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Africa: a Future Energy Supplier for Europe? Africa as a Member of Trans-European Transfer Networks and a Partner to EU on the Field of Electricity Industry

Šárka Waisová

Abstract: *The EU member states rank among the most developed countries in the world which also makes them significant electricity consumers. Electricity consumption in the EU member states has been increasing steadily over several decades and this tendency should be expected to continue in the future. Majority of the EU member states are not self-sufficient as to electricity production and have to cover greater or smaller part of their consumption by import from third countries. The present text deals with the possibilities of electric energy import to the EU countries from Africa. Thinking of importing electric energy from Africa, it is vital 1) to identify the source countries capable of producing sufficient volumes of electric energy and eligible to cooperation, and 2) to consider possible ways and means of the transfer of electric energy to European countries, i.e. to analyse the current state of transfer networks between European countries and North and Central African countries. The first part of the present text focuses on determining which countries in the North and Central Africa come into question as potential energy suppliers for the EU, the second part deals with the possibilities of electric energy transport from the North and Central Africa to Europe.*

Keywords: *electric energy import, electricity consumption, electricity production, EU, North Africa*

Introduction

The EU member states rank among the most developed countries in the world which also makes them significant electricity consumers. Electricity consumption in the EU member states has been increasing steadily over several decades and this tendency should be expected to continue in the future despite improving energy efficiency and implementation of saving policies in these countries (Bertoldi & Atanasiu, 2007)¹. Majority of the EU member states are not self-sufficient as to electricity production and have to cover greater or smaller part of their consumption

¹ The overall household electricity consumption increased by 10.8 % between 1999 and 2004, tertiary sector consumption increased by 15.6 %, and industrial consumption increased by 9.5 % within the same period (Bertoldi – Atanasiu, 2007: 3).

by import from third countries². Producing enough electricity and delivering it safe and sound to the end user are conditions of maintaining energy safety for European societies and their further economic development.

The increase in electricity consumption in the EU member states confronts those societies with the question of effecting sufficient volume of electric energy both for household and for industry and services consumption. In the present time, the energy needs of Europe (including the Russian Federation) are covered by nuclear power plants by 26 %, by thermal power plants (coal-fired, gas-fired, and oil-fired³) by 55 %, by hydro-electric power plants by 16 %, and 3 % are covered by renewable resources (mainly wind parks) (WEC, 2007b: 3).

The coverage of rising electricity consumption by increasing the production of the same by the EU member states seems potentially problematic in the middle-term horizon. The main reasons for this are as follows:

1. shutting-down of the coal-firing power plants (urged by the Kyoto Protocol stipulations),
2. overall ageing of all the power plants in Europe,
3. limited exploitation of renewable resources determined by the physical-geographical and economic conditions in European countries (e.g. the European rivers suitable for the production of hydro-energy are already fully utilized so that under given circumstances, this way of energy production cannot be further extended; for wind parks and solar power plants, there are no suitable conditions here as the overall number of sunny days is rather low, as is the number of localities where the revenue from electricity production in wind parks could cover their building costs; and last but not least, the price of energy produced from renewable resources is still remarkably higher than the production based on fossil fuels), and
4. rather cautious approach of the EU member states to nuclear energy industry.

Even though nuclear power plants seem, with regard to the Kyoto Protocol and decreasing resources of oil and gas, the most stable resource for electric energy, it is expected that the production of electricity in nuclear power plants will have been still decreasing until 2030. The nuclear reactors currently operated in the EU member states are getting older day by day, but the governments of these countries, being confronted with increasing aversion of their citizens towards nuclear energy, are not willing to take measures in order to revitalize the old or to install new ones. The decrease in the volume of electric energy produced by nuclear power plants is also connected to closing down

² Germany and Italy are examples of pure consumer countries (MVB Consulting, 2007: 55).

³ In Europe, oil power plants represent 9 % of the total thermal power plant capacity (WEC, 2007b: 4).

of some non-conformant plants in the new member states (e.g. Ignalina in Lithuania or Kozloduy in Bulgaria). Although some countries have decided to build new nuclear power plants (Romania and Finland have already started, Lithuania, Bulgaria and France are in the process of decision-making), it is obvious even now that these new plants cannot cater for the ever-increasing consumption in the member states.

The key question is how to secure sufficient and stable volumes of electric energy for the EU member states under the current circumstances (i.e. the stipulations of the Kyoto Protocol, closures of the worn-out and dangerous old reactors, unstable and unreliable gas and oil supplies). One of the possibilities is to import energy from third countries. This option would have been unheard of several decades ago but since then, the vast development in technologies have provided for deep-sea electric cables as well as thousand-mile-long high-voltage transfer and distribution networks. These technological developments have enabled both short-time storing of electricity and its transfer on vast distances with relatively minor losses. Nevertheless, with regard to the character of electric energy and to contemporary technological possibilities, the import of electricity is limited in terms of regions. The North and Central Africa belong to those regions that possess enormous capacity of generating electric energy and may come into question with regard to the current technological conditions. Some African countries are already capable of producing remarkable volumes of electric energy, mainly using their water sources (many big hydro-electric power plants have been built in Egypt, Ethiopia, Uganda, Kenya, and the Democratic Republic of the Congo) and earth gas resources (countries such as Algeria, Egypt, Tunisia and Libya).

The present text deals with the possibilities of electric energy import to the EU countries from Africa. Thinking of importing electric energy from Africa, it is vital 1) to identify the source countries capable of producing sufficient volumes of electric energy and eligible to cooperation, and 2) to consider possible ways and means of the transfer of electric energy to European countries, i.e. to analyse the current state of transfer networks between European countries and North and Central African countries.

The first part of the present text focuses on determining which countries in the North and Central Africa come into question as potential energy suppliers for the EU. As it appears, this includes mainly Algeria, Libya, Tunisia, Egypt, Ethiopia, and, speaking in a middle-term horizon, possibly also the Democratic Republic of the Congo. It seems appropriate to mention in this context that European countries (and commercial subjects) have been participating both financially and technologically in the building of African power plants, esp. hydro-electric ones, not only because such involvement may support their own energy safety but also may help them fulfil their liabilities under the Kyoto Protocol. Within the so-called *Clean Development Mechanism* (CDM) being a part of the Kyoto Protocol, developed

countries may support projects making use of renewable energy resources and projects of low-emission energy production, which will grant them credits they need to comply with their own liabilities under the Kyoto Protocol. Those credits are then traded within the *EU Emissions Trading System*.

The second part of the present text deals with the possibilities of electric energy transport from the North and Central Africa to Europe. It will become obvious that while the electricity import from the Central African countries such as Ethiopia and the Democratic Republic of the Congo is still rather hypothetical, imports from the North African countries are becoming more and more likely. Nevertheless, the question of linking the North African electricity networks to the European networks and harmonizing the electricity systems of the North African states with the European system is currently more important for the EU than the import as such. These transcontinental electricity networks should join the EU countries with the Maghreb, Mashriq and Near East countries, forming thus the *Mediterranean Ring*. The area might serve as both transfer and stabilising electricity network for the future.

African electric energy producers

With regard to transport distances, only the countries of North and Central (incl. Central West and Central East) Africa come into question as potential importers of electric energy to the EU. Of the countries situated in the mentioned regions, Ethiopia, the Democratic Republic of the Congo (hereinafter DRC), Tunisia, Libya, Algeria and Egypt possess the potential to produce volumes of electric energy sufficient enough to cover their domestic consumption and yet to import a remarkable part of it. Thanks to their geographical and physical conditions, Ethiopia, Egypt and the DRC are capable of producing hydro-electric energy, while Algeria, Egypt, Libya and Tunisia have remarkable resources of earth gas catering for electric energy production in gas-fired power plants.

Apart from the countries mentioned above, several other countries of the North and Central Africa have certain hydro- and geothermal potential, such as Kenya, Ghana, and Nigeria. Kenya, though, prefers exporting the excess energy to the *COMESA* member countries and to the *South African Power Pool*⁴ in the middle-term horizon; Ghana still has not concluded the plans for exploiting the Volta River; Nigeria prefers oil-fired power plants to hydro-electric energy and exports electricity mainly to the *ECOWAS* member countries.

In 2005, the Ethiopian government presented a 25-year plan for the development of Ethiopian energy sector. This plan includes finishing of a large system of

⁴ Country Analysis Briefs: Great Lakes Regions: Burundi, Kenya, Rwanda, Tanzania, and Uganda (<http://www.eia.doe.gov/emeu/cabs/eafrica.html>).

hydro-electric power plants, electrification of rural areas, and completion of high-current transfer networks catering for the export of electric energy from Ethiopia to neighbouring countries as well as to more distant regions, namely to the COMESA and EU member states. By 2015, nine hydro-electric power plants should have been built based on this ambitious plan. According to the plan, Ethiopia should be producing 3,150 MW in 2011 and by the year 2018 this volume should increase at 9,000 MW (Griffiths, 2007; Hailu, 1998). At present, more than thirty projects of transfer and distribution networks are in the process of being built. In context of the electric energy import to Europe, the completion of network connection to Egypt across Sudan is vital. The network linking of Ethiopia with Sudan should be completed in 2009 as a part of the broader *Nile Basin Initiative*, i.e. electrification of countries able to benefit from the hydro-electric energy supplied by the Nile. The Ethiopian plans for importing the electric energy to the EU member states rely on the completion of the *Mediterranean Ring* (cf. below). The Ethiopian electric energy could use the currently existent connection between Egypt and other Mashriq countries (cf. below) using Turkey as a consecutive transfer country. The electric energy produced in Ethiopia would then enter the EU market in Bulgaria, Greece, or Italy. Even though it may seem that the import of Ethiopian electric energy to Europe may come to grief due to the non-existent network connection between Sudan and Egypt, the contrary is the case. Sudan purchases the Ethiopian electric energy that is consumed in the south-east regions of the country, but at the same time it sells to Egypt the electric energy that is produced on its north. This Sudan's strategy counts mainly on the low price of the Ethiopian hydro-electric energy⁵; when bought, it helps reduce the domestic consumption of Sudan's own oil which then can be sold with a high profit (WEC, 2003 and ENTRO, 2006).

The development and reconstruction of the energy sector in the DRC were initiated in 2001 after the long-lasting fights had ended (except for the regions of North and South Kivu along the northern borders with Rwanda, Burundi, and Uganda). Unlike Ethiopia, the DRC still operates rather limited capacities for electric energy production. For the time being, the DRC is able to cover its domestic consumption. In the middle-term horizon (10 years), remarkable increase in electric energy production can be expected together with more active attempts of the DRC to enter the international energy markets. The energy production takes place mainly in the hydro-electric power plants on the Congo River⁶. The largest hydro-electric power

⁵ The production costs of 1 kW in the Ethiopian hydro-electric power plants equal USD 1.200, which is 1/3 of the costs in the other East African countries (World Bank, 2007: 8).

⁶ The Congo River is one of the very few rivers in the world that may be used, thanks to their physical geography, for the hydro-electric energy production without major river-basin modifications or building large reservoirs. This advantage cheapens the building of the Congo hydro-electric power plants and allows for building these in relatively short distances from one another.

plant on the Congo is the Inga system. Inga 1 and 2 were built during the 1970s and 1980s; at present, the Congolese government are planning building of Inga 3 and 4 (so-called Grand Inga) in cooperation with international investors (World Bank Group, International Monetary Fund, European Investment Bank, the EU, Canadian International Development Agency, etc.). Should this system be completed as planned, it would make the world's largest hydro-electric power plant (larger than the Three Gorges in China), producing the greatest volume of electric energy worldwide. The plans naturally include completion of transfer and distribution networks to cater for the Congolese electric energy entering the international markets. The current projects mainly count on exporting the Congolese electric energy to the EU member states (the transfer network is planned to lead from the DRC across the Central African Republic and Sudan to Egypt where it would join the Mashriq transfer network /cf. the above-mentioned Ethiopian electric energy export/) and to the South African Republic (cf. Map 10 in Appendices).

It is apparent from the above-mentioned that Ethiopia's becoming a potential electric energy supplier to the European energy market is quite feasible (as opposed to the DRC). On the other hand, should the Inga 3 and 4 hydro-electric power plants be completed, Kinshasa will become the greatest electric energy producer in the world; its potential thus may contribute very significantly to strengthening the energy safety of the European territory.

The capacities of the North African countries are by far lower as compared to those of Ethiopia or the DRC; however, their location grants them extraordinary opportunity to enter the European markets. The North African countries have already done so with their gas (Algeria, Tunisia, Libya) and over the past decade they have started to export also electric energy here (Egypt, Algeria, Libya, and Tunisia). The main resource used in the production of electric energy is earth gas in Algeria, Libya and Tunisia, while in Egypt it is, apart from gas, also the hydro-energy of the Nile (by ca 1/3)⁷. It may be expected for the future that also solar power plants may experience successful development here. Feasibility studies have been already processed and several European companies have started building smaller solar power plants.⁸ The Algerian government have already started building a test solar-thermal power plant in Hassi R'mel (about 400 km south of Algiers), hopefully to open in 2009. Building of a similar plant started in Morocco in 2008 (*Another Silicon Valley?*, 2008: 13). According to present estimations, the North African countries have the capacity of producing twice as much solar electric energy as the EU member states altogether. (Burgermeister, 2007).

⁷ Eurelectric Online. South and East Mediterranean Statistics Database: <http://www.eurelectric.org/Statistics/MedLatest.htm> (5. 6. 2008).

⁸ Estimations suggest that solar power plants covering in total 6,000 sq km built in the desert areas on North Africa could produce volumes of electric energy that would equal the Near East oil production, i.e. 9 bn barrels a year (Burgermeister, 2007).

The North African countries now export small to middle volumes of electric energy (cf. the table below), but majority of their export goes to countries with deep energy dependence on export and with no energy transfer links to other European countries (e.g. Spain or Italy – cf. the introduction chapter and Table 2), which makes them remarkable suppliers despite the relatively small volumes of the energy exported. It may be expected that the production capacity and, consequently, the volume of the electric energy produced in the North African countries will be rising steadily as those countries have opened their energy markets (both for production and transfer) to private investors who have started building first non-state solar, gas-fired, and hydro-electric power plants⁹.

Table 1: Export of electric energy from the North-African countries¹⁰

Country	Export to third countries (GWh, 2003)
Algeria	212
Egypt	959 ¹¹
Libya	102
Tunisia	115

The importance of the North African countries for the energy safety of the EU still consists less or more in their role of transit countries than in being direct strategic suppliers. However, with lifting the last barriers to total liberalisation in the southern EU countries (January 2011), the North African countries will become the key resource of electric energy on condition they will have been able to increase their production capacity by then. The North African transfer and distribution networks will become a gateway for the Ethiopian, Congolese and Near-East electric energy to the European energy market. Both the EU and North African countries pay great attention to building the transfer and distribution networks as well as to building new power plants.

Building the Euro-African electricity network

The different EU member states presently belong to three different electricity systems and some states are “systems to themselves”, i.e. they do not belong to any of the three systems mentioned. Majority of the EU member states belong to the European synchronous electricity *UCTE* (*Union for the Co-ordination of Transmission*

⁹ EIA, Energy in Africa: <http://www.eia.doe.gov/emeu/cabs/chapter5.html> (5 June, 2008).

¹⁰ Ibidem.

¹¹ As the table suggest, Egypt is the biggest exporter of electricity here. It should be noted though that majority of the export goes to Jordan at the moment.

of Electricity) system; Lithuania, Latvia and Estonia belong to the *IPS/UPS (Unified Power Systems)* covering the post-Soviet countries; Finland, Sweden and East Denmark¹² belong to the North European *NORDEL* system; Northern Ireland, the Republic of Ireland and the UK are independent electricity systems linked to the *UCTE (ATSOI, UKTSOA)* respectively); and finally, Malta and Cyprus are isolated systems standing outside the *UCTE* (cf. Picture 1 below).

With regard to the fact that majority of the EU member states belong to the *UCTE* system¹³, this framework has become a base for the common electric energy market as well as for plans on securing sufficient volumes and safe transfer and deliveries of electric energy within the EU circle and also within a broader European pool. The aim of the *UCTE* is to reinforce the system capacity so that greater or lesser sudden disturbances within the system (typically a drop-out of several power plants or an outage of substantial parts of the transfer system) would not result necessarily in a cut-off in electricity supplies.¹⁴ At present, the *UCTE* accommodates 23 European countries with more than 450 million inhabitants. In 2005, the total *UCTE*'s installed capacity amounted at 587 GW at the consumption of 2,600 TWh. The total span of the high-voltage transfer network equalled 200,000 km. (*UCTE, 2007a*).

The European electricity transfer network and cross-border connections emerged in the late 1950s when the following three systems were created: 1) France, Spain, and Portugal, 2) the Netherlands, Belgium, both German states (West and East), Austria, and Czechoslovakia, and 3) Italy and Switzerland (some small parts of Switzerland, though, belonged to the first two systems). These systems were independent of one another, linked only by several transfer 220 kV networks. The first two systems (or, better, their networks) were synchronised in 1958. In 1977, this synchronous system was joined by what then was Yugoslavia; Greece and Albania joined in 1985. In 1995, the *UCTE* was joined by the *CENTREL* system comprising transfer network operators from the Czech Republic, Slovakia, Hungary, and Poland. The former Yugoslav republics were temporarily suspended from the *UCTE*

¹² West Denmark belongs to the *UCTE*. Similar example of a country where different regions belong to different systems is Ukraine. Small part of West Ukraine belongs to the *UCTE*, while the rest belongs to the *IPS/UPS* (*UCTE, 2007*).

¹³ In fact, the *UCTE* members are the operators of individual transfer networks responsible for maintaining the common mode of securing electric energy deliveries and their safety. The *UCTE* had 33 members in 2007. (*UCTE, 2007a: 7*).

¹⁴ This plan also involves the completion of common European electric energy market. The key conditions for launching the common market, fulfilling thus the *UCTE* goals, are liberalisation of national energy markets and completion of the links among individual countries, as the current capacities of cross-border networks are not sufficient should the exchange and import increase. This urged the European Council in Barcelona in 2002 for setting a target for the EU member states, according to which the level of mutual linking among individual states should equal at least 10 % of their production capacity they will have reached by 2005 (*European Commission, 2006a: 3*).

in 1991 as their electricity networks and deliveries were often cut off due to the civil wars in the region; the new Balkan states did not return to the *UCTE* sooner than in 2004. Romania and Bulgaria became the new members in 2003 and since the same year also the West Ukraine has adopted the stipulations of the *UCTE*.

To provide for the stability and safety of the European synchronous electricity system including safe deliveries of electric energy, it is vital that the *UCTE* countries cooperate with the neighbouring systems and work towards the harmonization of the systems of those countries with the *UCTE*, including cooperation on building of new transfer networks among the different systems. Nevertheless, it should be noted that after linking the *NORDEL* and the Irish and British systems to the Continent in the 1980s, further cooperation with third countries (their electricity systems, that is) has come to a halt.

New attempts to reassume cooperation of the *UCTE* with other countries were initiated in the second half of the 1990s. This concerned plans on synchronisation of the Baltic power systems, the Black Sea countries power systems, and the Mediterranean. While the Baltic and Black Sea linking to the *UCTE* are still in the stage of feasibility studies, cooperation between the *UCTE* member states and the Mediterranean has been gaining momentum since then. This cooperation is encouraged namely by the determination of all parties involved to provide for the safety of the transfer networks and electricity deliveries. To the North African and Near-East states (Turkey included), their synchronisation with the European electricity system together with building (or rather finishing) cross-border electricity and transfer networks mean a thoroughfare to the European electric energy market.

The Mediterranean Ring and linking the North-African systems with the UCTE: Reinforcing the energy safety of the southern rim of the EU

The EU policy towards neighbouring Mediterranean countries is driven by the stipulations of the Euro-Mediterranean Partnership established in Barcelona in 1994. The Barcelona Process made allowances also for cooperation in the field of energy industry. The Barcelona Declaration included plans for the Euro-Mediterranean free trade zone for electricity to be established by 2010 (Eurelectric Online, 2006: unpagged), including the *Mediterranean Electricity Ring (MEDRING)*. In 2003, based on the Barcelona Declaration, the Maghreb memorandum of understanding was signed (see below).

One of the grounds for the EU member states' determination to link the North African states to the European energy sector is the fact that namely the South European states (such as Spain, Portugal, and Italy) are vastly dependent on the

import of energy sources (gas and oil) and linking them with the North Africa could lower the risks of being dependent on an exclusive energy supplier. While the South European countries can differentiate their suppliers of oil and gas (thanks to tankers), the options of electricity imports are rather limited, the limits being determined by the physical geographies of the Iberian and Apennine peninsulas. As for Spain and Portugal, it appears the best option to import electric energy from France, Morocco, and Algeria, while in the case of Italy the consumption of the northern regions could be covered by imports from Switzerland and France, and the needs of the Italian South (including Sicily and Sardinia), where the production of electricity almost equals zero, could be saturated by imports from Algeria, Tunisia, and Libya. The unsatisfactory situation of the South European countries has also been reflected in the European Commission plan on the trans-European network support. Of the nine priorities supporting the trans-European electricity projects, three have been focused on Italy, Spain, and Portugal. The EL2 priority deals with the building of new transfer networks in the north of Italy, the EL3 priority supports the building of new transfer networks between France and the Pyrenean countries, and finally, the EL9 priority supports the creating of the *Mediterranean Ring* and its linking to Sicily, Sardinia, Spain, Portugal, and Greece.

The so-called *Mediterranean Ring* (*MEDRING*) comprises the transfer and distribution networks of the *South West Mediterranean Block* (*COMELEC*, consisting of Morocco, Algeria, and Tunisia), the *South East Mediterranean Block* (Libya, Egypt, Jordan, Palestinian Authority, Lebanon, and Syria¹⁵), and Turkey. The *South East Mediterranean Block* is a synchronized electric system with the capacity of 35.3 GW, the consumption of 142.6 TWh, and more than 79 thousand km of transfer networks (data of 2005, UCTE, 2007a: 26). This block is linked to the electricity system of Iraq based on the regional EIJSTL initiative (cf. Picture 1).

The *South West Mediterranean Block* houses Morocco, Tunisia, and Algeria. The capacity of this block is 15.9 GW and the consumption is 55.6 TWh (data of 2005, UCTE, 2007a: 27). This block has made the biggest advancements as for the linking to the *UCTE* and the EU energy market. The first deep-sea link between Spain and Morocco was completed in 1997 (the project had been set in the 1980s, though) (UCTE, 2007a: 27), the second deep-sea connection of the same countries was realised in 2006. The overall capacity of both connections is 800 MW, but at present, only 400 MW are being transferred (UCTE, 2007a: 29). After the completion and full linking of the *Mediterranean Ring* to the *UCTE* system, the transfer between

¹⁵ Although Israel is an isolated system in this regard, negotiations on linking the Israeli transfer network to the transfer network of the regions under Palestinian authority are currently in process.

Spain and Algeria should amount at 24.5 TWh, Algeria thus becoming, besides France, Spain's biggest energy supplier in about 2010.

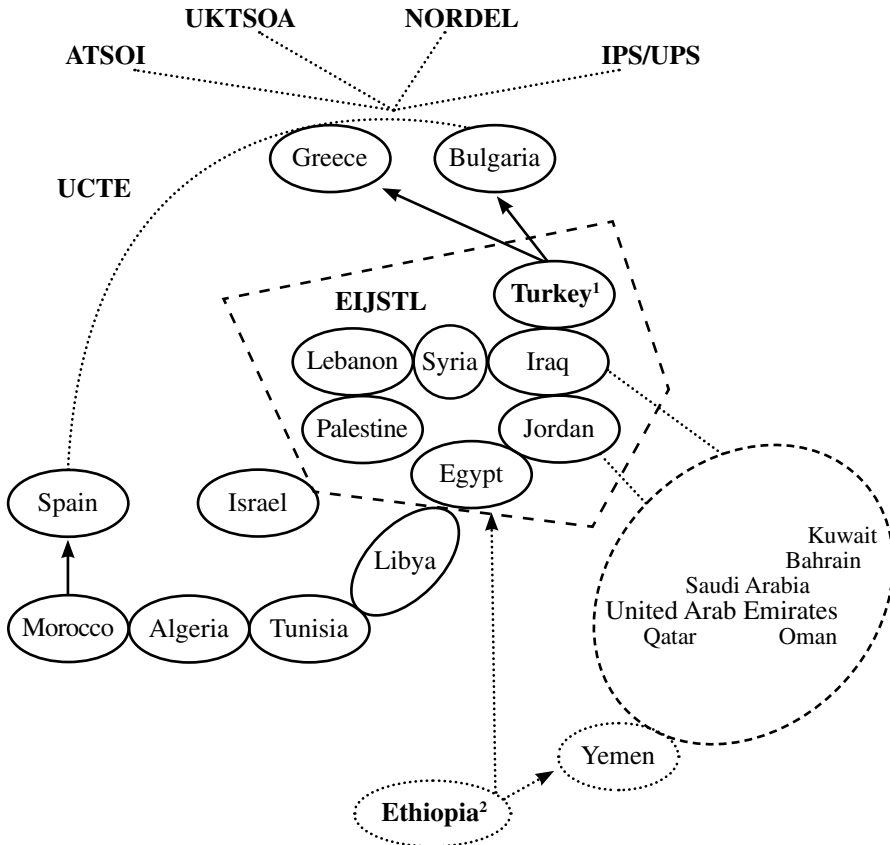
At present, the *Mediterranean Ring* is less or more finished, as the last barriers represented by the incomplete links between Tunisia and Libya and between Libya and Egypt (started already in 1998) and by the non-existent transfer network between Turkey and Syria have been lifted. Libya (as both a transfer and an export country) has been linked to the *Mediterranean Ring* over the past few years consequent to the finishing of a high-voltage transfer networks on the borders with both Tunisia and Egypt. The prospective building of a transfer network between Libya and Sicily is currently in the stage of a feasibility study. The whole of the South East European Mediterranean block is planned to be linked even to Iraq. The *Mediterranean Ring* is linked to the EU member states by the means of a transfer network between Turkey¹⁶, Bulgaria and Greece. After the completion of the transfer network between Libya and Tunisia and after the launch of the Syrian-Turkish link, the whole of the *Mediterranean Ring* shall be synchronised with the *UCTE* system (Singer, 2007).

Apart from accelerating the building of the transfer networks, the *Mediterranean Ring* is currently also experiencing remarkable integration in the energy sector. In 2004, the *ELTAM* project commenced with the aim of strengthening the transfer networks and building new high-voltage systems among Egypt, Libya, Tunisia, Algeria, and Morocco, to cater for enlarging the export capacity of the North African countries to the southern rim of the EU. The Maghreb memorandum of understanding of 2003 confirmed that Algeria, Morocco and Tunisia accept the European Commission stipulations regarding the internal electricity market of the EU. Based on the said memorandum and on accepting the stipulations (including any future ones)¹⁷, the Maghreb electricity markets have been incorporated in the internal EU energy market (Eurelectric Online, 2006: unpagged).

¹⁶ Plans on linking and synchronisation of the Turkish electricity network to the UCTE had first appeared in the 1970s but first practical steps towards their realisation were not been made sooner than in the 1990s. At present, several feasibility studies on the synchronisation have been finished and it can be supposed that the linking and synchronisation of the Turkish system with the UCTE will have been realised in several years' time. (UCTE, 2007a: 39). Turkey is an important partner to the EU not only as the "bridge" for the *Mediterranean Ring* but also as a junctor to the transfer networks of Georgia, Azerbaijan, Armenia, Iraq, Iran, and the countries of Central Asia. Cf. e.g. *Turkey. Review of the Investment Climate and Market Structure in the Energy Sector*. 2007. Energy Sector Secretariat. Moreover, Turkey is involved in the Economic Cooperation Organisation Interconnection Project. This project, being currently in the stage of preliminary feasibility study, is meant to support the building of a transfer network among Turkey, Iran, Pakistan and, in the future, also the states of Central Asia. (cf. e.g. Screening Chapter 21. Trans-European Networks).

¹⁷ Namely 2003/54/EC Directive, the so-called Electricity Directives, 1228/2003/EEC Directive regulating the cross-border electric energy transfers, and 2005/89/EC Directive on securing the deliveries and infrastructure investments.

Picture 1: The UCTE links to the North African and Near East electric frameworks (source: author)



- ¹ The cross-border exchange of electric energy in Turkey should increase by 62 % between 2005 and 2030 (TEN-Energy-Invest, 2005: 24)
- ² There is a deep-sea transfer network between Ethiopia and Yemen catering for Djibouti and Yemen.

Conclusion

The completion of the *Mediterranean Ring*, its incorporation in the *UCTE* system, and its direct linking to the EU transfer and distribution networks will have been finished in several years. The existence of the *Mediterranean Ring* will enable the North and Central African countries to enter the European energy market as exporters. The completion of the Euro-African electricity network is advantageous both for the EU

member states and for the North and Central African countries. The Central African countries may benefit financially from supplying the electric energy; the North African countries may, apart from the financial effect, reinforce their own energy safety as the *UCTE* will guarantee stable electricity deliveries for them. To the European countries, the completion of the *Mediterranean Ring* and the Euro-African electricity network are even more vital. It will grant the *UCTE* members greater energy safety in terms of securing stable electricity deliveries; to Spain, Portugal, Italy and Greece it will mean lower dependence on gas and oil imports and it also will enable them to diversify the source countries. At the same time, linking of the *Mediterranean Ring* to the electricity systems of the Near East countries will strengthen the partnership and cooperation between both regions.

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