  The population in the Maghreb will grow from about 85 million inhabitants today to 100 million in 2020. This important increase requires a high-level sustainable growth.

  It is undeniable that the combination of both elements (economic growth and an increasing population) will result in more energy needs.

– The second fact concerns the highly contrasting **energy situations** in Western Mediterranean, when it comes to comparing consumption levels, availability and distribution of hydrocarbon resources or considering energy trade.

  Unequal primary energy consumption underlines the insufficiencies in the development of the Maghreb countries, either considered separately or as a whole. Average primary energy consumption per capita is less than 1 ton oil equivalent (toe), when in northern Mediterranean countries it exceeds 3 toe. In other words, a northern Mediterranean inhabitant consumes three times more energy than a Southern Mediterranean.

  While in the North, European countries are dependent on oil and gas imports, hydrocarbon reserves in the Maghreb are very large, representing 5% of world oil reserves and more than 3% of total world gas reserves. They are, however, unequally distributed, and are concentrated mainly in Algeria and Libya.

  Trade among the Maghreb countries remains marginal. One is tempted to say that these countries seem to ignore one another, in spite of the needs, availability of the resources and the proximity of markets. The lack of cohesion on the political, commercial and financial fronts has so far prevented them from considering a common approach and a global vision for development.

– The third fact concerns the **economy**. Although the expression may seem somewhat strong, it could be argued that "*there are two perfectly distinct worlds*". There are indeed important gaps, in terms of development and revenues per capita, separating the northern and southern Mediterranean countries. Such differences in prosperity have affected relations between the northern and southern countries.

  Far from being a prosperous area there is clearly a lack of trust between the North and the South, as well as among the Maghreb countries themselves. This, combined with the uneven distribution of wealth in North Africa, is seriously hindering development in the region.

Cooperation between northern and southern countries has often taken the form of aid, provided by the North to the South, and of different dependencies, particularly commercial and technological, to the detriment of genuine and balanced partnerships.

These relations of dependency are due to the fact that exports outside hydrocarbons from the Maghreb countries to the European Union are limited, even decreasing, causing this region to be structurally in deficit. Further, these countries attract only a tiny part of the European capital flows every year.

– Finally, on the **commercial** front, the first observation concerns the persistent low levels of intra-Maghreb trade, given the fact that development issues are dealt with from a purely national perspective.

Indeed, trade balances in the Maghreb countries differ from one country to another. While Algeria and Libya have positive balances, as a result of their hydrocarbon exports, Morocco, Tunisia and Mauritania's balances are negative.

The prominent role of energy in the Maghreb countries' trade balances – imported by some of them and exported by others – shows the impact of excessive dependencies.

The second point worth making is that Europe, the main commercial partner, tends to globally consider the Maghreb countries as suppliers of primary energy and primary products, particularly agricultural products, and/or separate market opportunities to export manufactured and large consumption products and services.

It is true to say that, in order to profit from favourable cost and tax measures in tax-free areas set up recently in the South, European companies have delocalized parts of their activities in the Maghreb countries over the last few years. The conditions for a genuine partnership are, however, far from being met.

Energy situation and future outlook for the Maghreb

As far as energy is concerned, the Maghreb countries differ from one another in many respects. They show important discrepancies with regard to levels of consumption and the availability and distribution of hydrocarbon resources.

Energy consumption

In 2006, primary energy consumption in the Maghreb countries reached 75 Mtoe. Of the five Maghreb countries, Algeria is the largest consumer with 44% (34 Mtoe), followed by Libya with 25% (19 Mtoe), Morocco with 17% (13 Mtoe), Tunisia with 12% (9 Mtoe) and Mauritania with only 2% (1 Mtoe).

PRIMARY ENERGY CONSUMPTION 2006				
	Population	Consumption		
	M inhab	Mtoe	%	/capita
Algeria	33.3	34.0	44	1.0
Libya	6.0	18.7	25	3.1
Morocco	30.5	12.6	17	0.4
Mauritania	3.1	1.3	2	0.4
Tunisia	10.1	8.9	12	0.9
Total Maghreb	**83.0**	**75.5**	**100**	**0.9**

Sources : Regulation agencies, Ministries, National companies

Average primary energy consumption per capita is 0.9 toe in the Maghreb. In northern Mediterranean countries primary energy consumption per capita is threefold more important, reaching 3.2 toe.

These levels and inequalities in terms of energy consumption underline the importance of energy issues in the development of the Maghreb countries, either considered separately or as a whole.

By 2020, these disparities would remain and energy consumption in the Maghreb countries would dramatically increase, with +53 Mtoe. This 70% increase will be the result of the development of the electricity generation sector which will consume 31 Mtoe of fossil fuels (coal, oil and natural gas), representing nearly 40% of primary energy demand in the Maghreb region by 2020.

ENERGY CONSUMPTION FORECAST (Mtoe)			
	2006	2010	2020
Algeria	34.0	40.0	61.8
Libya	18.7	23.5	28.5
Morocco	12.6	16.6	20.0
Mauritania	1.2	1.4	1.7
Tunisia	8.9	12.6	16.1
Total Maghreb	**75.5**	**94.1**	**128.1**

Sources : Regulation agencies, Ministries, National companies

Hydrocarbon consumption

Oil consumption in the Maghreb reached 37.9 Mtoe, representing half of total primary energy consumption, whereas natural gas, with 31 Mtoe (34 Bcm) represents 41% of total energy consumption.

HYDROCARBON CONSUMPTION 2006						
	Oil		Natual gas		Other energies	
	(Mt)	%	(Mtoe)	%	(Mtoe)	%
Algeria	11.6	30.6	21.6	69.5	0.9	14.1
Libya	13.2	34.8	5.3	17.0	0.2	3.1
Morocco	8.1	21.4	0.5	1.6	3.9	60.9
Mauritania	1.0	2.6	-	-	0.3	4.7
Tunisia	4.0	10.6	3.7	11.9	1.1	17.2
Total	**37.9**	**100.0**	**31.1**	**100.0**	**6.4**	**100.0**

Sources : Regulation agencies, Ministries, National companies

According to projections for the whole Maghreb region, oil consumption is expected to increase by 24% to reach 47 Mt by 2020.

OIL CONSUMPTION BETWEEN 2006 AND 2020 (Mt)			
	2006	2010	2020
Algeria	11.6	13.0	15.0
Libya	13.2	12.3	13.3
Morocco	8.1	9.4	9.5
Mauritania	1.0	1.2	1.2
Tunisia	4.0	6.8	7.6
Total Maghreb	**37.9**	**42.6**	**46.6**

Sources : Regulation agencies, Ministries, National companies

Natural gas demand should grow dramatically by 135% between 2006 and 2020 to reach 80 Bcm. Consumption in power generation will increase from 17 Bcm in 2006 to 34 Bcm in 2020. Algeria will remain the largest natural gas consumer in 2020, with 50 Bcm, followed by Libya with 16 Bcm, Tunisia with 8 Bcm and Morocco with nearly 6 Bcm.

NATURAL GAS CONSUMPTION BETWEEN 2006 AND 2020 (Bcm)			
	2006	2010	2020
Algeria	23.7	28.6	50.0
Libya	5.9	12.1	16.5
Morocco	0.6	1.0	5.7
Mauritania	-	-	-
Tunisia	4.0	5.0	7.7
Total Maghreb	**34.1**	**48 .2**	**79.9**

Sources : Regulation agencies, Ministries, National companies

Electricity

Electricity consumption in the Maghreb reached 91.5 TWh in 2006. Consumption for each country was as follows: 38% in Algeria (34.3 TWh), 26% in Libya (24.0 TWh), 21% in Morocco (19.2 TWh), 15% in Tunisia (13.5 TWh) and less than 1% in Mauritania (0.4 TWh).

ELECTRICITY CONSUMPTION AND INSTALLED PRODUCTION CAPACITY (2006)		
	Consumption TWh	Installed production capacity GW
Algeria	34.41	8.0
Libya	23.99	5.8
Morocco	19.18	5.3
Mauritania	0.40	-
Tunisia	13.47	3.2
Total Maghreb	**91.45**	**22.3**

Sources : Electricity companies

Installed electricity production capacity in the Maghreb totalled about 22 GW. Although the electrification rate exceeds now 95% in the Maghreb countries, the needs in terms of production capacity are considerable. In fact, in order to meet their growing needs, the Maghreb countries will have to build an additional 23 GW production capacity over the next 10-15 years, therefore doubling their current capacity. Such development will require huge investments and building capacities.

Hydrocarbon reserves and production

Hydrocarbon reserves in the Maghreb are estimated at 7 billion tons of oil and more than 6000 Bcm of natural gas. These resources are unevenly distributed and are mainly concentrated in Algeria and Libya. Those countries possess 87% of the oil reserves and 71% of the natural gas reserves of the Mediterranean area.

HYDROCARBON RESERVES AND PRODUCTION (2008)

	Oil					Natural Gas				
	Reserves as of 31.12.2008			Production	Ratio R/P	Reserves as of 31.12.2008			Production	Ratio R/P
	10^3 Mt	% Med	% World	Mt	(years)	Bcm	% Med	% World	Bcm	(years)
Algeria	1.5	18.1%	1.0%	85.6	17.5	4600	53.3%	2.4%	86.5	53.2
Libya	5.7	68.7%	3.5%	86.2	66.1	1540	17.9%	0.8%	15.9	96.9
Tunisia	0.1	1.2%	-	4.2	23.8	95	1.1%	-	3.0	31.7
Maghreb	**7.3**	**88.0%**	**4.5%**	**176.0**	**41.5**	**6235**	**72.3%**	**3.2%**	**105.4**	**59.2**
Rest Med.	**1.0**	**12.0%**				**2390**	**27.7%**			

Sources: OPEC, BP Statistical Review, Cedigaz.,APRC

Libya holds 5.7 billion tons of oil reserves, representing nearly 66 years of production based on its current annual rhythm. Algeria has only 1.5 billion tons, representing 17 years of production based on current annual rhythms. As for natural gas, reserves are much more important in Algeria, with 4600 Bcm, than in Libya, with 1540 Bcm. In 2008, the Maghreb countries produced more than 176 Mt of oil and some 105 Bcm of natural gas.

Intra-Maghreb energy trade

Energy trade among the Maghreb countries is particularly low when one considers the needs, the resource availability and the geographical proximity.

The striking and fundamental observation is that trade in the oil sector among these countries is insignificant. In 2005, it reached 1.8 Mt, representing only 2.6% of total marketed oil quantities in the region, some 69.6 Mt.

The amounts of oil traded among the Maghreb countries in 2005 were as follows:

EXPORTS

200510^3 t Imports	Algeria	Libya	Morocco	Tunisia	Total Maghreb	Other Mediterranean countries	Rest of world	TOTAL
Algeria	-	0	0.03	0	**0.03**	402	450	852.03
Libya	0	-	0	0	**0**	0	29	29
Morocco	975	37	-	0	**1 012**	490	6 167	7 669
Mauritania	0	0	0.15	0	**0.15**	0	0	0.15
Tunisia	0	779	11.6	-	**790.6**	191	3 278	4 260
Total Maghreb	**975**	**816**	**11.78**	**0**	**1 803.18**			
Other Med.	20 159	45 372	0	1 317	66 848	-		
Rest of world	140	779	0	0	919		-	
Total	**21 274**	**46 967**	**11.78**	**1 317**	**69 569.78**			-

Sources: IEA, CPDP, BP

Algeria exported only 1 Mt of LPG to Morocco, representing 4.6% of its exports of oil products. Algeria does not sell oil to its neighbouring countries. Outside the small quantities of oil products imported from Algeria, covering some 10.6% of its needs, Morocco imports 6.7 Mt from outside the Maghreb region. As for Tunisia, it imports 0.8 Mt of oil from Libya of a total of 4.3 Mt imported annually, representing only 18.3% of its energy imports. It exports 1.3 Mt of petroleum products to countries outside the Maghreb region. Out of a total of nearly 47 Mt exported by Libya, only 0.8 Mt are sold to Tunisia; that is, 1.7% of its total oil exports.

As far as natural gas is concerned, Tunisia and Morocco are transit countries. Parts of the amounts of natural gas exported to Italy and Slovenia on one side and to Spain and Portugal on the other, are meant for Tunisia and Morocco respectively. In 2006, their share did not exceed 1.8 Bcm, representing 2.9% of Algeria's total gas exports.

In the electricity sector, cross-border trade in the Maghreb is shown in the table below. One may note the very low level of exchanges, only 0.7 TWh in 2006, representing 0.7% of total electricity consumption in the region. Although a line linking Libya to Tunisia was constructed in 2003, the two countries have not yet started trading electricity.

2006 (GWh)

		Exports						
		Algeria	Libya	Morocco	Tunisia	Egypt	Spain	**Total**
Imports	Algeria	-	-	136	135	-	-	**271**
	Libya	-	-	-	-	122.6	-	**122.6**
	Morocco	159	-	-	-	-	1 899	**2 058**
	Tunisia	141	-	-	-	-	-	**141**
	Egypt	-	91.2	-	-	-	-	**91.2**
	Spain	-	-	27	-	-	-	**27**
	Total	**300**	**91.2**	**163**	**135**	**122.6**	**1 899**	**2 710.8**

Sources: COMELEC, Electricity companies

The only significant amount of electricity exchanged is between Morocco and Spain with 1.9 TWh. A new 400kV line linking Algeria to Morocco has been brought to service recently. It is expected to make up for some malfunctions and make it easier for Spain to purchase electricity from Algeria.

The Maghreb countries barely trade among themselves and everything seems to point to a lack of trust; which has always been the basis for any trade.

2-6 Gas exports to Europe

In 2008, Algeria and Libya exported nearly 70 Bcm of gas, with 47.4 Bcm by pipeline and 22.4 Bcm in liquefied form.

60.5 Bcm, around 87% of total sold amounts, were exported to five Southern European countries: Spain, France, Greece, Italy and Portugal.

95% of the Maghreb's pipeline exports are imported by these five European countries, which also import 68% of the LNG exported by the Maghreb.

Exports										
2008	Algeria		Libya		Total Maghreb		Others		Total	
Imports	Bcm	%	Bcm	%	Bcm	%	Bcm	%	Bcm	%
Total	13.87	35.02	0.53	1.34	14.40	36.36	25.20	63.64	39.60	100.00
Spain Pipeline	8.97	82.52	-	-	8.97	82.52	1.90	17.48	10.87	100.00
LNG	4.90	17.06	0.53	1.84	5.43	18.90	23.30	81.10	28.73	100.00
Total	7.60	9.34	-	-	7.60	9.34	41.65	84.56	49.25	100.00
France Pipeline Pipeline	-	-	-	-	-	-	36.66	100.00	36.66	100.00
LNG	7.60	60.37	-	-	7.60	60.37	4.99	39.63	12.59	100.00
Total	0.70	16.91	-	-	0.70	16.91	3.44	83.09	4.14	100.00
Greece Pipeline Pipeline	-	-	-	-	-	-	3.20	100.00	3.20	100.00
LNG	0.70	74.47	-	-	0.70	74.47	0.24	25.53	0.94	100.00
Total	26.00	33.82	9.87	12.84	35.87	46.66	41.00	53.34	76.87	100.00
Italy Pipe Pipeline	24.44	32.45	9.87	13.11	34.31	45.56	41.00	54.44	75.31	100.00
LNG	1.56	100.00	-	-	1.56	100.00	-	-	1.56	100.00
Total	1.93	42.32	-	-	1.93	42.32	2.63	57.68	4.56	100.00
Portugal Pipeline	1.93	100.00	-	-	1.93	100.00	-	-	1.93	100.00
LNG	-	-	-	-	-	-	2.63	100.00	2.63	100.00
Total	**50.10**	**28.73**	**10.40**	**5.96**	**60.50**	**34.69**	**113.92**	**65.31**	**174.42**	**100.00**
Total 5 Pipeline	**35.34**	**27.62**	**9.87**	**7.71**	**45.21**	**35.33**	**82.76**	**64 .67**	**127.97**	**100.00**
LNG	**14.76**	**31.78**	**0.53**	**1.14**	**15.29**	**32.92**	**31.16**	**67.08**	**46.45**	**100.00**
Total	50.10	84.39	10.40	100.00	**60.50**	**86.71**				
Total 5 Pipeline	35.34	94.24	9.87	100.00	**45.21**	**95.44**				
LNG	14.76	67.49	0.53	100.00	**15.29**	**68.26**				
Total	1.75	2.95	-	-	**1.75**	**2.51**				
Other Med. Pipeline	1.75	4.67	-	-	**1.75**	**3.69**				
LNG	-	-	-	-	**-**	**-**				
Total	7.52	12.66	-	-	**7.52**	**10.78**				
Rest Pipeline	0.41	1.09	-	-	**0.41**	**0.87**				
LNG	7.11	32.51	-	-	**7.11**	**31.74**				
Total	**59.37**	**100.00**	**10.40**	**100.00**	**69.77**	**100.00**				
Total Pipeline Pipeline	**37.50**	**100.00**	**9.87**	**100.00**	**47.37**	**100.00**				
LNG	**21.87**	**100.00**	**0.53**	**100.00**	**22.40**	**100.00**				

Sources: IEA, BP, CEDIGAZ

While the Maghreb producers are heavily dependent on their exports, the five Southern European countries have diversified their supply sources. Natural gas imported from Algeria and Libya represents less than 35% of total imported gas. However, the share of gas imported from the Maghreb varies from one country to another. With more than 50 Bcm, Algeria contributes with nearly 29% to the five European countries' gas supplies. On the other hand, its dependency on its exports to these countries exceeds an average of 84% (more than 94% by pipeline and 67.5% in liquefied form). Libya exported a little more than 10 Bcm, nearly in totality by pipeline to Italy, contributing with 13% to Italian gas supplies. The agreement signed with the Italian ENI should help Libya to raise by 3 Bcm/year its pipeline exports. The agreement provides for the construction of an LNG factory to liquefy 5 Bcm/year. With the coming into service in June 2010 of the MEDGAZ pipeline, which (in its first phase) will carry 8 Bcm of Algerian gas to Spain, and the construction of the GALSI pipeline to transport 8 Bcm to Italy via Sardinia (expected to be completed in 2012-2013), Algerian gas supplies to the five European countries should in term exceed 76 Bcm. More LNG volumes are expect-

ed to be exported with the boosting of the Skikda LNG factory and the increase in the Arzew liquefaction capacity. By the end of the decade, 80 to 85 Bcm of gas will be exported from the Maghreb by tanker or pipeline, direct and fixed links, representing a major contribution to the supply security and a diversification of import sources for the five Southern European countries.

Intra Maghreb co-operation

So far, the Maghreb countries have separately sought to:

- develop their exports to their main partner, the EU ; mainly primary products (hydrocarbons and agriculture);
- attract foreign investments.

They ended up competing against one another, not only to export their products but also to attract international capital flows. In addition, their exports are particularly sensitive to exogenous factors: oil prices for Algeria and Libya, the ups and downs of agriculture and the tourist trade for Morocco and Tunisia. To illustrate the importance of these insufficiencies and deficits, one may cite the intra-Maghreb trade which represents only 3% of foreign trade in the area. According to some experts, the delay in implementing the economic integration process within the Arab Maghreb Union's framework costs them each 2% of their GDP yearly. Another cooperation path would have been to promote the development of integrated projects by Maghreb-based economic players. Such an approach would have helped them to join forces in their trade with the EU, to offer complementarities within their production structures and to become fundamental partners for European companies. In the energy sector, each of the Maghreb countries, faced with its needs, has to mobilize huge funds. In the short and medium terms, such financial pressures and the growing demand for energy may result in tensions on the supply side and therefore in shortages.

The question one may ask is whether the Maghreb countries will be able, separately, to raise the necessary funds given their economic situation, the size of their markets, the low credit rating of local demand, and the gaps in available public financing.

In order to face this huge challenge, several solutions could be envisaged.

The development of intra-Maghreb energy trade

This is vital! It holds great potential, provided that the Maghreb states show some political will and encourage it on the commercial standpoint.

Globally, by 2020, more than 18 Mtoe could be traded among the Maghreb countries, representing some 15% of total primary energy demand in the region.

Among the concrete initiatives that could be envisaged in the short and medium terms, one may mention:

- The *construction of multi-product pipelines* (LPG, petrol and diesel oil) linking production and distribution units located near the Algerian-Moroccan and Algerian-Tunisian borders to the neighbouring markets.
- The *use of natural gas,* in particular in Morocco, in power generation as well as in industrial sector. A network of pipelines could be constructed to link the Maghreb Europe pipeline crossing the Moroccan territory to inland industrial zones and large cities.
- The *development and optimum exploitation of cross-border electricity lines.* This initiative would contribute to increasing electricity trade, reducing consequently the constraints to build new production capacity.

Implementing integrated partnership projects

It is necessary, today more than ever, to develop new paths for cooperation at regional level; cooperation that would allow the Maghreb ultimately to face many challenges, particularly economic development and demographic growth. The basic principle would be to create joint companies gathering players from the Maghreb countries to develop integrated projects within the framework of cross-interest partnerships. Reforms implemented by the Maghreb countries separately over the last few years, have contributed to liberalizing their respective markets, but should of course be harmonized and made compatible. Further, inviting other Mediterranean countries to join this cooperation programme would make it easier to meet the criteria for financing and project implementation. As far as the Maghreb is concerned, the approach should no more be based on "every country for itself", a policy which has so far been privileged. The assets of the whole region should be taken into consideration: geo-strategy, economy, trade, finance, but also a young workforce. Listing all the fields that offer regional integration opportunities would be impossible. However, as an illustration, it is worth mentioning two concrete examples:

- New projects in petrochemicals are envisaged or being implemented in Algeria, in particular to produce :

- polypropylene, plastic used to manufacture car parts as well as food packaging;
- polyethylene terephtalate (PET), plastic used for making mineral water bottles and polyester;
- Linear Alkyl Benzene (LAB), an intermediate in detergent production.

These projects could be developed within the framework of genuine and multi-form Maghreb partnerships.

They would constitute an opportunity not to limit production to semi-finished products but rather consider the manufacturing in the Maghreb of added value products, such as car parts, packaging, plastic bottles, polyester and detergents etc.

Another cooperation project could be envisaged in the phosphate and nitrogen fertilizer industry. It is high time the Maghreb countries considered partnering and developing common projects instead of being in

competition against one another: Morocco and Tunisia on the phosphate fertilizer market, Algeria and Libya on the nitrogen fertilizer market. Is it logical for Morocco and Tunisia to continue to purchase ammonia from distant markets, while Algeria and Libya are producing and exporting it?

All of these projects require important investments. It would be to the advantage of the project developers to consider a regional market, large enough to be able to cope with competing products imported from the Middle East. Such integrated projects, requiring technological know-how but also human, technical and financial resources, would create more jobs. Furthermore, they would contribute not only to supplying the large domestic market but also to exporting Maghreb-made finished and more remunerating products.

Common sustainable development thinking

The Maghreb countries have recently initiated a few sustainable development projects to somewhat reduce the constraints linked to the environment and the access to energy. It is perhaps praiseworthy but clearly insufficient given the fact that they are doing this separately. In fact, the Maghreb countries would gain immensely by agreeing to put in place deliberate policies, based on energy efficiency and a better use of renewable energies, particularly solar and wind energies. For instance, a large number of small solar electricity production stations could be constructed in the region. Combined with the construction of local factories to produce solar panels and equipment, these projects would have a positive impact on the economic and social development of rural areas, while meeting the cost criteria. Such initiatives would depend on the human and technical capacities of each Maghreb countries, gathered within the framework of an integrated common project, large enough to meet the financial criteria.

Promoting sub-contracting in the Maghreb

Existing industries in the Maghreb require sub-contracting, in particular in the oil, gas and electricity sectors. Manufacturing spare parts for these industries would be entrusted to small- and medium-sized companies, using existing Maghreb-based expertise. In fact, huge funds are disbursed yearly to import spare parts for industry, while there is a potential for sub-contracting expertise and capacities that could be strengthened and network-structured to meet demand in the Maghreb countries. Such dynamics would have to respond to the requirements of industrial maintenance and engineering. This would help develop progressively the manufacturing of technologically and technically elaborate equipment as well as the capacities to implement projects in the Maghreb.

Maghreb-Europe co-operation

It is worth underlining the strong and pressing necessity to develop a more ambitious cooperation between the Maghreb and Europe. However, this cooperation would have to be based on a totally different logic than the one governing their relations today. Indeed, it is

high time that these countries put in place economic policies within the framework of an approach based on equitable and mutually profitable regional development. This said, the question is to find a sector that could play the role of catalyst or leverage to initiate this new partnership. Paradoxically, it is the unevenness in energy resource distribution among the Maghreb countries, which could be the basis for the development of interdependencies, complementarities and solidarity. By way of an illustration, one may mention the following guidelines and/or projects:

Gas relations based on supply security & market security

The first obstacle to the security of energy supply for the European countries is clearly the constraints weighing on domestic production and demand, resulting in uncertainties as to the level of required imports. If the level of the reserves seems important in the Maghreb region, exploiting these volumes of oil and gas is not a sure thing, given the necessary and particularly high levels of investments required, not only for the development of the reserves but also for transporting them to the consuming markets. Therefore, it is vital to integrate the set of problems specific to the Maghreb energy suppliers into the European competition logic, by developing ambitious, stable and long-term cross-interest industrial partnerships between northern Mediterranean companies and southern producers. North-South cross-interest partnerships should be considered at different levels of the energy chain, including prospecting, production, transport, liquefaction, re-gasification, electricity production and marketing. Such partnerships would guarantee the security of supply for one party and security of market for the other. Today, it is necessary to give coherence to the energy industry by dealing with the security issue within a global perspective, from field development to consumption. Besides, a coherent approach could not be envisaged without a stable regulatory framework that would take into consideration, in an objective way, the interests of each and every stakeholder.

Developing new gas infrastructures

Several major infrastructures have been realized within the framework of long-term contracts, contributing to a large extent to the security of gas supplies of the southern part of Europe.

However, a long-term visibility and a common vision would help attract the necessary funds to develop new infrastructures, in particular:

The Trans Saharan Pipeline (Nigeria – Algeria)

The participation of European gas companies in the Nigeria – Algeria pipeline project (particularly, Spanish, French and Italian) would be synonymous of strategic and structuring partnership. The opportunity for the European companies would be to join the Algerian Sonatrach in a consortium to bring Nigerian gas to Hassi R'Mel field where it would be re-injected and stored. The European companies would therefore constitute reserves and tap into their shares according to their needs.

This project would have several merits:

- On the energy front, it would contribute to the long-term supply of the southern part of Europe;
- On the financial and commercial front, it would require less investments and would be contractually and technically easier to implement;
- On the political front, it would help to develop the region economically and reduce the northbound migration flows of populations from transit and neighbouring countries.

The EU could contribute with a financial support since such projects would be of geo-strategic importance for the long-term supply of the European market.

The MENA pipeline

This pipeline would link gas exporting countries in the Middle East to the Maghreb region and from there to the southern part of Europe. It would carry gas from Iraq and go through Jordan and Egypt, using the existing Arab Gas corridor, which would be strengthened and used for reverse supplies. The pipeline would then go through Libya to reach Hassi R'Mel field in Algeria.

This project has several advantages:

- It would transport important Middle Eastern gas volumes to European buyers through the Maghreb region;
- This pipeline would go through producing countries and would help develop existing gas fields, particularly in Libya;
- It would be a means to diversify gas supplies, since Hassi R'Mel would become a "*hub*" and would be used to supply LNG to consuming countries in the eastern part as well as the western part of the Mediterranean.

Developing power generation stations in partnership

Although rural electrification has made major progress in the South in the last few years, access to electricity is not always guaranteed and so much remains to be done. Access to electricity for populations of the South should be as important as the security of energy supply to the northern countries. It is an additional major stake of the new Maghreb-Europe cooperation. The idea would be to set up in collaboration with the Maghreb countries a global plan for the construction of electricity production units within the framework of joint ventures. Some power stations could be coupled to sea water desalination units; sea water desalination being a vital sector for the future of the Maghreb. Some stations could produce electricity for exportation.

Sustainable development

Sustainable development offers many opportunities which, if they were to be seized, would help initiate intersectoral collaborations and open the door to new concepts and novel approaches for cooperation in the region. This would require the implementation of vigorous and voluntaristic policies based on energy efficiency and a wider use of renewable energies. Among the many ideas for partnership, one may mention the following:

(i)- a Maghreb-scale project which would provide for the construction of several site for the production of electricity (using photovoltaics or thermal solar technology). In addition, the PV panels as well as the thermal collectors and related equipment could be produced locally.

This integrated project would be sufficiently large to meet the criteria in terms of costs and financing. Besides, a Maghreb-wide integrated project would have a positive impact on the economic and social development of rural areas: improved water pumping techniques and consequently better irrigated agricultural fields, construction of small cold storage units and development of tourist trade in semi-desertic areas. It would contribute to:

- helping rural populations to settle down in the South while reducing concentrations in large towns, reducing demand for non-renewable energy sources and the impact on the environment, favouring local development;
- somewhat reducing migration flows to the European countries without having to raise barriers or pass more stringent immigration laws.

(ii)- Another field of cooperation concerns the impact of climate change. The Mediterranean countries will need to prepare for this environmental metamorphosis while in the same time, and paradoxically, face an inexorably growing energy consumption. To be able to cope with drought, water needs, and generalized air conditioning systems in the building sector, these countries will have to take action today to raise their water availabilities as well as their electricity production. If nothing is done, the growing population combined with the rural exodus will cause these countries to experience an urbanization wave at a speed and a scale unseen in the area. Water is another sector that presents risks. Demand continues to grow and has already reached the limits of the renewable resources in these countries. In an attempt to prevent the expected terrible consequences, some states intend to launch sea water desalination projects. Therefore, using renewable energies in water production could be envisaged in order to avoid the negative spiral, or at least reduce its effects. The Mediterranean region is doomed to know tighter and tighter interactions between the water and energy sectors. More coherent energy policies need to be introduced at national and regional levels, including regulation and efficiency norms, in favour of stable integrated energy services market.

Cooperation would contribute to replicating successful projects in some countries as far as optimum and rational usage of energy is concerned. It would also help create a *Mediterranean green energy market*, by introducing reforms and economic incentives (water tariffs, carbon taxes, subsidies in favour of clean technologies, etc.) adapted to the reality of each Mediterranean country.

Training and Research & Development

It would be fruitless to seek to establish genuine and sustainable partnerships without considering training and research & development as well. It is necessary to think of creating in the southern Mediterranean countries joint training institutes and research centres. Several regional institutes could be built to train engineers and technicians in different energy-related fields and sectors. Such institutes would be supported by international Research and Development Centres, with which they would develop programmes for applied research in areas of mutual interests.

Conclusions

To conclude, I would say that energy could play a major role: firstly, as a gathering factor in the Intra-Maghreb relations; secondly, as a driving force in the implementation of a regional Maghreb-Europe balanced and interdependent cooperation. Two necessary conditions need to be met: a political understanding and a common approach to meet the challenges the region will be faced with. Maghreb's main commercial partner is Southern Europe. It is therefore legitimate to think that the European countries should also be involved in projects related to the development of the Maghreb. This would be considered a step toward establishing balanced relations between the two zones, with the ultimate goal of integrating the Maghreb region. Given the existing imbalance between the North and the South, the huge funds that will have to be invested, and the human and technical means that will be required in the future, the energy sector is one of the fields where privileged cooperation can only be positive. Indeed, it is clear that the current geopolitical remodelling, the still-rampant economic crisis and the hectic pace of globalization require the Maghreb and European countries to make the right choices now; be they strategic, economic or political.

SOLAR ENERGY AND THE MAGHREB REGION

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Introduction

The Maghreb is a resource rich region. For many decades, mining, minerals extraction and the exploitation of oil and gas fields have played an essential part of the economic landscape along the entire Southern Mediterranean coast from Egypt to Morocco. Libya and Algeria together account for about 50% of Africa's proven oil reserves, while Algeria, Egypt and Libya together hold 56% of total proven African natural gas reserves. Morocco is the world's largest phosphate exporter, while phosphates and other mining activity account for nearly 50% of Tunisia's export earnings.

However, there is one natural resource, which so far has received scant attention, despite an abundance that has few parallels around the world: Solar Energy. Calculations by the Institute of Technical Thermodynamics at the German Aerospace Center (DLR) show that just 0.3% of North Africa's desert surface area would be required to serve the electricity and desalinated water needs of the entire Middle-East-North-Africa (MENA)-EU region. Even a small fraction of this would already be sufficient to meet a significant percentage of growing local electricity needs, while providing significant export opportunities for sales into Europe's electricity market.

It is this abundance of solar potential, which, unlike fossil resources, is inexhaustible and without polluting and toxic side effects that makes solar energy an attractive option for the Maghreb to develop a new pillar in its resource exploitation and processing industry. If it were to be utilised as a resource both for domestic energy supply as well as electricity exports, it could furthermore increase the wealth of the Maghreb's nations, and contribute to a decarbonised electricity supply.

Solar Technologies Overview

There are two principal solar energy technology options for the Maghreb region – Photovoltaic (PV) modules, which are scalable from small household-level applications to larger scale "solar-farms" and concentrating solar power (CSP) technologies, which are suitable for power plants from ca. 50MW to utility-scale sizes of several hundred MW.

These different scales, as well as the different states of technology development, call for a differentiated analysis of the options for development in the Maghreb. With regard to technology development, it is important to recognize recent analysis undertaken by the World Bank, comparing cumulative total global investments into different renewable energy technologies to-date.

GLOBAL CUMULATIVE INVESTMENT TO-DATE	
Wind Energy	$200bn
Solar PV	$100bn
Solar CSP	$2.5bn

This article will focus on solar CSP technology, but will first briefly review the status of solar PV, to put the subsequent discussion into perspective.

Recent Developments in Solar PV

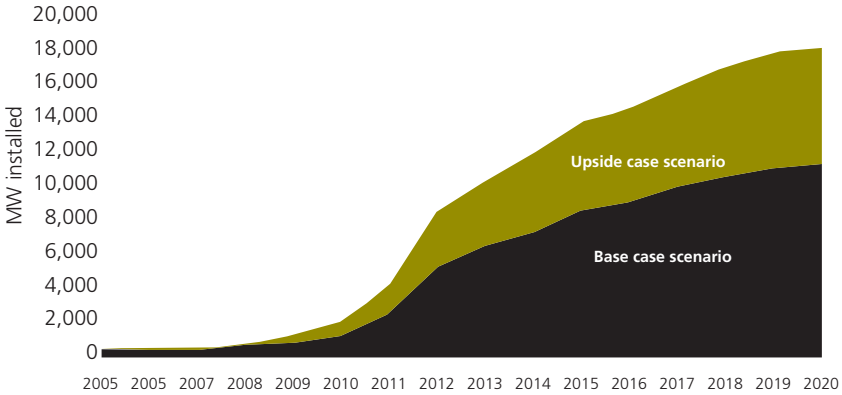
The world-bank figures highlight that both wind energy and solar PV have already grown into sizeable industries, while CSP is still at the beginning of its learning curve. In fact, the solar PV industry installed over 7GW of modules in 2009, which equates to approximately €25-30bn market turnover. Industrial-scale manufacturing plants have been established over the past years in Asia, most notably China, as well as Germany and the USA due to favourable national support programmes. Competition in the industry is fierce and prices have been cut almost in half over the past 18 months due to falling raw-material prices and the scaling up of manufacturing plants in low-cost jurisdictions.

In this context, the aim of establishing a competitive and sizeable PV manufacturing industry in the Maghreb appears very challenging. The minimum size for competitive factories is now measured in gigawatts (GW) rather than MW, and capital expenditure is in the order of >€1bn for a vertically integrated wafer-cell-module plant of such scale or its thin-film technology equivalent. Most aspects of the technology are underpinned by patent protection, adding another layer of competitive hurdles for establishing a new industry in the Maghreb with little track-record of research and development so far. While not impossible, it would take significant investment, both of resources and management capabilities, as well as political commitment to succeed along this pathway. However, there is substantial scope for small-scale (below 1MW) installations of PV modules in the off-grid as well as the residential and commercial rooftop market. As President Barack Obama frequently remarks in his speeches, these are "jobs that cannot be outsourced overseas", while adding value at home and provide a basis of new skilled service jobs that can underpin a country's expansion of its infrastructure development.

Several Maghreb countries, including Tunisia, Algeria and Morocco, have now launched dedicated support policies for the nascent solar PV installation sector. However, resources for these policies have so far been limited and large-scale support programmes, such as European-style "feed-in tariffs" that guarantee a premium price for the electricity from solar PV over the plants' lifetime, have been rejected as too expensive to implement. However, expected cost reductions of solar PV installations to the target range of the PV industry of below €2/Wp by 2012 for a full system are likely to bring the cost of electricity production close to that of household electricity price in many Maghreb countries.

Solar CSP industry and market developments

Figure 1: Conservative and "upside" scenario of growth in the CSP industry (Deutsche Bank 2009) OBAL



Source : Deutsche Bank estimates based on current projects as announced by end of 2008.
**This chart assumes that all knon projects as of 2008 come on stream*

Turning to CSP technology, technological advances are in a less mature stage of development. Investments into CSP peaked in the late 1980s and early 1990s with the development of 350MW of plants in the Mojave Desert in the USA, but then flatlined for nearly

two decades as oil prices plummeted and dedicated incentive schemes were not renewed. Only when Spain and the USA opened their markets again with specific support policies for CSP did new project development start, which is now expected to deliver several GW of operating power plants in the coming decade.

The long dearth of projects and only recent resurgence of activity suggests that the learning and innovation rate of CSP will be high in the coming years and costs will follow a steep reduction curve, as the installed base is low and each doubling of capacity can be achieved in relatively small increments. However, it also implies that important decisions are currently taken about the major manufacturing locations for CSP components and the centres of learning and innovation in the industry.

Deutsche Bank, in a recent industry review (2009), forecast annual installation to expand more than tenfold to ca. 11GW of CSP plants

per annum by 2020, in a conservative scenario. This growth trajectory follows a classic "S-Curve" shape of innovation diffusion, with technological breakthroughs leading to a period of rapid technology take-up and market penetration, creating substantial new industries in its wake.

This is a substantial opportunity for the Maghreb, both in projects that emerge in the region, providing scope for engineering, construction and product development opportunities, as well as in the establishment of new industries. As experience from the solar PV and wind energy industry shows, substantial local markets attract companies to set up R&D as well as equipment manufacturing facilities. Analysing the components that form a standard CSP plant, there is a substantial amount of standardized manufacturing, which can be adapted to the existing light- and medium-sized manufacturing industry already operating in the region.

Developing the solar CSP industry in the Maghreb can generate at least three major benefits:

1. Making electricity production independent from fossil fuel price swings and generating significant export revenues from electricity sales in Europe
2. Developing a sustainable local industry with substantial opportunities for creating local value add in manufacturing and engineering services both in the Maghreb region and for export markets
3. Catalysing the integration of the Maghreb electricity markets to facilitate electricity trades "East-West", as well as serving as the backbone for electricity exports into Europe "South-North".

An Opportunity for Industrial Development

The starting point for these developments are concrete CSP project opportunities in the Maghreb. It is important to note that conceptionally, these are similar in their requirements and operation to hydrocarbon projects. Hence, institutional as well as engineering know-how and experience for such projects has already been accumulated in the Maghreb region and can readily be applied to this new technology.

CSP projects require land in the sunniest parts of the Maghreb, often away from the coast, on which the technology can be installed. In the Sahara desert, this land currently has few alternative uses and hence the economic opportunity costs of utilizing it for CSP projects are low. Once installed, mirrors and solar receivers capture the solar energy and transform it into heat, and finally into electrical energy, which then needs to be transported to the electricity demand centres through high-voltage electricity cables. This is akin to the gas or oil extraction projects that work on land concessions and are connected to pipelines that transport energy to the major demand centres at home and abroad. The only difference being that the solar energy potential does not diminish with the maturity of the plants and "solar exploitation projects" have theoretically infinite lifetimes.

However, the most important short-term hurdle for the development and implementation of CSP projects are the high costs relative to power

plants based on fossil fuels, primarily oil and natural gas. While these cost dynamics fluctuate with global commodity markets, and peaks of oil prices of $150/barrel make CSP plants competitive, long development cycles for new projects mean that short-term price swings in themselves are currently not sufficient to make new long-term solar CSP projects economic on a pure commercial basis.

However, this dilemma resembles a classic "catch-22" problem of market coordination. Detailed bottom-up engineering analyses, such as Sargent and Lundy (2003) demonstrate the potential for significant cost-reductions of CSP technologies once the industry scales up, yet current market hurdles prevent the technology from being widely diffused in the first place.

Policy Options to foster technological innovation and cost reductions

Faced with the same "catch-22" challenge in wind energy and solar PV technology, many countries offered various forms of support schemes to create market niches for renewable energy to grow and become more cost competitive. As the figures from the World Bank above bear out, these policies have been successful in creating a viable global industry, which has been capable of successively lowering costs of electricity production and thus lowering the burden of required support to the point where it is no longer needed.

In the context of the EU-MENA region, this offers the opportunity of a grand "bargain" between the European and Maghreb countries, creating a win-win situation for the countries on both sides of the Mediterranean. EU countries have just signed up to ambitious targets of 20% renewable energy by 2020. The new EU Renewable Energy Directive 2009/28/EC now allows the physical import of renewable electricity from non-EU member states to count towards that target, subject to certain conditions. EU member countries can even implement joint-initiatives for the import of renewable electricity and share the costs.

At the same time, both the physical solar potential, as well as the resultant cost of electricity production from CSP technology, are significantly more advantageous in the Maghreb. This provides the incentive to connect the Maghrebian and European electricity networks, so that electricity from CSP plants on the Southern side of the Mediterranean can be exported to the countries on the Northern Shores.

There are several ways in which EU member countries can make use of the new provisions under the EU Renewable Energy Directive. Individual states can open their national renewable energy support policies to imports of renewable electricity either on a unilateral or multilateral basis. In principle, domestic policy could simply be extended to the imported amount, whether this is based on "feed-in tariffs", tradable "green certificates" or auctions, which are the most prevalent policy mechanisms currently in use. However, if several countries decide to pool the efforts to open their markets for imported electricity, novel policy options can be considered.

For example, an EU power purchasing agency can be considered, whose objective is to purchase renewable electricity from North Africa and offer it on European markets. This model has recently been proposed by ESTELA, the European solar thermal industry association. The advantage for member states would be that they could pool their resources to obtain best prices from CSP power plant operators in the Maghreb, for example through regular tenders or auctions. The advantage for power plant operators is to have a bankable electricity off-taker that can provide long-term power purchase commitments, which are essential for obtaining finance for the construction of CSP plants. The difference between initial electricity prices and the costs of electricity production from CSP would be covered by the EU member states in the same way in which renewable electricity is supported today. This difference is expected to diminish over time as CSP costs are reduced. Should fossil fuel prices continue to rise above historic levels, cost convergence could be further accelerated.

Benefits of policy support for solar export projects

Whichever mechanism is chosen, these incentive schemes for renewable electricity provide for premium prices of electricity for a defined period, directly supporting the growth of CSP plants in the Maghreb. Crucially, in this way, electricity production is not only supported for the export markets in Europe but also, indirectly, for domestic supply as well. This is for two reasons: Firstly, EU premium prices indirectly support a portion of the domestic markets, as some of the premium obtained can be used to subsidize a percentage of each CSP plant's production for domestic supply. Secondly, and more importantly in the long-run, the scale-up of the industry in the Maghreb and the resultant cost reductions and innovation are accumulated locally and, once established, are available for any subsequent development.

In this way, European countries can meet their renewable energy target at a lower cost than if they would have to support the marginal renewable energy technology at home to meet the 20% target. The European incentive schemes to bridge the cost differential between conventional and CSP technologies can be considered an "innovation and learning investment" that will support the scale-up of a new industry and have long-term benefits from lower-cost sustainable electricity production.

At the same time, industrial development is supported in the Maghreb countries. This goes beyond traditional commodity or agricultural exports, where value-add is often only created post-exports. For CSP projects, up to 60% of total value-add is expected to be created locally.

Technological and Industrial development in the Maghreb

CSP projects are made of a series of industrial components, many of which are standardised and benefit from economies of scale at large production volumes. Yet, while Spain and the US have recently seen significant pick-up in project activity, CSP component production has not yet expanded to a global level with significant economies of scale. Furthermore, to use

the jargon of the "technological innovation" literature, no single "technological paradigm" has yet emerged in the CSP industry. If anything, the traditionally dominant design of "trough" technology is increasingly being challenged by the emerging "tower" technology. This presents a substantial opportunity for Maghreb countries to establish themselves as "poles" for these new applications as they emerge.

Tower technology holds several advantages. In order to understand the differences between the two, a short technical background is required: trough technology is installed in long rows of round-shaped (parabolic) mirrors, which reflect sun-light onto a tube in the centre of the mirrors. This heats a "heat-transfer-fluid" (HTF), often oil, which runs through the tubes, collecting the heat and delivering it to a heat-exchanger in an adjacent power block, which transforms the heat into steam, thus driving a conventional steam turbine. These configurations currently have performance characteristics of 400C heat and 100bar pressured steam, with conversion efficiencies from solar to electricity of between 12-14%.

In contrast, solar towers produce steam directly, by reflecting sunlight onto a single receiver area at the top of a tower, which is surrounded by a field of thousands of mirrors. This removes the need for HTFs, as a solar boiler, placed at the top of the tower, absorbs directly the heat from the receiver area and heats the water inside to generate steam. This is fed into the turbine situated at the foot of the tower, further removing the need for kilometers of piping and reducing the losses and parasitic power consumption associated with this. BrightSource Energy, a solar tower technology provider with several advanced CSP projects in the USA, consequently aims for operating temperatures of 550C and 140-160bar pressures, thus vastly increasing the operating efficiency of the whole plant to >20%. Together with the reduced need for specialist components and piping, this is set to deliver a step-change in costs.

Another major advantage of tower technology is that the higher operating temperature allows the plants to switch to a dry-cooling approach of the power block, which reduces water requirements by 90% compared to the water-cooled standard in trough technology. This is particularly pertinent for solar export projects in the desert environments of North Africa where water is a major bottleneck.

Models show that utilizing tower technology in the North-African deserts and assuming moderate learning curves will deliver levelized costs of electricity (LCOE) that will be cost competitive with European wholesale prices in a timeframe towards 2020, which is the current reference point for the EU's renewable energy, as well as various carbon reduction targets.

Solar electricity exports as an opportunity for cooperation within the Maghreb and with Europe

Studies of technical potential and solar resource availability demonstrate that even with multi-gigawatt-scale solar export projects, it would still be feasible to utilise solar technology for large shares of domestic electricity supply in the Maghreb countries. Moreover, scale up of these projects provides the opportunity to strengthen the linkages between electricity

networks in the Maghreb. Although physical interconnections between the national electricity grids have been in existence for several years, cross-border flow of electricity has so far been minimal.

As electricity projects expand, strengthening electricity networks and interconnections becomes more pertinent. Common security standards require electricity networks to withstand the unexpected and sudden removal of the largest generating unit, or largest single transportation cable, without creating black-outs or destabilizing the grid. This is known as the n-1 standard. Current installed electricity generating capacity ranges between 20GW in Egypt, over 6GW in Algeria and Libya, 5GW in Morocco to 3GW in Tunisia. The opportunity for electricity exports to Europe can quickly exceed the capacity of a single country. For example, Italy's installed electricity capacity is over 80GW, and annual electricity consumption in 2020 is expected to reach 400TWh. To source just 2% of Italy's electricity consumption from solar export projects in the Maghreb would require the production of 8TWh, which equals close to 2GW of CSP plants and including thermal storage to extend operating hours of the solar plants into the night.

Such a capacity represents two thirds of the total capacity installed in Tunisia and about one third of the capacity installed in neighbouring Algeria and Libya. Managing such large volumes of electricity production in a secure manner would require closer cooperation between neighbouring grid operators to ensure maintenance of security standards, serving alternative electricity transport routes in case of outages and failures, as well as developing a diverse network of export links that are already being proposed between the Maghreb and Europe.

Simultaneous development of industrial scale CSP plants across the Maghreb would call for a grid solution that equally matches the scale and ambition of solar export projects. Already, high-voltage transmission lines link several Maghreb countries, but this would need to be expanded to a true high-voltage electricity highway from Morocco to Egypt in order to facilitate the expansion of solar energy. The development of an HVDC Highway along the Southern shore of the Mediterranean could be a further catalyst to electricity market integration among Maghreb countries and facilitate the expansion of CSP projects. Both the Maghreb countries as well as the European Union would have an interest in such a development and financing could hence be shared on both sides of the Mediterranean.

Through such high-voltage electricity exchanges, the market is not just developed for the export of solar electricity to Europe, but also for inter-Maghreb trade of electricity. Most countries in the Maghreb still consider electricity supply a public good, but private tenders and private operators have recently been introduced into the construction and management of power plants, and this could evolve further along the value chain to electricity trade and supply. Hence, solar export projects could become a driving force for the integration of electricity markets in the Maghreb, as much as for the development of new energy infrastructure links between the Maghreb and Europe. Ultimately, consumers on both sides of the Mediterranean would benefit from the gains of trade through lower production costs of electricity and the meeting of renewable energy targets

Policy Requirements and remaining challenges

So what is holding back the advent of large solar export projects? The major regulatory and policy contributions that could enable the implementation of the first concrete project opportunities is described below.

As much as banks become familiar with the financing of CSP technology and costs are becoming more competitive, solar export projects would be placed into a novel regulatory environment, which does not exist today. Special treaties and laws, both within the exporting and importing nations, as well as between them, have typically regulated gas export pipelines. No treaties exist for electricity export cables between North Africa and Europe today.

While the EU has given priority to energy infrastructure investments and operates a neighbourhood investment programme with Northern Africa, no attempts have yet been made to formalize an investment framework that would govern the installation of numerous electricity cables across the Mediterranean, either on a merchant-basis or in cooperation between national grid operators. However, a first interconnection project between Italy and Tunisia has now commenced with agreements on a bilateral basis.

Furthermore, besides novel South-North electricity cables, an expanding base of large-scale solar plants in Northern Africa will require reinforcements of electricity links between Northern African countries as well. Such links could be an important co-benefit of increased South-North electricity trade and promote the integration of electricity markets in the Maghreb and form the basis for further expansions of solar export projects.

A second set of regulatory challenges is the creation of a market for imported renewable electricity in Europe. Given the requirement to bridge the cost gap between renewable energy and fossil fuels, as well as the "first-of-a-kind" risk of placing solar power plants into such a novel operating environment (both regulatory and physically), there is a need for dedicated support policies to foster the development of the first set of solar export projects. The Desertec Industrial Initiative (Dii) of large European and North African industrial companies is an expression of the recognition of these complexities, with no one member firm willing to explore a solar export project on its own.

As discussed above, a dedicated solar export purchasing agency could pool the resources of those European countries that are willing to import renewable electricity from North Africa. Furthermore, EU member states can open their national renewable energy support policies, such as feed-in tariffs or tradable green certificates, to North African imports on a bilateral basis.

The participation of major financing institutions in the Dii, as well as recent programmes launched by the World Bank and European Investment Bank indicate that the arrangement of project finance will not be a major hurdle for solar export projects. CSP technologies have been project financed in the past and lending into Northern African countries

frequently occurs, often in syndications with multi-lateral financing institutions or development banks. The off-take in a mature electricity market such as the European adds to create a stable investment framework.

Conclusions

Market opening in Europe coupled with infrastructure investments in cross-Maghreb, as well as cross-Mediterranean cable links will create the conditions for large-scale private investments into solar export projects. This creates a win-win situation for countries on both sides of the Mediterranean, as the EU can meet its renewable energy targets more cheaply and effectively, while the Maghreb can develop a novel pillar in its traditional energy and resource exploitation industry.

As described at the outset, just 0.3% of the North African deserts' surface area would theoretically be required to serve the electricity and desalinated water needs of the entire MENA-EU region. This is the backdrop to the energy devoted by many policy-makers, private companies and academics to making South-North export projects a reality, not in the distant future, but much sooner than many sceptics might think.

BUILDING TRUST CAN TAKE THE FORM OF INVESTMENT. SOME IDEAS TO ADD TO A FASTER GROWTH IN THE MAGHREB

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BUILDING TRUST CAN TAKE THE FORM OF INVESTMENT. SOME IDEAS TO ADD TO A FASTER GROWTH IN THE MAGHREB

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Last July, under the title *Energy & Regional Integration in the Western Mediterranean,* a seminar brought together in Barcelona 30 senior managers, bankers and academics, many of whom have held senior positions in state and private companies on both sides of the Mediterranean and in international organisations. The seminar discussed the 5 papers included in this publication: the result was a lively debate on the key role Energy could play in the political and economic agenda of the region. The driving idea, from the very beginning, was to look at what role North African countries might play in a world where the balance of economic and political power has, over the past decade, and is shifting in a manner which few in the west had envisaged and many still refuse to acknowledge. Because this shift is forcing Europe and North America to take account of the views of countries which simply did not matter, economically speaking a generation ago, the process is a painful one. Some in Europe have chosen to bury their heads in the sand and continue to put forward arguments which make little sense in 2010, other are fearful of the loss as they see it of three centuries of supremacy of western economic interests.

If Western Mediterranean countries on both shores are able to take an unsentimental approach, new industries and many new jobs could be created which would add value to production in North Africa while European technology could be seriously transferred to North Africa. Such changes would in turn build competitiveness into the region's industry and insert the Maghreb into the new added value chain emerging across the globe, which is tilting so decisively towards Asia.

The Process of Barcelona, launched in 1995, has run its course but it is far from obvious that the Union for the Mediterranean, launched in 2008, will deliver on its ambitious projects.

One can argue that the Barcelona Process has always lacked the critical mass of investment needed to allow any serious economic take off and that the much vaunted corporate upgrading (*mise à niveau*) never

really materialised except in a limited way in Tunisia. As to the European Union's Neighbourhood Policy, it can be described as a "*cache misère politique*". Most countries have continued to favour their traditional bilateral relations with European countries at the expense of their horizontal North African ones: in other words everybody has been indulging in multilateral bilateralism.

The broader regional context has of course not helped: to a deepening crisis in the Middle East and unresolved questions of frontiers in the Maghreb must be added the growing reluctance of the European Union (EU) to accept Turkey as a future member. Enlargement fatigue characterises the EU's attitude towards all its neighbours. Even before that fatigue set in we can concede it is doubtful whether the EU was interested in a devious long term strategy of promoting greater flows of energy exchange with North Africa. That said, everybody could agree it is up to North African political leaders to act as they had done in the mid 1980s when the GME project was initiated by the Algerian head of state, Chadli Bendjedid and King Hassan II of Morocco.

Investment projects beyond gas pipelines, in certain energy and mineral sectors, notably phosphates and renewable energy - particularly solar power, offer *win win* opportunities for all involved: North African and European companies but also American, Australian, and Chinese firms, both private and state run. **Natural gas and phosphate rock in particular offer rich opportunities: if combined they could boost the production of fertiliser, a commodity whose potential world market is huge. North Africa – which boasts phosphate rock, gas, ammonia and sulphur in abundance, offers a very cost effective base to manufacture fertiliser**. Demand for fertiliser is expected to grow exponentially for decades to come as food requirements across the world and standards of living in China and other fast rising countries increase dramatically. The Chinese factor is key here as much of China's arable land is poor. The increase in the price of fertilisers, which reached a peak along with most agricultural commodities in 2008, gave a taste of the money to be made by feeding the world. The recent flurry of takeovers in the fertiliser industry worldwide points to strong growth in this sector in the years to come.

Manufacturing certain types of plastics, an increasingly versatile input for the packaging, building and the transport industries also offers many opportunities. With a fast growing and young population, both the housing and the food processing sectors offer many opportunities in North Africa. In both instances – fertiliser and plastics, medium and smaller private entrepreneurs could work downstream from major state and private companies, thus helping to enlarge the pool of skilled labour, know how and inter sector trade between countries. These factors strongly suggest

that the idea of a *Chemical Maghreb*, well beyond fertilisers and plastics, is worth pursuing – modelled on the way Germany developed an Eastern Europe hinterland for its car industry after 1989.

Looking to 2030, the prospect of gas pipelines which would feed Nigerian gas into the Algerian depleting gas fields of Hassi R'Mel or/

and Iraqi gas to Europe via Egypt and Libya may sound bold, even fanciful today but who is to say that such long term scenarios are not worth looking at? The

European Commission has expressed interest in the idea of a Trans Saharan pipeline from Nigeria but the flexibility and ever lower costs incurred in moving gas in the form of Liquefied Natural Gas (LNG) suggests shipping gas from Nigeria could well remain an attractive option. What will not change is the fact that planning energy supplies will continue to require long term thinking. The history of the 20th century, notably in the Middle East bears ample witness to that. **Another tantalising prospect is that of concentration of solar power both to generate electricity and desalinate water in a region where water stress is growing fast and the broader environment is under considerable threat. Yet it boasts in the Sahara huge resources of renewable energy sources.**

Furthermore, by using their renewable energy sources to generate electricity, North African countries would not only meet their growing needs in electricity and at the same time but make more oil and gas available for exports. The links between conventional energy projects, most

notably natural gas, could be reinforced because the long track record mentioned with regard to the delivery of natural gas bodes well for any future electricity links supporting solar power projects in the Sahara. Joint shareholdings by European and North African partners in such solar export projects can make perfect sense. However, unless the policy framework for renewable energy is not skewed towards helping the development of renewable energy (price subsidies etc) both in Europe and the Maghreb, it is not obvious that Maghreb producers would gain more export income which could contribute to overall economic output. An adequate legal framework – in the case of solar exports these are needed on both sides of the Mediterranean, could be used to drive a dynamic *quid pro quo* of institutional adaptation *ie* the Europeans could open their markets and support pioneer solar projects in return for adequate investment frameworks for such projects.

Today of course, the imbalances in the region are what most strike the observer – in the age pyramid of the populations on both shores, in the level of consumption of energy, in the production of oil and gas. These are described in detail in one of the papers included in this publication and, if leveraged within the framework of a medium term plan could improve the

region's economic standing in the world, encourage the building of new industries and help transfer technology - more jobs, more skills and more trade in the Maghreb would feed a greater sense of security, a diminishing sense of threat on both shores.

Some in Europe fear to depend for their gas supplies too much on Algeria – for more than 40%-, while conveniently ignoring the uncertainty the producing countries face in developing their resources when they do not know how much gas in particular Europe will need in 20 years time; some Europeans also quite fail to appreciate that countries

which import much of their basic foodstuffs also feel at risk. Another perception however points out that markets are by their very nature uncertain and North Africa, particularly Algeria have to become more nimble operators, as countries like China have proved to be. In a broader sense the fear of the "Other" transpires from many perceptions, a fear reinforced by Europe's abdication of any independent policy towards the Middle East and the difficulties it has encountered in securing its gas supplies from Russia.

These difficulties are projected by some in Europe onto Maghreb producers despite the fact that the complex relationship which exists between Russia and Ukraine and Belarus has no equivalent in the Maghreb and that Algeria's record as a reliable supplier has been without blemish for nearly half a century. **A key challenge in North Africa today is how to promote joint industrial ventures between Moroccan and Algerian state and private companies. Some ideas have been brought up: *Sonatrach*, the Algerian state energy company and *Office Chérifien des Phosphates*, the kingdom's state phosphate company should buy into each other's capital; two leading Moroccan and Algerian banks should do the same.** Both Moroccans and Algerians are at one on this interesting idea. However, bearing in mind the difficult political relations between the two countries, triangulation offers an avenue worth exploring as a way of soothing fears felt on both sides of the Algerian-Moroccan border. In other words encourage leading Tunisian, Spanish, French, Italian, German and British companies to take a stake in some new joint Maghreb ventures. After all the *Enrico Mattei* and, a decade later the Duran Farell pipelines were successfully completed by this very means: not only were European funds involved but Italy and Spain/Portugal joined in the respective projects as key stakeholders.

To come to concrete proposals (after too many words and very little results in the process of integration of the Maghreb) two realistic projects could be imagined: an ammonia and a plastics plant. Both make a lot of sense if one were to develop the Maghreb: the first would help to enlarge on existing Moroccan fertiliser plants and offer the most competitive cost base in the world for producing certain types of fertilisers; the second would help boost a sector which manufactures key inputs for a broad range of industrial sectors at very competitive prices. Both would encourage private investment downstream and offer qualified jobs in the region. Such projects could well call upon investment from leading Spanish and other European fertiliser groups and from Tunisian companies. Such cross shareholding would help lay to rest the fears of "energy security" or whatever other form of security which seems to haunt a number of people on both shores. Building trust can take the form of investment. Likewise leading North African companies should be allowed – encouraged-, to buy into the capital of pipelines and plants in Europe. The situation BP is confronted with today is an example of this: why could Algeria, through a sovereign fund, not express an interest in injecting capital into a major oil and gas company which already had a stake in Algeria ? That would meet he need of BP for more capital in a difficult moment and encourage the transfer of technology. In such a case Algeria would state that it does not

wish to influence BP's policy. **Securitising Europe cannot simply take the form of tight visa policies and cooperation on counter terrorism. It has to come in the form of greater industrial cooperation. Such a policy ties in well with the idea of the Maghreb as a "reservoir de croissance" for Europe** – indeed a faster growing and very young population offer ample opportunity for faster growth compared with Europe-. The flying geese theory, in which a more developed country or group of countries encourages its industries to climb up the value chain and encourages neighbouring states to do the same from a more modest start, initiated after 1945 by Japan can well be a source of inspiration, yet many Europeans are still very reluctant to consider Maghreb countries as partners: fear seems to stalk their vision or maybe it is simply a deep reluctance to look upon people who were not so very long ago "colonial subjects" as equals.

This brings us back to the fall out of the Barcelona Process. Preaching democracy is all well and fine but the EU and the US have so often practised the contrary of what they preach that, in the Middle East and North Africa such exhortations fall on deaf ears. Yet this state of affairs in no way

detracts from the urgent need for all North African countries to show greater respect for the rule of law, offer more transparent legal procedures and allow greater freedom of expression and information. Despite being run by a single ruling party, China is changing fast on these fronts: why can North African states not take a leaf out of the book of such a successful economy? Why are their elites blind to the advantages, in economic terms at the very least, of such an evolution? **When combined with fear of terrorism, Islam and the "Other" the consequence is that too many**

outsiders, not least among big international investors, have a vision of the Maghreb which is too bleak and detrimental to what are mutual economic interests. Contrary to what many think in Europe, the Maghreb is prospering in a number of ways – the Chinese would not be there in ever

growing numbers if the region were of no interest, they would not be buying ports in southern Italy and companies in Piraeus – China has a strategy for the Mediterranean, of which the Maghreb is but one component. How will the Europeans and the North Africans react when they wake up to China's fast growing influence in the region? As China becomes a key stakeholder in what Europeans like to think of as their backyard, the latter will discover the Asian giant works according to its very own interests. By then any role the Western Mediterranean might aspire to

will have evaporated before it even took shape. One could do worse at this stage to quote the title of the brilliant book by the chief economist of one of the world's largest banks, HSBC – Stephen King: "Losing control: The Emerging Threats to Western Prosperity."

Old habits are difficult to eradicate. Old networks of complicity between political and security elites on both shores of the Western Mediterranean lead too many senior European politicians whose main concern is to ensure stability in North Africa to support the current rent seeking political elites which hold sway in the Maghreb. This support comes at a price however as

these very same Europeans appear blind to the rise of a younger generation of state and private Maghreb entrepreneurs who are increasingly frustrated by the incompetence and lack of vision of their own political elites. These younger technocrats, often educated in Europe and

America's best universities perceive the European political elites as condescending and caught in an economic time warp. The past few years have damaged western economies but also destroyed western prestige.

The political rulers of North Africa are still beholden to certain European rulers but the new technocratic elite well understands that never again will the west, and Europe, have the last word. The deep fault lines the crisis has revealed in European economies suggests it is high time European political leaders took another look at how to manage their economic relations with their immediate neighbours to the south. A growing number of European economic elites understand this as the economic ground has already shifted decisively in favour of Asia – might not the Maghreb be next in line, as Turkey already is?

European political elites should concentrate on economic projects which make sense in today's fast changing world – in other words, given the right legal framework set up projects which could attract private investment from all over the world – and would be of mutual benefit. After all the two pipelines which carry gas from Algeria to Europe have been both reliable and have

reduced the risk of armed conflict in North Africa. Why not enlarge on such success stories? Lack of bold leadership is not just a North African characteristic today but a European one. Europe spends a lot of time attempting, with limited success, to influence the internal politics of Latin American or Asian countries: would it not be better advised to be more active in a region which lies on its doorstep and which is so rich in mineral, qualified people and historical ties not all of

which are negative? The disunity of North Africa is not only the result of local feuds, it is the result of the Cold War and of Europe's reluctance or maybe lack of interest, at least until recently, to countenance a less fractious Maghreb. Unlike Turkey, whose elites no longer do the bidding of

the US or the EU when called upon to do so, North African leaders seem unable or unwilling to imagine a long term future for the Maghreb, let alone build one and promote those entrepreneurs whose way of thinking and appreciation of how the world is moving is way ahead of their political

leaders, stuck in a narrow nationalist time warp which makes no sense in economic and industrial terms.

In spite of all this complexities, there are some ideas which are worth exploring and which offer ample opportunity for faster growth in the region – faster growth which would enhance mutual security. The four projects that might be worth promoting include:

1. Cross shareholding between Sonatrach and Office Chérifien des Phosphates
2. Cross shareholding between two leading Moroccan and Algerian banks
3. A joint ammonia plant
4. A joint plastics plant

Such projects could – indeed should, involve international investors and companies from the Maghreb, Europe, North America and Asia. Such bold thinking would signal that the Western Mediterranean was no longer suffering from a "crisis of ideas, of analysis, of perception." **There is no shortage of capital and if capital is fleeing the region it is precisely because the regional leaders – in the Maghreb but also in southern Europe, seem unable to think out of a box which still favours clichés about the other, about aid and democracy.** Now is the time to practice a little economic *realpolitik,* discuss some really new ideas, face up to the role energy and other minerals could play as facilitators or basis enablers in helping to anchor the Western Mediterranean firmly in the new world economic map

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