

SUSTAINABLE GLOBAL ENERGY DESERTEC CONCEPT

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"In the coming decades, global developments will confront mankind with unprecedented challenges: climate change, a population growth far beyond Earth's present carrying capacity, the global striving for prosperity, and increasing demands for energy and water, are the core problems we are faced with. 200 years of global industrialization has resulted in an unparalleled standard of living and an increased life expectancy for part of the world's population. However, all this has been and is still being achieved at a price: alarming environmental destruction as well as climate change which can no longer be ignored.

These things will mean dramatic changes to life on Earth in the future."

Desertec Foundation's Red Paper

"Within 6 hours deserts receive more energy from the sun than humankind consumes within a year."

Gerhard Knies, Chairperson supervisory Board of the Desertec Foundation

INTRODUCTION

The ambitious Desertec initiative has been designated as the energy megaproject of the 21st century. It started in 2008 as a collaboration between 43 member countries constituting the "Union for the Mediterranean." As an initiative of the "Club of Rome," the Trans-Mediterranean Renewable Energy Corporation (TREC) concept involves making use of the abundant unused solar energy in the deserts and wind on their seashores to promote global energy security and help protect our climate. Private sector involvement is through a limited liability Company under German law (GmbH) designated as the Desertec Industrial Initiative (DII).

Its aim is to exploit the wind and solar energy resources of North Africa for use at the local level and ultimately its surplus exported to Europe. It appears as a Commonwealth sharing capital and land resources based on the model of the old Roman Empire with the Mediterranean Sea as a large lake between Europe and North Africa and the Middle East. Electrical power would be transmitted over long distances using High Voltage Direct Current (HVDC) transmission with cables on the sea floor. The initial project for Europe, the Middle East and North Africa (Eumena) has expanded into Desertec versions for North America, Australia and Asia.

Studies by the German Aerospace Center (DLR) show that within 40 years, solar thermal power plants in particular will be capable of generating economically more than half of the electricity needs of the Eumena region at that time.

In order to meet today's global power demand of 18,000 TWh / year, it would suffice to equip about three thousandths of the world's deserts, an area of about 90,000 km² with solar collectors of solar thermal power plants. This is a small fraction of the Sahara Desert's total area of 9 million km², or $90,000 / 9 \times 10^6 = 0.01$; which is 1 percent of its surface area. About 20 m² of desert would be enough to meet the individual power demand of one human being day and night. Given the political will, it would be possible to achieve a worldwide realization of the Desertec Concept in less than 30 years [1]. It is hoped that it will cover the electrical demands of North Africa and the Middle East as well as 15 percent of Europe's electricity by 2050 at a cost of \$556 billion or €400 billion.

DESERTEC INDUSTRIAL INITIATIVE, DII



Figure 1. DeserTEC concept for Europe, Middle East and North Africa, Eumena. Source: DeserTEC Foundation.

In the DeserTEC Industrial Initiative (DII), private sector companies pursue the accelerated implementation of the DeserTEC concept developed by the Club of Rome and TREC.

The DII's three core objectives are to:

1. Analyze and develop a technical, economic, political, social and ecological framework for implementing the DeserTEC concept,
2. Initiate industrial preparations for implementing the DeserTEC concept,
3. Develop specific business plans and associated financing proposals for the implementation of the DeserTEC concept.

The DII will work on these objectives in close cooperation with the DeserTEC Foundation under the following guiding principles:

1. The focus of the DII's activities in the field of power generation will be on the sun and wind as renewable sources of energy. The investigations carried out to identify suitable technologies for power generation and transmission will not be biased towards a particular outcome.
2. The DII's regional focus will be on Eumena, i.e. Europe, the Middle East and North Africa.
3. All of the DII's activities will be aimed at developing viable business and investment plans within three years of its establishment.

4. From the very beginning of the project, the aim will be to start supplying electricity to the European Union and to generate sufficient power to meet the needs of the producer countries as soon as possible. The aim is to supply around 15 percent of Europe's electricity by 2050.
5. The DII's work will not be limited to individual aspects of the Desertec concept. The approach adopted in investigating power generation, transmission and sale will always be a holistic one, and will also take into account the political and social parameters and the development needs of the producer and transit countries (for example, combination with seawater desalination).

NORTH AMERICAN DESERTEC

A North American Continent Desertec concept has emerged to use the wind solar, geothermal as well as the biomass resources in a long term sustainable manner.

To handle increasing amounts of renewable energy, existing power lines will need to be upgraded to carry electricity generated from wind in inland areas such as Wyoming, Concentrating Solar Power (CSP) from Eastern California/Nevada/Arizona and geothermal energy from mountain California to the nation's energy hungry coastal cities such as Los Angeles. The TransWest Express Project is such a plan.

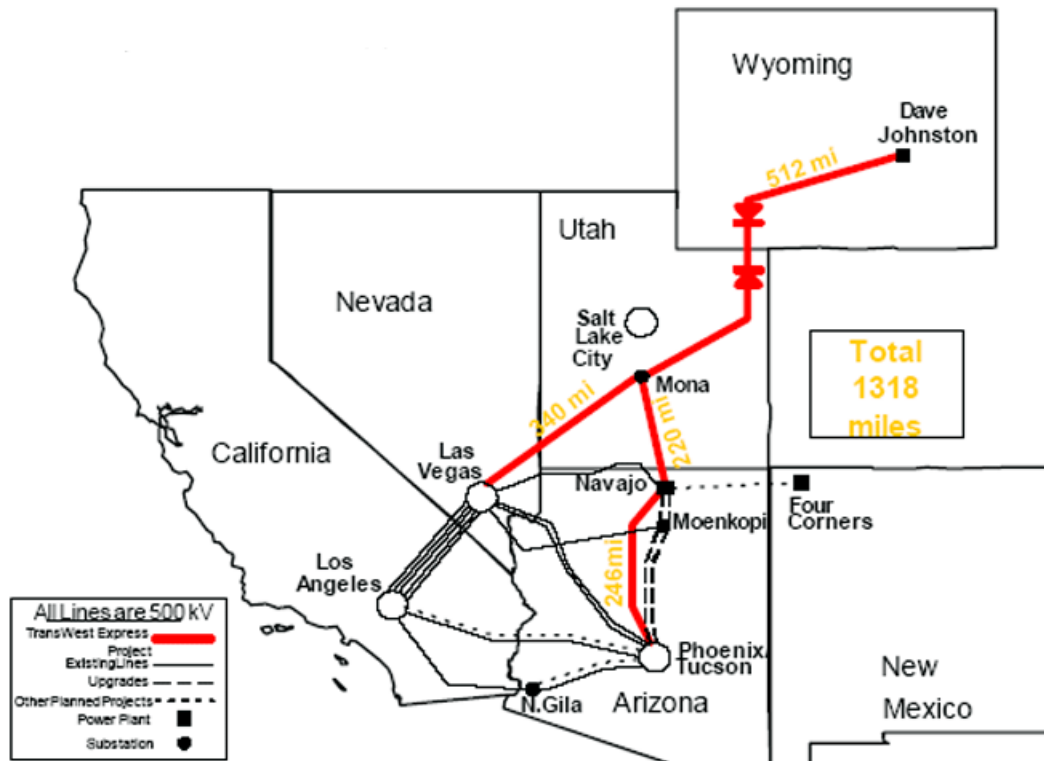


Figure 2 . TransWest Express Project, Alternative E, power generation and transmission lines in the American West.

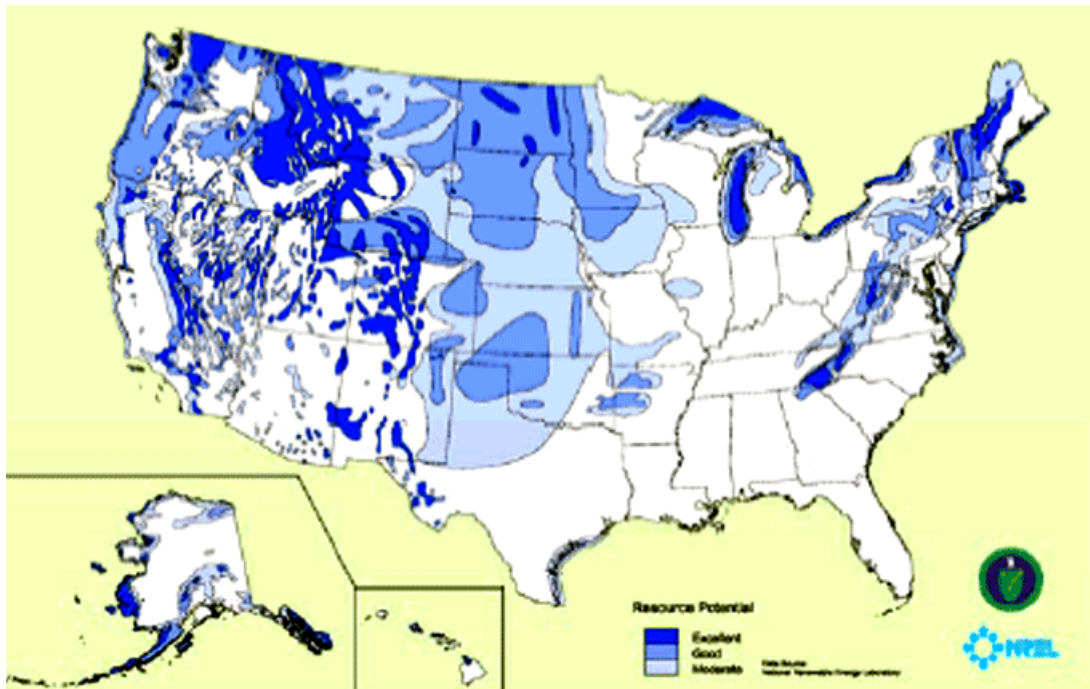


Figure 3. Wind energy resources in the USA. Source: NREL.

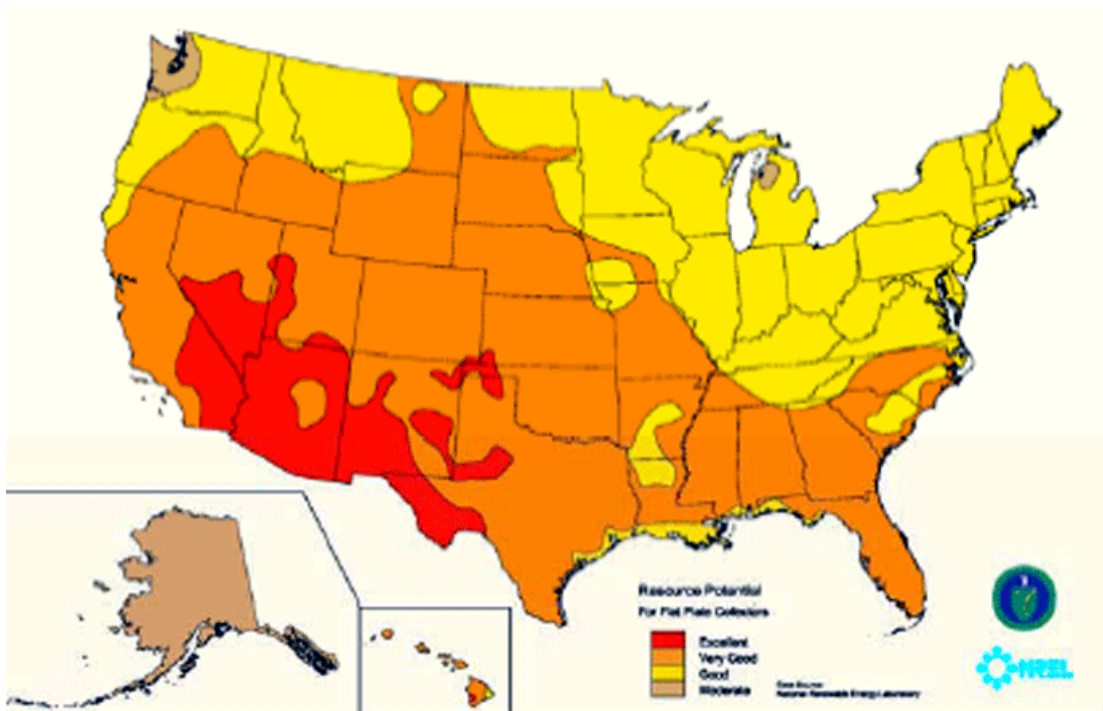


Figure 4. Solar energy resources in the USA. Source: NREL.

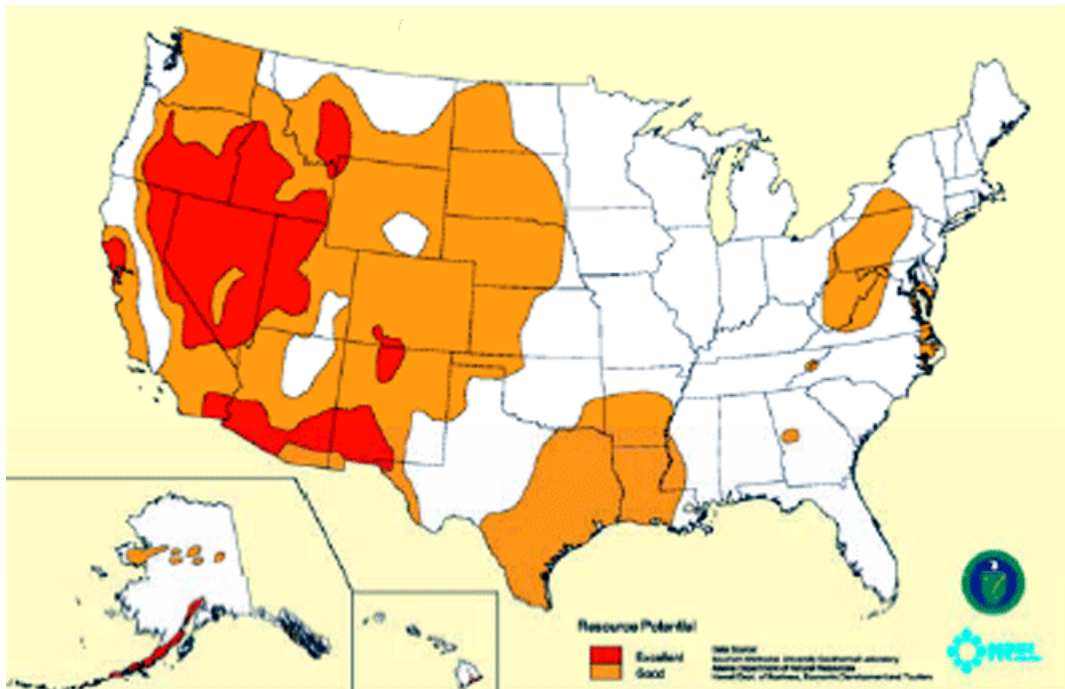


Figure 5. Geothermal energy resources in the USA. Source: NREL.

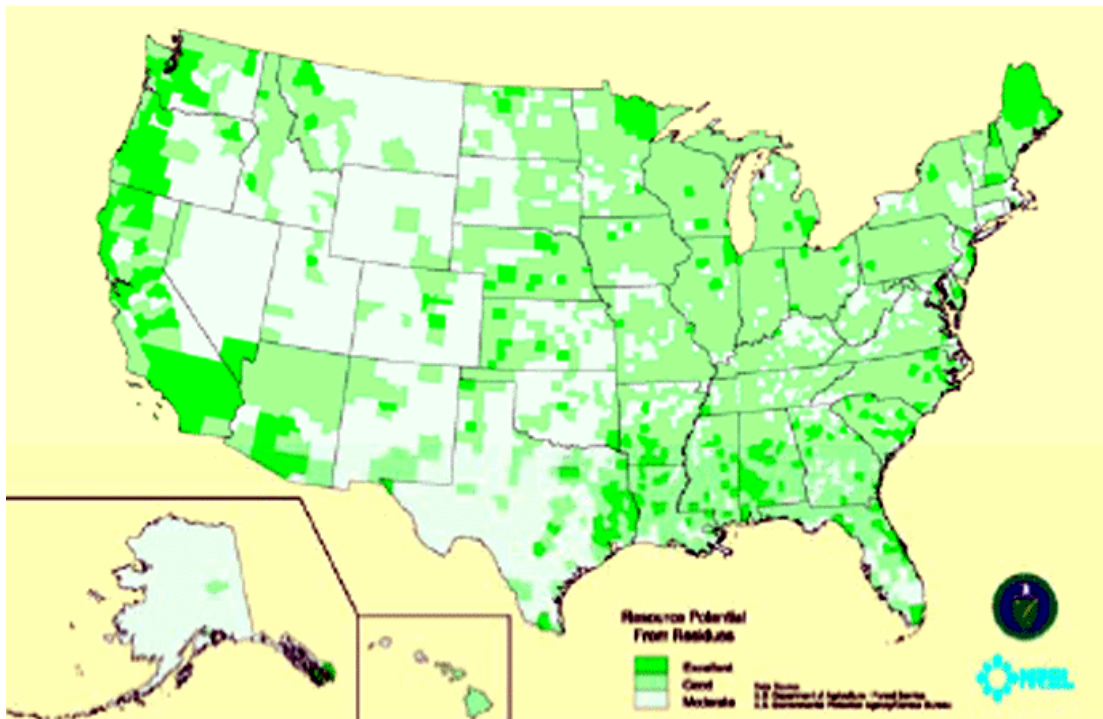


Figure 6. Biomass energy resources in the USA. Source: NREL.

DESERTEC AUSTRALIA AND ASIA

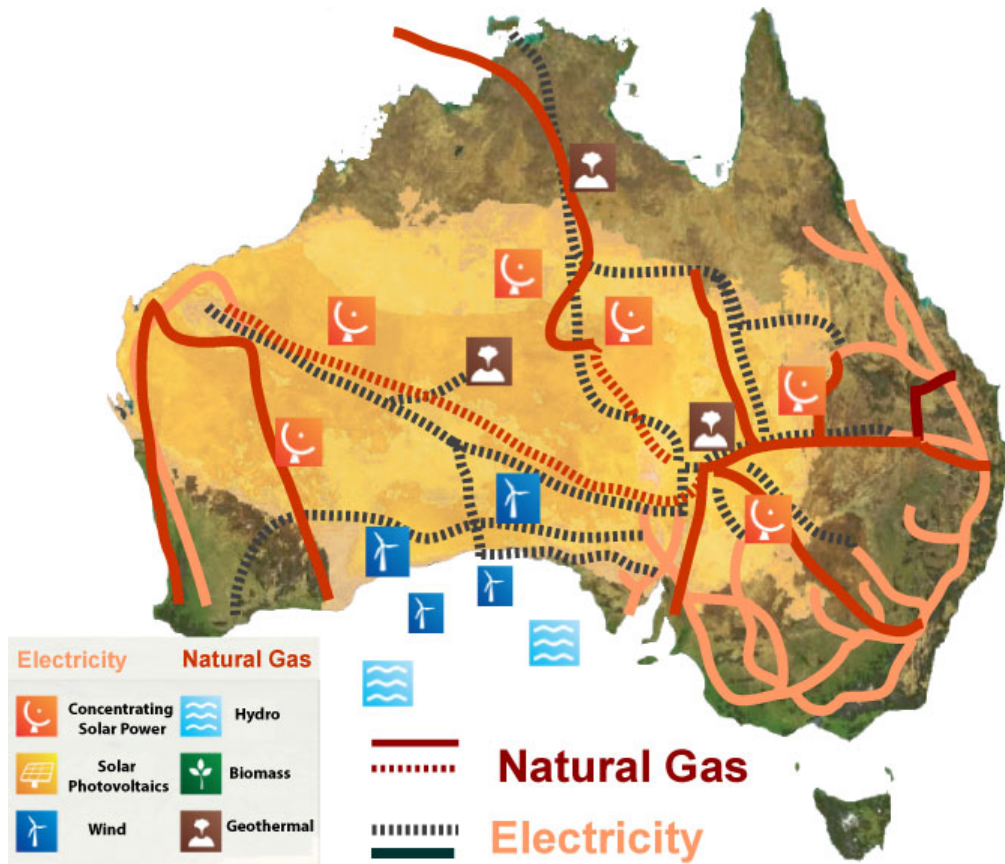


Figure 7. Desertec Australia concept. Source: Desertec-Australia.

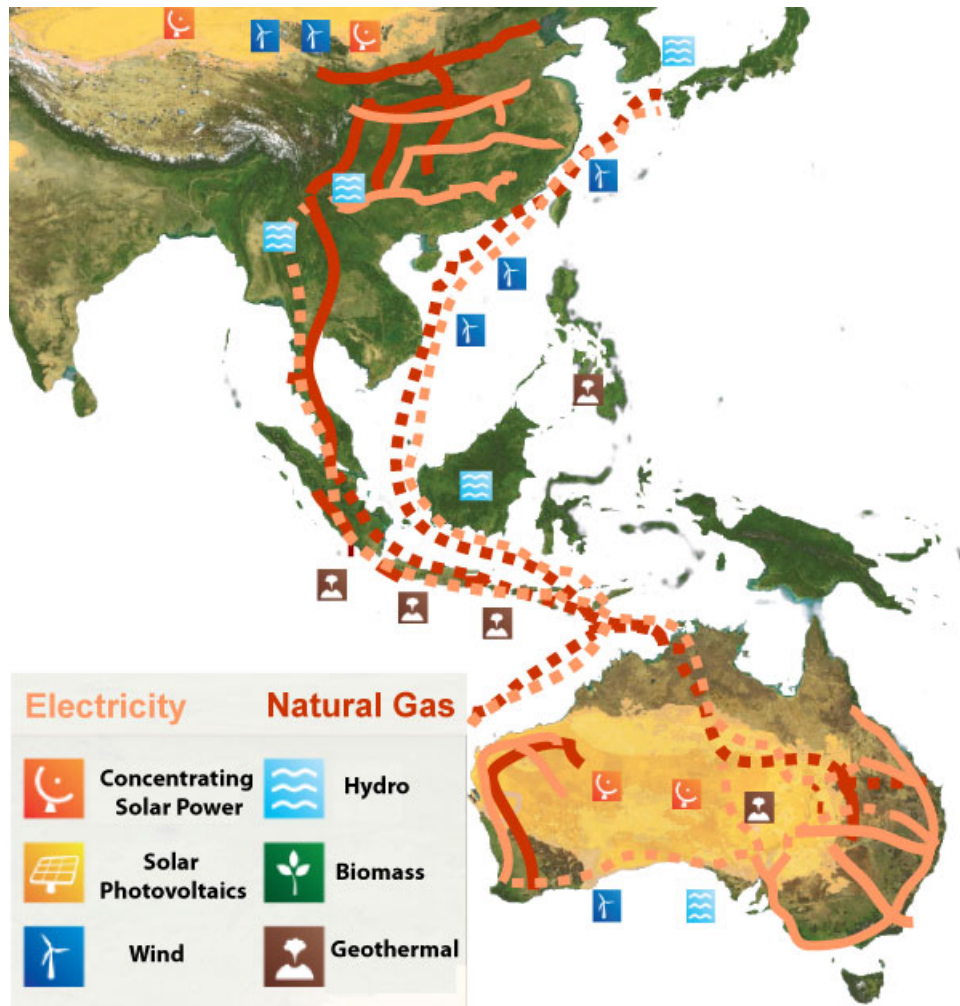


Figure 8. Desertec Asia concept. Source: Desertec-Asia.

The Desertec-Asia plan involves connecting Asia through a 6,000-8,000 km electricity and natural gas transmission system stretching from southern Australia to Japan and South Korea.

Australian surplus concentrating solar power, geothermal, wind and wave energy, along with natural gas, would flow northward to Indonesia. There, it would be joined by Indonesia's surplus natural gas, geothermal and hydro power.

The combined energy supplies, joined by Malaysian hydro, southeast Asian biomass and Mekong wind, would then be transmitted to China, Japan and South Korea through a 'non-discriminatory, common-carrier' infrastructure operated like a toll road.

Further north, China's Inner Mongolia and Xinjiang provinces could contribute solar and wind energy. In the East Asian Sea, networked offshore wind farms and wave and tide machines would contribute more energy. Regional natural gas and hydro energy supplies would 'load balance' the entire system in a hemispheric network.

DISCUSSION

There is a need to create the legal, regulatory, economical and technical framework to pave the way for such a project. The energy business, which is as profitable as the telecommunications business, must be opened to those who wish to produce energy either on a distributed or on a centralized way, while finding a market for their product. This necessitates the deregulation of the existing system of public monopolies of the electrical utilities. The production, transmission and distribution components must be made independent of each other, providing flexibility, entrepreneurship and manufacturing possibilities.

Some have derided the project as an unrealistic, expensive and technically challenging White Elephant; pointing out the political problems associated with a multinational project in an unstable part of the world. A hurdle to overcome is the lingering perception of neocolonialism hidden agenda with European investment in North-African Energy Resources.

In a socially and politically acceptable scenario, the producing countries themselves, rather than the consumer ones, would lead in the implementation of the initiative in developing local Desertec projects with the aim of first supplying their own energy needs while offering their surplus production for export to the consuming ones in a mutually beneficial win-win arrangement.

Social peace and political stability are requirements for investment, but they are also products of the project by providing gainful employment and improved standards of living. It is ironic in this case that the perceived problems are themselves the incentives for the solution. Socioeconomic development and the development of democratic structures will evolve concurrently hand-in-hand [2].

REFERENCES

1. Gerhard Knies, Gerhard Timm, Friedrich Fahr, Gerry Wolff, Max Schon, Michael Straub, Hani Nokraschy and Oliner Steinmetz, eds. "Desertec Foundation, Red paper, An Overview of the Desertec Concept," 2010.
2. Alison Kilian, "Arab Spring Boosts Dream of Desert Power," Der Spiegel, May 26, 2011.