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Emission free energy from the deserts

How a 'crazy Desertec idea' has become reality
in North Africa and the Middle East

SMART BOOK PUBLISHER

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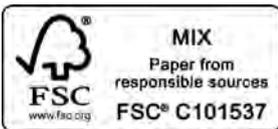
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Part 1

o. Introduction

o.1 The Desertec initiative, once a love baby of the German industry

The idea that the deserts of the Middle East and North Africa (MENA) could deliver enough renewable energy to cover the demand of their own population and to power a part of the European market was not entirely new in 2009, but in that year quite unexpectedly a group of the largest German companies launched a unique and sensational initiative to make that happen by 2050. That was very surprising, as at that time not many industrial players worldwide would give much credit to large plans for the development of ‘outrageously expensive’ renewables at all, left alone in politically sensitive areas such as North Africa and the Middle East. Despite much scepticism and exactly in the depressed era of a major financial crisis the so-called ‘Desertec Industrial Initiative’ (Dii) was founded in Munich, near the headquarters of giant multinationals Siemens and MunichRe, to work with the international community. It was a powerful sign of hope and spirit. This new venture became a clear mandate to bring the public and private sectors in the related countries in motion for the benefit of ‘power from the deserts’. The expectation of the initiators in those days was that up to 15 percent of the European electricity demand could by 2050 be served with power from mainly ‘huge solar thermal installations’ in the deserts and electricity being transported via high voltage DC cables from the southern to the northern regions of the Mediterranean and from there to Germany. The Desertec vision quickly became very popular in Germany and far beyond, although it was not yet very clear at that time what it was really all about. The industry group Dii was meant to challenge the vision and to pave the way for implementation in a realistic and pragmatic way. The main motivation of the German industry originated, evidently, from the

creation of a new market for profitable power plant projects in the deserts.

The idea in those days was, that such projects could only be financed if the electricity would be delivered physically to Europe, even to Germany, which was used to massive de facto subsidization of renewables. However, in due course Dii has placed the movement for power from the deserts in a broader international, intercultural, technological and energy market context. The initial focus became more orientated on localisation of the industry with benefits for desert countries and integration of not only 'green electricity', but in a broader sense 'green energy' from MENA into the global energy markets. To date hydrogen and other synthetic emission-free energy carriers are becoming part of the 'package'.

Desertec may initially have raised attention as a sort of 'top-down planned economy type of road map', imposed by mainly German companies. However, the industry group Dii has taken steps to make this false perception more realistic, more international. Today, the main players in Dii are the Chinese 'master of power grids', State Grid Corporation of China, the Saudi-based market leader in the region, ACWA Power, and German renewable energy leader, Innogy. Also, Siemens, ABB, First Solar and many international companies are (again) on board. In the region itself the United Arab Emirates and Morocco have been the driving forces in the beginning, but today almost all countries are heavily involved in the energy transition. Solar and wind energy have become competitive. There is no more need for begging for subsidies. Renewables are swiftly becoming emancipated in the energy markets of the three neighbouring continents, Europe, Africa and Asia. Moreover, energy is getting exchanged from one area to the other depending on supply and demand. Local governments, industries and people, rather than foreign players, are becoming the prime winners. A convincing proof is the fact

that Dii's main local partner, ACWA Power, has quickly become the number one in the region.

Today, in 2019, the authors observe a convincing case for renewables in all countries of MENA, even in politically unstable areas. As renewables in the deserts have become competitive across the board, the traditional subsidies for fossil energy have become superfluous, if not completely ridiculous. Governments are, courageously but still socially acceptable, gradually scaling down such subsidies. After years of wasting energy in the production countries and ever more costly import dependency in countries without oil or gas sources, a sort of 'normalisation' is taking place. Each desert country in the region has the same fair chances to make best use of indigenous solar, wind and perhaps hydro sources. The MENA region is quickly developing into a 'powerhouse' for emission-free electricity ('green electrons'), hydrogen and other energy carriers ('green molecules').

In fact, Dii evolved in ten years from Desertec 1.0 (power from the deserts for Europe) via Desertec 2.0 (emission-free power for MENA in the first place) to Desertec 3.0 (emission-free electrons and molecules for MENA and for the global energy market!)

To date it almost seems hard to believe that there has been so much disbelief, ridiculing and confusion ten years ago. The process, from where Dii started then until today, has been fairly dynamic and sometimes bumpy, but it is a story of great progress and success. An exciting story, which will undoubtedly continue in the next decades. The German industry has embraced power from the deserts ten years ago as their love baby. That German love baby has now, so to say, become a young adult. It is no longer a remote 'Germany show'. The process is now driven by local stakeholders in cooperation with global partners. It has become unstoppable and will move on until energy supply in MENA will have become fully emission-free. Surplus energy will

be fully available to the global energy markets. The regional and international industry will, hence, be ensured of many years of business opportunities in the regional energy transition.

Today, it may be hard to believe that in 2009, at the start of Dii, energy from the desert was perceived as something exotic, uncertain and very uneconomic. Today we know that the desert regions will swiftly become the powerhouses for emission-free energy.

o.2 Establishing a ‘not for profit’ enabler for renewables

First, eleven mainly German companies and the Desertec Foundation (a German NGO) founded Dii (Desertec Industrial Initiative) in Munich, to discover during a period of three years whether the Desertec vision really has ‘hands and feet’ and how the idea could be implemented... In close coordination, a statute was laid down in advance which formulated the mission and goals. During the following three years, Dii would develop studies and ideas for framework conditions, some reference power plants and a roll-out plan for investments up to 2050. The project met with great public response. Expectations of a future that could depend significantly on energy supply from the desert were high.

Initially, most of the founding companies still adopted a wait-and-see attitude. At the board level, however, Desertec was a present topic: Attractive business opportunities were seen in a new market and an advance into the field of renewable energies seemed imaginable. The hope that the German government could extend the then generous promotion of renewable energies in Germany to the MENA region further increased the interest of companies.

The joint initiative of industry and the Desertec Foundation, which is still very young and committed to ideological goals, was welcomed by the German government and it pledged its support. However, there was no actual consultation with European stakeholders or governments, institutions and civil societies in the MENA countries before the creation of the initiative – the initiative was a real surprise.

Thomas Rüschen of Deutsche Bank acted as chairman of the shareholders' meeting in the early years. During this phase, the initiative grew into a unique international gathering of 20 voting companies and 35 associated partners. At the end of 2012, Frank Detlef Drake of RWE took over as Chairman. He guided the company through the high waves that hit a dramatic shift among the shareholders and associated partners. The Desertec Foundation withdrew from the initiative in mid-2013. By the end of 2014, Dii had completed the studies intended at the time of foundation and formulated investment ideas. Dii's key report 'Desert Power 2050' showed the long-term perspective for a (nearly) emission-free energy market in MENA and electricity exchange with Europe. In 2015, Dii relocated its operations to Dubai, an inspiring centre for innovation in the region capturing tremendous synergies. Desertec thus entered into a next phase, primarily concentrating on the MENA region. Since then, shareholders have been a Saudi company (ACWA Power), a German company (Innogy) and a Chinese company (CEPRI/SGCC). From the Arab metropolis, Dii, with the help of many international partners, is now working not only for emission-free power, but for emission-free energy in general in the MENA region and for the exchange of energy with the world market for emission-free energy, including Europe.

0.3 Collegiality and Controversy

The governance of a very heterogeneous industrial group is a dynamic process that requires special leadership skills from the Dii manager Paul van Son. In the beginning, the exchange with key persons in the shareholder circle took place quickly and unbureaucratically. In the background, very committed board members of the participating companies, such as Thorsten Jeworrek (Munich Re), Caio Koch-Weser (Deutsche Bank), Udo Ungeheuer (Schott) and Peter Smits (ABB), provided advice and support. The former Environment Minister and commissioner of the United Nations Environment Programme (UNEP), Klaus Töpfer, was available to the Dii leadership for some time as a special envoy. An Advisory Board, headed by Hans Müller-Steinhagen, director of the German Aerospace Center (DLR) and later dean of Dresden Technical University, also advised the Executive Board, which included the Tunisian State Secretary Abdelaziz Rassaa and the CEO of Royal Air Maroc, Driss Benhima. In addition, there were several external key advisors such as Gerhard Hofmann, former political chief correspondent of RTL and N-TV, Wolfgang von Geldern, former State Secretary of the federal government, and the law firm Hengeler Mueller from Munich. The relationship with the Desertec Foundation was ensured through its Founder Gerhard Knies member of the Club of Rome and Friedrich Führ.

The CEO of Dii was given great freedom to develop the company's programme and build a competent team. The relationship between the Management Board and the shareholders was characterised by trusting and collegial interactions. Compliance was ensured by explicit regulations and constant monitoring by the corporate group. Under Van Son, Dii used the Dutch 'polder model' in the coordination between the various companies with their different business objects, as the *Financial Times Deutschland* reported under the heading "Sent to the Desert" (Gassmann

30.10.2009). The cards were on the table from the beginning. All those involved worked together to find solutions to the problems, dilemmas and challenges that were plentiful in the first two years.

0.4 From electricity for Europe to energy structures for the region

However, this has not hindered the development of numerous collaborations. Together with the Fraunhofer Institute for Systems and Innovation Research, ground-breaking studies were conducted and intensive discussions were held with stakeholders from politics, institutions, the media and civil society in Germany, Europe, the MENA countries as well as China, Japan and the USA. The dilemmas of the Desertec idea and the realities of the market gradually became visible. The original, strongly constricted idea of building solar power plants in the deserts and bringing the electricity generated there to Europe proved unrealistic in this simple form. It was much more sensible to work with local governments to build a market in which renewable energies can compete. To this end, however, the necessary infrastructure and a fundamental openness of the market to the international and intercontinental exchange of energy expected in the long term must be guaranteed.

The idea of generating energy in the deserts of this world has long since lost the appearance of the exotic; in many countries it has become part of government plans. How and when an almost completely emission-free energy supply can be realized is the subject of countless controversies. But the direction is clear and the process is unstoppable. Many players are already active in the various local markets. Dii is still one of the driving forces behind this development, without receiving much media attention. It is a signpost with a wide network and access to decisionmakers in

the MENA region and beyond. German companies have lost their pioneering role within the project. Arab, Asian and a few European companies are now taking the initiative.

1. Desertec – an idea gets outlines

The sun-drenched deserts of the MENA region are increasingly becoming the site of a massive energy revolution. The sun shines particularly intensely on the desert soil. This makes these desert regions one of the best places in the world for solar energy. Constant winds blow along the coasts. In the Gulf of Suez and in the Strait of Gibraltar and many other places, large wind farms have been built. As far as renewable energies are concerned, the early considerations on this matter began around 1990 in the context of the Club of Rome. Initially, it was politicians, scientists and economists from the Club of Rome and the Jordanian Energy Research Centre who developed a vision initially called Desertec.

The Sahara dominates the north of Africa. It stretches 6,000 kilometres from the Atlantic Ocean in the west to the Red Sea, which separates Africa from the Arabian Peninsula; between its northern and southern borders lie 2,000 kilometres. It is the largest desert in the world and extends over more than nine million square kilometres. The collective imagination connects the Sahara with gigantic sandy areas. In fact, only a quarter of the area is covered with sand. The majority consists of mountains, stone and gravel areas. The desert of deserts is joined to the east by other deserts: the Syrian desert, the Nefud desert and the Rub-al-Chali desert.

In these regions less than 50 millimetres of rain fall annually, which corresponds to one tenth of the Central European average. On the other hand, 700 times more solar energy reaches the surface than mankind currently obtains from fossil fuels (Martin 2016). The first considerations as to how this almost inexhaustible source of energy could be harnessed were aimed at producing clean energy using solar thermal power plants and distributing it to the world's population with low losses by

means of high-voltage direct current (HVDC) transmission – more than 90 percent of humanity was to be reached in this way. Prince Hassan bin Talal of Jordan, the former president of the Club of Rome, suggested this model. The idealistic and visionary image was questioned, examined and improved in the following decades, because Desertec also turned out to be an extensive international search process in which the most diverse organisations and players were involved.



Figure 1: The North African desert landscape. Source: Thomas Isenburg

While very few people live in the deserts of the region itself, the coasts are densely populated. People also settled in fertile regions such as the Nile Valley. In 2018, North Africa had a total of about 200 million inhabitants. At the same time there were 500 million people in Europe. Unlike in Europe, however, the North African population is growing rapidly despite crises and challenges. The situation in the Middle East with its 350 million inhabitants is similar to that in North Africa. So, there are more

people living in the MENA region, including Turkey, than in the European Union. This fact has interested scientists in Europe for some time, as well as energy and water issues in the region.

In 1968, long before the idea for Desertec was born, the Club of Rome was founded. At first it was a rather elitist discussion circle: its members were spread all over the world, preferably male and all in influential positions. However, when the study *The Limits to Growth* (Meadows et al. 1972) appeared in 1972, it initiated a broad debate on the environmental implications of our actions that extended far beyond the ivory towers. The book also had an enormous impact against the background of the first oil crisis in 1973, when the authors were awarded the Peace Prize of the German Book Trade. At the Massachusetts Institute of Technology (MIT), young researchers led by the American economist Dennis Meadows and his co-authors Donella H. Meadows and Jorgen Randers used computer-aided simulations to model the Earth's system behaviour over the next 130 years. Five different scenarios resulted: If world population, industrialization, pollution, food production and the exploitation of natural resources were to continue to develop as before, the world's absolute growth limits would be reached over the next hundred years. However, the book does not read exclusively pessimistic: its authors were convinced that the self-destruction of human civilization could be stopped by technical innovations and targeted control.

In the mid-1970s, the German physicist and philosopher Carl Friedrich von Weizsäcker explained the current state of knowledge on climate change to Federal Chancellor Helmut Schmidt. However, the first findings about this phenomenon go back much further. As early as 1824, Jean-Baptiste Fourier described how trace gases in the atmosphere can contribute to warming the climate. In 1860, the physicist John Tyndall proved that these are mainly water vapour and carbon dioxide (CO₂). In 1896, the