Energy Projects

Partnerships and Perspectives of Arab-German Cooperation

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Message of Greeting

Dr. Philipp Rösler

Economic relations between Germany and the Arab region are experiencing a high level of momentum. This is true for the energy sector as well. When it comes to energy, German companies offer an abundance of innovative technologies, products and services at competitive conditions. This new business guide to the energy sector, which is published by the Ghorfa Arab-German Chamber of Commerce and Industry, provides an attractive and easy-to-understand overview of Germany's expertise in this area, including specific examples of projects that German firms have implemented in numerous Arab countries.

It is our aim to ensure that cooperation between Germany and the Arab world remains very close in the future. Major opportunities exist in areas such as the expansion of renewable energy, the modernisation of power grids, and the improvement of energy efficiency. Within the framework of our own efforts to transform Germany's energy supply, the German government has adopted ambitious targets in all three of these key areas. We now want to achieve these targets in an economically viable way, so that Germany can become one of the most energy-efficient and climate-friendly economies in the world without compromising competitiveness and prosperity. Working together in partnership with the countries of the Arab world can contribute to this goal.

That's why we work to promote the business activities of German companies in the Arab region by creating a positive policy environment and by providing support for promising projects – for example, we are setting up bilateral energy partnerships that will intensify energy sector cooperation to the benefit of all sides.

I am convinced that Arab-German energy relations will generate tremendous economic opportunities in the future. In this spirit, I wish all of the companies involved in these projects continued success in developing profitable business initiatives.

Sincerely yours,

Dr. Philipp Rösler | *Federal Minister of Economics and Technology*

Dear Reader

Dr. Thomas Bach

We are pleased to present you the first detailed publication on Arab-German cooperation in the field of energy. This book highlights some of the most interesting and promising projects in the Arab World in which German companies are participating.

The energy sector is a main sector for Arab-German business relations. While German companies traditionally have been key suppliers for conventional power plants in Arab countries, the cooperation extended to the field of renewable energies in recent years. This is due to the high number of projects in this business area stretching all over the Arab world, from Abu Dhabi's Masdar City to Kuraymat in Egypt and Desertec's project of reference in Morocco, with German companies participating in all of these projects.

Growing demand and growing production necessitates the development and extension of transmission and distributional networks across the Arab world, such as the GCC power grid.

Closely linked to all of these projects is the question of energy efficiency. In times of growing demand and costs of energy production, the best way to save the environment is to avoid excessive consumption. Therefore, numerous projects of green building and energy-saving measures are on the agenda in the Arab world. German companies are taking a leading role in this regard, for instance in Jordan, the United Arab Emirates and Qatar.

More efficient desalination plants are of high importance. German companies lead in the fields of evaporation technology and reverse osmosis. Water, irrigation and desalination technologies remain among the priorities of Arab-German cooperation.

The Ghorfa Arab-German Chamber of Commerce and Industry has been active in encouraging Arab-German cooperation in the energy sector. The first Arab-German Energy Forum in October 2010 in Berlin attracted more than 300 decision-makers from both sides. A recently signed cooperation agreement between Ghorfa and the Desertec Industrial Initiative and the Ghorfa working group "Energy" are constantly pursuing better exchange and coordination concerning Arab-German energy cooperation.

We sincerely thank Mr Thomas Kraneis, Executive Director Customer Relationship Management of Lahmeyer International, and Mr Jürgen Hogrefe, General Manager of h. c. hogrefe consult, for their input and their contribution to this volume. We would further like to thank Ms Rafaela Aguilera Alvarez, Ms Traudl Kupfer, Mr Clemens Recker, Ms Nicola Höfinghoff and Ms Anhar Al-Shamahi for their work and effort to realize this book project.

We wish you an informative and instructive reading and hope to see you at one of our energy-related activities.

Thomas Bach | *President* Abdulaziz Al-Mikhlafi | *Secretary General*

Abdulaziz Al-Mikhlafi

Conventional Energy

Despite the growth in alternative energy solutions, conventional energy remains for the time being the prime source of power and electricity in the Arab world and in Germany. Oil and gas still made up more than 90 per cent of primary energy consumption in the Arab world in 2010. The cooperation between Germany and the Arab world has a long and successful history with German companies being involved in a number of promising projects.
A number of modern oil- and gas-fired plants have been built by German companies in Arab countries who also seek to introduce new technologies such as heat recovery systems and co- and trigeneration. Due to industrial diversification and population growth, the demand for energy and electricity is set to sharply increase in Arab countries, which in turn necessitates the build-up of conventional as well as alternative energy production plants.
This chapter highlights some of the latest developments and technologies in Arab-German conventional energy cooperation and presents selected projects of reference.

Shoaiba Stage III gears up for the summer peak operation

Alstom Power
Marc Villemin | *Project Director*

The first unit of the Shoaiba III project is expected to start delivering power this summer. The start-up will be the culmination of what has been a huge effort to shorten the construction/commissioning schedule of the latest stage of Saudi Arabia's largest power plant.

Located on the banks of the Red Sea in Saudi Arabia is the Kingdom's largest power plant. The Shoaiba power project already has an installed capacity of 4,400 MW from its first two stages, and the addition of Stage III will increase this capacity to 5,600 MW. The Saudi Electricity Company (SEC), a majority state-owned corporation, owns the Shoaiba power plant.

The plant is of tremendous importance. It provides electricity in the western grid of Saudi Arabia including the holy city of Makkah. With Ramadan starting August 1, 2011, and then occurring in the summer for the next few years, the area will have an even greater demand for power during the hot summers due to air conditioning needs.

Shoaiba is a huge and ongoing development. The contract for the first three oil-fired 400 MW units of Stage I was signed in 1998. In phase 2 of this first stage two further units have been added, giving Stage I a generating capacity of 2,000 MW from five units. Following completion of Stage I in 2003, Alstom signed a contract in March 2004 for the construction of Stage II (Phases 1 and 2) for another 6 × 400 MW units, bringing the total output of the plant to 4,400 MW.

Four years later, in 2008, the contract for Stage III was awarded. Stage III will supply three more 400 MW units. This contract includes designing, manufacturing, supplying, constructing, installing, commissioning, and testing of the entire plant, including boilers, STF40 steam turbines, GIGATOP 2-pole turbogenerators, sea-water flue gas desulphurization systems for the removal of SO_2, and the complete balance of plant and systems for the three units. The consortium partner, Saudi Archirodon, was to carry out all the associated civil works.

Delivered and stored flue gas cooler modules

Efficiency Improvements Using Heat Recovery Systems for Conventional Power Plants

Babcock Borsig Steinmüller (BBS)
Bernhard Michels | *Managing Director* and
Frank Adamczyk | *Head of Heat Recovery Department*

In times of fuel shortage and tight economical circumstances the competition between power plant operators is even more fierce. In order to meet these market challenges a scheduled and ensured plant runtime is a precondition for conventional power plants. Due to the fuel price development this also applies to the Arab states increasingly.

In addition to economical aspects the protection of the environment is considered as a decisive factor in securing our future. A use of non-renewable resources that is free of pollution is essential to achieve these aims.

It is a main interest of the energy producers to operate power plants as long and efficiently as possible. Modernisation and retrofits, like heat recovery, gain a new significance in this context as these means reduce pollutants quite effectively or increase the efficiency.

With an integrated heat recovery system the runtime of an existing power plant can be extended significantly. The heat recovery system uses the heat downstream of the electric precipitator and upstream of the flue gas desulphurization to be used i.e. for air preheating or condensate preheating. This method increases the efficiency of a power plant up to 3%, the so-called "Green Megawatts". The system was developed by the heat recovery department of Babcock Borsig Steinmüller, which belongs to the Bilfinger Berger Power Service Group. Meanwhile it is described worldwide as "Best Available Technology" (BAT) in modern fossil new built power plants.

In the following example of the fossil fired Mehrum power plant (750 MW_{el}) a further operation of another 25 years was the pre-condition to examine four different alternatives for heat recovery and finally, to integrate an individually modified heat recovery system. This paper describes the integration of the system in the existing power plant, in particular the planning, realisation and operation of the plant with "air preheating by using flue gas waste heat". Additionally it points out economical advantages due to savings of primary energy and trading with CO_2 emission rights, which might be the basis for installing similar applications in the Arab states.

MWM GmbH, Company Headquarters
Based in Mannheim since 1871 when it has been founded by Carl Benz, the inventor of the automobile.

Decentralized Power Generation in Combination with Heat and Cold Supply

MWM GmbH

Carl Benz, the inventor of the automobile, founded the "mechanical workshops" in Mannheim in 1871. Today MWM GmbH is one of the world's leading suppliers of very efficient and environmental friendly systems for energy production.

The company, based in Mannheim, Germany, draws on over 140 years of experience in the development and optimisation of combustion engines for natural gas, special gases, and diesel. Together with its partner Descon Power Solutions from Lahore, Pakistan, we are going to extend its market presence in Pakistan. Since 2009, Descon Power Solution, a subsidiary of Descon, one of the leaders in engineering, chemicals and power industry within the region, offers services such as engineering & design, supply & installation, commissioning operation & maintenance, supply of spare parts and emergency trouble shooting for the supplied generator sets.

There are many reasons for the increased popularity of natural gas to generate both power and energy in the world. While coal is the cheapest fossil fuel for power generation it is by far the most damaging as burning coal releases the highest levels of pollutants and greenhouse gases into the atmosphere.

Renewable Energy

For a number of years the issue of renewable energies has become increasingly important in the Arab world and in Germany. While Germany pursues the energy turnaround, projects and facilities have been implemented in Arab countries from Morocco in the west to Oman in the east. This includes solar energy, hydropower and wind power generation. While Germany is a key global player in renewable energy technologies, the Arab world offers ideal conditions for the implementation of solar and wind projects. The will to further strengthen the role of renewable energies has been manifested in Abu Dhabi's successful bid for the International Renewable Energy Agency. Renewable energy projects fostered by German companies and initiatives in North Africa are to build a comprehensive Arab-German cooperation in this field. Next to oil and gas, the renewable energies will prove to be a major field of an Arab-German energy partnership. This chapter explores projects of reference in this sector from North Africa to the Arab Gulf states.

Parabolic trough collectors at Andasol 3 plant in Spain

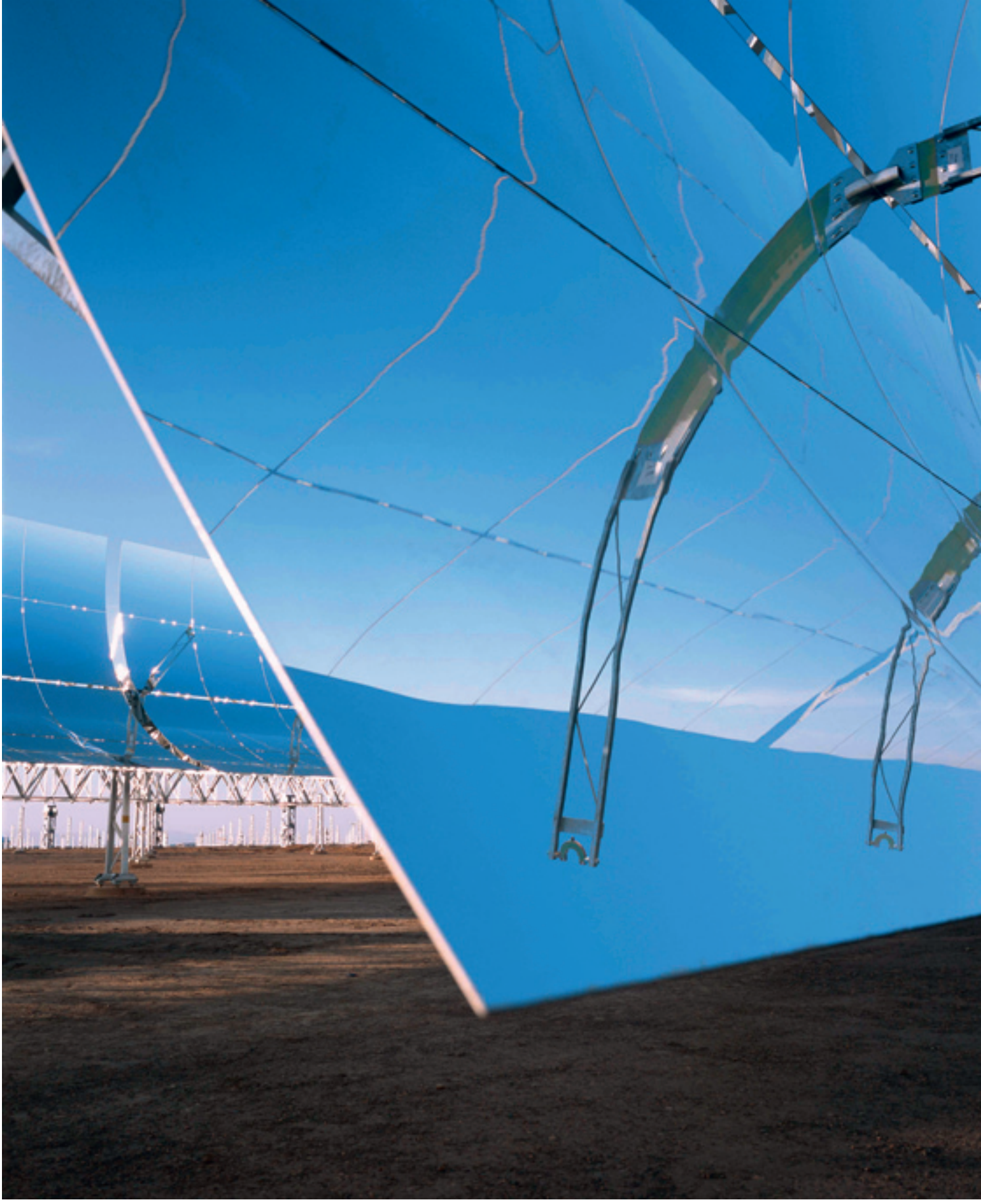
Solar Thermal Power Plants – Egypt's Kom Ombo and Others

Ferrostaal AG
Gerret Kalkoffen | *Head of Business Development Power & Solar*

Ferrostaal is a global provider of industrial services in plant construction and engineering. As a technology-independent system integrator, the company offers development and management of projects, financial planning, and construction services for turnkey installations in the segments of petrochemicals, power & solar and industrial plants.

The worldwide demand for power is growing and both the costs of fossil fuels as well as the dependencies on its import are bound to increase as supplies tighten. Simultaneously the awareness of climate change is promoting renewable energies for sustainable growth. Solar thermal power plants are such renewable energy technologies. They concentrate sunlight with mirrors, e.g. in parabolic trough shape, and produce heat energy that is fed into a steam turbine which drives a generator and produces electricity. The great benefit is that electricity can be provided at any time of the day – because energy can be stored in tanks as heat, which is far less expensive than storing electricity in batteries. Today, with no costs for feedstock and due to technology, scale, and experience, solar thermal power plants are cost competitive and reliable.

The World Bank has committed to contributing to the deployment of solar thermal power plants in emerging countries with appropriate solar conditions. The International Finance Corporation (IFC), part of the World Bank Group, manages the Clean Technology Fund (CTF). The CTF has a total volume of US $ 5 billion, of which US $ 750 million are dedicated to solar thermal power plants in the Middle East and North Africa. These funds have been pre-assigned to 13 projects under soft-loan conditions: 40 years repayment period, 10 years grace period, 0% interest and a service charge of 0.25 %. This way, the CTF is a major supporter of technological advancements and the establishment of sustainable energy production.



Parabolic trough collectors at Andasol 3 plant in Spain

Shams One
100 MW Concentrated Solar Power Plant

Fichtner GmbH & Co. KG
Matthias Schnurrer | *Director Gulf Area* and
Martin Schmitt | *Project Engineer*

As the first major hydrocarbon-producing economy in the Gulf Region, Abu Dhabi has established its leadership position in renewable energies by launching the Abu Dhabi Future Energy Company (ADFEC). This company is heading the MASDAR (Arabic: source) Project, whose main purpose is the development of Masdar City, which will consume only solar power and other renewable energies.

Solar technologies are rapidly becoming a major focus worldwide as a sustainable energy source, and the MASDAR Initiative, Abu Dhabi's landmark renewables program, is driving the adoption of advanced solar technologies in the UAE.

ADFEC is already operating Masdar City's 10 MW solar PV plant that came on stream in 2009. Another prime project being developed by ADFEC is a 100 MW concentrated solar power plant, known as Shams One Solar Power Plant (Arabic: sun), which will play a significant role in promoting renewable energies, as it will be one of the biggest solar thermal power plants in the world and is the first large-scale solar power generation plant in the Gulf Region.

Shams One is owned by Shams Power Company, a special purpose vehicle comprising Masdar, with a 60 % stake, in a joint venture with Abengoa Solar, Spain, and Total, France, each with 20 % holdings.

Fichtner was involved in this project from day one and supported ADFEC as its technical consultant and transaction advisor for the entire project development phase. Fichtner's services included preparation of the feasibility study, conceptual design and drawing up tender documents as well as support during the transaction process up to award of contract. Fichtner is currently acting as owner's engineer, being responsible for design review, site management and supervision of commissioning up to commercial operation of the power plant.

Shams One Plant construction site

Solar investigation tower in Jülich, Germany

AlSol – Feasibility for a Solar Thermal Tower Power and Gas Turbine Plant in Algeria

Kraftanlagen München GmbH
Gerrit Koll, MBA | *Sales and Business Development Manager Energy & Environment Technology*

On 24 August 2009, the national administration of scientific research of Algeria, Direction Générale de la Recherche Scientifique et du Developpement Technologique (DG-RSDT), and the Solar-Institute Jülich (SIJ) signed a cooperation treaty to realise a further developed solar tower power plant on basis of the open volumetric air receiver technology in Algeria. Based hereon as a first step, a feasibility analysis and a basic engineering for the construction, commissioning and operation of a solar tower power plant were carried out by Kraftanlagen München under a contract of SIJ. Moreover, SIJ was also in charge of proposing conceptual ideas for an adjacent technology demonstration and research centre, the so-called Technopol, as a basis for future scientific cooperation and exchange between Algerian and German research communities.

Objectives

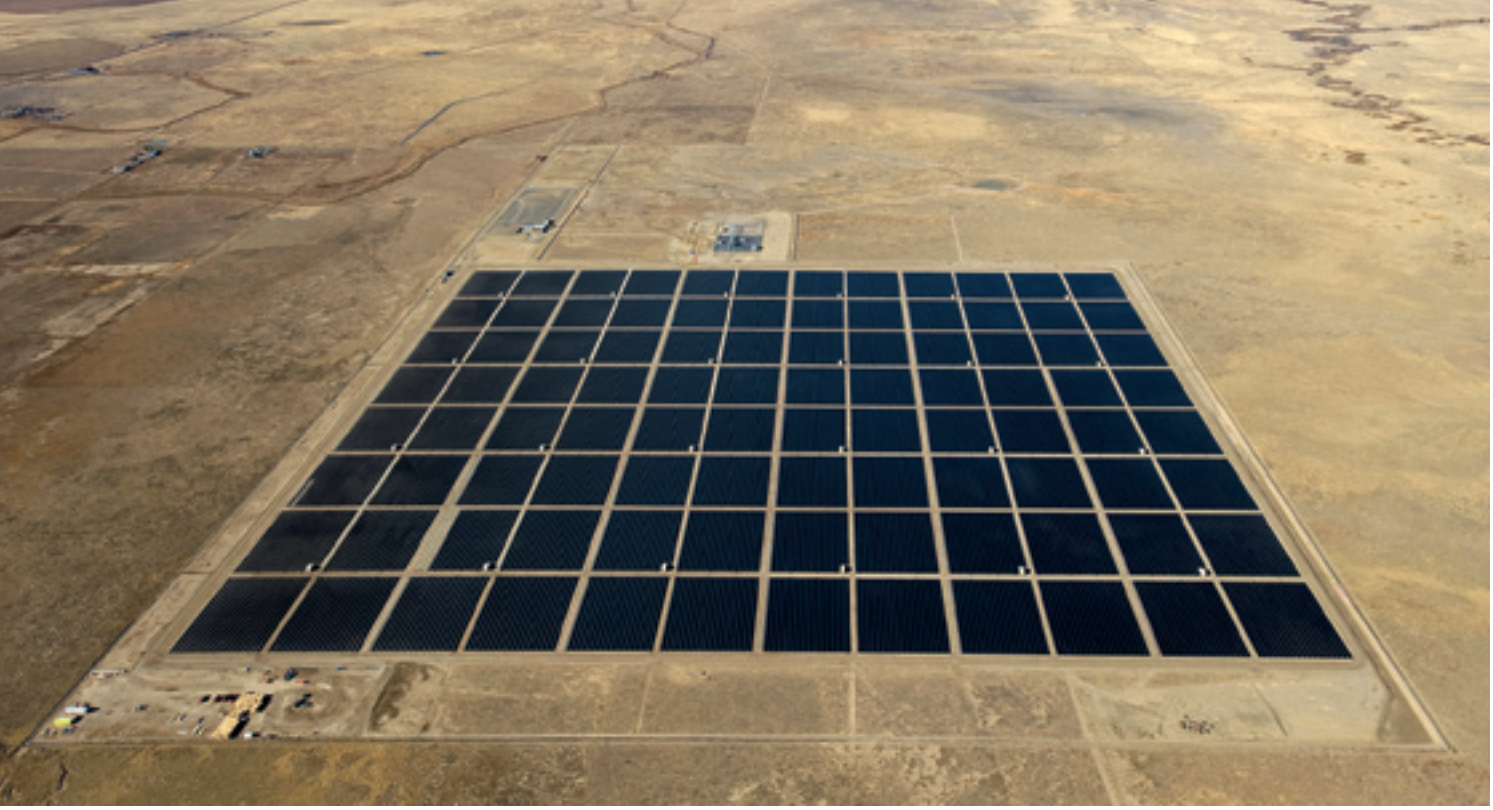
When the project AlSol started, the SIJ, DG-RSDT, the Algerian partner "Centre de Développement des Energies Renouvelables CDER" and the German partners Kraftanlagen München GmbH (KAM), Deutsches Zentrum für Luft- und Raumfahrt e.V. and IA Tech GmbH have conjointly worked out the project prerequisites:

- Power plant design providing a broad spectrum of operation cases for future R&D-studies
- Proximity to research institutes, universities and airports in the north of Algeria in order to strengthen the Algerian solar energy research network on an international level
- Innovative plant concept with gas turbine hybridization and heat storage for operation on demand and high plant availability
- Modular plant design providing a scale-up ability to commercial plants

Site evaluation and conceptual analysis

Out of three target regions in the north of Algeria eight possible sites have been identified and analysed in a two stage approach. The selected site, fulfilling all project requirements for a feasible erection and operation of the solar tower, is situated in Bourkika (Wilaya of Tipaza), in the north of Algeria, well connected to the research institutes of Blida University and CDER in Algiers. The expected annual DNI is 1,900 kWh/(m^2 a).

With regard to the boundary conditions of the potential sites a main focus was set on developing an advanced plant concept. Due to the highly synergetic integration of a gas turbine into the air cycle of the open air receiver technology, e. g. similar working fluids and temperature levels, different GT-hybridization concepts providing timely parallel or serial operation of the thermal heat supplying components (solar receiver and gas turbine) were developed and benchmarked against a



First Solar, 30 MW, Cimarron (New Mexico, USA)

The Value of Renewable Energies in the MENA Region

First Solar GmbH
Karim Asali, MBA | *Technical Development Manager*

Renewable, high-tech energy production starts contributing to energy independence in MENA

In Western Europe and the U.S.A. power generation using renewable energy systems has achieved an increasingly strong position within the energy mix in recent years. In particular wind energy and photovoltaic (PV) have found a pivotal role in Germany, Denmark, Spain, Italy, Japan, California, and other countries through national incentive schemes such as feed-in laws and tax breaks. A dynamic industry that optimises its production processes continuously, and a massive increase in production and power generation capacity has been the result. This enabled the industry to produce products and build power generation systems at costs steadily closer to or even lower than conventional power production from heavy-fuel oil, gas, and alike.

Energy markets are shifting towards renewable energies in three phases: today, we are experiencing the end of the first phase, in which public subsidies are driving the market while helping the industry to reach market maturity. The final, third phase, is characterised by a sustainable energy economy – the ultimate goal of this transition towards a clean, green energy production. Sustainable, in this context, also means the achievement of power generation costs which are equal to or lower than fossil-generated electricity on a comparable basis.

We are now in a transition phase – the second phase – with its special challenges. A feature of this phase is the opening and creation of new markets with lower requirements for subsidies and the willingness to question existing energy and economic structures. This allows a gradual adaptation of new and renewable resources. However, economies investing in renewable energy will also have to revise their energy laws and power grid structures, decentralise power generation and accelerate electricity market liberalisation processes.

Current conditions of the site: relatively flat with good soil conditions, perfect for the development of a PV plant.

Masdar's 100 MW Noor 1 Photovoltaic Project

Lahmeyer International
Camilo Varas | *Project Manager*

The Abu Dhabi Future Energy Company (Masdar), a UAE based company, is planning the construction of a 100 MW photovoltaic power plant in the United Arab Emirates called Noor 1. The Noor 1 project, foreseen to start operations at the end of 2013, will be one of the l argest PV plants worldwide, generating over 160 GWh of electricity per year. Furthermore, the Noor 1 plant will be the first of a set of three 100 MW photovoltaic power plants intended to be built in the same area under the name Al Ain Solar Park.

Noor 1 – which translates from Arabic into "Light 1" – will form part of Masdar's growing renewable energy project portfolio in the UAE, which includes, among other solar and wind projects, a 100 MW CSP project called Shams 1, currently under construction by a consortium between Abengoa (Spain) and Total (France).

The construction of the Noor 1 project will not only represent a major step in UAE's renewable energy targets, but also the cornerstone for the development of large scale PV projects in the MENA region.

It is no secret that the constant cost reduction on PV modules seen in recent years has rendered the PV industry more attractive and competitive than other renewable energy options (e. g. CSP). This fact, together with a combination of a vast energy resource (solar irradiation) and available land, has made large scale PV projects a perfect match for renewable energy development in the MENA region.

Thanks to its extensive track record in photovoltaics, Lahmeyer International was entrusted with the role of technical advisor to Masdar. The tasks include the preparation of the project design considering state-of-the-art technologies and practices, technical assistance during the tendering phase (tender document preparation and bid evaluation), and contract negotiations.

For this challenging project, Lahmeyer has formed a team of multidisciplinary and highly skilled experts i. e. power, mechanical, civil, renewable engineers, among others, who are prepared to cope with the particular needs of the project. Furthermore, Lahmeyer's local office in Abu Dhabi plays a key role within the team, confirming the worldwide presence of LI and the ability to undertake projects globally with key local knowledge.

"Power&Life Container" installed in Neuenrade, Germany.

Sustainable Energy for Remote Radio Towers in Algeria

SaEnergy Systems GmbH
Klaus Naderer | *Managing Director*

Continuing fluctuations in the Algerian national electric power system cause considerable off-times in the mobile telecommunication system. As a result, one of the local mobile network operators (MNO) is looking to install emergency power systems for existing radio towers and to operate new radio towers off-grid by using the "Power&Life Container" (PLC) – a mobile power plant developed by SaEnergy Systems. SaEnergy Systems is currently working with a partner on the bidding phase of the project.

Installation and maintenance of mobile telecommunication networks in Algeria is a challenging task. As one of the largest territorial states in the world, and the largest one on the African continent, Algeria demands a great deal from its nationwide telecommunication operators. Roughly 87 % of the country is considered Saharan territory, with almost 80 % being devoid of any vegetation. This makes expanding the national power grid to remote installations like radio towers difficult, as well as expensive. The very range of power supply networks necessary for covering such a large country with such demanding environmental conditions makes technical difficulties within the power supply inevitable. Fluctuations in the national grid, leading to off-times in telecommunication networks, are the consequence. Therefore, technical installations that depend on permanent and steady power have to be provided with a power back-up. So far diesel-powered generator sets and battery systems have filled this niche.

While Algeria is one of the largest oil exporting countries in the world, the government declared in February 2011 that in order to conserve its fossil fuel reserves, and free itself from a unilateral dependency, the country is planning to generate 40 % of its energy from renewable energy sources by 2030.

Visualisation of pilot wind farm

Wind Energy in Libya

CUBE Engineering GmbH
Stefan Chun | *General Manager*

As one of the world's largest crude oil exporters, Libya soon realised the potential of the use of renewable energy (RE) technologies in its own country (including solar and wind, among others). Already at the end of the 1970s, proprietary studies, demonstration projects and small pilot projects were gaining ground in the huge desert country – about 85 % of the land surface is covered in sand desert or steppe – and fourth largest country in Africa. A larger, national and commercial use of the technology, however, was confined to the large centres in the west (Tripoli) and east (Benghazi). At the end of the 1990s, the first wind atlas for the coastal region was created at Al-Fateh University in Tripolis.

After years of isolation the strong growth of Libya's economy at the beginning of this century resulted in a huge demand for energy. The forecasts called for approximately 10 % growth per year for the circa 6.5 million inhabitants of the relatively sparsely populated state. The national energy provider GECOL (General Electricity Company of Libya) is aware of the finite nature of oil and gas resources. Over several years, GECOL developed a strategy for covering the energy demand of its customers with new and existing technologies. From this, a master plan was created, which calls for a 10 % share of renewable energies in generation of power (by 2012–2015). For wind energy, this share represents about 500 MW of installed wind park capacity.

Visualization of Nyala wind farm

Installation of a wind measurement station in Nyala in 2001

Location of the three wind farm sites

First Larger Scale Wind Park Projects in Sudan

Lahmeyer International
Dr. Patric Kleineidam | *Head of Department Renewable Energies – Wind Energy,* Matthias Drosch | *Project Manager Wind Energy*

In recent years, African countries have started to enter the wind energy market. However, only Morocco, Egypt and South Africa have implemented large scale wind farms to date. Kenya has commissioned a pilot wind farm in recent years, and Ethiopia and Nigeria are currently constructing their first wind farms. Countries such as Tanzania, Lesotho and Ghana are expected to follow.

One reason for this positive growth is the promising wind conditions between the Red Sea coast and the African Rift valley. These wind conditions can be found in Sudan as well. Thus, the Ministry of Electricity and Dams (MED) of the Republic of Sudan has decided to develop three wind farm projects with a total capacity of 300 MW. These three projects are comprised of the 20 MW Nyala wind farm, 100 MW Dongola wind farm and 180 MW Red Sea Coast wind farm. At all three project locations, good wind conditions (>7 m/s) can be found, comparable to the highest occurrences in Sudan (> 8 m/s). At the Red Sea Coast a high quality wind measurement campaign is currently under preparation in order to confirm the expected values, which have been measured by former wind measurement campaigns. The development of wind energy in Sudan started in 2001 and 2002, when wind measurement campaigns were undertaken in southern Darfur as well as northern Sudan to determine areas of high wind speed. Regarding these, the area near the city of Nyala, capitol of the state of Janub Dafur, and the northern region near Dongola village at the western side of the Nile River have been identified as the most feasible locations for building wind farms. For these sites, feasibility studies and wind measurements were performed in 2002 and 2003. At that time Lahmeyer International, Germany (LI), was already involved as technical advisor.

Implementation plan for three wind energy projects

In February 2011, LI was appointed by MED as its consultant to act as the owner's engineer for all three projects. The services comprised the review and update of t he former feasibility studies as well all design, tendering, contracting and supervision services leading up to commissioning of the wind farms.

Dongola wind farm, with a total capacity of 100 MW, will be built in two phases, where Phase I comprises 20 MW and Phase II comprises 80 MW. The first phase of the project will be connected temporarily to the existing 33 kV electrical grid. At later stages, the final wind farm capacity will be connected to the 220 kV grid system, which is currently under construction and will connect the villages of Dongola and Wawa.

Power
Transmission and Distribution

With increasing electricity and power demands in Arab countries, pressure is not only exercised on the production side but also on the distribution and transmission. Interregional and international cooperation is imperative in this regard, as is highlighted by the GCC power grid for instance and future networks covering North Africa and linking it to Europe. German companies have been involved in setting or overhauling existing distribution networks and their experiences will prove valuable for upcoming projects. This also includes a more thorough access of oil or gas-driven power plants to high voltage grids. The reference projects that are presented in this chapter show some of the successful German participations and activities in Oman and Qatar.

Electricity Interconnection Projects among Arab Countries

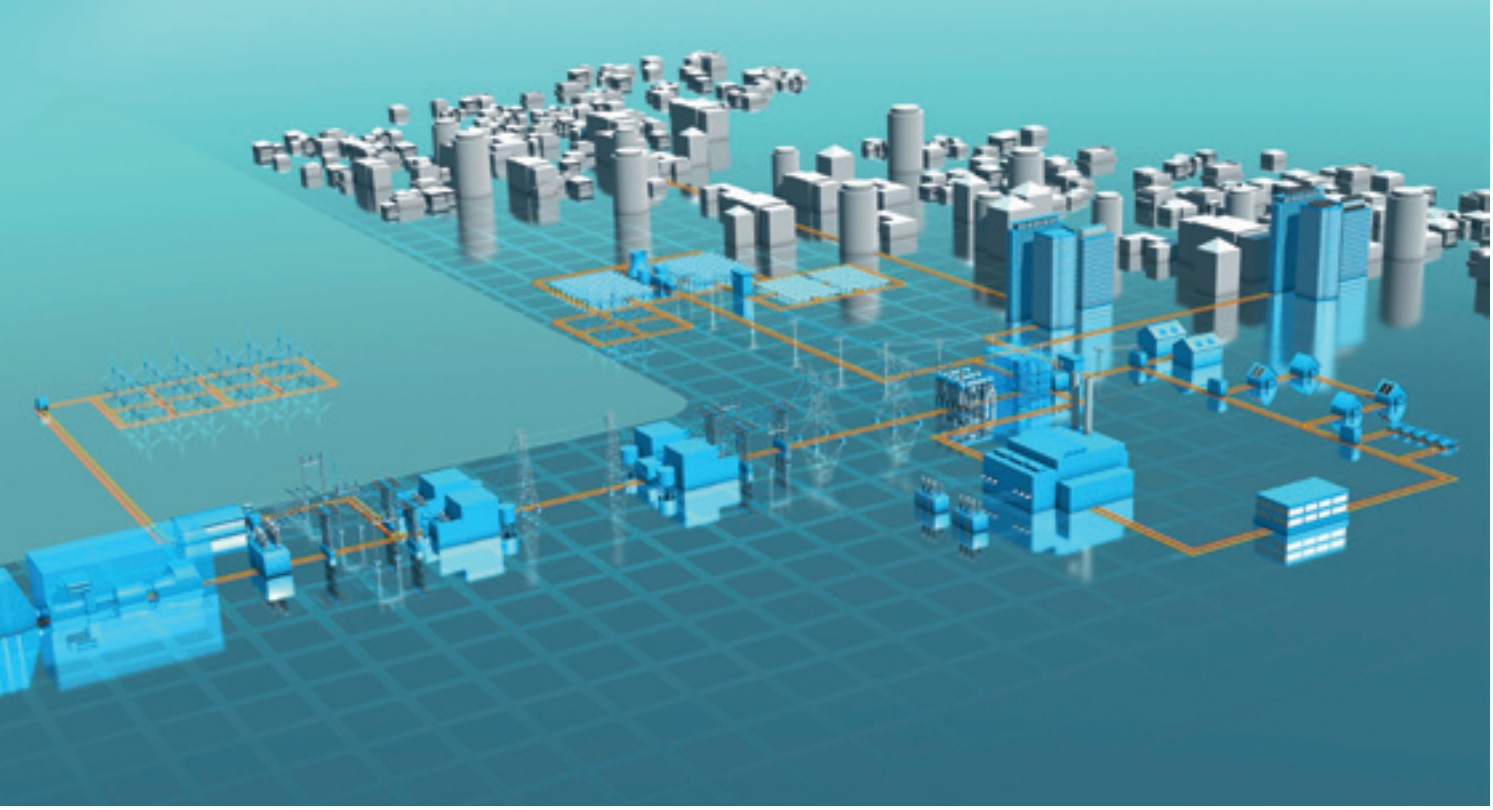
Arab Union of Electricity
Fawzi Kharbat | *Engineer, Secretary General*

There are many areas of cooperation between the Arab Countries in the electricity sector. One of the most important areas is the electricity interconnection. The importance of this interconnection comes from the projects among the Arab Countries on one hand, and between the Arab countries and Europe on the other hand.

Without doubt, electricity interconnection projects help in minimizing the investment capitals in new generation capacities. This has recently been carried out in a detailed study by the Arab Union of Electricity about the new generation capacities needed in the Arab Countries during the period 2010–2020. The study estimated that 200 GW of new generation capacities have to be build over the above mentioned period in all Arab Countries. The above estimates were based on the average growth rate of 6–10% in electricity demand over the period 2003–2010, while the growth rate in the world is less than 3%, and in the developed countries it is around 1.2%. According to the forecast announced by electrical utilities in the Arab countries for the coming 10 years, the growth rates in electricity demand will keep its high trend as in the past years.

Table 1
Installed capacity in Arab countries

	2010	2020
Installed capacity	188 GW	388 GW
Steam turbines	29.8%	35%
Gas turbines	42.5%	25%
Combined cycle	15.3%	27%
Diesel	1.9%	1.4%
Renewable	0.4%	3%
Hydro	5.6%	4%
Nuclear	–	1%
Others	4.5%	2.8%



Smart grids will improve efficiency, reliability and safety of the power supply chain, a radical shift from the problems faced today.

Smart Grids – Powering a Cleaner Energy Future

Siemens Middle East
Dietmar Siersdorfer | *CEO Energy Sector, Middle East*

Few people purposely set out to waste energy. In fact, if you talk to individuals, corporations, utilities and governments around the world, everyone is aware of the impending energy demand growth that will come from the forecasted increase in regional and global population. The need to spare and share and distribute resources more evenly is crucial now. Sustainability is the buzzword. The political will is there, the good intentions seem sincere, but it is not happening fast enough. Not yet. We need to think and act smarter and technology will be the answer. Experts believe that the world needs intelligent power grids in order to meet the growing demand for energy in a way that is eco-friendly and reliable. Consequently, the smart grid industry will see increasingly dynamic growth fueled by climate change, fast increasing urbanisation, and economic stimulus programs.

Smart grids are a key focus area for industry and energy giants worldwide. Siemens, for example, is demonstrating expertise in smart metering, grid intelligence and utility data management in countries like the UK, Germany, Denmark, and Sweden. Smart grid technology will see a high degree of intelligence in the energy systems where all kinds of infrastructure are connected along the entire energy chain. One of the key advantages of the smart grid is that every source of energy – conventional, non-conventional and renewables – can all be fed into the system that can partially act like a storage for a more strategic energy use. Combining all areas of expertise gives Siemens an early starter advantage to help solving the looming monumental issues of scarcity, power cuts and unreliable energy supply in the MENASA (Middle East, North Africa and South Asia) region and beyond.

Ground breaking for Dukhan Road Super

Doha is growing

Qatar Grid Expansion Project

Fichtner GmbH & Co. KG
Anne-Katrin Schneider | *Project Assistant*, Nebojsa Jokanovic | *Project Engineer* and Carsten Mohr | *Projects Director*

"Al Dahama", Arabic for the flower of the spring, was chosen as the logo for the campaign waged by the desert country of Qatar in its bid to host the Olympic Games in 2016.

This is indeed an apt symbol for this pulsing, colorful Emirate. Although Doha's application was unsuccessful in this case, it has already been selected as the venue for the Soccer World Cup in 2022. Doha, the capital of Qatar, used to be an enormous construction site for some time now: there is hardly any corner of the city where construction is not underway and there is no traffic link that does not have to be diverted twice per year for upgrading and widening. Everything is to be made bigger, better, quicker and, above all, more modern. This is certainly a realistic objective, thanks to the availability of revenues from the second biggest natural gas deposits in the world. To keep pace with the breathtaking rate of growth, the state-owned energy supply utility, KAHRAMAA, has instituted an expansion programme for its electrical networks, split into several phases.

In December 2005, a consortium of Fichtner and the Serbian company Energoproject was awarded a contract for rendering engineering services of Phase VI of this expansion programme. 88 new 220/132/66/11 kV transformer substations as well as the extension of 27 existing transformer substations with transformer ratings totalling 5.3 GVA and a capital investment volume of just about € 1.0 billion had to be planned, constructed and connected to the national grid.

A site office was opened in early 2006 and the number of employees steadily rose, as in autumn 2006 the joint venture was retained for the subsequent Phase VII of the project. Within Phase VII, additional three new 400/220/132/66/11 kV transformer substations on the newly introduced 400 kV EHV level as well as an additional 32 substations on the 220/132/66/33/11 kV levels, with transformer ratings totalling 16.2 GVA and a capital investment volume of just about € 1.6 billion had to be planned, constructed and connected to the national grid.

Installation of a 132 kV line on concrete masts, near Nimr, in Oman

Market Introduction of Innovative Mast Solutions in the Middle East

Europoles GmbH & Co. KG
Tobias Fersch | *Head of Special Projects*

Rising energy demand as a result of industrialisation and population growth require the expansion of power networks and the enhancement of mains reliability. This applies especially to the high-growth regions of the Middle East. In order to meet such increasingly demanding requirements, new and innovative solutions for overhead power lines play a critical role.

Initial situation in Oman

Petroleum Development Oman (PDO), the petroleum enterprise in the Sultanate of Oman, has experienced serious problems with the wooden pole systems that they have used until now. Their greatest difficulties involve pole fires caused by arc-overs on polluted insulators. Also responsible here is the extreme desert climate with scarce precipitation, very high maximum temperatures, enormous daily temperature fluctuations, and a huge amount of dust and salt in the air. Additional problems with the wooden pole systems used previously were greatly non-uniform pole quality, extreme pole sensitivity to ambient conditions, and damage from termites and fungus. These problems had costly consequences for PDO, since every site in its oil fields requires power supply. Power outages result in very expensive shutdowns of pumping. The solution for Oman was the use of spun-concrete masts made of high-strength concrete.

A 33 kV section pole in a coastal area, near Al Ashkara, Oman

Additional projects in Arabian countries

Owing to their good growth prospects, Arabian countries are especially interesting for Europoles GmbH & Co. KG – particularly in the field of infrastructure. Together with local partner companies, Europoles is prepared to invest in promising markets. In this sense, Europoles intends to use Oman as a base for further entry into the Middle East. There are, in addition, sales offices for North Africa in Algeria and Morocco. Experience gained in Oman will also benefit North Africa. In the planned North African production plant, pre-stressed spun-concrete poles will be produced for development of North African infrastructure: including railway electrification, power supply, antenna supports for communication, and illumination of streets and roads. These efforts will create 300 new jobs, and Europoles' own training centre will operate there.

Pre-stressed concrete masts and towers made of high-strength concrete not only have an exceptional long life cycle (more than 80 years, according to scientific investigations), but also offer greater performance features – both of which represent ideal product characteristics for the demanding climate regions of the Arabian world. Owing to their cost effectiveness, they offer the ideal basis for sustainable development of infrastructure, and they promote the local economy by production in the area.

Energy Efficiency

While efforts are being taken to make the production and distribution of energy and electricity more sustainable, the most effective solution to avoid rising prime energy consumption costs and environmental damages is to reduce the demand of electricity in the first place. Energy efficiency and green building architecture play a central role in the overall plans to promote energy sustainability. Better insulation techniques and resorting to vernacular architectural solutions are ways to achieve higher energy efficiency.
As Germany is implementing its scheme to overhaul its real estate structure and make it more energy-efficient, technological leadership of German companies will also lead to an increasing German participation in the improvements in energy efficiency in the Arab world. Legal frameworks and encouraging programs to promote the energy efficiency in Arab countries are underway and both sides can profit from each others' experiences.
This chapter looks at Arab-German projects on energy efficiency in the United Arab Emirates, Jordan and North Africa.

Energy Efficiency in the Construction Sector in the Mediterranean

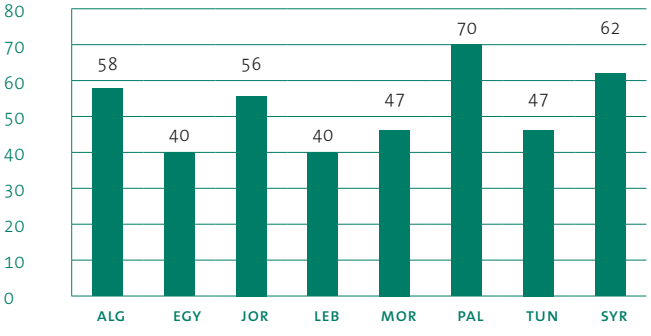
Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)
Florentine Visser | *MED-ENEC Key Expert*, Dr. Nikolaus Supersberger | *Senior Business Developer Energy, International Services*

Economic development improves living standards; however, the reverse side is an increase of energy consumption, also in the Southern and Eastern Mediterranean countries. With growing populations in this region the national energy consumption is rising even more.

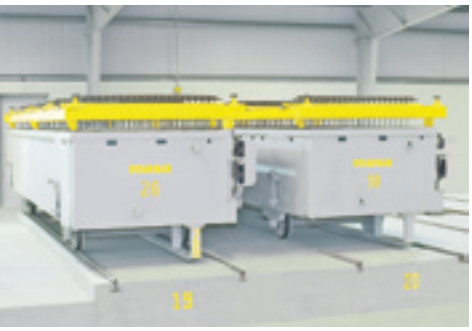
In addition to that the energy prices are expected to rise, whether for oil, gas or electricity, as a result of a growing demand on the world energy market and due to a decrease in supply together with higher supply costs. Therefore governments in the South East Mediterranean region are starting to remove subsidies on energy prices as it is becoming a heavy load for the state budget.

Energy saving is becoming a key issue not only for the economic development and energy security of a country, but it also pays off for companies and individual households. The benefit for all is that the reduction of energy consumption helps to lower the emission of greenhouse gases, thus contributes to environmental sustainability and avoiding the negative effects of climate change: rising of temperature and sea level, floods and droughts.

Electricity Consumption Building Sector
(% of Total Electricity Consumption)



Source: MED-ENEC



Hardening car with reinforcement

Autoclaves for optimised curing

Block shifting device for reinforced panels

Energy Efficiency with AAC Building Materials

Masa GmbH
Peter Sommer | *Marketing Director*

Environmental friendly production, energy efficiency, high thermal insulation, easy workability, easy handling and transportation – advantages that speak for themselves and make Aerated Autoclaved Concrete (AAC) products more and more demanded worldwide. Masa provides all machinery and equipment to produce those products.

AAC technology advantages and the Middle East market

AAC has been produced for more than 70 years. Due to the fact that it offers considerable advantages over other construction materials, such as an excellent thermal efficiency, it gives a high contribution to environmental protection to reduce energy for heating and cooling. This is one of the reasons why it also became one of the major building materials in "hot countries" like the Middle East area.

AAC products include blocks, wall panels, floor and roof panels as well as lintels. It is a lightweight building material which provides structures, insolation and fire protection. The products are used for internal and external construction and apply as building material in commercial, industrial and private sectors. The following main advantages can be listed:

AAC's excellent thermal efficiency makes a major contribution to environmental protection by sharply reducing the need for heating and cooling in buildings. There is no need for additional isolation of buildings. The thermal isolation is extremely high compared to clay bricks or concrete blocks (0,08 – 0,27 W/(mK)).

AAC supports the builder on site to set up buildings faster and easier, because of very accurate and light blocks. In using larger formats, walls have less joints per m^2 of wall compared to concrete block or clay walls. It is easy to cut blocks which minimizes the solid waste during installation.

Even though regular cement mortar can be used, 98 % of the buildings erected with AAC materials use thin bed mortar, which comes to deployment in a thickness of ⅛ inch.

AAC material can be coated with a stucco compound or plaster against the elements.

AAC's high resource efficiency (1 m^3 of raw materials gives approximately 5 m^3 of building products) gives it low environmental impact in all phases of its life cycle, from processing of raw materials to the disposal of AAC waste. This process related waste material can be recycled back into the system.

AAC's light weight also saves energy in transportation. The fact that AAC is up to five times lighter than concrete leads to significant reductions in CO_2 emissions during transportation.

The suspended "cradle" used for the ETICS installation

Meeting the Challenges of Thermal Insulation at the SOFITEL Hotel, Jumeirah Beach Residence, Dubai

Caparol LLC
Ahmed El Bayaa | *Regional Sales Manager*

When commissioning the building of the new Sofitel Hotel in Dubai, the Sofitel Luxury Hotels Group was faced with building regulations requiring all new buildings to meet certain thermal insulation standards in line with the drive to reduce carbon emissions and conserve energy. At the same time the building had to meet the client's and architect's design vision and portray Sofitel's brand values. Pioneering building practices were introduced to meet new local regulations, and the result was a successful ETICS installation that both met and set new standards.

Legislation was introduced in Dubai in 2006 that made the inclusion of thermal insulation in new buildings mandatory. Design and construction standards and practices in Dubai are high profile so adopting international practices is an important consideration for such legislation to be implemented. For a city growing as fast as Dubai, reducing the demand for electricity is a critical long term success factor. Since it is unlikely there will be any reduction in demand, the construction of additional new generation capacity becomes a necessity and hence, the Dubai authorities have felt it necessary to introduce the practice of mandatory thermal insulation to balance this demand.

Introducing thermal insulation regulations in a desert climate could seem incongruous, but it becomes obvious if one considers the huge differences between outdoor and indoor temperatures. Since air conditioning is standard for most modern buildings and outdoor temperatures can go up to 50 °C in summer, (the temperature differential can be up to 30 °C), there is huge energy saving potential from thermally insulating the building shell. This will then maintain the internal temperature and stop air transfer through the building walls. Thermal insulation is standard in countries with a cold European climate and interestingly the energy saving potential provided by thermal insulation in a hot climate is up to four times higher than it is in a cold climate.

Water Pumping Station (Picture courtesy of WILO SE)

Energy Efficiency and Climate Change Mitigation: Triple Win for the Water Authority of Jordan

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)

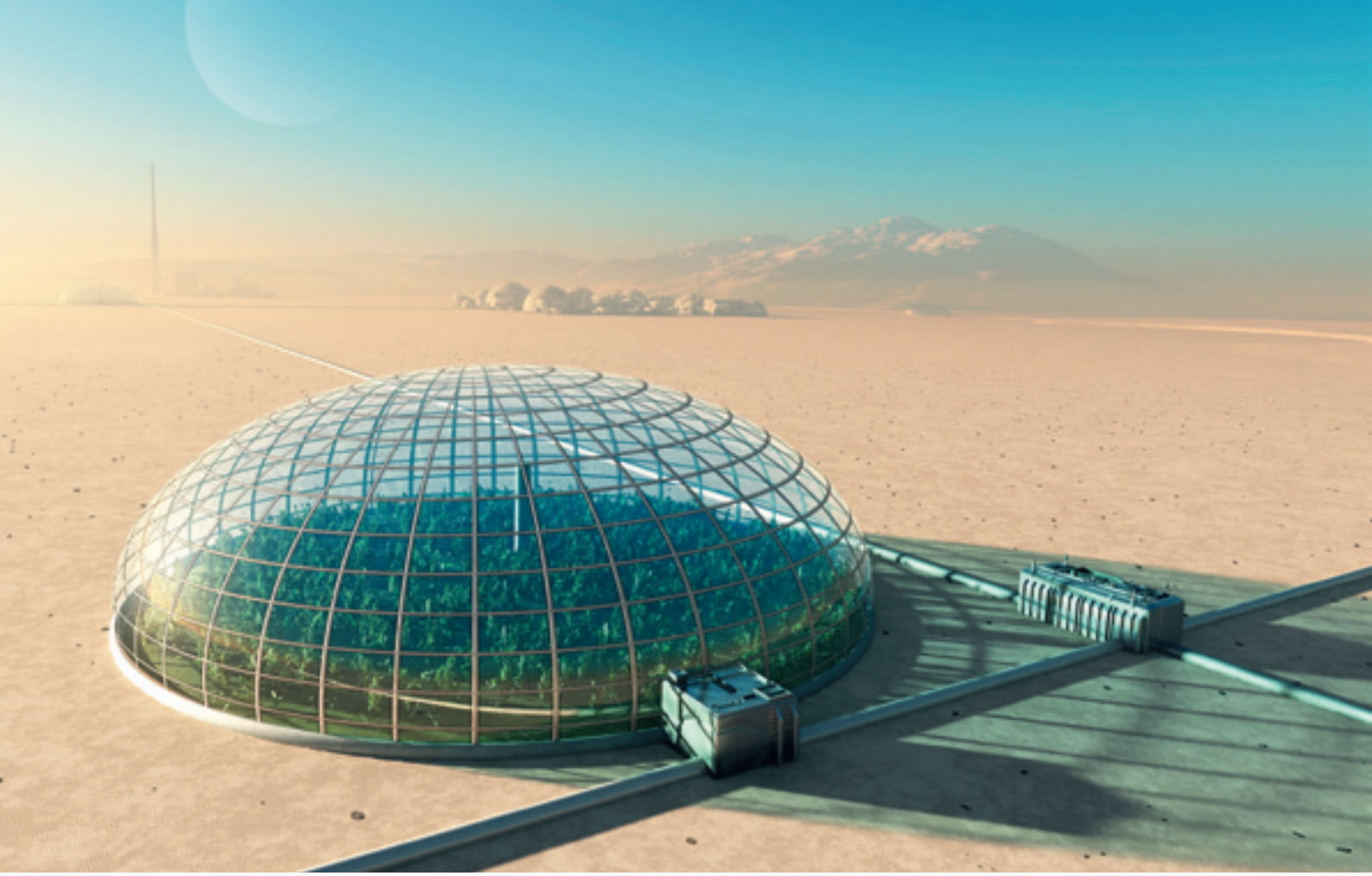
Dieter Rothenberger | *Head of IEE Programme*

The Water Authority of Jordan (WAJ) is the largest electricity consumer in the country, using about 15 % of Jordan's entire electricity production. In addition to high costs, this leads to high emissions of greenhouse gases, since Jordan's power supply is almost exclusively based on fossil fuels. The hydraulic conditions imply that the fresh water needs to be lifted 1,400 m from the Jordan Valley to reach the consumers in the cities. Under these circumstances, one of the main causes for the high levels of electricity consumption is the huge technical inefficiency in the operation of the water pumps, which includes inappropriately sized and operated pumps and deficiencies in O & M processes.

Project background and approach

In 2008, the German Federal Ministry for Environment, Nature Protection and Nuclear Safety (BMU) started the International Climate Initiative (ICI) to support approaches aiming to reduce greenhouse gas emissions. The project "Improvement of Energy Efficiency of WAJ in the Middle Governorates" (IEE) was the first project worldwide approved by BMU within the ICI and is being implemented by the Deutsche Gesellschaft fuer Internationale Zusammenarbeit (GIZ). The project was originally planned for 2.5 years, but has been extended by another 2 years for a country-wide roll-out.

The IEE is structured in two parts: In part 1, an energy audit was conducted for the major consumers of electricity of WAJ in the three governorates of Balqa, Madaba, and Zarqa. This energy audit consisted of pump performance measurement, and electro-mechanical investigations. To this end, water flow, pressure and electricity consumption was measured, as was the system's performance. Based on the derived factual efficiency, the energy saving potential was calculated, assuming the use of improved technology and better operations, and the required investments were estimated.



Water, Desalination and Irrigation

Because of their arid climate, Arab states and in particular the Arab Gulf states are in need for powerful water desalination plants that increase the energy demand in these countries significantly. The production of fresh water and the recycling of waste water require strong distribution and transmission networks. These have to keep pace with increasing demand caused by growing populations and extending cities. New technologies such as solar desalination are economically and ecologically promising. Projects of reference that include the participation of Arab and German companies or institutions have been planned or implemented in most Arab countries. With the demographic growth and industrial diversifications in Arab countries, the demand for desalinated water and the necessity to recycle waste water will further increase.
The Arab-German cooperation in this field ranges from dam extensions in Sudan to solar desalination and projects in Jordan and Egypt.

Naga Hammadi Barrage

The Naga Hammadi Barrage on the River Nile

Lahmeyer International
Werner Bürkler | *Chief Resident Engineer and Project Manager for Construction Supervision,* Bernd-R. Hein | *Senior Geotechnical and Dam Expert,* Bernd Metzger | *Business Development Director*

Between June 2002 and May 2008, a new barrage across the river Nile was constructed, 135 km north of Luxor, Egypt. The 336 m long structure includes a sluiceway with seven weir bays, two navigation locks, a power plant, and a bridge over the barrage. The complete diversion of the Nile river, the construction pit in the river bed as well as the structures themselves required large-scale and adopted technical solutions. Before and during the construction period the project was followed by an extensive environmental and social action programme.

An important project for the population and environment

The clients for the project were the Ministry of Water Resources and Irrigation and the Ministry of Electricity and Energy of the Arab Republic of Egypt. The funding of the project was secured by credits of Kreditanstalt für Wiederaufbau (KfW), the European Investment Bank (EIB), and through the national budget of Egypt.

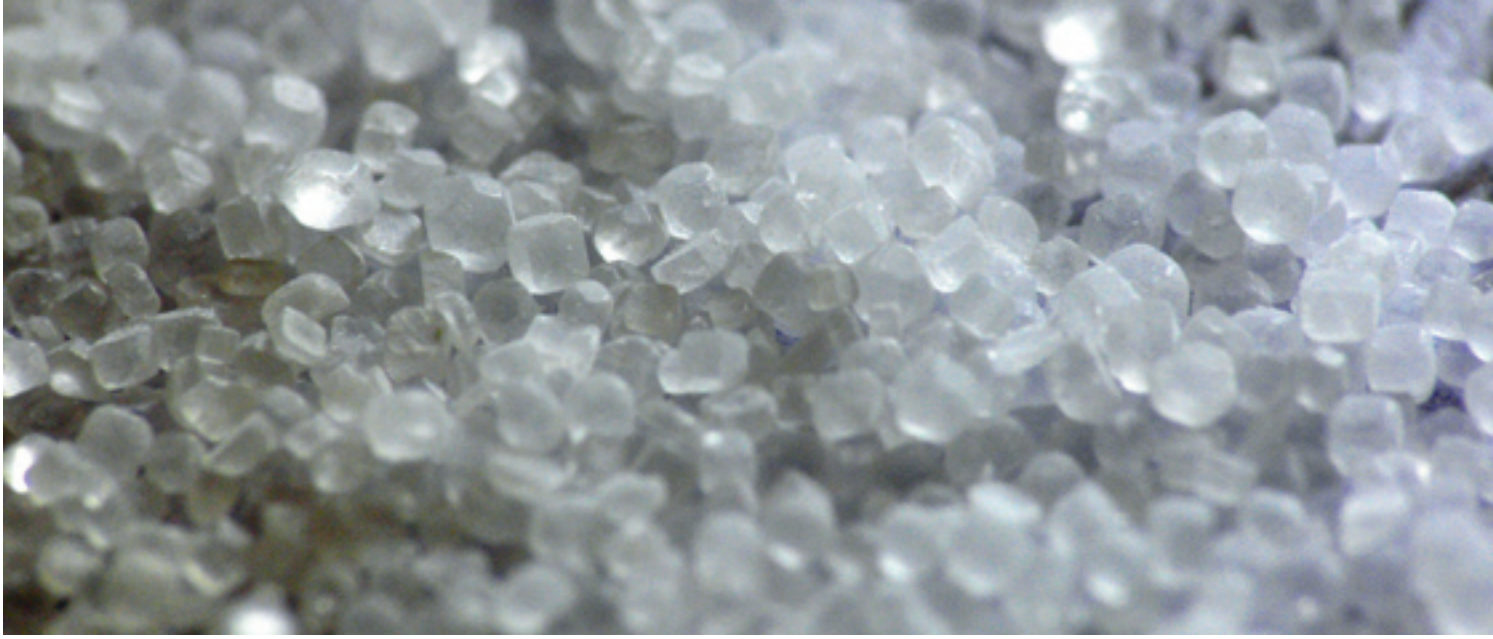
The consultant was a consortium of international consultancy companies under the leadership of Lahmeyer International, Germany. The consultant elaborated the feasibility study, the tender design, assisted in the award of the contracts (five lots) and performed site supervision services.

The two years post-commissioning period of the project started in June 2008 and came to an end by May 2010. The following report demonstrates the development process of this project, which took more than 10 years and concludes one year after the post-commissioning period.

The Naga Hammadi Barrage (NHB), referred to in the report as the "Barrage", was constructed on the river Nile from 1927 – 1930. It is located some 12 km north of the town of Naga Hammadi. The location of the Barrage, generally expressed as a river distance in kilometres downstream from the Aswan Dam, is at km 359.50.

The Barrage is one of three structures on the river Nile in Upper Egypt (excluding the Aswan and High Aswan Dams), which control the water levels for some distance upstream. The others include Esna Barrage located to the south at km 166.65 and Assiut Barrage to the north at km 544.75. The river reaches between Esna and Naga Hammadi and Assiut Barrages are 192.85 km and 185.25 km, respectively.

The primary purpose of the Naga Hammadi Barrage, as also for the other two barrages, was to expand the cultivated area in Upper Egypt by raising the water levels to enable irrigation all



Algerian Desalination Market Update

ILF Beratende Ingenieure GmbH
Thomas Altmann | *Executive Vice President, Energy & Desalination*

By the year 2011, 13 seawater desalination projects with a total capacity of 2.26 million m³/d will be developed in Algeria, contributing to what is probably one of the largest growths in national capacity in recent years. After the planned completion of the desalination programme by 2012, the newly installed seawater desalination facilities will contribute about 70 l per capita per day to the drinking water supply of the densely populated coastal strip along the Mediterranean, where more than 90 % of Algeria's population lives.

Market situation

The Algerian seawater desalination programme is part of an ambitious presidential programme of water resource development. For drinking water supply, this programme comprises 22 new dams by 2009, several huge water transfer systems with lengths up to 740 km, installation, as well as upgrading and repair of drinking-water supply systems of huge municipalities. For wastewater treatment, the programme comprises:

- construction of 40 new wastewater treatment plants
- upgrading and repair of 20 existing wastewater treatment plants
- construction of 50 wastewater lagoons
- important investments in wastewater collection systems

During its expansion into the Algerian market, ILF Consulting Engineers has been involved in seven of the projects as lender's engineer and independent expert, accounting for more than 60 % of the country's planned seawater reverse osmosis (RO) capacity.

The major projects developed in Algeria are summarised in the table "Desalination projects in Algeria", which shows the location, main shareholders of the project companies and desalination capacity of the projects. These are built along the Mediterranean coast with the majority of plants located west of Algiers in areas both subject to a rapid expansion and lack of fresh water. The Algerian desalination programme benefits from international project finance with a strong involvement of national investors and lenders. In 2001, Sonatrach and Sonelgaz, the two largest public companies in the Algerian energy sector, created the 50 : 50 % joint venture company Algerian Energy Company (AEC).

AEC's core objectives is to develop seawater desalination plants in partnership with international investors, where the two parties set up a project company responsible to design, build, operate, and own the water produced. In all but the early projects, AEC has taken a 49 % share in the project company,

Market Development and Business Opportunities in the Power Sector of Saudi Arabia

Saleh Hussein Alawaji, Ph. D. | *Deputy Minister for Electricity, Ministry of Water and Electricity,Chairman of the Board, Saudi Electricity Company (SEC), Kingdom of Saudi Arabia*

Saudi Arabia experiences a rapid development in social, industrial, economical and infrastructure projects as well as concerning a growing population. Today, Saudi Arabian factories are not only producing for the local market but also for the international market with some of the largest petrochemical plants in the country.

Saudi Arabia has a very young population. Every year more than half a million new citizens who need jobs and accommodation in the future have to be welcomed. Traditionally, even young couples require an individual home which should be affordable. More or less all domains of the public infrastructure including the education system are growing fast and will offer a lot of opportunities. These factors make the demand for electricity growing at high rate.

In the last decade the demand of electricity has increased with an annual average rate of 8 %. The installed capacity has already reached 53 GW (43 GW from SEC power plants, 10 GW from other producers), and the peak load reached 47.3 GW. To meet the growing demand, 3–4 GW of installed capacity have to be added each year. At the same time aggressive measures have to be implemented to control the increasing demand.

As one of the largest producers of fossil energy, Saudi Arabia has a solid financial background. The required investments for the power projects are estimated to reach 400 billion Saudi Riyals (about 75 billion Euros) for the next decade which will overstress the possibilities of the power sector's budget. The contribution from the private sector (local, institutional and foreign investors) is expected to reach 30–40 % of the required investment volume. For the time being liquid fuel and natural gas are the only energy sources for power generation. Increasing demand for fuel supply is one of the drives for the government to investigate all the possible options to diversify the fuel mix for the power sector and water desalination, such as nuclear and renewable energy sources.

The power sector of Saudi Arabia needs capable and reliable partners for executing, operating and maintaining these challenging projects. Additionally, there are many opportunities for a joint cooperation in the associated research and development, as well as in an industrial and technical aspects related to the power sector. The sector is well prepared to consider and support all kinds of cooperation options, and is open for all kinds of proposals from the German side.

In the following, brief background information and a glance of the business opportunities in the power sector of Saudi Arabia, as well as information about the power market development in the region will be given.

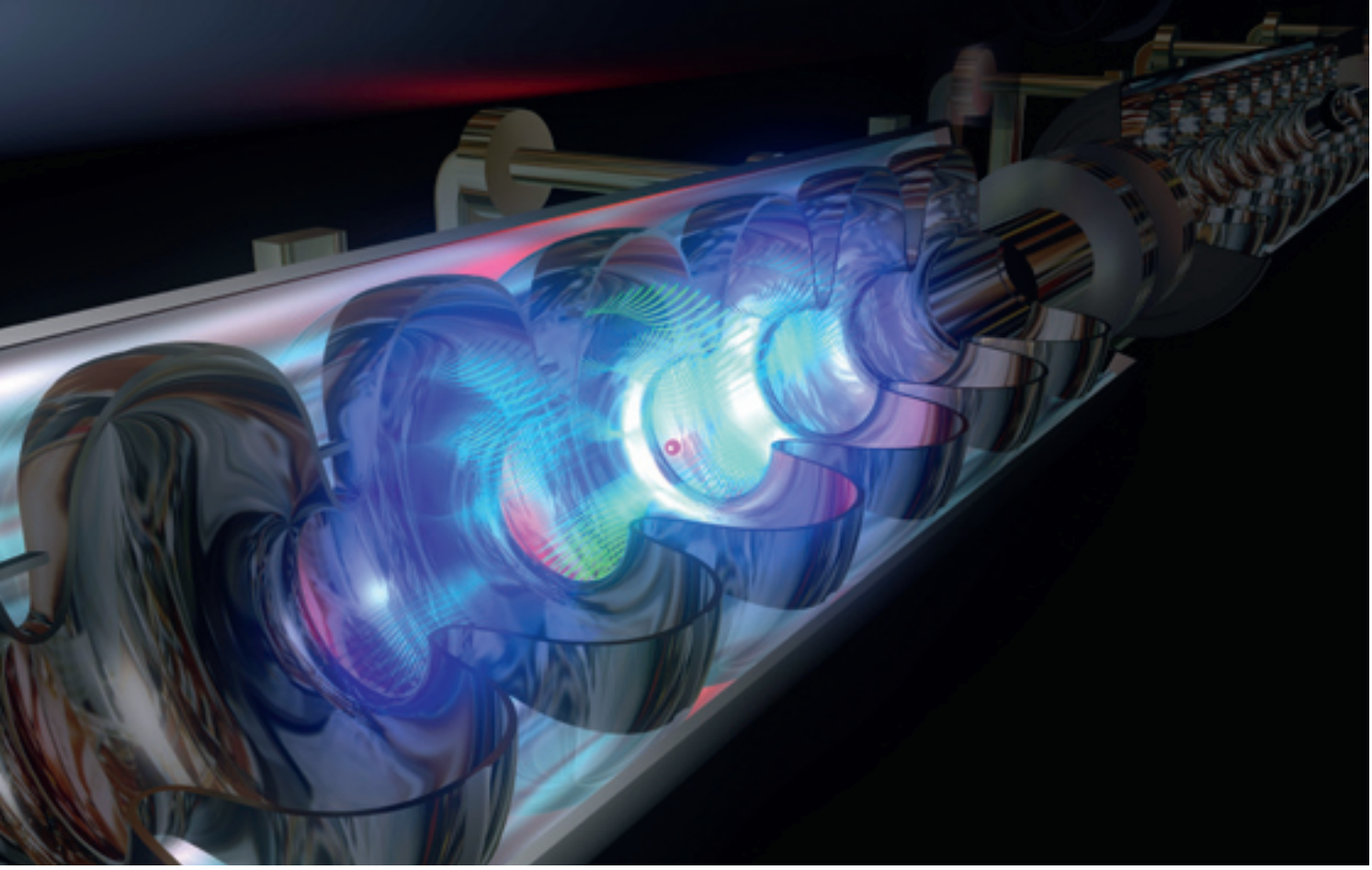
Renewable Energy Finance – Bringing the Private Sector in

Amereller Legal Consultants
Dr. Kilian Bälz | *Attorney*

The future of renewable energies in the MENA region depends on attracting private sector investment. In the past, most projects in the region were either funded by the government or through international development cooperation. Now, projects are moving into a new phase. Egypt, Jordan, and Morocco have tendered renewable energy projects that are based on the BOO model. The private investor will build and operate a wind or solar farm and in return will be granted a power purchase agreement under which it can feed electricity into the grid for a guaranteed price.

Financing renewable energy projects in the MENA region can be challenging. Intense sun radiation and constant winds can be taxing on the equipment, and technology is not proven under the prevailing climate conditions. Moreover, any investment in renewable energies is based on long-term considerations, having a horizon of usually 15 to 25 years. This is much longer than an investment in MENA real estate where investors often expect to break even after three to five years. Last but not least, since 2011 the political landscape in many MENA countries is in flux. Whereas the transformation of Egypt and Tunisia ultimately has the potential to substantially improve the investment climate, during the transitional period investors are exposed to additional political risk.

The following shall give a brief overview of the key legal risks relating to private financed renewable energy projects. It will highlight the challenges for sponsors and financing institutions and will provide some initial guidance on how these issues can be addressed.



Acceleration in a resonator.
Electromagnetic fields accelerate the electrons in the superconducting resonators.

Knowledge for the Desert – A Euro-Mediterranean Partnership on Science and Energy

Deutsches Elektronen-Synchrotron DESY
Stephan Haid | *Project Manager*

Given the many existing links between Europe and its southern Mediterranean neighbours and considering the current political upheavals in Tunisia, Egypt, and other Arab countries, Europe is asked to send a clear signal of support to help strengthening the capacities of its neighbours in Middle East and North Africa (MENA).

A stable democratic consolidation has only a chance if it is accompanied by a sustainable economic development that is based on forward-oriented jobs for the young population in the Arab world. Particularly among the youth, the unemployment rates in many Arab countries are the highest worldwide. The poor employment opportunity is one of the reasons for the protest movement. But also democratically elected governments will have to address the social and economic problems and have to demonstrate a sustainable perspective for its fast growing population.

Type of technologies considered for the first reference project. Source: SIEMENS

The Industrial Consortium Dii: Building a Sustainable Energy Future Based on the Desertec Vision

Dii GmbH
Paul van Son | *Dii CEO*

Energy is one of the crucial elements for life on earth. The main sources of energy today are exhaustible and the use of such has a negative impact on our natural environment. In order to protect living conditions for the present and future generation, a reliable and sustainable energy supply will therefore be one of the major challenges of mankind. The recent worldwide re-evaluation of our energy supply following the Fukushima catastrophe accelerates the pressing question of our times: Where are the large sustainable energy resources for the future?

An immense energy potential can be found in the deserts globally. All regions of the world that have access to this potential could be sustainably supplied with clean power. The Desertec vision points out the enormous amount of energy being released from the sun to the deserts of our earth every day. An abundance of electric energy could be generated from these sources and existing technologies would be capable of delivering this energy to the diverse energy markets day and night. As a result of the growing energy cooperation between Europe (EU), the Middle East and North Africa (MENA), these regions now have a unique chance to inaugurate a new era based on partnership and which will contribute to their joint prosperity.

Dii, the industrial consortium comprising 56 institutions from all over the world, works towards creating the framework for the implementation of the Desertec vision in the EU-MENA regions. The specific aim is to deliver the framework for large-scale use of renewable energy from the North African and Middle Eastern deserts. Desert power is initially intended for both the local energy demand of the producing countries and export. Desertec is a vision: an overall concept rather than one centralised, stand alone project. Numerous individual projects will be created in cooperation with local stakeholders (governments, companies), aiming to produce and transfer power generated from renewable energies. Dii is the facilitator, catalyst and coordinator of the entire process.

Alstom Power

Alstom is a global leader in the world of power generation and transmission and rail infrastructure. Alstom builds the fastest train and the highest capacity automated metro in the world, provides turnkey integrated power plant solutions and associated services for a wide variety of energy sources, including hydro, nuclear, gas, coal and wind, and it offers a wide range of solutions for power transmission, with a focus on smart grids.

Project: Shoaiba Stage III
Contact: **Nader Abdellatif** | *Country President Saudi Arabia*

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Amereller Legal Consultants – Mena Associates

Amereller Legal Consultants are a law firm specialised in business law in the MENA region with offices in Cairo, Damascus, Dubai, Baghdad, Erbil and Basra. In Germany, the firm has offices in Munich and Berlin. Amereller advises multinational companies, international organisations and leading Arab businesses on investments across the MENA region. For a long time, investments in renewable energies and climate change have been a focus of Amereller and lawyers of the firm are called regularly to advise on energy law and policy in the region.

Project: Renewable Energy Finance – Bringing the Private Sector in
Contact: **Dr. Kilian Bälz** | *Attorney*

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kb@amereller.com | www.amereller.com

Arab Union of Electricity (AUE)

Arab Union of Electricity (AUE)

AUE was established in 1987. Active members: 29, represent electricity ministries and utilities in the Arab Countries, and 20 Associate members in addition to 2 observing members. AUE aims at developing and improving the generation, transmission and distribution of electrical Energy in the Arab world and fosters cooperation and coordination among its members in the fields of development, improvement and integration of the electricity sector.

Project: Electricity Interconnection Projects among Arab Countries
Contact: **Fawzi Kharbat** | *Engineer, Secretary General*

Arab Union of Electricity
P. O. Box 2310, Amman 11181
Phone: +962 6 581 91 64
fkharbat@nepco.com.jo | www.Auptde.org

Babcock Borsig Steinmüller (BBS)

Babcock Borsig Steinmüller GmbH (BBS) is a subsidiary of Bilfinger Berger Power Services GmbH. It is one of the leading services providers for the power generating industry. Its activities focus on engineering-based power plant services and project business. The service concept of BBS combines a wide product and service range for every area of power plant technology. Babcock Borsig Steinmüller currently has approximately 1,000 employees worldwide.

Project: Efficiency improvements using heat recovery systems for conventional power plants
Contact: **Dipl. Ing. Frank Adamczyk** | *Head of Heat Recovery Department*

Babcock Borsig Steinmüller GmbH
Duisburger Straße 375, 46049 Oberhausen, Germany
Phone: +49 208 45 75 79 70
frank.adamczyk@bbs.bilfinger.com | www.bbs.bilfinger.com

Bollinger + Grohmann

Bollinger + Grohmann Ingenieure is a Frankfurt based engineering consultancy with more than 25 years experience and expertise in structural engineering and design. Founded in 1983, today Bollinger + Grohmann has 100 employees in four European offices and one office in Australia. They provide a complete range of structural design services for clients and projects worldwide. For years Bollinger + Grohmann has been collaborating successfully with numerous internationally recognised architects and strives to always provide the best solution through their creativity and technical excellence.

Project: Sheikh Zayed Desert Learning Centre, Al Ain, United Arab Emirates (UAE)
King Fahad National Library, Riyadh, Saudi Arabia
Competition – Place Lalla Yeddouna, Medina, Fès, Morocco
Contact: **Dr.-Ing. Lamia Messari-Becker** | *Head of Sustainability and Building Performance*

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Caparol LLC

Caparol manufactures high quality coatings and thermal insulation systems. It is the market leader in Germany and Austria and is the third largest paint manufacturer in Europe. Caparol was established in Dubai in 1998 and manufactures a full range of products locally. Recent successful projects in the U.A.E. include the installation of thermal insulation solutions at the Sofitel and Ritz Carlton Hotels, launch of a low voc paint and a colour scheme for the Jumeirah Golf Estates project.

Project: Thermal Insulation at the SOFITEL Hotel, Jumeirah Beach Residence, Dubai
Contact: **Ahmed El Bayaa** | *Regional Sales Manager*

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CUBE Engineering GmbH

Project: Wind energy in Libya
Contact: **Stefan Chun** | *General Manager*

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Since the last 20 years CUBE Engineering has brought its professional services to bear on more than 3,000 renewable energy projects in 48 countries with a combined output in excess of 10 GW. Our services include management consulting, wind assessment, planning and project management, environmental assessment, electrical grid and networks, decentralized energy systems and solar assessment.

Deutsches Elektronen-Synchrotron (DESY)

Project: Euro-Mediterranean Partnership on Science and Energy
Contact: **Stephan Haid** | *Project Manager*

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Notkestraße 85, 22607 Hamburg, Germany
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Stephan.Haid@desy.de | www.desy.de

The Deutsches Elektronen-Synchrotron DESY is an internationally renowned centre for the investigation of the structure and function of matter. DESY is a member of the Helmholtz Association and stands for scientific expertise, excellent research infrastructure, and long lasting strategic collaborations with national and international research institutions.

Dii GmbH

Project: Building a sustainable energy future on the basis of the Desertec vision
Contact: **Sigrid Goldbrunner** | *Corporate Communication*

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Founded in Munich in October 2009, Dii is an international industrial consortium which works towards creating the framework for the implementation of the Desertec vision in Europe, the Middle East and North Africa. As facilitator of the entire process, Dii aims to achieve three objectives these being the creation of a technological, economic, political and regulatory framework in order to attract investments, the initiation of selected reference projects to demonstrate feasibility and the development of a long term implementation concept by the year 2050 to guide investment and funding.

Europoles GmbH & Co. KG

Project: Market Introduction of Innovative Mast Solutions in the Middle East by Construction of Local Production Facilities in Nizwa, Oman
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As market leader in Europe for poles, columns, towers, and other carrier systems Europoles supports companies throughout the world in solving their infrastructure and construction challenges with extra safety and quality. The long-established company, located in Bavaria, Germany, supplies standard and special solutions made of steel, concrete, and FRP, for medium-sized companies as well as for large corporate entities.

Ferrostaal AG

Project: Solar Thermal Power Plants – Egypt's Kom Ombo and Others
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Ferrostaal is a global provider of industrial services in plant construction and engineering. As a technology-independent system integrator, the company offers development and management of projects, financial planning, and construction services for turnkey installations in the segments of petrochemicals, power & solar and industrial plants.

Fichtner GmbH & Co. KG

Project: Qatar grid expansion
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With over 1,800 employees Fichtner offers engineering and consultancy services worldwide in the field of thermal power plants, renewable energies, energy transmission and distribution, energy efficiency, energy economy, waste management, environmental management, environmental protection technologies, climate protection, water supply and sanitation, hydraulic engineering, transportation as well as business consulting and IT consultancy.

FICHTNER

With over 1,800 employees Fichtner offers engineering and consultancy services worldwide in the field of thermal power plants, renewable energies, energy transmission and distribution, energy efficiency, energy economy, waste management, environmental management, environmental protection technologies, climate protection, water supply and sanitation, hydraulic engineering, transportation as well as business consulting and IT consultancy.

Fichtner GmbH & Co. KG

Project: Shams One 100 MW concentrated solar plant
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First Solar

First Solar manufactures solar modules with an advanced semiconductor technology and provides comprehensive photovoltaic (PV) system solutions. First Solar has an extensive track record of engineering procurement and construction for utility-scale PV power plants in desert regions. The company is delivering an economically viable alternative to fossil-fuel generation today. From raw material sourcing through end-of-life collection and recycling, First Solar is focused on creating cost-effective, renewable energy solutions that protect and enhance the environment.

First Solar GmbH

Project: The value of renewable energies in the MENA region
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giz

MED-ENEC
Energy Efficiency in the Construction Sector in the Mediterranean

Working efficiently, effectively and in a spirit of partnership, the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) supports people and societies worldwide in creating sustainable living conditions and building better futures. In addition to the German Federal Government, GIZ also provides international clients with its expertise in terms of economic and result-oriented services.

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

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Project: Improvement of Energy Efficiency of the Water Authority of Jordan (IEE)
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ILF
CONSULTING ENGINEERS

ILF Consulting Engineers was founded in 1969 and has since then provided design, project management and construction supervision on more than 2000 projects world-wide. Having worked in 35 countries ILF ranks high among the international consultancy firms engaged in the energy and desalination industry.

ILF Consulting Engineers Germany

Project: Algerian desalination market update
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Kraftanlagen München GmbH

Project: AlSol – Feasibility for a solar thermal tower power and gas turbine plant in Algeria
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In Germany and Europe Kraftanlagen München GmbH (KAM) is a leading company for power plant and industrial plant construction. With several decades of experience in engineering, piping erection and turn-key power plant construction KAM provides complex solutions in the energy sector, with more than 2,000 staff members and a yearly turnover of more than € 360 million. KAM offers a broad scope of services in the field of chemical- and petrochemical plants, piping systems in conventional and nuclear power plants and turn-key solutions for all kind of thermal power plants. For concentrating solar power plants KAM has developed the open volumetric receiver technology for solar tower power plants from laboratory to power plant scale implementation in Jülich. KAM offers own solutions for Heliostat Fields, Receiver and Hot Storage technology up to complete turn-key power plants.

Lahmeyer International

Project: Masdar's 100 MW Noor 1 photovoltaic project

Lahmeyer International

Project: First Larger Scale Wind Park Projects in Sudan

Lahmeyer International

Project: The Naga Hammadi Barrage on the river Nile
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40 years of successful project development in Arab and Middle East countries, rendering engineering and consulting services in the fields of energy and hydropower and water resources, make us a reliable partner. The sound adjustment of conventional and new technologies with state-of-the-art know-how is the key to preserve precious primary energy resources and the reasonable use of renewable energies.

Masa GmbH

Project: Energy Efficiency with AAC Building Materials
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Masa GmbH, Germany, supplies machinery and plants for high capacity production of high quality concrete blocks, pavers and slabs as well as sand lime bricks and aerated autoclaved blocks. Masa offers services and support from design through manufacturing, assembly, commissioning, training, production, and service.

Ministry of Water and Electricity

Project: Market Development and Business Opportunities in the Power Sector of Saudi Arabia
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The rapid developing power sector in Saudi Arabia creates great business opportunities for the local and foreign investors. The sector is interested in, and well prepared to build a long-term partnership with capable, qualified and reliable partners in order to cooperate for tackling the major challenges facing the sector. The German business community and industry are among the best candidates for this partnership.

MWM GmbH

Project: Decentralized Power Generation in Combination with Heat and Cold Supply
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The long-established company MWM in Mannheim, Germany, is one of the world's leading system providers of highly efficient and eco-friendly complete plants for decentralised power supply with gas and diesel engines.
For 140 years, the company has stood for the reliable, uninterrupted provision of electricity, heat, and cooling at all times and at any location.
MWM has 1,270 employees around the globe.

SaEnergy Systems GmbH was established to create alternatives for independent power generation based on renewable energy. The company's focus is the reliable and efficient combination of wind and solar power with energy storage systems enabling the provision of affordable, sustainable electricity and water in remote areas, in disaster relief situations, or as power back-up systems.

SaEnergy Systems GmbH

Project: "Power&Life Container"
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Siemens Energy in the Middle East is a leading supplier of a complete spectrum of products, services and solutions for the generation, transmission and distribution of power and for the extraction, conversion and transport of oil and gas. Siemens is the only technology company to offer future proof solutions along the entire energy conversion chain. Not only has Siemens provided the technology behind many of the region's key infrastructure projects, the company also continuously strengthens the long term commitment to the region with significant investments to industry and education as well as involvement in corporate social responsibility projects.

Siemens Middle East

Project: Smart grids for a cleaner future
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