Knowledge for the Desert



Towards a new energy/science partnership between Europe and MENA





Helmut Dosch DESY





Member of Helmholtz Association

Mission:

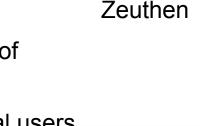
Development, construction, operation and scientific exploitation of accelerators

Provide (open) access and services for national and international users

- Accelerators
- Photon Science
- Particle and Astroparticle Physics

Research Collaboration with leading labs worldwide

Budget ~ 180 Mio €/a Employees ~ 2000





Research Infrastructures: DORIS (-> 2012), FLASH (-II), PETRA-III, XFEL, TIER-2

External Users: ~ 3000/year from 45 countries







Motivation

- Our mission: construction, operation and exploitation of large research infrastructures for accelerator-based research
- > large research infrastructures are energy intensive
 - synchrotron radiation sources, neutron sources, X-Ray lasers, high magnetic field facilities
 - DESY 2010: 16 MW Power, 140 GWh/year, about 70 kt CO₂/year
 - future development of energy prices ?
 - how climate neutral/sustainable should research centers be?
 - = >Question of energy supply is of strategic relevance



Science is Energy-Intensive



University ~150 kWh/(m²a)

laboratory space (bio/chem/phys) ~300 kWh/(m²a)

residential area

~40 kWh/(m²a)

Estimation for Germany: ~110 Universities, 1.5 M students R&D spent at Universities: €11 billion

Electricity: ~3500 GWh/a Cost: ~€3,5 billion/a



Sustainability Concept for DESY

C Better Energy Management of Facilities

Existing energy consumption data only on highly aggregated level First Step: set up an energy management / controlling system

- What are detailed electrical power / heat consumption levels at various buildings/ labs/offices?
- How do they compare to benchmarks ?
- Are there clear drivers/issues identifiable to improve efficiencies/gain savings on demand or supply side?

Strategic Research in Advanced Materials for Renewable Energies

Interdisciplinary research effort in Helmholtz association: Materials Science Joint effort between research fields "Matter", "Energy" and "Key Technologies" DESY: insitu high precision analysis of materials performance on a molecular level **ERF issue:** see GENNESYS White Book Chap. 5.6.

5.6.	Energy technology	
	5.6.1.	Overview: Nanomaterials for energy
	5.6.2.	Energy production
	5.6.3.	Energy conversion
	5.6.4.	Energy storage and transportation
	5.6.5.	Energy saving

Sustainability Concept for DESY



Recommendation for

Future Role of Europ. RIS for Energy Research

THERMOELECTRICITY H, PRODUCTION FUEL CELLS Nanoscale photocatalysts Nanocrains, interfaces Membranes, interfaces, catalysts Formulation of new materials with · Corrosion resistant materials · Better catalysts tolerant to CO increased conversion performances Hydrogen induced embrittlement Proton conductive materials New materials stable at very high Nanosafety sensors Optimise the membranes for an · High temperature materials improved durability temperature Develop performing interfaces to improve · Understand the interface diffusion - Better design the electrode structure electron and photon transport SOLAR CELLS **CONVERTER MATERIALS** Quantum dots, thin films, polymers Metals, nanocomposites, coatings Control the band gap of the materials Tailor coating materials Chemistry at the interfaces Diagnostic the weak points at the Control crystallographic orientation in nanoscale the thin film and interface Control the in-service performance · Corrosion, erosion and radiation morphology Photon collection, and electron and resistance Weight reduction photon transport LIGHT SOURCES **BIO-FUELS** CONVERSION LED, quantum dots **Catalysts, bioinspired materials** Control the nanosize New highly selective reactions Control the electron-hole Interface reactivity recombination PRIMARY Understand the physical processes NUCLEAR FISSION ENERGIES Prepare new nanomaterials Alloys, ceramic nanocomposites Sun SAVING **CARRIER PRODUCT** Nuclear High temperature stability Wind INSULATION Radiation stability Waves **Nanocomposites** Natural Develop the high specific area ENERGY das ENERGY NUCLEAR FUSION Corrosion resistance Tide Alloys, ceramic nanocomposites Crude oil High temperature stability Precipitation Radiation stability Coal STRONG LIGHT-WEIGHT MATERIALS Geothermics **FOSSIL FUEL CONVERSION** Composites, carbon nanotubes **Catalysts, reactor materials** Suppress the defects In-situ testina Mechanical properties with ultrahigh Structure-function relationships strength STORAGE New stable composites Corrosion resistance TRANSPORTATION Nanosensor coatings Light weight structural materials Advanced microreactors BATTERIES SUPERCAPACITORS H₂ STORAGE **POWER TRANSMISSION** Nano-oxides. interfaces Nanoporous, nanotubes Nanoporous, nanotubes LINES Diffusion and connectivity · Develop higher specific area Understand the H sorption Carbon nanotubes, metal Order-disorder phenomena Increase voltage Develop highly reactive area High scaling of composites Electrode formulation Nanosensors for safety New kinetics of adsorption- Ambient condition stability Electrode formulation · Extension of the interface desorption Coating Ionic and electronic conductivity Electron transport phenomena Porous structure at the nanoscale

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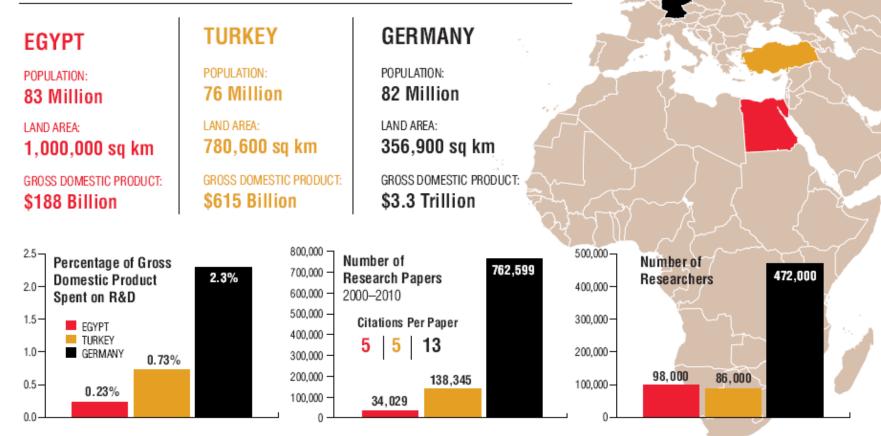
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A Tale of Three Countries Science Magazine, Vol. 333, July 2011

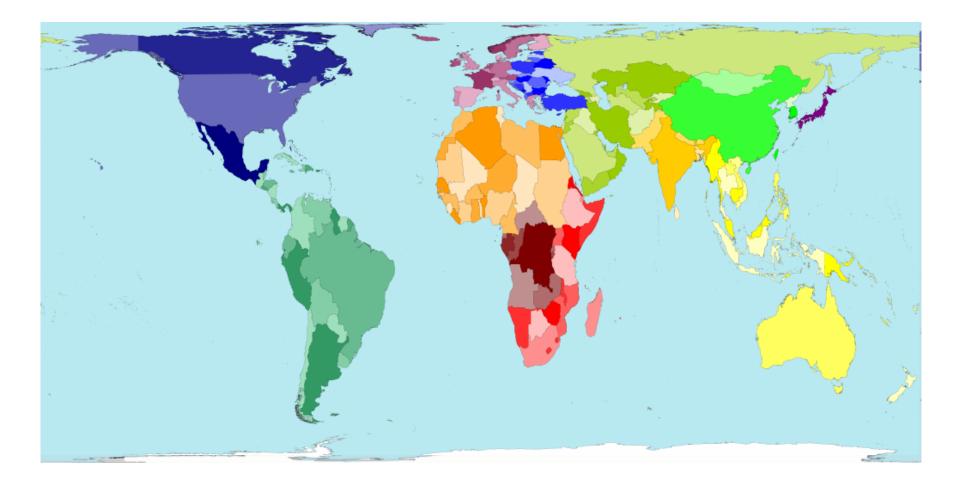


"Basic education is not sufficient to create wealth, to address concerns of food, water and energy security, to provide better health services and better infrastructure. For that, science is required." (Adnan Badran/Moneef Zou'bi)

UNESCO Science Report on Arab States 2010



The knowledge gap between North/South



~80% of all R&D spent by OECD countries another 15% by India, China and the industrialized countries in East Asia only 5% is left for the remaining countries.



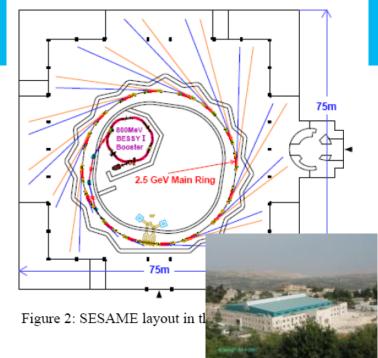
Location of Research Infrastructures for Photon Science





SESAME

- SESAME "Synchrotron-Light for Experimental Science and Applications in the Middle East" in Jordan
- developed under UNESCO auspices and modeled after CERN governance – uniting scientists from the region
- state-of-the-art third generation synchrotron source
 to be operational in ~2014
- > BESSY I as donation from Germany serves as 800 MeV Booster
- > first three planned beamlines
 - protein crystallography
 - X-Ray absorption Fine Structure / Flourescence Spectroscopy
 - IR Beamline



RI as a centre of excellence

- strengthens fundamental research
- capacity building
- seed various research communities
- training/education young scientists
- fosters collaboration in MENA and w/ EU

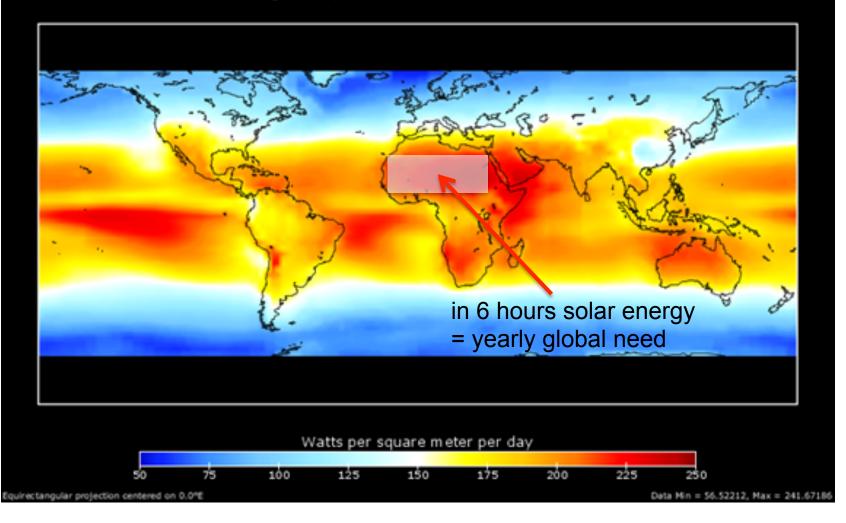
"a quintessential science for peace project" (UNESCO)

Europe should better support it



The Solar Potential in the South

Average Daily Solar Radiation at the Surface



It is like a rain of 160-300 liter oil per m2 per year

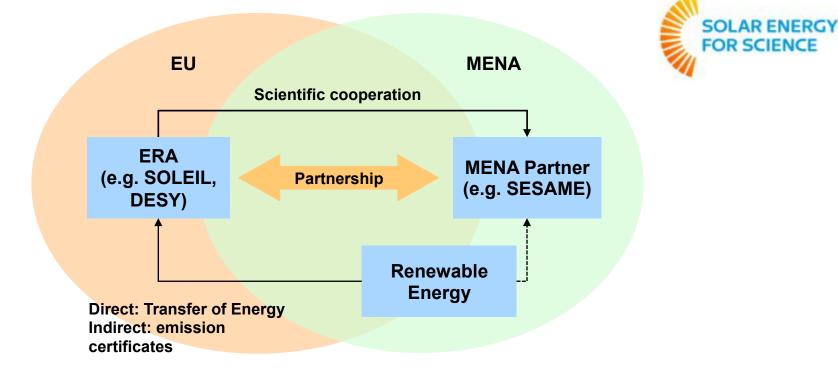


Energizing the MENA Deserts

- Potential win-win situation however, it requires
 - favorable political regulations and conditions (in export-/import countries)
 - upgrade of power grid infrastructure
 - "Capacity building" in MENA
 - more knowledge/science/technology transfer from North to South and jointly coordinated research agendas
- > Proposal: Europe-MENA energy/science partnership
 - understand both regions as common knowledge area for shared interests in energy/water/climate change
 - coupling of sustainable energy supply MENA-EU to knowledge transfer/collaboration



Concept of a joint energy/science partnership



- > Research institutions as "path finders" science building bridges
- Enhance S&T cooperation with MENA partners as stimulus to promote/deploy renewable energies in MENA
- Prospect/Vision for EU-MENA: direct physical transfer of solar energy (via high voltage DC transmission lines)
- Knowledge transfer from north-south energy from south-north as "in-kind" contribution

Symposium Building Bridges – 19/20 May 2011 **DESY - Hamburg**

- Organizers:
 - DESY, Helmut Dosch, Frank Lehner
 - German Aerospace Center DLR, Robert Pitz-Paal
 - in cooperation with Egyptian Academy of Scientific Research, Prof. Dr. Maged El-Sherbiny and SESAME, Prof. Dr. Khaled Toukan
- Patronage: UNESCO
- Chairman of Advisory Board: Prof. Klaus Töpfer
- Topics
 - Climate Change, Renewable Energy and Societal and **Developmental Challenges**
 - Science, Sustainability and Responsibility
 - Solar Energy Projects in MENA and around the world
 - Bridging Solar Energy from MENA to Europe
 - Scientific & Educational Projects in MENA as Anchor Points for Collaboration and Capacity Building
 - Towards a Science / Energy Partnership





SYMPOSIUM 19/20 MAY 2011 DESY HAMBURG GERMANY

www.solar4science.de



Cultural Organization

Natural Sciences Sector





http://www.solar4science.de



250 participants from 30 countries Strong MENA representation Brought together various research communities

Signed DESY-SESAME MoU

Cyprus delegation offered follow-up symposium in December 2012 (under EC presidency)

Press Clipping

The New Hork Eimes



June 20, 2011

Can North Africa Light Up Europe With Concentrated Solar Power?

By LISA FRIEDMAN of

The first in a series.

HAMBURG, Germany -- Twenty-five years after Gerhard Knies conceived of powering Europe with the Sahara Desert's sun, the North Africa Solar project has grown into something considerably more than a mere mirage, but it's still less than a reality.



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Solence and Development Network
News, views and information about science,
technology and the developing world
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NEWS

Middle East desert solar plan criticised

Mićo Tatakwić 20 May 2011 | EN | FR

[HAMBURG] A plan to turn the desert sunshine of the Middle East and North Africa (MENA) into electricity, both for the region and for export to Europe, has been criticised for ignoring the needs of local people and the science community.



Berliner Seitung

Archiv + pros + pa, Mai + Wissenschaft

Textarchiv

Steiniger Wüstenstrom

Auf dem Weg zu Solarkraftwerken in der Sahara gibt es noch zahlreiche technische Probleme zu lösen Frank Grotellischen

Riesige Solarkraftwerke in der Sahara sollen in einigen Jahrzehnten Nordafrika und Teile von Europa mit Strom versorgen. Das ist die Visio Desertec-Projekts. Seit Jahren arbeiten die Pachleute an dem Plan - doc Weg ist holprig.



issues

Nevents

Swap solar energy from the Middle East and North Africa (MENA) for scientific equipment or access to facilities in Burope. Boost the scientific level in the region through exchanges and collaboration. Batablish in Cateo a joint European-MENA solar energy center for research and implementation of mievant technologies. Power the region's scientific facilities with solar everyy.

Boargia Le concep Desette c ale vent en poupe et gagne

de plas en plas de soutien politique

Dish git d'installer

dans les désents d'Afrique du Nord

de l'électritité

des centrales solaires

doct une partie sesait acheminde en Bumpe

Those are among the ideas thats one 250 scientists, policymakers, and others came up with in May at the Solar Energy for Science symposium held at DESY, the Electron Synch rotron labontory in Hamburg, Germany. The atmosphere at thes ymposium "was really unbelievable. It was a festival," says DESY director Helmut Doach. "You'tend to get drunk from the ideas, but see have to find out what is realistic." The symposium was the inaug

Enthusiasm is high for collecting solar energy in the Middle East and North Africa, with some to be exported to Europe. But doing so requires overcom-ing political, social, legal, technical, and financial obstacles. 1/ 12 The Solar Energy for Science symposium in May ritracted 250 attendees from 35 countries. Libya was the only Middle Eastern or North African country not opronentia d

Report And Report

1 1 1

Щедрое солнце Сахары

Deserte: - это план превращения солнениято тепла на пустьен Сенерной Африки и Баконего Востока. нектричество, в переую очередь для мужд арабского нира, а затие и Баролы. Вну был госанцён «Сольныма энергия для науки», процедский в конце нал в Германии, в научное це



о перспективная атовной энергитива, а Гереклика решила акобща от ней отказаться в атключить свои последное АЗС в 2022 году. На ктом фоне акактак вокруг многожилинардного reportera Departer, asservat anyone organizationes. Hecastron en то что волнения в вребском мере, изаелось бы, ставит под актрос саму визножность развития закото месштабного проекта, в работу актемитись крупные научные центры Паросонога. Среде полникается од даряда негисто симписация -DESY, Heavageri experiosevecuel users (D.P. Aragment stywest exchagoaners a teastational Erenna, SESAME (the Synchrotron-light for Experimental Science and Applications in the Modia Hauth a Moplanese. B are pedione yvacraceare Sunce 200 чилових, патал честь из саторых пребыла на стран Африка и Бликонето Постова. В сечестве докладунное выступале чинны Парокомесских, придставлятили различиных международи ортанизаций и жинистирста по экортетики и скрани окруматовций среде, ЮНВСКО, учёные со всего мере, в том исле набалевские лауреаты. Были и куреалисты, каторы: пристающи на сманазнум Оливер Лафиен на Ассоцияцие Information programmer of the second se

Покле траледка на Фудусние екралейские страны задужалесь

To opposite charge analytics, gootherwise appropriate conversional техновыше алектростинциями всего 0,3 процента в фректе саях



Geganicate dalle steam

Arja Haukkasalo

Tutkijat ovat parhaita sillanrakentajia kriisien aikana

Aurinkosähköä Euroopan tarpeisiin Pohjois-Afrikan autiomaa-alueilta

Afrikassa ja Lähi-idässä maissa autinko paistaa 3000 tuntia vuodessa. Keski-Euroopan maissa, kuten Saksassa, tuntimäärä jää tuhariteen. Suomalaiset saavet nauttia yöttömästä yöstä kesällä, muita joutuvet turvautumaan kainovaloon talvalla.

Myös tuuliolosuhteikaan Välimeren rannikon maat ovat ympäri vuoden paremmassa asemassa kuin Keski- ja Pohjoismiskunnan vuoden kulutusta vastaava määrä. Edellä olevaa väitettä toistettiin myös Hampurin aurinkoenergiasymposiumissa toukokuussa 2011.

TIEDETOIMITTAJA 2 / 2011

Hampurin DESY-tutkimusinstituuttissa järjestettyyn kansainväliseen aurinkoenergiasymposiumin kokoontui satopoisto merivedestä vaativat kuitenkin ja aurinkoenergiaan erikoistuneita tutkijoita sekä energiayhtiöiden ja niille tekpaljon sähköä. Sähköä on tuotettu Arabimaissa fossiilisilla polttoaineilla, kosniikkaa toimittavien yritysten edustajia

solar-energy hubs

Temps fort

Scientists help make deserts into

Quand le désert illuminera l'Europe

Contra anticipa I. Bacaretaran Centra

and serve to serve

3

Conclusions

- Uneven spread of knowledge and of solar energy potential between Europe and MENA
- Understand Europe and MENA as a common area to set up a common knowledge base with shared interests in energy/water and climate change mitigation
- > A new energy/science EUMENA partnership
- European RIs should join this initiative ! ERF ! Follow-Up "Buildung Bridges"- Congress, Cyprus 2012

