Arabian Desert Solar Energy Proposal

Feasibility Study
Payoff

Solar Electricity
and
Hydrogen

2010

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Status of Global Resources

Actuality

Oil, gas, coal and uranium will end
in the mid if this century

Action

Investments in solar
electricity and hydrogen

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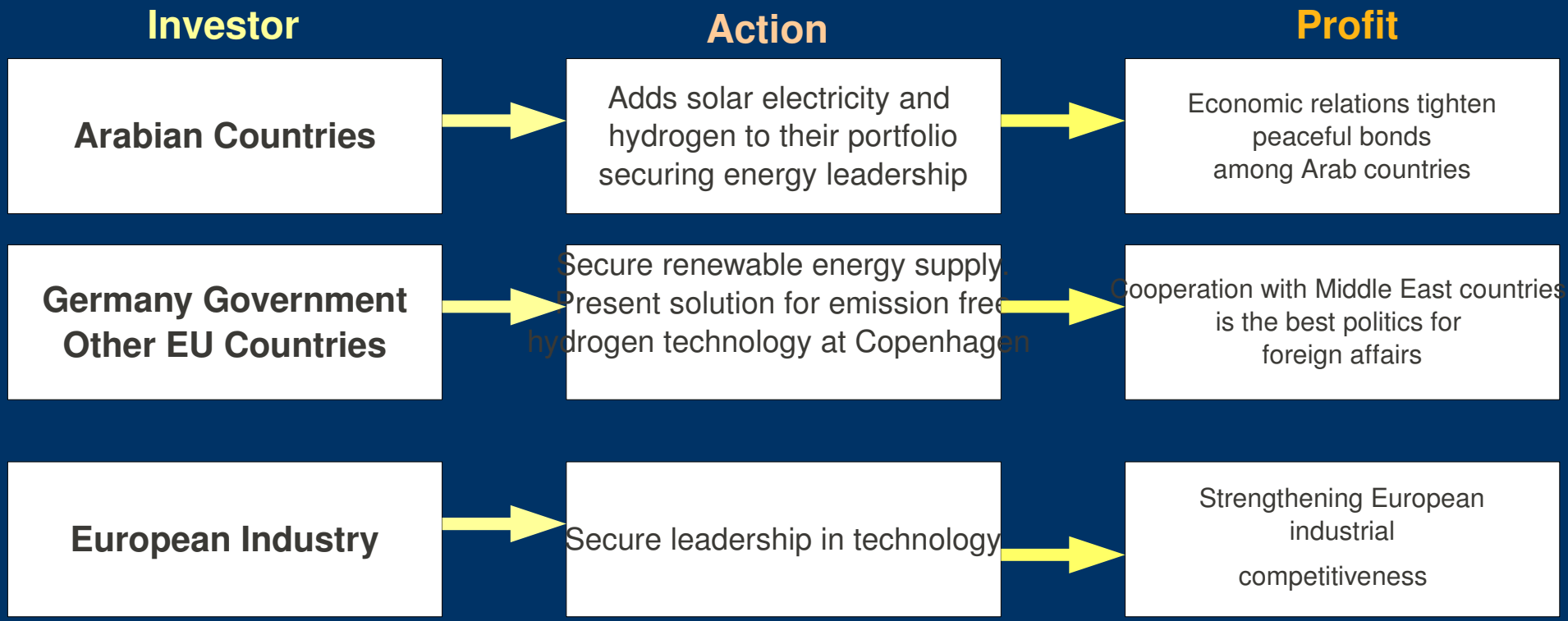
Investing in green energy
Who profits ?



Business is the best solution for Peace **Profit +**

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Why should Germany invest in renewable electricity and hydrogen ?

Electricity Production in Germany

Coal	**45.3 %**
Lignite	23.9 %
Hard Coal	21.4 %
Nuclear Energy	26.4 %
Natural Gas	11.3 %
Crude Oil	0.7 %
Others	16.1 %

German electricity is based on coal rising heavy citizens reactions.
Nuclear power plants will shut down in Germany by 2020.

Solar electricity may be a par of the energy mix

Primary Energy Consumption in Germany

Crude Oil	**37.7 %**	**(Transportation)**
Natural Gas	22.8 %	
Coal	23.9 %	
Lignite	13.0 %	
Hard Coal	10.9 %	
Nuclear Energy	12.6 %	
Renewable Energy and Others	5.0 %	

Traffic is increasing and car makers fail to reduce fuel consumption. Bio fuel is no answer, and E 10 plans were discarded.

Hydrogen cars may become a German contribution for Copenhagen 2009.

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Is Germany the only emission producer ?

Country	% of the world CO2 emission	% of the world energy consume	% of the world population Mio
USA	21 %	20 %	4.6 %
China	18 %	15 %	20.5 %
Russia	5 %	5 %	2.2 %
India	4 %	5 %	17.0 %
Germany	3 %	3 %	1.3 %

- USA is by far the highest polluter and does not cooperate with international climate agreements. It will rely on nuclear proliferation.

- Germany´s rank as polluter is nr. 5. It must present innovations at the UN Conference in Copenhagen 2009.

- The Arabian solar energy project may be a substantial contribution to decisions to be made in Copenhagen in 2009.

What Source of emission may be reduced ?

Source	CO2 Emission
Power plants	25 %
Industry	20 %
Cars/Transport	13 %
Buildings	10 %
Forestry	17 %
Farming	13 %
Others	2 %

- Power plants and cars/transport are main targets of the Arabian solar energy project.

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Who are the main greenhouse gases ?

	Million Tons of carbon equivalent	
Carbon dioxide from fossile fuel combustion	1 547.0 (82 %)	← Solar electricity and hydrogen targets main greenhouse gases
Methane (CH4)	175.8 (9 %)	
Nitrous oxide (N2O)	97.5 (2 %)	
Other Carbon Compounds	30.7 (2 %)	
HFCs, PFCs, FS6	31.4 (2 %)	

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The European Market is eager to accept solar electricity and hydrogen

Production : Consume Balance

Production Million Barrels/day		Consumed Million Barrels/day	
OPEC	35,9	USA	25,5
USA	14,3		
Russia	10,1	Europe	15,3
North Sea (Europe)	4,6	Other Asian States	9,2
Other GUS States	2,7	Pacific Region	8,3
Other not OPEC States	18,1	China	7,5
		Middle East	6,7
Total	85,7	Latin America	5,5
		GUS States	4,0
		Africa	3,1
		Total	85,1

No market because of low fossil fuel price and lacking environment awareness in USA.

High petrol prices. Hydrogen targets greenhouse gases from cars. High environment awareness in Europe.

USA : There is no market for hydrogen because of very low fossil fuel prices and lacking environment awareness.

EUROPE: Very attractive market for solar electricity.
Emerging market for hydrogen to replace 15,3 million barrels/day used mainly as fuel for transportation.
Price of petrol in Europe is threefold the US price.

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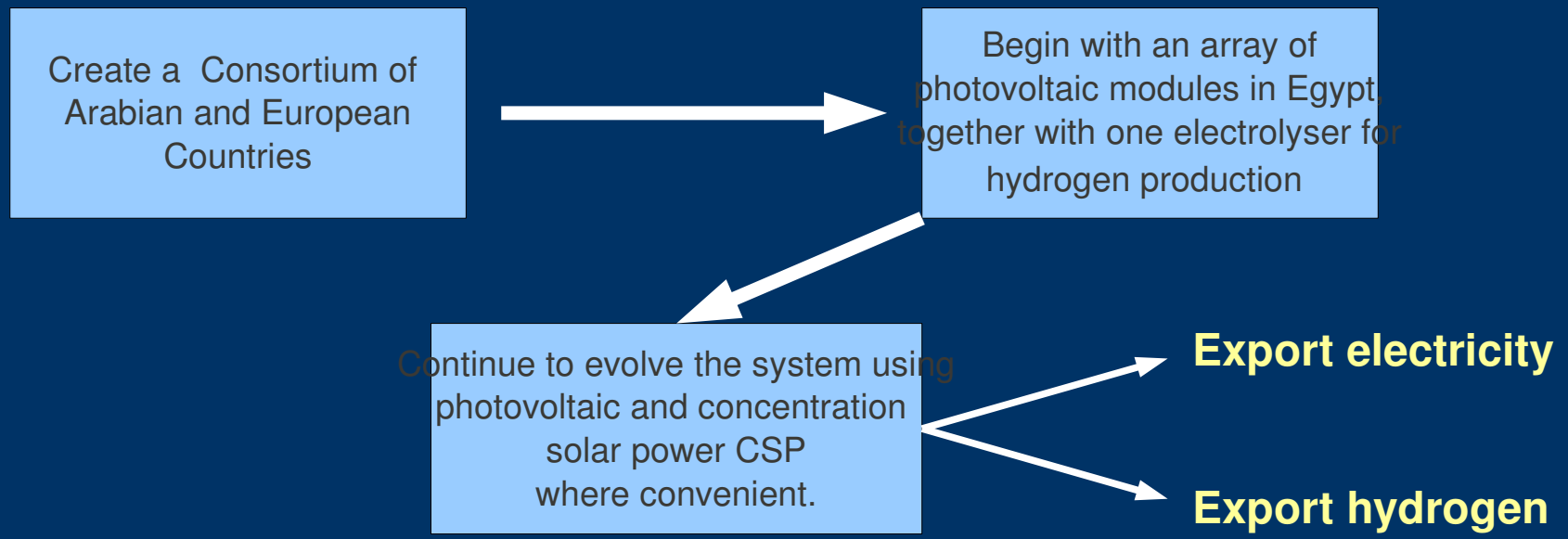
How can immediate results be achieved ?

Photovoltaic arrays can be installed immediately. The system may be increased or reduced as necessary. It produces direct current
which can be used directly by electrolysers and can be transported as such over long distances.

Photovoltaic arrays can be installed anywhere. They do not need water or additional steam and turbines to move an electrical generator. There are no moving parts and no operation personal is necessary.

Photovoltaic is free of trouble, ready to achieve immediate results, even during the installation phase.



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Where to start ?

Start in Egypt
Starting PV arrays and a small production of hydrogen in Egypt, water of the Nile can be used. Hydrogen tanks can be transported by ship to Europe.

Kuwait/Saudi Arabia
From Kuwait to Tabruk PV modules arrays could be best located marked with dots.

Solar electricity is exported to Europe crossing Jordan, Syria and Turkey.

Hydrogen plant will be located in Egypt. Needed current can be supplied by the PV arrays from Kuwait and Saudi Arabia.

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How to introduce a hydrogen economy without infrastructure

Combining solar electricity with hydrogen production, an initial surplus may be maintained to supply a growing market.

Hydrogen economy is not a dream, it is reality !

Of high interest will be the introduction of hydrogen cars in cities like high traffic. Berlin, Hamburg and Norway have already a fleet of hydrogen buses. Berlin will buy another 250 Neoman Hy Buses in 2009.The mineral oil companies Total and Aral and Statoil provide hydrogen refuelling stations. According to Thorsten Wagner from Neoman ""The future will be a mix of natural gas, hydrogen, synthetic fuel and conventional fossil fuels." [1] [2]

BMW develops hydrogen combustion cars, meanwhile other corporations set on fuel cells for their cars. Energy experts from the Wuppertal Institute for Climate, Environment and Energy do not support hydrogen economy on account of the high needed to produce it. The Institute failed to consider the unlimited amount of solar energy of the Arabian deserts. Their arguments are not valid any more. Zero input generates enormous green electricity for electrolysis of water.

Biodiesel in Germany: According to Spiegel Online German soil could yield about 2 million tons of biodiesel every year, however, Germany consumes 130 million tons of petroleum every year. Biodiesel replaces food crops and will never lead to an independence from petroleum. Even its role in the mix of green energy will be modest. [4]

[1]Spiegel Online:Heralding hydrogen economy. Berlin´s brave new world of transport. 22.12.2006
http://www.spiegel.de/international/0,1518,455499,00.html

[2] Green Car Congress: Berlin Transit to buy up to 250 hydrogen buses.
http://www.greencarcongress.com/2006/07/berlin_transit_.html

[3] Spiegel Online: BMW´s Hydrogen 7. Not as green as it seems. 17.11.2006
http://www.spiegel.de/international/spiegel/0,1518,448648,00.html

[4] Spiegel Online: Farming the worlds energy 22.9.2006
http://www.spiegel.de/international/spiegel/0,1518,426736,00.html

- Governments should support the Arabian Consortium.
- Oil industry should invest in the new technology.
- Car-maker do not need to power down their car, because hydrogen as fuel is free of greenhouse gases.

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Who may participate ?

The Kingdom of Saudi Arabia	35 %
The State of Kuwait	20 %
The Emirate of Abu Dhabi	10 %
Qatar	10 %
The Republic of Syria	10 %
The State of Egypt	5 %
Other States, such as Germany and industry	10 %

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Costs and Revenues

	Costs B EUR/25 Y	Income B EUR/25 Y	
1 GWh PV Plant			
30TW at 0.19 EUR/kWh		5.70 B EUR	
45 TWh at 0.07 EUR/kWh		3.15 B EUR	
		8.85 B EUR	8.85 B EUR
Hydrogen Plant			
Hydrogen produced from 500 kWh		9.244 B EUR	
Electricity at 0.07 EUR/kWh	- 2.625 B EUR		
		6.619 B EUR	6.619 B EUR
Investment Costs			
1 GWh PV Plant	-3.000 B EUR		
Hydrogen Plant	-0.375 B EUR		
	-3.375 B EUR		
Net Payout in 25 years			**12 Billion EUR**

The calculated scenario of 1 GWh installation:

500 kWh exported as electricity

500 kWh used for the production of hydrogen

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Germany´s commitment to the Kyoto-Protocol

According to Germanwatch the German government should think about possibilities to send another strong political signal to the global public – just like the British government has done with the Stern review. [1]

The situation in Germany:
- German car maker do not appreciably reduce the fuel consumption of their cars.
- The increase of alcohol in German fuel E10 up to 10% was discarded.
- Bio fuel competes with food crops and harms the environment.
- A number of new coal power plants are being built in Germany.
- The nuclear alliance between England and France, leaves Germany in an energy isolation.

The German delegation will have serious problems to present solutions for a better climate at the Conference at Cancún 2010. Initiating a coopoeration with the Arabian solar electricity and hydrogen economy Germany may take leadership of the European countries introducing solar electricity and hydrogen in its green energy mix.

[1] Germanwatch: Breafing Paper: Bali, Poznan, Copenhagen - Triple Jump Towards a New Quality of Climate Policy (Febr. 2008) http://www.germanwatch.org/klima/bapocoe.htm

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Promoting renewable energy versus cooperating with the new energy economy

Germany subsides photovoltaic electricity with 0.49 EUR / kWh. Paying a price of 0.19 EUR/kWh at EU border would be acceptable for renewable electricity while initiating the new hydrogen economy.

Germanwatch comes to a point writing: “Enhancing energy efficiency, promoting renewable energy and – in case this
path proves its feasibility – CO2 capture and storage from fossil fuel power plants (or from second generation biofuel processes) represent "no-regret" strategies since they help to reach both targets at the same time.

In practice, however, we currently observe boosting investment in the exploration of coal and oil sands and energy production from these sources. This is part of a strategy that plays off energy security against climate security.” [1]

Promoting solar energy from the deserts, European countries, especially Germany may integrate photovoltaic / concentrating solar power CSP energy in their mix of green energy and turn Germany the first country to have transportation based on hydrogen.

[1] Germanwatch: Breafing Paper: Bali, Poznan, Copenhagen - Triple Jump Towards a New Quality of Climate Policy (Febr. 2008)
http://www.germanwatch.org/klima/bapocoe.htm

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Hydrogen driven cars leading to clean fuel

Currently, hydrogen vehicles utilize hydrogen produced from hydrocarbons by steam reforming. The production of the hydrogen creates additional emissions due to input energy based on fossil fuel.

Solar energy from photovoltaic / concentrating solar power CSP from the desert turns the production of hydrogen climate friendly and feasible.

Solar energy is available in enormous amount. There is no input necessary and the output in such an order that calculate effectiveness of the plant is secondary.

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Electric hybrid cars will use hydrogen

Researchers say hybrids vehicles will use hydrogen in near future [1]

Offer and colleagues 2010 reviewed hydrogen fuel cell and battery electric vehicle options for a road transport system and its cost in 2030.
The authors write that hydrogen fuel cell electric vehicles will be important road transport in near future, however, the battery electric vehicle with hydrogen fuel cell range extender is recommended. Technology roadmap may begin with plug-in internal combustion engine hybrids and change then to hydrogen fuel cell extender.

The authors also stress that battery electric and hydrogen fuel cell vehicles should not be regarded as antagonistic, either/or options but that both should be pursued and supported.

[1] Offer GJ, Howey D, Contestabile M, Clague R, Brandon NP: Comparative analysis of battery electric, hydrogen fuel cell and hybrid vehicles in a future sustainable road transport system. Energy Policy Volume 38, Issue 1, January 2010, Pages 24-29 Doi:10.1016/j.enpol.2009.08.040
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Choosing the location for best efficiency of investments

In 2009 Germany installed 10 GigaWatt photovoltaic arrays. In 2010 another 6 to 10 GigaWatt will be added, which nears 21 GigaWatt of nuclear power plants in Germany.

Efficiency of German subsidies for green energy questioned: Each German family will be billed 144 Euro in 2011 for additional costs of green electricity, a total of 3,8 Billion Euro each year. These subventions are payed mainly for photovoltaic electricity in Germany. The efficiency is to be questioned, because Germany has only 1000 hour of sunshine wheras the Arabian deserts account for 3000 hours.

Similar situation is reported from U.S.A, where electricity prices in Ontario are rising caused in part by the Ontario government's Green Energy Act. [2]

Efficiency is a matter of location: Wind farms are efficient in Germany which has strong and steady winds. Subventions for wind farms should be applied there.

Solar energy, however should move to Arabian deserts, such as Kuwait. Applying the subventions of photovoltaic electricity to projects in the sunbelt would increase efficiency of the installed systems an increase the efficiency of the investments. Hydrogen technology may be generated to stabilise the grid and may be used as fuel for transportation.

[1] Stromkunden muessen mit drastischen Aufschlaegen rechnen. Spiegel Online 14.10.2010
http://www.spiegel.de/wirtschaft/soziales/0,1518,723136,00.html

[2] Green Energy Act means Ontario Hydro prices 'going up like a rocket'. Wind Concerns Ontario 8/22/2010.
http://windconcernsontario.wordpress.com/2010/08/22/green-energy-act-means-ontario-hydro-prices-'going-up-like-a-rocket'/

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