

DWZ Energy Conference Report

November 8, 2015

## “Rethinking Energy: Scientific Input – Social Output”

Providing a secure national energy supply, which includes the balanced, sustainable use of the available resources coupled with continuous development of the highest energy efficiency levels, is at the core of a country's socio-economic development.

In Germany, as well as in Egypt, the sustainable energy production and its larger inclusion in the energy mix are vibrantly debated. This debate is being mirrored by numerous Egyptian-German research collaborations, which are fostered through multiple projects by the partners of the German Science Centre (DWZ).

Questions surrounding the interdisciplinary topic of energy cannot be answered from an economic perspective alone, but need strong input from the research sector. Simultaneously, it is indispensable to include the political context of the energy agenda in social discourse in order to do justice to the holistic demand for sustainable socio-economic development.

The goal of the conference was to impart and deepen the understanding of the complexity of the multidimensional nature of the topic energy through five different working groups. Through an interdisciplinary approach, as is represented by the DWZ's network, complex interrelations were emphasized and discussed with Egyptian partners. From the expansion of renewable energies, to socio-economic implications and the adaptation of energy consciousness within the education sector, the entire range of the topic is analyzed and recommendations for action developed. Among the key action points were the development of a clear, committed plan for Egypt's energy mix that would inspire longer term investment, better finance mechanisms for renewable energy projects, more human resource development and technical training at universities to meet RE industry needs, improvement of Egypt's recently implemented Feed-in-Tariff system to encourage on-grid solutions, more attention and assistance for SME projects and increased energy efficiency.

In her keynote address, Dr. Miranda Schreurs, Director of Environmental Policy Research at Freie Universität Berlin, discussed Germany's energy transition “Energiewende” and goal to reduce greenhouse gases 80-95% by 2050. That transition has primarily been driven by private citizens, who produce over 35% of the renewable energy. They have created energy coops and communities are coming together to establish biomass, PV or wind energy projects. The transition toward renewable energy has created 371,000 new jobs in Germany alone, Schreurs said.

Renewable energy does not have to be more expensive if coupled with energy efficiency measures like changing appliances, insulating windows and not running air conditioning all the time, she said. The costs of small PV installations in Germany are approaching the cost of coal, Schreurs said.



"Germany is not the sunniest country; we have 900 hours of sunshine a year, but here in Cairo you have 3,000 per year. On beautiful days, at the peak of the day, 50% of Germany is powered by the sun. Imagine the potential in Egypt," she said.

In Egypt, said Laura Oexle, Head of the Science Department at the German Embassy "the energy crisis, which is still ongoing – but maybe less noticeable than last year – virtually forces us to rethink the current system of energy supply. I can partly understand that the energy crisis requires urgency measures alleviating the situation in the short-run. Investments in coal and nuclear energy are examples of this. A long-term strategy, an energy scenario for the next decades, taking into account the rapid population growth and the severe consequences of climate change are, however, indispensable."

## Session 1: Innovative Business Models Enabling Establishment of Renewable Energies in Developing Countries

Egypt has pledged to have a 20% share of renewable energy in its energy mix by 2020. While setting up goals is a very encouraging first step for Egypt, the actual implementation of this target will need to be accompanied by supporting policies and by the creation of an attractive market for private investors. To encourage the growth of the sector, Egypt's Minister of Electricity Mohamed Shaker introduced a Feed-in-Tariff (FiT) scheme for renewable energy in September 2014, de facto opening up the energy market to private entrepreneurs, who have since rushed to apply to the new scheme. There remains the question as to what kind of business model could support such a policy, as the session chairman Rainer Herret, CEO of the German-Arab Chamber of Commerce, pointed out.

The "Benefits of Solar Energy in Egypt" were presented by Dr. Thomas Schlegl, the head of the Energy System Analysis Group at Fraunhofer Institute for Solar Energy Systems ISE. According to him, the Photovoltaic (PV) market is bound to become a market of hundreds of billion dollars per year in the near future, driven by the drastic price reduction of the technology. "The price drop will continue, and we expect prices of PV to be reduced by 40% to 70% in the next 35 years," he said, convinced that PV will offer the lowest electricity cost in the future. In order for a PV project to take off, two issues need to be clustered: the quality of the product and its low price, all integrated into the state's existing energy system and legislation. In order for a country to efficiently and successfully integrate RE into its energy mix, it needs to consider local conditions very carefully including what resources are available and the state of the infrastructure before giving a framework to investors. The potential of job creation is very real in the PV market, since parts of the value chain can be done locally, like the installation, and solar cells could be produced using desert sand. The part of balance-of-systems (BOS), including e.g. ground works, mounting structure, cables and installation can be realized locally rather easily. For covering the whole value chain from the feedstock, over the wafer, the PV cell and PV module, Fraunhofer ISE has developed a full integrated industrial cluster for the development, production and application of PV power in Egypt. The concept for silicon based PV modules leads to highly competitive costs for PV modules and solar electricity. PV offers to each country a high potential for local penetration, and



its decentralized nature creates pockets of energy and employment in off-grid areas.

Yassin Abdel el-Ghaffar, the Founder and Managing Director of the company SolarizeEgypt, gave an insightful presentation into the hurdles of starting a solar business in Egypt. It is very difficult to enter the market as a start-up, since this sector is so capital-intensive, he said. It took nine months before he found his first client, who turned out to be the American University in Cairo, looking to install a decentralized 17kW system on the campus in New Cairo. The AUC agreed to let SolarizeEgypt use this project as a demonstration site to show the technology's potential to future clients, which was the company's platform to emerge as a serious actor in what has become a very competitive market since the FiT scheme was introduced. To this day, wind and solar energy comprise less than 1% of energy production in Egypt, which is still largely based (at 91%) on fossil fuels. "The solar radiance in Egypt is one of the highest in the world, with an average of 2500kW/square meter per year, and 300 sunny days per year." Before the FIT scheme was introduced, it did not make any sense for RE companies to compete with energy sold by the government at artificially low, subsidized prices, according to Abdel el-Ghaffar. The FiT, accompanied by the announcement of the gradual phase-out of all fuel subsidies over the next five years, has changed the situation, even though the scheme as it currently stands is more beneficial for large-scale applications. Since the FIT gives better prices to larger systems over small-scale and decentralized systems, it remains a challenge for SMEs to compete. This is why Abdel el-Ghaffar is trying to reintroduce the net-metering system which was abandoned when the FIT started. "We want to create a lobby group to reenact the net-metering scheme, which gives much more attractive tariffs to small application of PV," he said. He also believes banks have a role to play in streamlining the finance process of RE start-ups. Since the FIT introduction, 95 (solar energy) companies compete on the market in Egypt, driving some of them to sell at a loss just to secure clients. According to him, there should be increased consumer awareness on the quality of the system, rather than favoring the cheapest system per kilowatt. Also, in order to encourage more citizens to erect PV modules on their roof for self-consumption and to feed into the national grid, the government should respect its commitment to purchase the excess power produced. "We were delighted when the first check was received by our customer last week, this give a very positive signal," he says.

Moving forward and integrating more solar into Egypt's energy mix, requires the country to build a megawatt scale track record and provide Independent Power Producers (IPP) financing options, Abdel el-Ghaffar said. Energy experts should exist in banks to facilitate the launch of off-grid projects, and the process to obtain a license to produce electricity should be made easier.

During the rich conversation which followed the two presentations, experts in the assembly expressed what they see as a major hurdle to the large-scale deployment of solar systems in Egypt. The main concern remains the upfront cost of the technology. In the Western Desert, which has land in abundance and groundwater resources, farmers still rely on diesel generators to pump water for irrigation. Hybrid solar/diesel pumps remain expensive, and farmers don't get any support from banks to acquire those systems, which would considerably lower their reliance on diesel. The Agricultural Development Bank has a plan that was declined by the Central Bank of Egypt for such projects. Storage is also an issue, and batteries are still very expensive and only last two years in Egypt due to the extreme heat, so they haven't proved economically competitive thus far.



## Session 2: Social Commitment Towards Ambitious Energy Transformation Goals

Dr. Florian Kohstall, Head of FU Berlin Cairo Office, led the session on society's role in spurring the shift toward renewable energy and the barriers to ambitious energy transformation goals, which often include lack of acceptance for the feasibility and economics of renewable energy, vested interests in business as usual and so called Nimby (not-in-my-backyard) resistance to RE projects.

Germany's civil society has had a particularly active role in influencing the energy mix of the country, primarily resulting from resistance to other forms of energy. Outcry against nuclear energy for example was extremely strong following the disaster in Chernobyl and renewed after Fukushima. Coupled with that societal pressure also came financial investment and ownership from the citizens themselves, which was fostered by the formation of citizen cooperatives under a legal framework that guaranteed long-term investments in RE would be beneficial. Thus, German citizens became the game changer in the country's shift to renewable energy, according to Dr. Sebastian Helgenberger, head of the Transdisciplinary Panel on Energy change at the Institute for Advanced Sustainability Studies e.V..

Egyptian citizens would be more likely to engage if existing RE projects and potential applications were made more visible, rather than being hidden at secure and remote desert locations, said Sarah El Battouty, architect, Presidential Advisor and Founding Chairman of ECOconsult. Her firm has worked with a variety of companies to convince them that greener buildings and energy efficiency are an integral part of the long-term health of their businesses. She compared renewable energy investment with a country by country happiness index, suggesting that those countries that are already engaging in RE development are more innovative and also happier societies.

Mitigating not-in-my-backyard resistance and engaging citizens could also be accomplished by fostering more small-scale RE projects, said Senior EcoConServ Consultant Amr Sobhy. Though Egypt's RE market and framework is currently geared toward large-scale projects, smaller projects are better able to address citizen complaints and concerns through the planning and implementation phases.

Citizenry and industry are only two components in the energy shift, but without a supportive government, durable legal frameworks and rule of law, any meaningful change is significantly hampered. Prof. Dr. Mohammad Reza Farzanegan from Center for Near and Middle Eastern Studies (CNMS) of Philipps-Universität Marburg presented his study of the moderating role of political institutions in air pollution-economic development nexus in the MENA region, according to which the MENA countries can significantly deal with the negative externalities of economic growth for environment by investing in their democratic institutions.

The discussion also tackled how we can connect best practice models and that foreign aid in Egypt is not always conducive to building an RE framework because it leads to a scattered landscape of different projects funded by different groups.



### Session 3: Securing the Future of Clean Energy by Policy Measures

In order to secure the large-scale deployment of renewable energy sources, the Egyptian government needs to make its support clear by adopting policies to build investors' and end-users' trust in the market. As Dr. Mohamed El Sobki, Executive Chairman of the New and Renewable Energy Authority (NREA) pointed out, Egypt has shown an increased commitment in the past year to enact legislation that would benefit the expansion of this market.

Law 203 of 2014 focused on schemes to develop RE. This law introduces the IPP public competitive bidding scheme, which refers to the process where a government identifies and reserves a site for private development. This scheme has committed projects for the next seven years for a capacity that exceeds 3200MW, for which the licenses have already been granted.

The second scheme introduced by Law 203 is the merchant scheme, which puts the suppliers and the end users in direct relation. Dr. El Sobki explained that there are currently two service providers under this scheme: the Italgem group, which is a consortium of cement industries who will produce 200MW of wind energy by 2019, and Elsewedy group which will produce 600MW of wind.

The third scheme is the Feed-in-Tariff, which should expand over the next few years to incorporate 1750MW of wind by 2018, 500MW of PV by 2017, and 150MW of rooftop applications by the same year, which amounts to a total of 4300MW.

Dr. El Sobki also stressed the importance of energy efficiency and conservation: "It is a key factor to develop energy efficiency, and our target is to achieve an 8% reduction in our anticipated energy use from our expected usage of renewable energy by year 2022," he said. The additional energy needs will be covered by interconnectivity with neighboring countries and renewable energy. The current target is to reach 20% of electricity produced by renewables by 2020, and though other experts in some of the sessions were not as confident Egypt was on track to meet its goals, El Sobki believes the country could reach 30-40% of its electricity production from RE by 2035.

Engineer Ahmed Sedky, a senior consultant at EIM-Energy, gave a presentation on the geopolitics of renewable energy, asking whether they would be similar or vastly different from the current geopolitics of conventional energy sources. For a region like the Middle East and North Africa, where the energy sector produces 49% of the world's oil and 41% of the gas used worldwide, the large-scale deployment of renewables is bound to reshape regional politics. Saudi Arabia's role is likely to diminish on the international scene with the integration of a large RE part in the region's energy mix. Sedky believes that Germany, the country of the most revolutionary energy transition 'Energiewende', is the most advanced in terms of RE geopolitics. He also believes that Desertec, a program promoting large-scale deployment of wind and solar energy in the world's deserts, has been canceled due to geopolitical issues, namely that a growing number of European States and stakeholders lost confidence in the Middle East's ability to provide a large chunk of its energy in a reliable way. The recent discovery of the immense gas fields in the Mediterranean will also present a challenge to the adoption of RE in the region. On Egypt, Sedky expressed confidence that the country could become a massive producer of clean energy since very few other countries benefit from such



large, vacant swathes of cheap land and excellent sun radiation. Also, at the core of RE sources is their decentralized quality, which means that the periphery would have an opportunity to develop – which in turn will grant them more independence. Sedky thinks we need to spur a conversation on the adoption of RE, and to stress that the current transition is much more than that: “It is an energy and technological revolution, nothing less,” he said.

Dr. Ahmed Badr, Director of the Regional Center for Renewable and Energy Efficiency (RCREEE) gave an abundance of information in his presentation about how various countries in the MENA fare in terms of RE integration and the schemes that are being used to foster RE projects.

“Overall, the current installed capacity in the MENA countries is far below the targets defined by the governments,” said Badr. Nonetheless, several countries have adopted ambitious policy frameworks to encourage the deployment of renewable energy projects in the region, which Badr sees as a promising development. Morocco now uses IPP public competitive bidding, Algeria just introduced a FiT, Egypt uses different mechanisms (FIT, merchant scheme and IPP public competitive bidding), and Jordan started a direct proposal submission and initiated its competitive bidding process. According to Badr, almost 50% of Arab countries have public financing channels for its RE projects. Algeria, Egypt, Jordan, Morocco and Tunisia have created public funds for RE development, and two countries created state-backed private sector companies to invest in RE projects: the UAE with Masdar city and SIE in Morocco.

The reason why investments have been lagging behind is mostly due to the risks that exist. For example, 64% of banks are reluctant to invest in the MENA region. Banks or any financial institution face risks like machinery obsolescence, building and technical risks, operational risks, environmental risks, political and regulatory risks, market risks and weather-related volume risks. According to Badr, “If we want to ensure sustainability and increase the penetration of RE in the region, governments will need to work with the private sector to deal with the risks associated and encourage investments.”

#### Session 4: Bridging the Gap: Academia and Industry Collaboration in Energy Efficiency

Several obstacles are hindering academic-industry collaboration in Egypt, including the economic downturn and political instability, which shrunk R&D budgets at many companies as well as investor confidence, according to Dr. Adel Khalil of Cairo University’s Faculty of Engineering. Financial instruments, legislation, market enhancement and infrastructure development are all needed to encourage industry and investors in renewable energy, he said. Investors also have complaints about the Feed-in-Tariff scheme introduced earlier this year and how it will be implemented and guaranteed.

Rebuilding trust between the government and large and small investors is a crucial first step, which would be supported if Egypt made a clear, official vision for the energy mix and development over the next few decades, said Wael El-Nashar, CEO of Onera Systems, a need also reiterated by several other experts.

When those barriers to investment are removed, industries will be more likely to invest in research with universities and projects like the Egyptian Renewable Energy Cluster Initiative, which Dr. Khalil coordinates. The cluster is still in its conception and planning phase.



Technical University Munich already benefits from a geographic cluster of many businesses and research institutions surrounding the university's several campuses and has developed strong partnerships in recent years. However, even at German universities such robust industrial-academic cooperation is a recent development, according to Dipl. -Ing Kordula Schwarzwald, Project Coordinator of "The NeXus of Water, Food, Energy" at the university. She suggested one way to foster trust and stronger ties is to recruit industry professionals to supervise masters' degree candidates.

In addition to advanced degrees, more technical training programs are needed in Egypt, where there is an abundance of engineers but a shortage of technicians to meet industry needs.

Prof. Dr. Ehab Abdel Rahman presented the drawbacks and advantages of various forms of energy including financial and environmental costs, concluding that concentrated solar power is the most advantageous and efficient form of renewable energy to invest in for the future, however he stressed that each country should maintain a diverse energy mix to guarantee supply continuity.

## Session 5: Innovative Concepts for Network Stability Despite Variable Energy Infeed

On the technical side, experts addressed the challenges of integrating RE in the grid without overburdening the system.

Prof. Dr. Ahmed Hamza H. Ali, Mechanical Engineering Department of Assiut University, emphasized the importance of solving issues that will arise from the variable nature and unstable frequency/voltage of wind and solar power before installing large RE projects. He is working on a master plan which considers the extension of power capacity mix and distribution to ensure the quality of the power supply.

Dr. Bernhard Wille-Hausmann, head of Energy Management and Grids Group, Fraunhofer Institute for Solar Energy Systems said smart grid technology and grid planning also needs to be modified when RE is incorporated. A master plan provides the umbrella framework and then other things need to be incorporated like a smart grid system. Another issue he addressed was that battery system installation is already competitive but will not necessarily be welcomed by grid operators because they cannot control a distributed supply system.

Focusing on the demand side, transmission and distribution, one of the biggest challenges for Egypt and MENA is the dust in the air. Despite the wealth of solar radiation, panel efficiency is significantly decreased when coated by dust, and technical or HR solutions need to be developed to local conditions to deal with such complications. Technical solutions can be costly and adaptation is a challenge because it's a learning process that involves a lot of testing in local conditions. Even with investments in time and money to create viable solutions, market technology will likely change after a few years requiring new trials and adjustments.



Focusing on the transmission grid side, Dr. Majeed Adul-Hameed, Power System Engineering Specialist, Siemens S.A.E, presented the challenges faced by the Electrify Grid when required to integrate large renewable power stations. Mainly these challenges are attributed to the variability, availability of energy and controllability. These problems affect the network stability in deferent ways. Manufacturer developing new technologies and solutions to alleviate the stability problems associated with integrating large scale renewable resources to the Grid. These technologies and solutions required the Grid operator and manufacturer to carry out various studies to define optimum solutions comply with the Grid Code.

When it comes to grid codes, which are already in place in Egypt, the issue becomes application. Regulation is complicated when you have several power suppliers and becomes even more so if you have supply, transmission and distribution separated as in Egypt. The country's regulatory authority has a qualified team, but one action point suggested in the discussion about grid management was that the authority needs more power to act and apply the capacity of its staff, said Session Chairman and MED-ENEC Team Leader for the EU/GIZ Dr. Kurt Wiesegart.

## Conclusions

Several countries in the MENA region have recently adopted ambitious policy frameworks to encourage the deployment of renewable energy projects for residential, commercial and industrial applications. The introduction of the Feed-in-Tariffs in many Arab countries has opened the renewable energy market to the private sector, which is further encouraged to invest in light of a regional tendency to phase out fuel subsidies, which have previously hampered RE competitiveness.

The price of RE technologies continues to go significantly lower, and experts believe that PV should provide the cheapest energy in the future and become a multi-million dollar industry. It was widely agreed that energy efficiency must go hand-in-hand with RE development and energy strategies.

There are still many challenges to achieving a large-scale penetration of RE technologies on the market: high initial investment cost, the variable quality of the technology locally available, the lack of demonstration sites and the less attractive tariffs for smaller scale applications. A clear energy mix target is also needed, as well as strong and durable legislative support and policy frameworks, and cooperation between governments and the private sector to reinforce trust and lift the risks associated with investing. RE also would benefit greatly from more collaboration between academics and industry professionals, particularly in Egypt where the economic downturn and political instability has reduced the budget in R&D. On the technical side, one of the biggest challenges at hand is to cope with the large amount of sand in the air, which enormously reduces solar panel efficiency, and site-specific solutions need to be found.

Experts concurred that Egypt is making progress, but many questioned whether increasing the RE energy share from less than 1% of the energy mix to the 20% by 2020 national goal is feasible. Renewable energy growth and development is inevitable, but countries need to maintain a diverse energy mix to guarantee continuous and stable supply from a variety of sources.