

THE PROJECT; IRAQ DESERTEC IS THE FUTURE SECOND ELECTRICITY SUPPLIER TO EUROPE THROUGH TURKEY

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ABSTRACT

Under the DESERTEC Concept, the first proposed project, concentrating solar power systems, photovoltaic systems and wind parks would be spread over 17,000 km² of the African Sahara desert. Produced electricity would be transmitted to European Countries by a super grid of High Voltage Direct Current Cables UHVDC. An Iraqi international network of scientists and experts from the field of renewable energies and gas and oil reserves has interfered with DESERTEC network and proposed the second project to be in Iraqi western desert. The general thought is to use solar power during daytime plus natural gas during night time and to export the generated power via a transmission system to Europe through Turkey. The envisaged power amounts to > 6,000 MW. The obtained DC power with +/- 800 KV potential shall be transmitted by overhead lines UHVDC from the Iraqi western desert to Romania through Turkey. An approximated and very simplified KWh cost calculations has shown that the proposed project is feasible.

Keywords: Iraq Desertec Project, Mediterranean Renewable Energy, High Voltage Direct Current UHVDC

Introduction

In addition to the certain commitment of the industrialized countries to achieve the Kyoto targets and brought tragic disaster in Fukushima in Japan, following the nuclear accident, shame and fear all over the world. Germany has declared a permanent nuclear power plants by 2020 followed by Austria, Switzerland and Denmark. These and other reasons of strategic environmental, economic and political reasons pushed much of the world thinking and planning hard to find alternative energy sources for those mentioned in order to maintain levels of energy consumption in these countries in the near term and long term.

Of the most important moves by a group of European countries led by Germany founded an organization called "Desertec". This organization is simply a concept proposed by the DESERTEC Foundation for making use of solar and wind energy in global deserts.

The DESERTEC Concept was developed by the Trans-Mediterranean Renewable Energy Cooperation (TREC) and a worldwide network of scientist, politicians, and entrepreneurs

associated with the Club of Rome [DESERTEC Foundation, Retrieved 2010-12-24]. The concept wants to tackle the problem of climate change using studies carried out by the German Aerospace Center (DLR) on behalf of the German Federal Ministry for the Environment.

DESERTEC Foundation started with the idea to supplying Europe with energy from deserts [EurActiv, (2009-07-22), Retrieved (2010-12-24)]. According to the organization it has now widened its concept for supplying the whole world with clean energy and for fighting climate change. Desertec stresses that the importance to work with national governments and political bodies like the EU and similar bodies all over the world, to create the right framework of laws and regulations, and incentives for the project [DESERTEC Foundation, Retrieved 2010-12-24].

The original and first region for the assessment and application of this concept is the EU-MENA region (Europe, Middle East and Northern Africa). The realization of the DESERTEC concept in this region is pursued by the industrial initiative Dii, [Dii GmbH. Retrieved 2010-12-24].

Under the DESERTEC Concept, the first proposed project, concentrating solar power systems, photovoltaic systems and wind parks would be spread over 6,500 square miles (17,000 km²) of the Sahara desert [McKie, Robin (2007-12-02), Rzhevskiy (2009-06-29)]. Produced electricity would be transmitted to European and African countries by a super grid of high-voltage direct current cables UHVDC [Rzhevskiy (2009-06-29), Kanter, James (2009-06-18)].

It would provide a considerable part of the electricity demand of the MENA countries and furthermore provide continental Europe with 15% of its electricity needs.^{[2][4]} By 2050, investments into solar plants and transmission lines would be total €400 billion.^[5] The exact plan, including technical and financial requirements, will be designed by 2012 [Van Loon, Jeremy; Von Schaper, Eva (2009-07-13)].

An international network of scientists, experts and politicians from the field of renewable energies and gas and oil reserves in Iraq has interfered with DESERTEC network to persuade TREC to get the second project to be in Iraq. Produced electricity would be transmitted to European countries by UHVDC through Turkey.

The most attractive points to this mission were:

- 1- The proposed area lies in the high intensity region of solar energy Fig (1).
- 2- The location is geographically, direct and indirectly, connected with Europe through Jordan, Syria and Turkey. Fig (2) shows the proposed connection through Turkey.
- 3- Free and available land suitable for the establishment of large-partisan and broad scalable in the long run and future extension.
- 4- A huge reserve of natural gas available in the region supports the implementation of thermal power generation for the short run in parallel with renewable energy projects. This will help to achieve economic feasibility for the establishment of transport networks in the short term.

- 5- Available sufficient water in the region for the water requirement used in the solar plant to clean dust off panels and for turbine coolant.
- 6- The strong desire of the Turkish government to implement this project in Iraq and the urgent need for energy helps a lot to implement line carrier to Europe via Turkey, in addition to the rush of a number of Turkish companies to invest in Desertec power plants and the line carrier.
- 7- As stated in the Desertec studies and the other literatures, there is a need for huge amounts of energy at this time to Iraq, Turkey and the countries of Europe, which makes thinking in the production of thermal energy in parallel to the production of renewable energies, to achieve higher economic feasibility in addition to the speed of implementation. ***This can be achieved whenever a gas and solar energy are available in the same area.***

The **objectives** of this paper are; to clarify and confirm the above points and presenting the simplified substantiated study to provide the reader with the initial conviction. The experts and specialists interested in this subject are hardly working to encourage the interested international companies to finance and implement the technical and economic feasibility study and detailed designs of the primary project.

Fig.(1)

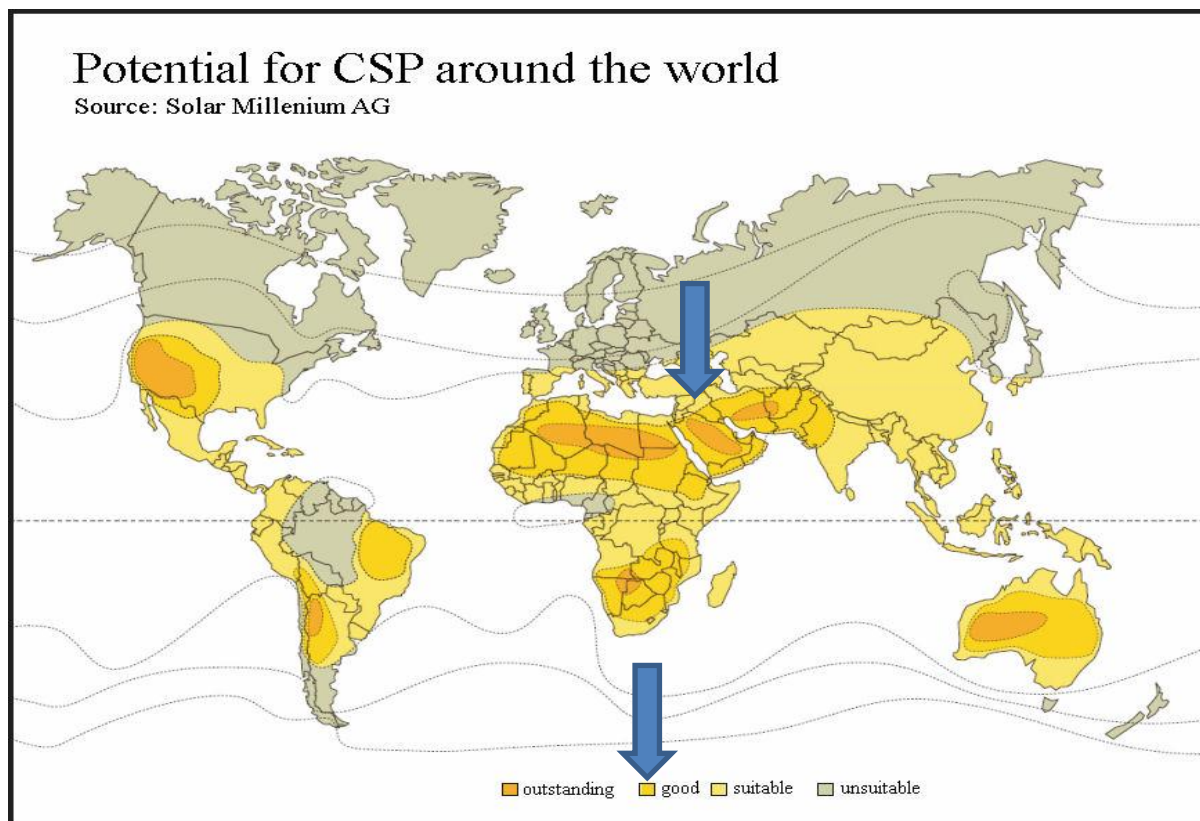
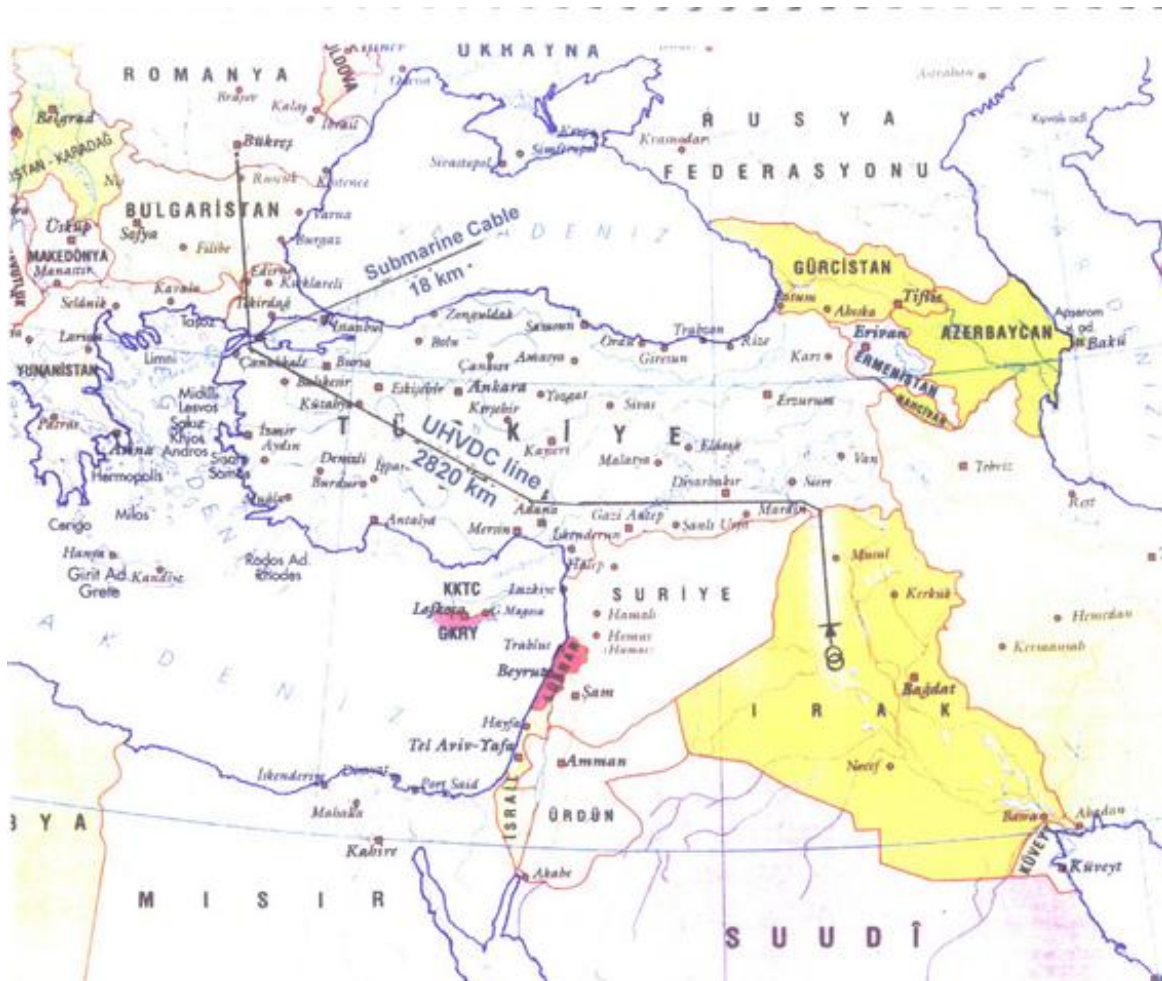


Fig (2) Proposed UHVDC Line Route (Iraq – Turkey – Bulgaria to Romania).



1- General Information about the Project

In Al Anbar region of Iraq a huge amount of solar power in addition to natural gas is available. First considerations have identified a promising project by combining these available resources with possibilities for power export.

The general thought is to use solar power during daytime plus natural gas during night time and to export the generated power via a transmission system to either Turkey or even Europe. The envisaged power amounts to 6,000 MW for the first stage.

For this purpose, the natural gas from existing wells will be exploited and brought by pipelines near the Euphrates River where 6 x 1,000 MW gas fired power plants will be constructed. In

addition a feasible amount of solar power plants shall be erected which will supply a part of 6,000 MW during daytime. The output of all these power plants will separately be brought by 400 KV AC overhead lines to the north of Euphrates river, where 2 x 3,000 MW converter stations shall be established in the north of Euphrates river near the City of Ramady to convert 400 KV AC to \pm 800 KV DC.

The obtained DC power with \pm 800 KV potential shall be transmitted by overhead lines from Al-Anbar Province Desert - Iraq to Romania through Turkey.

Environmental study is needed to assess possible harm the nature, humans, flora and fauna. The CO₂ and other harmful flue gas emissions should be minimized using latest technologies.

The investor will carry out above mentioned works and operate the system and sell the produced electric power for a period in which he recovers his Investments with his profit and interest. After the satisfaction of the investor of recovering his investments and profits, he has to deliver the complete system to be operated by Iraqi private sector. The investor shall pay Iraq for the cost of the used gas immediately after starting production of electricity until the delivery of the system [Lahmeyer International GmbH, Bad Vilbel, Germany, (Oct 2011)].

2- Proposed Project Pre-Feasibility Study

Al- Anbar Investment Commission has proposed to invite one of the confident and efficient consulting corporations to perform a pre-feasibility study which will be essential and very important for the decision makers to verify the perspective of such a project. The internationally well experienced, consultant firm (Lahmeyer International GmbH, Bad Vilbel,-Germany) has been suggested to perform this study. This consultancy firm has presented their proposal to include, simply, the following stages:

- Stage 1: Data Collection and Preliminary Investigations
- Stage 2: Elaboration of Possible Project Configurations
- Stage 3: Economic Comparison and Ranking of the Proposed Project Configurations
- Stage 4: Pre-Feasibility Study for Most Economic Project Configurations including Financial Analysis

The Pre-Feasibility Study should prove the technical and financial feasibility of the project. The study proposed to be prepared by a consultant experienced in solar thermal power plant technology and in thermal power plants. In addition consultant's expertise in Independent Power Producers scheme is requested.

The objective of the study is to define the generation system and to determine the best technical solution for exporting 6,000 MW of electrical power generated from gas and solar units in the Al Anbar region in Iraq for consumption in the European power grid. The technical analysis shall include the technical design according to project identification level and the assessment of the

line route for the interconnection line. The study has to prove the economic and financial feasibility of the selected technical option.

The most appropriate technology with competitive generation cost and acceptable risk should be identified. The components, the layout and the characteristics of such solar installations should be described. The study shall outline investment cost as well as financial and economic generation costs.

The integration of the projects to the international electricity grid should be investigated. Finally, supplementary infrastructure installations as well as environmental and social aspects have to be considered.

3- Simplified and approximated Calculations For Investments, Cost Of Kwh, And Selling Price In Romania For European Networks^{}**

The followings are the approximated and very simplified KWh cost calculations if (for the first stage), 1000 MW Solar plus 5000 MW gas fired combined cycle power plants is installed in Al Anbar area and a 2820 Km long UHVDC transmission line is constructed from Al Anbar to Romania including Converter station in Al Anbar and Inverter station in Romania.

- Investment for 1000 MW Solar Power Stations (USD) : 4 500 000 000
- Investment for 5000 MW gas fired Power Stations (rough estimation) : 5 500 000 000
- Investment for 400 KV AC transmission lines from P/P to Converter : 200 000 000
- Investment of Converter and Inverter Stations each 6000 MW : 1 000 000 000
- Investment of 2820 Km UHVDC transmission line to Romania : 4 200 000 000
- TOTAL (USD) : 15 400 000 000

- Load Factor : 0.75
- Average Load : $0.75 \times 6000 \text{ MW} = 4500 \text{ MW}$
- Losses are 122.7 MW during average power transmission.
- Actual power to be delivered in Romania = $4500 \text{ MW} - 122.7 \text{ MW} = 4377.3 \text{ MW} = 4\,377\,300 \text{ KW}$
- Energy sold per annum = $4\,377\,300 \text{ KW} \times 8760 \text{ hours} = 38\,345\,000\,000 \text{ KW hours}$ (In one year, there are 8760 hours)
- Assumed Interest and depreciation = 12%
- Fixed Cost USD = $0.12 \times 15\,400\,000\,000 \text{ USD} = 1\,848\,000\,000$
- Running Cost = Cost of Gas per annum + Salaries + other operation Expenses + Taxations = $1\,620\,000\,000 \text{ USD (for gas)} + 156\,000\,000 \text{ (for salaries + other expenses + taxations)}$

= 1 776 000 000 USD (Reduced, because 1000 MW less gas power is consumed and no payment is made to solar energy coming from Sun)

- Total Cost = Fixed Cost + Running Cost =
$$= (1848000000 \text{ USD}) + (1776000000 \text{ USD}) = 3\,624\,000\,000 \text{ USD}$$
- Cost per KW hour = $(3\,624\,000\,000 \text{ USD}) / (38\,345\,000\,000 \text{ KW hours}) = 0.0945 \text{ USD per KW hour}$ (9.45 US cent per KW hour) this is the cost at delivering point in Romania
- Assumed selling price per KW hour in Romania in 2017 = 0.13 Euro = 0.17 USD
- Difference between selling price and cost per KW hour = $0.17 - 0.0945 = 0.0755 \text{ USD per KW hour}$
- Difference in Total = $38\,345\,000\,000 \text{ KW hour} \times 0.0755 \text{ USD / KW hour}$
$$= 2\,895\,047\,500 \text{ USD}$$
- In one year Earning is: 2 895 047 500 USD
- Total investment was: 15 400 000 000 USD
- The return of investment = $15\,400\,000\,000 \text{ USD} / 2\,895\,047\,500 \text{ USD} = 5.32 \text{ years}$
- Total investment will return in 5.32 years if selling price is 0.13 Euro per KW hour
- If gas power is used instead of solar power at nights, this time period may extend to 6 years

With all these rough calculations and studies, and without too deep details, it seems this project is feasible.

** Calculations have been done in collaboration with Dr. Ahmed Kasikci (Power Transmission Consultant Engineer / Izmir-Turkey).

4- Conclusion

Through the above, the following conclusions can be drawn:

- 1- Strategic environmental, economic and political reasons pushed much of the world thinking and planning hard to find alternative energy sources in order to maintain levels of energy consumption for the short and long terms.
- 2- DESERTEC Foundation started with the idea to supplying Europe with energy from deserts, especially those includes considerable gas reserve.

- 3- Produced electricity could be transmitted to European countries by a super grid of high-voltage direct current cables UHVDC.
- 4- An Iraqi scientists and experts found that, under DESERTEC concepts, Iraq could be the second source of energy to European countries because of the available; broad lands, solar energy, wind energy, geothermal energy and gas reserves.
- 5- An approximate and simplified KWh cost calculations has shown that this proposed project is *feasible and could be highly attractive for investment*.

5- REFERENCES

1. DESERTEC Foundation. Retrieved 2010-12-24, "Our Global Mission".
2. Dii GmbH. Retrieved 2010-12-24, "Bringing the Desertec vision into reality".
3. EurActiv. 2009-07-22, Retrieved 2010-12-24 "First steps to bring Saharan solar to Europe".
4. Kanter, James (2009-06-18). "European Solar Power From African Deserts?". The New York Times. Retrieved 2009-07-03.
5. Lahmeyer International GmbH, Bad Vilbel, Germany, Oct 2011, "Integrated Solar Thermal Power Plants in the Al Anbar Region of Iraq. Terms of Reference for Consulting Services for Preparing a Pre-Feasibility Study"
6. McKie, Robin (2007-12-02). "How Africa's desert sun can bring Europe power". The Observer (London). Retrieved 2007-12-08.
7. Rzhnevskiy (2009-06-29). "World's Most Daring Solar Energy Project Coming to Fruition". The Epoch Times. Retrieved 2009-07-03.
8. Van Loon, Jeremy; Von Schaper, Eva (2009-07-13). "Siemens, Munich Re Start Developing Sahara Project". Bloomberg. Retrieved 2009-07-15.