

BUILDING BRIDGES



A Proposal for a Joint Energy / Science Partnership between MENA and Europe

Abstract

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In the course of the global climate discussions we propose a new form of joint energy / science partnership with key institutions from the MENA region. Scientific collaboration that stimulates cooperation on various levels will generate specific incentives for the development of renewable energies in MENA and in the long-term will speed up the export of solar power to Europe. At the same time this energy / science partnership is intended to contribute to sustainable growth and development in the MENA region through “capacity building”.

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1. Introduction

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.

DESY develops, builds and operates large scale research infrastructure like accelerators and detectors which attract every year more than 3000 scientists of very diverse scientific disciplines from all over the world. World-class X-ray sources like FLASH and PETRA III allow deep insights into structure and function of matter. When the European X-ray laser XFEL, which currently is under construction, will start operation in 2014 it will dramatically widen our horizon and open completely new fields of application.

DESY – Development,
Construction and
Operation of Large
Research Infrastructure

Large-scale research infrastructure such as accelerators, synchrotrons radiation sources, neutron and laser facilities across the globe are a prerequisite for research at the forefront of various scientific disciplines. However, operating these facilities require a significant amount of energy. Due to volatile energy costs, tight budgets, and increasing environmental concerns research infrastructures are incited to develop mid- and long-term strategies aimed at achieving for the future a sustainable energy supply that is eventually carbon neutral.

Currently, the facilities at DESY have a power input of 24 MW corresponding to an annual consumption of about 200 GWh¹ that is mainly provided by fossil sources. This is equivalent to the energy consumption of a German city with roughly 50 000 inhabitants.

For DESY a reliable, affordable and sustainable supply with electric power is of strategic importance. Besides implementing measures to increase energy efficiency DESY is developing a general concept for a sustainable energy supply that includes both the use of domestic off shore wind energy as well as future electricity imports from desert regions.

Sustainable Energy
Supply of Strategic
Relevance

This paper drafts a basic cooperation concept which couples scientific exchange with energy transfer between DESY and partners of the Middle East and North Africa. It is based on the conclusions of a major symposium “Solar Energy for Science” that was held on 19/20 May 2011 at DESY in Hamburg.

¹ Using the average energy mix in Germany as a reference this corresponds to releasing roughly 110 kt CO₂ per year.

2. Challenges for the Future

Global developments like climate change, growth of worldwide population as well as striving for enhanced prosperity lead to increased demands for energy and water, which entail immense and unprecedented challenges for humanity.

The goal of ecological, economic and social sustainability in the energy sector can only be achieved by serious exploitation of renewable energy sources. At least since the nuclear disaster of Fukushima, several countries have realized an urgent need for cleanly produced energies.

The large-scale export of power from regions with high solar irradiance in the Middle East and North Africa (MENA) to Europe is an essential element of the much-publicised DESERTEC concept² and of the EU-Mediterranean Solar Plan³. This would not only reduce greenhouse gas emissions but would also help developing or emerging countries to obtain sustained economic growth with the goal to enable climate protection at a global level.

The German Ministry for Environment initiated studies of the German Aerospace Center DLR already in 2006, which demonstrated that Concentrating Solar Power Plants (CSPs) could reliably supply a firm capacity necessary for a stable grid corresponding to 15% of the European power requirements in a cost-effective and environmentally compatible way by the year 2050⁴.

Globally the potential of solar energy is immense: In only six hours the deserts of the earth receive more energy from the sun than mankind consumes in one year. All necessary technologies to make use of this enormous potential are in place and well proven. Concentrating Solar Power Plants (CSPs) are thus ideal for supply of secure solar power⁵. Differences in local solar irradiance favour the installation of CSPs in the MENA region over

Renewable Energies
and Sustainability

Solar Power from the
Deserts is attractive

²In October 2009 twelve companies and the DESERTEC foundation set up the DESERTEC Industrial Initiative Dii GmbH. It is the aim of this industrial consortium to advance the analysis and the development of technical, economic, political, social and ecological framework conditions concerning a CO₂-neutral energy production in the deserts of MENA. In the recent CDU/CSU/FDP policy accord of the German Government it is recognized that there is a need for political action to substantially support the solar energy initiative DESERTEC.

³The "Union for the Mediterranean" which was founded in 2008 by all 27 EU Member States and 16 states around the Mediterranean basin has put forward a Mediterranean Solar Plan to build up to 20 GW of renewable power in the MENA region by the year 2020. The EU High Commissioner for Energy, Günther Oettinger, has announced in June 2010 that first solar energy is imported from North Africa to Europe by 2015.

⁴The DLR studies "MED-CSP", "AQUA-CSP" and "TRANS CSP" showed that concentrated solar thermal power stations could produce sufficient energy and water desalinated for the increasing need of these countries as well as for Europe if less than 0.3% of the MENA desert area were used. The study "MED-CSP" puts a main emphasis on the renewable power supply in MENA, while "AQUA-CSP" analyzes the supply with drinking water through desalination.

⁵The International Energy Agency IEA has identified CSP's "as one of the key technologies that is at the heart of the energy revolution because they can make the largest contribution to greenhouse gas emission reductions". Similarly, the German Physical Society, DPG, recognizes CSP's as one of the best options to provide CO₂-neutral energy in large quantities.

South Europe due to the availability of high-voltage direct-current-transmission lines with relatively low transmission losses.

Despite the fascinating perspectives and the added value for Europe and for MENA, a number of challenging political, regulatory and economic obstacles hinder implementation of this concept.

Currently, the cost of electricity production with a solar thermal system (12-20 ct/kWh) is still too high to compete with fossil energy sources. Although many countries in the MENA region already force an expansion of alternative energy sources, a guaranteed market in Europe is required to exploit the high economic potential. The more of such facilities are installed the lower will be the production costs. According to estimates⁶ the cost for solar thermal power will be reduced by up to 50% when in 2025 a total of 60 GW will be installed worldwide. This will make solar energy competitive with power from fossil sources.

Further, a political-regulatory framework (both in the exporting as well as the importing countries) and reliable long-term incentives such as feed-in tariffs and investments in expansion of the network infrastructure are needed. It will also be particularly important to clearly demonstrate and communicate the benefits for the producing countries, such as superior security of local energy supplies, enhanced economic growth and emerging new jobs. This aspect is of particular importance in view of the modernization process in the Arab World as a stable democratic consolidation has only a chance if is accompanied by a sustainable economic development.

Sustainable economic
Perspective for the
Arab world

After the climate change conference in Copenhagen climate policy faces a crisis. A comprehensive and binding agreement is presently not in sight. Further climate negotiations can only bring substantial progress if all partners are willing to move towards each other. Industrial nations that are mainly responsible for the historical and present CO₂ emissions must demonstrate their willingness to support developing and emerging countries with financing commitments and/or technology transfers such that the latter are not slowed down in their future implementation of climate protecting measures.

Establish Model
Alliances with Climate
Pioneers

In its policy paper "Climate Policy Post-Copenhagen" the German Advisory Council on Global Change (Wissenschaftlicher Beirat der Bundesregierung Globale Umweltveränderungen, WBGU) recommends that Germany and the European Union form targeted alliances with ambitious developing and emerging countries in order to speed up the transition to a climate compatible world economy. Extended exploitation of renewable energy and the expansion of EU emissions trading should be in the focus of such sub-global alliances. Furthermore strengthened cooperation in the areas of education, research and technology transfer between EU and selected countries is needed.

⁶ A.T. Kearney "Solar Thermal Electricity 2025", June 2010

3. Building Bridges through Science

Science and technology are key determinants for economic growth and societal well-being. Without any doubt there is a clear relationship between R&D expenses and socio-economic impact of a country. In addressing the human challenges of the future, scientific research will be crucial to find sustainable solutions in a world of growing population, climate change and declining resources. Participants of the Potsdam Nobel laureate symposium "Global Sustainability - A Nobel Cause"⁷ declare the importance of science for a sustainable development and the necessity of an extensive transformation of our society to meet the future challenges.

Science and Sustainability

Developing and emerging countries are most severely affected and threatened by a changing world. Scientific and technological cooperation with these countries becomes more and more important as common sustainable solutions for energy, water and food need to be found. Industrialized nations are in the lead to shape the North-South relations as a decisive factor for mastering these problems in a responsible way⁸.

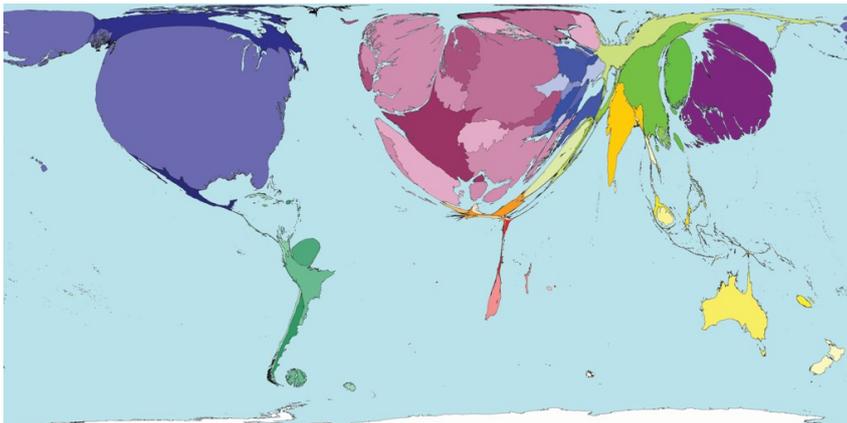


Figure: The worldwide knowledge gap between North and South as measured by scientific publications. Source: www.worldmapper.org.

However, there is large knowledge gap between North and South. About 80% of all resources worldwide for R&D are spent by OECD countries. Another 15% are covered by India, China and the industrialized countries in East Asia, while only 5% is left for the remaining countries. This is meagre in terms of the enormous challenges these countries face as they could contribute much to their solutions.

Knowledge Gap between North and South

⁷ The Potsdam-Memorandum is the result of the First interdisciplinary Symposium „Global Sustainability – A Nobel Cause“ that was held in October 2007 in Potsdam. It was attended by several nobel laureates to discuss the best scientific and political strategies to stabilize the climate.

⁸ "What is needed (to reach the Millenium Development Goals – MDGs) is true partnership of developed and developing countries – a partnership that includes S&T. Cooperation among the scientific and technological communities of different countries and regions yields a large reservoir of knowledge and expertise. If every nation gains full access to this broader world community of science and has the opportunity to develop an independent science capability, its public can engage in a dialogue about the benefits and risks of new technologies" (Kofi Annan)

Until now, the investments in science and technology are not yet significant enough to act as an effective motor for sustainable development in these regions. Moreover, transfer of science and technology alone is not sufficient to unfold their potential unless appropriate education and research capacities are locally established to absorb, generate and exploit new knowledge. Science does not advance in the laboratory alone, but needs interactions, collaboration and the exchange of people and ideas. It is about scientific cooperation and research partnerships between industrialized and developing countries that must be massively enhanced to build up together the common knowledge base in seeking specific solutions to the most severe problems in these regions and that finally lead to future sustainable development.

Establishment of appropriate Education and Research Capacities

Science per se has a cooperative and international character and can build bridges into the future. To this end science and scientific cooperation should also be understood as an instrument of international diplomacy as we seek solutions to problems that affect us all. Scientific cooperation creates trust and acceptance and brings to bear peace-making and stabilizing effects in societies. Cultural, regional and political differences can more easily be overcome by scientific exchange. For instance, important impulses to terminate nuclear arms race came from eastern and western scientists who aligned with each other on the basis of the Einstein/Russel manifest in the Pugwash movement „Science and International World Affairs“, which received the 1995 Nobel Peace Prize. This peace-making role of science was also reflected in the message given by Barack Obama at his historical speech in Cairo in spring 2009 when he proclaimed: “My vision for science is peace”.

Science Diplomacy to support Reform and Modernization Processes

4. EU-MENA Partnership

There are pressing challenges in MENA: The rapidly increasing energy (and water) demand in MENA will soon exceed the current supply capacities. It is expected that the electrical energy consumption in MENA will more than triple by the year 2050 with respect to today. Water scarcity is already a serious problem in MENA and population growth will further aggravate the situation. However, the potential of solar energy in MENA countries is immense⁹.

Depending on solar infrastructure and capacities, MENA might be able to produce enough energy and co-generated water through seawater desalination for its own demand and export surplus energy to European markets. Having recognized this potential the governments of the

Advantageous Climate Conditions and rising Energy Demand in the MENA Region

⁹ The MENA region provides advantageous climate conditions for usage of solar energy. High level of solar irradiance with an annual average of 2400 kWh/m², abundant areas of desert in combination with limited natural resources make the application of solar thermal technology in this region an obvious choice. Every year up to 250 GWh of energy per square kilometre of desert could be harvested with solar power plants exceeding by far the potential of other renewable sources such as wind, biomass, hydro or geothermal energy

MENA region have set corresponding goals to further develop renewable energy in their countries¹⁰.

Given the many existing links between Europe and its southern Mediterranean neighbours and considering the current 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 MENA.

For the development of effective solutions Europe and MENA have to understand themselves as a common area around the Mediterranean basin of shared interests to face together the challenges of sustainable energy/water supply as well as climate protection. In view of these fascinating prospects we propose a new energy/science partnership that is based on a sub-global deal between the two regions to stimulate the promotion and stepwise deployment of renewable energies in MENA through scientific and technological cooperation and capacity building. On the long term run surplus energy from MENA could be directly or indirectly transferred to Europe and compensated through appropriate knowledge transfers from North to South.

Europe and MENA as a
common Area of
Energy and Knowledge

The central element of the proposed strategic partnership is a scientific cooperation between European research institutes and selected partner institutions in the MENA region. For example granting access to large scale European research infrastructures, establishing local scientific-technological research capacities, fostering scientific exchange, training of young scientists and promoting technology transfer are essential ingredients to enable more active participation of MENA partners in building up a knowledge base. As a flagship of a new energy/science partnership European research centres and energy-intensive large-scale research facilities could serve as first off-takers of green MENA energy while offering in return scientific cooperation with their partnering institutions in MENA.

Scientific Collaboration
as Core Element

Scientific collaboration offered by the European partners is coupled to a binding agreement by MENA partners to advance exploitation of renewable energy in MENA and to accelerate the integration of a green Euro-Mediterranean energy market with the aim that the participating partners will get direct or indirect access to sustainable energy resources.

As long as direct physical electricity transfer from the desert regions to Europe via direct-current transmission line is not yet available, sustainable energy supply can still be indirectly supported by exploiting CO₂ certificate transfer from the MENA region to Europe.

Indirect Trade via CO₂-
Certificates

The Clean Development Mechanism (CDM) includes the option of indirect trade with solar energy. Within the framework of the Kyoto Protocol CDM promotes emission-limiting projects in countries that do not have any reduction obligations (developing countries). The reduction in the developing country can then be credited to industrialized countries in the form of "Certificated Emissions Reductions" (CERs). Within the European Union Emission Trading Scheme CERs can also be credited to enterprises.

A model for a joint energy/science cooperation between e.g. DESY and Germany and the MENA region is outlined below. As an illustrative example, we use the SESAME¹¹ synchrotron

¹⁰Morocco's ambitious national energy strategy aims for a renewable energy fraction of 42% by the year 2030. Similarly, Egypt plans to increase its renewable energy fraction to 20% by 2020. In order to achieve this Egypt plans to build 600 MW of wind, 500 MW of solar energy plants, and 600 MW of hydropower between the years 2012-2017.

source in Jordan as strategic partner candidate. The power demand of SESAME could be covered by a solar power plant located in Jordan. Besides the mere energy supply the solar power plant could act as test- and training centre to demonstrate the usability of regenerative technologies. If the synchrotron radiation source were entirely powered with renewable energies instead of the presently foreseen fossil the energies greenhouse gas emission would be reduced. Subject to certification as a CDM-project emission certificates could be credited to DESY which would allow DESY to offset part of its own power consumption in a climate-neutral way. In return DESY supports SESAME with various scientific transfer and exchange programmes.

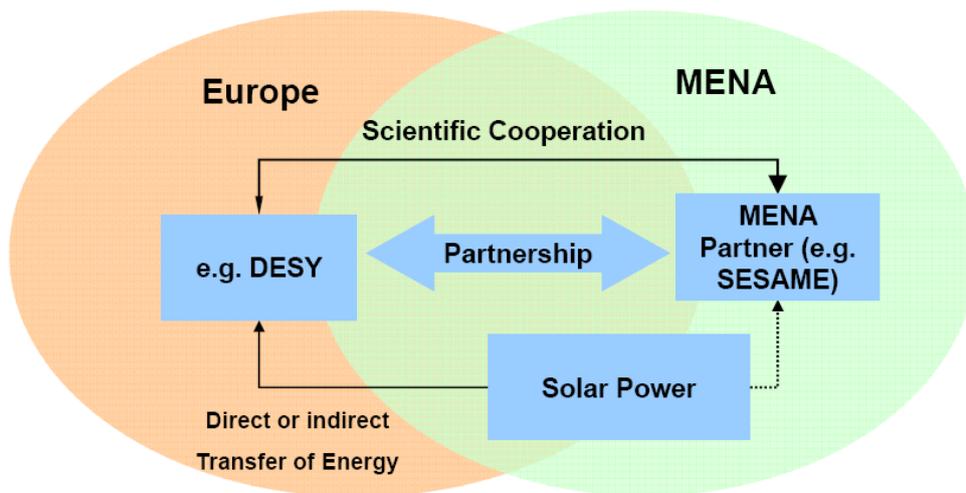


Figure: Model of a joint Energy/Science Agreement between DESY and MENA Institutes

The willingness of developing and threshold countries to engage in climate political activities is contingent upon provision of substantial technological and financial services from the industrial countries. Besides the CDM mechanism and the voluntary emissions trading market governmental funds are important instruments to generate financial resources for reduction of greenhouse gases in developing countries. To this end the World Bank has already set up the Climate Investment Funds¹². In addition to multi-lateral structures further governmental initiated funds for climate protection measures have been implemented¹³. Corresponding publicly funded grants should primarily be used for projects that do not easily find a commercial funding.

Together with partners from MENA a first prime example project based on the proposed joint cooperation model can be launched. Such a showcase would act as stimulus for further follow-up projects and entail investments on national or European level. The long-ranging goal

¹¹ SESAME – Synchrotron Light for Experimental Science and Application in the Middle East

¹² The Clean Technology Fund Investment Plan for MENA intends a financing of 750M US\$ to mobilize further 4.85bn US\$ from other sources to deploy 1 GW of CSP power.

¹³ Japan has set up the Cool Earth Partnership Fund with an amount of 10 bn US\$ over five years. The European Union has established the Global Energy Efficiency and Renewable Energy Fund (GEEREF) to mobilize private investments in developing and emerging countries.

is that DESY, but also other national or European research centres, cover some of their power needs from renewable energy sources in MENA and in return offer scientific exchange with partner institutions in this region.

5. Potential Partners in the MENA Region

The Euro-Mediterranean partnership between the European Union and the countries of the Southern Mediterranean began in 1995 as a result of the Barcelona process. The partnership, which implies reciprocity, solidarity and co-development, is intended to establish political, economic and social cooperation. Based on the Barcelona process the Union for the Mediterranean consisting of EU members, countries bordering the Mediterranean plus neighbours like Mauritania and Jordan started to operate in March 2010. Intensified scientific cooperation with neighbour countries of Europe in the context of the European Research Area (ERA) is a means to encourage possible access for these countries to the European Framework Programme. In higher education many countries in the Middle East and North Africa seem to have great interest in a more regular cooperation with European partner universities and research institutions to increase their level and prestige.

In the following the research centre SESAME (Synchrotron Light for Experimental Science and Applications in the Middle East) will be presented in more detail as a potential partner institute for a joint energy/science agreement. The multilateral cooperation project SESAME situated north of Amman, Jordan, is a modern, third-generation synchrotron light source under construction. The idea to contribute with science to peace and stability in the region resembles the spirit of CERN, the European Organization for Nuclear Research. SESAME is modelled institutionally on CERN as an international organization under the patronage of UNESCO with Bahrain, Cyprus, Egypt, Iran, Israel, Jordan, Pakistan, the Palestinian Authority and Turkey as member states.

Being the first synchrotron light source in the Middle East, it will strengthen significantly natural sciences and life sciences in the entire region. Following the vision of Herman Winick (SLAC) and Gustav-Adolf Voss, former DESY accelerator director, the decommissioned storage ring BESSY I was given as a donation by Germany to SESAME and will now be used as booster ring for the main storage ring. The SESAME light-source is technically on track for experiments to begin in 2015. Based on decades of successful experience in Europe and around the world such research infrastructures are vital as they educate young researchers, counteract brain drain, and supply valuable cooperation links to international scientific communities.

SESAME would be an ideal starting point to anchor a partnership envisioned by DESY. A joint energy / science partnership with a centre of excellence in the region would constitute an impressive model alliance between Europe and MENA. With such a showcase, Germany would strengthen its leading role in research and climate policy and send valuable signals for the entire Euro-Mediterranean dialogue.

Access of southern
Mediterranean
Countries to European
Research Area

Multilateral
Cooperation Project
SESAME

Partnership between
SESAME and DESY as a
Showcase for Solar
Energy for Science

6. The Wider Framework

In the context of the German internationalization strategy of the Federal Ministry for Research „Strengthening Germany's role in the global knowledge community“ one of the four main primary objectives is the intensification of the cooperation in terms of education, research and development with developing and emerging countries. Our Solar Energy for Science Initiative allows forging a strategic partnership between Germany and countries from the MENA region for a sustainable development through scientific exchange, which will smoothly fit in the internationalization strategy of German science politics.

Internationalization
Strategy of German
Science Policy

The Helmholtz Association is the largest science organization of Germany. Altogether 30,000 employees work in 16 research centres, which have the mission to pursue long-term research goals on behalf of the state and society. The Helmholtz Association strives to gain insights and knowledge so that it can help to preserve and improve the foundations of human life. It does this by identifying and working on the grand challenges faced by society, science and industry. Helmholtz research centres perform top-class research in strategic programmes in six core fields: Energy, Earth and Environment, Health, Key Technologies, Structure of Matter, Aeronautics, Space and Transport. Many of the research centres build, operate and use a number of worldwide first-class large research facilities which are indispensable in sciences for knowledge increase. These research facilities, such as particle accelerators, synchrotron radiation sources, X-Ray lasers, neutron and ion sources, or high performance computer centres attract the best researchers and the scientific talents from all over the world. Due to its strategic orientation and its wide research portfolio the Helmholtz Association can take a special leading role to shape and form the further development and arrangement of an energy / science partnership with MENA.

Wide Research
Portfolio of Helmholtz
Association

Finally, for the strengthening of the worldwide competitiveness and leading role of the European community the European research framework programme emphasizes a strong and coherent international science and technology politics, which takes into account third countries. As associated countries the Mediterranean countries are of a special significance which was underlined with the foundation of the Union of the Mediterranean - a forum for dialogue and partnership between the member states of the European Union and MENA countries in the Mediterranean Basin, with the aim of strengthening relations among them. The cooperation between the EU and the Union of the Mediterranean is multifaceted and includes a wide range of joint programmes and activities. A special priority is set in the areas of science, innovation and research.

Special Priority in the
Areas of Science,
Innovation and
Research within the
Union of the
Mediterranean

7. Symposium and Further Steps

“Building Bridges” was the motto of the Solar Energy for Science Symposium (<http://www.solar4science.de>) under UNESCO patronage that took place on 19 and 20 May in Hamburg, the European Green Capital of the year 2011. Organized by the DESY in cooperation with the German Aerospace Center DLR, the Egypt Academy of Scientific Research and Technology ASRT and the Synchrotron radiation laboratory SESAME in Jordan, this Symposium brought together a broad range of expertise from various research fields and communities to make first steps towards a joint European and MENA energy and science region. The central question at the symposium was how scientific cooperation could sustainably support and promote the fascinating concept of energy from the desert.

First steps towards a joint European and MENA Energy and Science Region

For two days, about 250 participants from 30 countries focused on the chief objectives of the symposium: pointing out scientific links between Europe and MENA, identifying restraints in terms of energy policy and initiating a coherent approach to foster scientific cooperation between Europe and the MENA region in the field of basic research and solar energy. More than 50 speakers along with a very active audience with strong MENA participation discussed a wide spectrum of exciting and important aspects of a strategic energy and science partnership. A number of follow-up actions were presented at the Symposium:

Together with other research laboratories -such as CERN and the ESS, the future European Spallation Source - DESY has initiated a workshop on energy management for large scale research infrastructures which will be held on 13/14 October 2011 in Lund, Sweden (<http://www.esss.se/energyworkshop>). This workshop will be the first of its kind and brings together international experts on energy and representatives from energy-intensive laboratories and future large scale research projects all over the world in order to identify the challenges and best practice with respect to energy efficiency optimization, sustainable solutions and implementations on the supply and demand side as well as to review the challenges represented by potential future technological solutions.

Research Infrastructures and Sustainability

DESY is working on an own sustainability concept with the aim to implement energy controlling & management tools that allows a better understanding of the environmental impact and profile of its activity and to devise future energy-efficient measures and strategies.

Already before the beginning of the Solar Energy for Science Symposium, DESY agreed on a scientific cooperation with SESAME – a first pilot project in accordance with Solar Energy for Science. The two research centres intend to cooperate in a variety of areas of activities like use of synchrotron radiation for basic and applied research, education and training of young scientists and deepening of the Euro-Mediterranean dialogue by attracting further follow-up projects between scientific institutions in Europe and the MENA region.

SESAME and DESY Cooperation

A second symposium to broaden and deepen the European-MENA scientific dialogue will be hosted by the Cyprus Institute in winter 2012. Due to its location in the Mediterranean Sea, its presidency of the council of the EU in the second half of the year 2012, and the significance of the Cyprus Institute for the whole Mediterranean Area, Cyprus will be the ideal host for follow-up symposium under the motto “Building Bridges” between Europe, North Africa and the Middle East. DESY will support this major event significantly.

Follow-up Symposium Cyprus 2012

8. Literature

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