The US Energy Initiative

Introduction to the US Energy Initiative

- Financial crisis and climate change control
- Hydrogen for transportation implementation
- Electric grid stabilisation
- Revenues and technical progress
- Immediate results

Index Slides

- **The Signs of the times**

Those who ignore the signs of the times
will be punished by the economic evolution.

Desert Energy Project

Gateway to Disaster

The traditional way to handle it

Very expensive. No effect.
All are losers.

3 Litre cars and up
2,3 g CO2/km

Fossil fuels
nuclear powere

2,5 Litre cars
1,9 g CO2/Km

Energy mix
Biofuel, Efficiency
Energy spare bulbs
Heat pump, Fuel efficient tires

Maintaining Status Quo

Chronology of Disaster

Only 6 month changed the World

Sept 2008
Booming economy
Stability

November 2008
Bank crisis
Wall Street crash
Oil 148 USD/b

February 2009
hundreds of billion
USD rescue for banks
heavy help for car
manufacturers
oil 38 USD/b

Prediction IEA:
In 2013 oil 200 USD
End of Century:
6°C warming

Avoiding Disaster

Only moderate help at start is necessary. Immediate revenues.

Time is running out

3 Litre cars and up
2,3 g CO2/km

Consortium of governments
and private enterprises
and car manufacturers.
Immediate start

1 Litre cars
near zero emission
Solar electricity
from the deserts

Global Agreement
at Climate Conference
Kopenhagen 2009

According to IEA a “decarbonisation” of the world's energy system is needed to avoid "abrupt and irreversible" climate change.

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Actual situation

From 1993 until 2000 United States and the global economy experienced eight years of peace and prosperity.

The following years, from 2001 on, destabilised nations, emission of greenhouse gasses exploded, and worst of all, a financial crisis of unprecedented severity which is getting worse day by day reduced the investments for climate protection.

Real estate market, banks, car makers and related businesses from U.S.A. broke down igniting a global recession.

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Local activities will not be sufficient to counter the global recession and will not cope with the growing demand of renewable energy. A new view of technology and a new view of aesthetics must be found.

The U.S.A., as biggest polluter, must abandon its standpoint that environmental politics is bad for the economy. New hydrogen technology will bring new markets for a starving automotive industry.

There is more than local activities necessary to secure energy supply and keep nature unharmed. New technologies wit immediate results are needed to get the economy back to life.

Immediate results

The Energy Initiative is focused on activities which give immediate results and may be completed in few years. Other power plants take years, when not decades to start their work. It will than be to late.

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Why change to Solar energy/Hydrogen Economy?

The Climate Killers

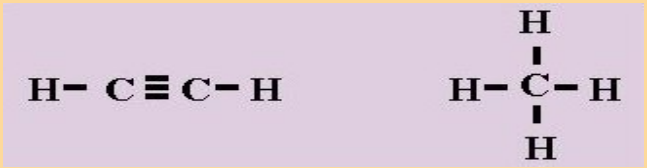
Fossil Energy from Petrol, Coal and Gas

Burning fossil fuel destroys valuable chemical resources the world needs and will rapidly deplete natural stores in a foreseeable time. The climate change due to increasing emission of CO2 by USA, China and India is accelerating the rapid depletion process.

CH3.....CH3 + 8O2 = CO2 + 4H2O +
+ C (soot particles) + Sulphur + SO2 + Ash + Energy

Oil and some Gases

High C:H Density.
High CO2 Emission



Some Gases

Low C:H density.
Reduced CO2 Emission,
but no zero emission.

All devices based on burning carbon compounds including bio alcohol and bio Diesel, should not be encouraged any more.

Solar energy/hydrogen: has zero emission and will boost business.

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The Climate Killers

	Million Metric Tons of Carbon Equivalent	
Carbon dioxide from fossil fuel combustion	1,547.0	(82%)
Methan	175.8	(9%)
Nitrous oxide	97.5	(5%)
Others	31.7	(2%)
HFCs, PFCs, FS6	31.4	(2%)

- **SO2:** Acidifies the soil and sea. Nature is extremely sensitive to PH variations.

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Biofuels result in monoculture and depletion of environment using increased fertilisers and pesticides.

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U.S.A. Position to climate change (2002) [1]

“Addressing global climate change will require a sustained effort, over many generations. My approach recognizes that sustained economic growth is the solution, not the problem - because a nation that grows its economy is a nation that can afford investments in efficiency, new technologies, and a cleaner environment." President George W. Bush February 2002

[1] The White House: Global Climate Change Policy Book. February 2002.
http://www.whitehouse.gov/news/releases/2002/02/climatechange.html

This target was failed. Neither economic growth nor a cleaner environment was attained.

In 2008 its has become eminent that we must act today. This generation has to reverse the depletion process otherwise the damage will not be repaired any more. The primary cause of climate change is the increasing demand for energy. Climate change is caused by the emission of heat-trapping gases - mostly carbon dioxide (CO_2) - from vehicles, industry, power plants and deforestation. Solar energy and hydrogen as fuel is the clean energy source which may be installed as a global system in this generation.

U.S.A. Administration leaves the country and the rest of the world in a deep economic crisis.

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Activities of USA and not Kyoto Protocol supporting countries [1]

Asia Pacific Economic Cooperation (APEC) Declaration on Climate Change

It is flexible and not binding

The 2007 Meeting Sept 9. is a „no action pact“ and was signed by all 21 states, including China. No action before 2012. Start of the Declaration: 2012

APEC targets for 2020

1- Reduction of Energy Intensity: The amount of energy which is needed to produce 1 Dollar product is to be reduced by 25% until 2030. (Cost effective and not climate related. It is not CO2 related.)

2- Forest Plantation: Planting of 20 Mio Hectares to absorb 11% of emitted CO2 by 2020 are planed. (Not feasible , as bio fuel takes land and forests)

[1] APEC leaders set goals on climate change. Many experts dismiss plan, which aims to cut 'energy intensity' 25% by '30. Sept. 8, 2007
http://www.msnbc.msn.com/id/20648432/

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The five biggest climate killers

USA has the highest CO2 emission and energy consume per capita.

Country 2007	% of world CO2 emission	% of World Energy consume	% of 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 has the highest CO2 emission and energy consume . China has lower emission and energy consume as USA, but a five fold population to live from.

The emission and how to avoid it

	CO2 emissic	Suggested remedy
Power plants	25%	PV, ISCC electricity for daytime integrated in a mix of fossil/wind energy
Industry	20%	Integration of solar energy to reduce costs
Cars / transport	13%	Hydrogen – cars
Buildings	10%	Solar energy, windmills and hydroelectic
Forestry	17%	Electricity and fuel from solar energy.
Farming	13%	Use of hydrogen as fuel for tractors and machines
Others	2%	Use of electricity and/or hydrogen as fuel

Air traffic must be reduced to a minimum because emission cannot be influenced decisively.

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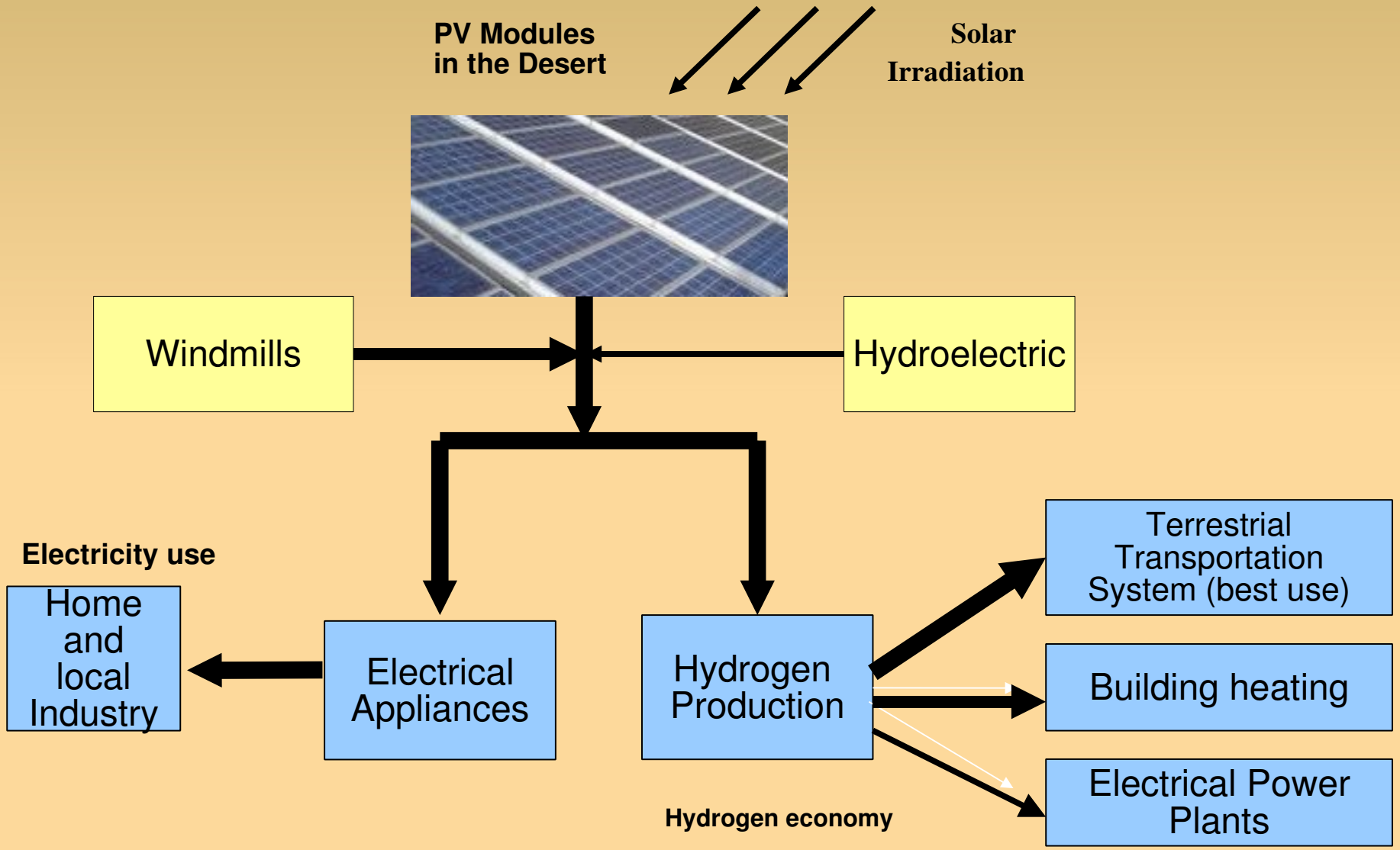

- Solar energy, Windmills and Hydroelectric provide clean energy for the whole world.

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Payback of Energy Consumed during Production of PV modules [1]

The IEA says that the payback of the energy consumed during the production of the modules will be realized within three to four years, considering the high levels of solar irradiation from deserts.

Emission from production of PV modules can further be reduced to near zero by using the solar energy generated in the earth´s sun belt.

[1] IEA Photovoltaic Power Systems Program: Basics of PV: Environmental Considerations.
http://www.iea-pvps.org/pv/index.htm

Environment [2]

If photovoltaics are located where photosynthesising plants would normally grow, they simply substitute one potentially renewable resource (Biomass) for another.

Solar energy does not compete with plants in desert zones and does not harm environment so as it would do in vegetated regions.

[2] Wikipedia: Photovoltaics
http://en.wikipedia.org/wiki/Photovoltaic

Hydrogen Source

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 farms from the desert turns the production of hydrogen so inexpensive that the introduction will be feasible and emission can be reduced near zero.

Hydrogen Combustion Engine

The common internal combustion engine, usually fuelled with gasoline (petrol) or diesel liquids, can be converted to run on gaseous hydrogen. BMW has cars with combustion engines which use hydrogen and change to gasoline when no hydrogen refilling station is on the route. This is the perfect solution during the buiding of the hydrogen infrastructure. Fuel cells and electric motors and researches on metal hydrides and compression are promising fields.

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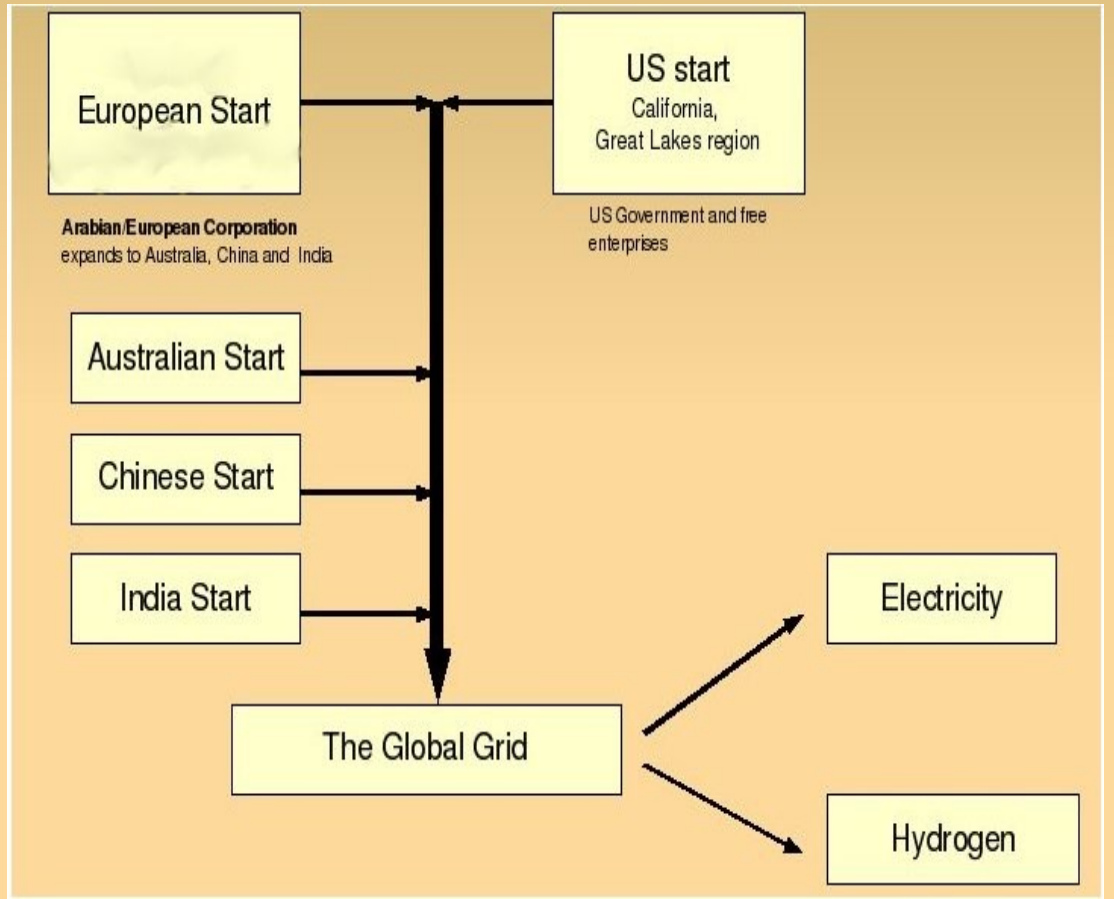
Hydrogen produced by electrolysis of water using solar energy brings global prosperity



Hydrogen Market

Hydrogen as fuel for transportation is a new market niche in USA and Europe. The inexpensive solar electricity from the desert can open this market niche for USA to widen its energy portfolio fit for generations to come.

Hydrogen can reduce the burden of traffic emission in crowded regions. It is where tighter regulations will force the move to a partial replacement of traditional fuel with hydrogen.

Air traffic

The market of jet fuel will remain unaltered strong as there is no alternative for kerosene.

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The standard hydrogen engines

Two hydrogen internal combustion engines with twin intake of hydrogen/gasoline should be promoted as standard equipment of American cars:

46kW (63 PS) with 1 litre (1.060 ccm) displacement.

55,2 kW (75 PS) with 1,2 Litre (1.248 ccm) displacement.

Cars equipped with hydrogen engines between 46 kW and 55,2 kW should be free of all taxes. Production made in cooperation between all US car manufacturers will reduce price. There will be no distortion of the market with additional subventions of the Government when all car manufacturers can buy the standard engines at the same price.

All car models may retain individual bodywork maintaining a diversified market with two standard engines. All models may also be presented with engines of the conventional engines of the market, regardles to their spezifications, but they will keep the present taxes and will not profit of the subventions. This keeps the openfree market.

Other long-term vision of sustainable energy systems using of a mix of different variety of energy forms postpone decisions which have to be made today.

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Summary

Solar energy from the deserts is the gift of nature which may supply energy for whole world. Together with wind turbines and hydro-electric power, integrated in a global grid, clean energy may be available around the globe.
Hydrogen obtained by electrolysing water is the fuel for transportation of the future.

The modular planing of the system allow small local starts to grow easily. The production of hydrogen can be started on demand. Distribution of hydrogen may be made using recyclable portable tanks being distributed to the petrol stations. Later on
hydrogen may be produced at the petrol station with their own equipment, using electricity from the grid.

U.S.A. Is in a good position to produce solar electricity and hydrogen from its deserts of California and hydro-electric power from the Great Lakes region. Other local starts in Africa,such as the EU Desertec project and isolated activities in the Middle East, are capable to supply the US and Europe with solar electricity and hydrogen. Other important local sites are Australia, India and China which may be united with a global grid according to Fuller.

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Who may Profit from the hydrogen economy?

Car makers: The companies which introduce the hydrogen technology will be leading the world market of cars.

Energy providers: It will be an improvement of their energy portfolio. Investments will be considerably less than drilling for oil.

Improving employment: The whole economy of countries engaged with Solar energy and hydrogen production will have a beneficial impact on job security and wealth from the revenues.

Governments: All governments may profit from a proposal of this global initiative in the decisions of the United Nations Climate Change Conference in Copenhagen in 30. November – 11. December 2009

Who must be on start?

Europe, due to its high energy prices, its high population density and its location near to the deserts of Africa is economically and regional structure is predestinated for an early start.

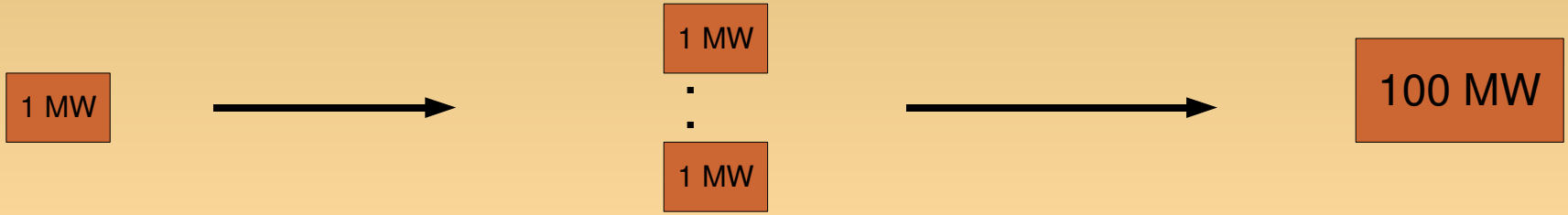
U.S.A., the biggest CO2 emitter, relies on cheap coal and low petrol prices. It missed to adapt its policy to an ever changing global market. The necessary changes must be crucial, but they bear a huge economical chance to feed the market with new cars and a new infrastructure.

- **Technical Study**

The US Energy Initiative

Technical Study

Modular Buildup



First Unit of 1 MW

5.556 modules Type 180
130 X 130 Metres area covered

Cost whole construction USD

Modules	2.300,000
1 Electrolyser	1.027,000
Planning	250,000
Inverters	600,000
Building	123,000
Construction	820,000
Total USD	**5,120,000**

More Units of 1 MW added focussed on final 100 MW

Final 100 MW

555.600 modules Type 180
1,3 X 1,3 Km area covered

Cost whole construction USD

Modules	230,000,000
45 Electrolysers	36.972,000
Planning	500,000
Inverters	49,200,000
Building	2,400,000
Construction	75,000,000
Total USD	**394,072,000**

The price of a single PV module is 3.70 EUR/Watt. Bulk discount of 20% is attainable depending of the dimension of the system, therefore 3,00 EUR/W was used here

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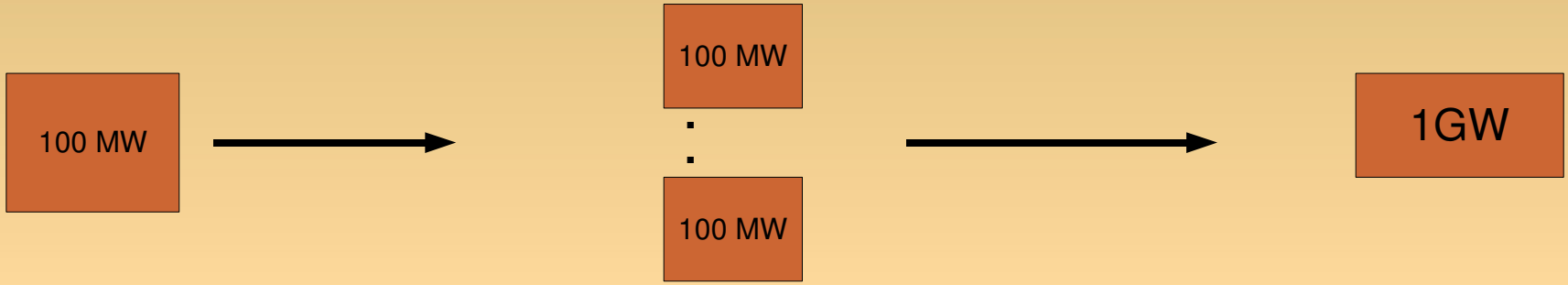
Technical Study

Modular Buildup



First Unit of 100 MW

Total USD 394,072,000

More Units of 100 MW added focussed on final 1 GW

Final 1 GW

555.600 modules Type 180

1,3 X 1,3 Km area covered

Cost whole construction USD

Modules	2,300,000,000
450 Electrolysers	369,720,000
Transmission	680,000,000
Planning	500,000
Inverters	60,300,000
Building	20,000,000
Construction	530,000,000
Total USD	**3,960,520,000**

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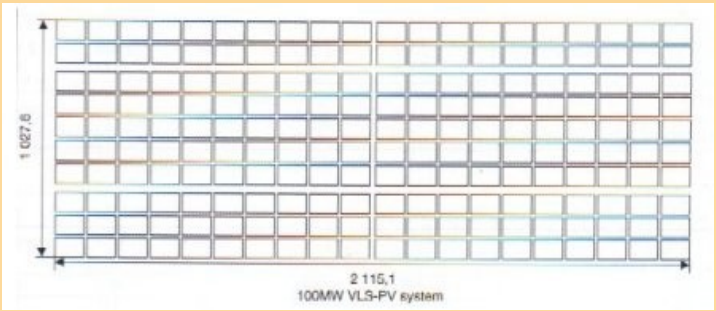
Technical Study

100 MW Photovoltaic System

Phase 1 of the project consists of the construction of a 100 MW photovoltaic power plant.
800.000 PV modules with 125 W/h capacity will be linked in 4 units, each consisting of 200 subunits which consist of 4000 PV cells. The area needed is 2.4 km² (2.1 X 1.1 km). The Number of modules may vary according to the type being used.



Evolving to 1 GigaWatt System

Phase 2, 3 and 4: To complete 1 GigaWatt System nine 100 MW blocks will be added. Transmission cable to Europe from Phase 1 may be used for the initial HVDC line.

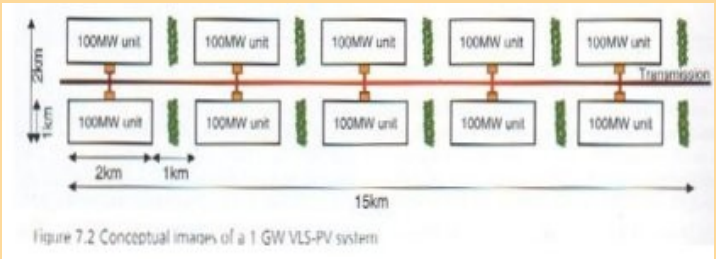
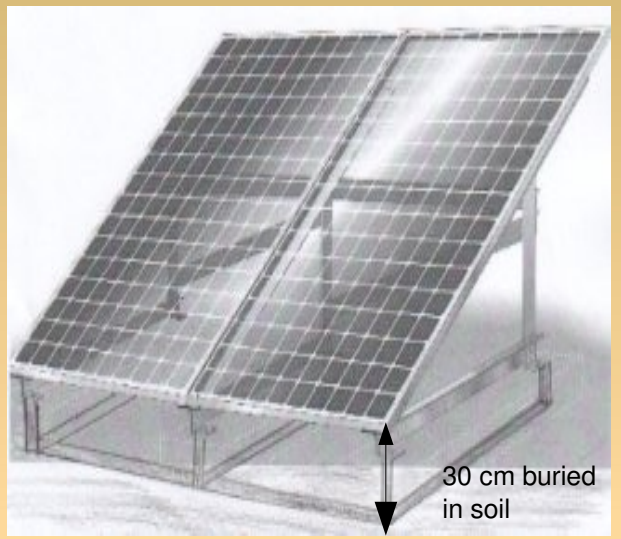


Figure 7.2 Conceptual images of a 1 GW VLS-PV system

Mounting of PV Modules

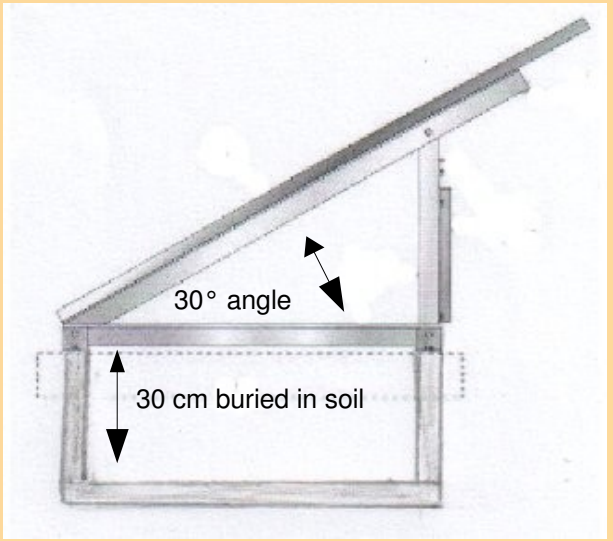
Modules must be mounted in an angle of 30°. Squared metal construction, buried 30 cm deep provide the support of the PV module mountings. This avoids extensive concrete devices as basis.

To improve efficiency structured modules are being developed improving light absorbance at large angles of incidence.



No tracking device is used to avoid failure of moving parts, additional fixation volume and high investment. Sun tracking provides an increase of efficiency of 30% but causes failure of the system and requires continuous maintenance of skilled personal. Tracking devices are thus recommended where available area is very limited.

In extensive deserts a maintenance and failure free device without moving parts are essential. Fixed mountings are thus strongly recommended.



Electrolyzer

One electrolyser type 485 NM³ may be installed for test production of hydrogen. A total of 450 electrolyzer complete the whole project. All units can be added as needed because of a modular concept which insures perfect customisation and orientation on market demands.

Initial tests may be performed in arid region. Water may be supplied by tank truck. Main production should, however take place in the proximity of a river.

Hydrogen: 100 MWatt/h produces 23.255 Nm³ of Hydrogen/hour equivalent to 9.299litres (2,431 US Gallon) gasoline/hour.

Hydrogen Transport and filling stations

Hydrogen will be transported in multi-way tanks which can be delivered to gas stations in recycling modus. Bulk transport of these tanks in standard containers which may be mowed on road and on sea. Local production at petrol stations using electricity from the grid may complete the project.

Hydrogen car, how it works

Volkswagen

VW “space up!”

One charge of the lithium-ion batteries brings a range of 100 kilometres. With the hydrogen E-cell drive additional 300 kilometres are available to reach the next hydrogen refill station.
Hydrogen technology is independent of long battery recharging. Battery weighing 180 kg may be substantially reduced , using hydrogen power instead.

BMW

BMW relies on combustion engine which uses hydrogen and switches to petrol in case no hydrogen filling station is reached. The change from hydrogen to petrol happens automatically. BMW aims to reach a fuel efficiency of one kilogram of hydrogen for 100 kilometres.

Ford

Ford announced that it will equip its C-Max model which an hydrogen-combustion engine, as an intermediate step on the way to the fuel-cell. Ford technology uses three tanks with a total volume of 119 litres. Very high compression of the gas enables the car to drive 200 kilometres with one filling. In Berlin Ford hydrogen cars are using the fuel-cell technology.

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The Start of the System

A good location for a PV array is the desert of the West and hydroelectric from the great lakes. Direct Current from the PV arrays can be transported anywhere by HVDC line,

When the system evolves to 1 Giga Watt, and up, electrolysers should be located in proximity of a river.

Water consumption: 0,9 litre demin. water is needed for the production of 1 Nm^3 Hydrogen.

100 MW system: consumes approximately 21.000 litres water/hour.

1 GW plant: consumes around 2 000 Tons of water/d. Gasoline equivalent: 920 000 litres (243,000 Gallons). Considering variations of weather conditions equivalence of 500 000 litres may be assumed as average days production of hydrogen.

HVDC overhead line

Transportation will be achieved using High Voltage Direct Current (HVDC) lines.

The overhead transmission line of 2 500 km will interconnect the different blocs and transmit high direct current to where it is needed.

The start of the project may omit the long distance lines and use the produced energy for local distribution and start of the hydrogen production meanwhile the transmission line is being constructed.

Underground line will only be used in sensitive areas.

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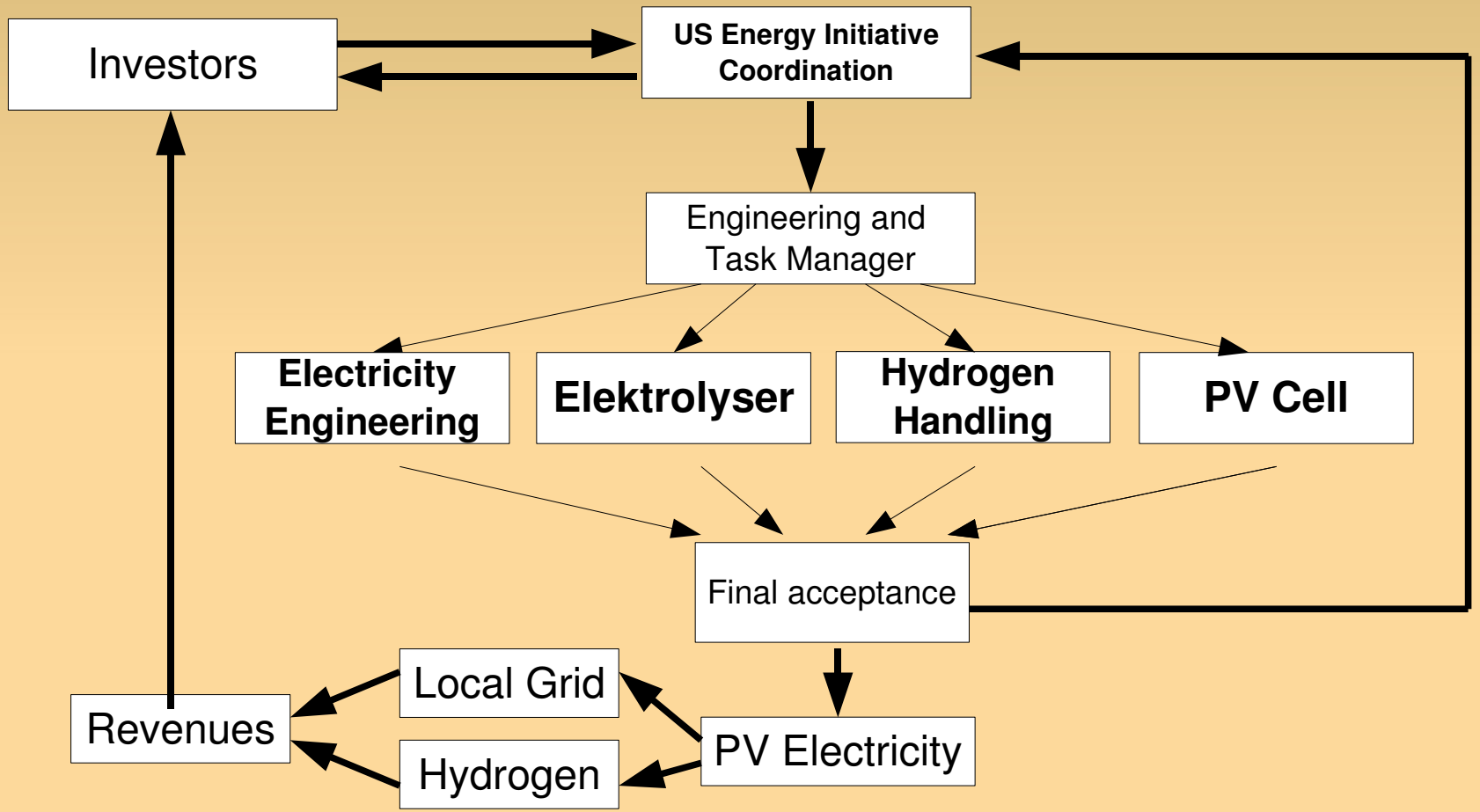
Task Flowchart



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Conversion Factors

1 Nm³H2 = 4.30 KWh
1 KWh = 0.233Nm³H2
1 Kwh = 0.349 Gallon gasoline
1 Nm³ H2 = 0.34 litre gasoline
1 US Gallon = 3.785 litre
1 US Gallon Kerosene = 3.092 Kg
Density of Kerosene = 0.817
Density of gasoline vehicle = 0.737
Density H2 = 0.0899 Kg/Nm³
1 kWh = 0.092 litre gasoline
1 Litre H2 liquid = 0.27 litre gasoline
1 Kg H2 = 2.75 Kg gasoline
0,9 litre water = 1 Nm³ hydrogen
10 hours sunshine/day 300 days/Year

Hydrogen Data: http://www.h2data.de/

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- **FINANCING**

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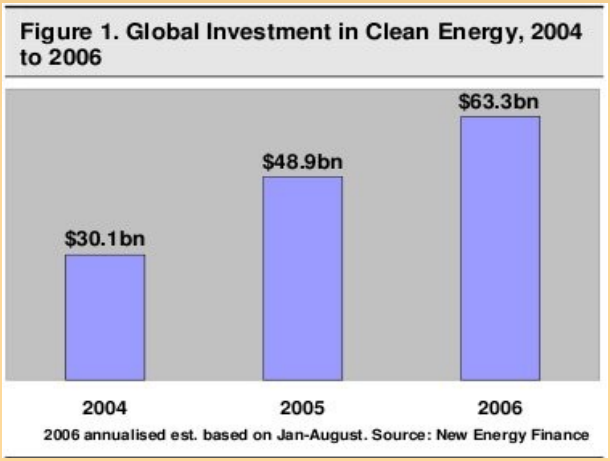
Financing

Prosperous clean energy investment means:

- **Investing in the right tool for the right business**
- **Investing at the right location**
- **Investing in a field not already dominated by established corporations**



Source: New Energy Finance: Global Clean Energy. Investment Overview. Trends and Issues in the Financing of Renewable. Energy and Low-Carbon Technology. Prepared for the Clinton Global Initiative. New York, 20-22 September 2006. http://www.clintonglobalinitiative.org/NETCOMMUNITY/Document.Doc?&id=42

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Choosing the right tool

Wind Turbines

Technically very complicated. Many troubles are known.
Three bladed, upwind, horizontal axis machines, typically larger than 1 MW capacity.

The rotational energy is transferred through a gearbox to a generator, where it is converted into electricity. There are about 19 separate components for the wind turbine.

When the wind blows over 60 mph the mechanism turns 90 degrees from prevailing winds to reduce stress on internal components and to prevent stalling due to over-speed conditions.

Cost / MW	**123,000 USD**
100 MWWind Capacity	**12,300,000 USD**

Difficult construction
Based on moving parts
No location change possible

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Choosing the right tool

Solar-Thermal Plants

According to New Energy Finance:

50 MW Solar-Thermal Plant costs $24.4 Million [1]

8.9 GW Solar-Thermal Plants costs $ 28.5 Billions [1]

- Very long planing and construction time.
- Very sophisticated tracking system and heavy concrete foundations needed.
- Steam turbine as core of the system

[1] Giant Mirrors Tap Sun, Subsidies in Europe's Clean Power Bid. Blomberg. 24.09.2008.
http://www.bloomberg.com/apps/news?pid=20601109&sid=aESker8lE5B4&refer=e

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Choosing the right tool

PV Cells

For dependable, maintenance-free very large photovoltaic array monochystalline silicon cells are recommended. This technology is mature and present best performance under desert conditions.

Price/Watt = $4.75 (Price subjected to variations)
The price is decreasing rapidly and thin layer modules establishes new lows.

Alternatives

Other PV cell innovations

The innovations are not the best solution for desert environment. Some are
- si Microamorphous silicon thin film
CDETE Cadmium telluride
CIGS Copper indium gallium diselenide
Flexible
Thin-film solar cells are are inexpensive alternatives.

Metallurgical grade silicon

CaliSolar developed less expensive solar cells using “dirty” metallurgical grade silicon. Upgraded Metallurgical Silicon (UMG Si) is substantially less expensive than the electronic grade silicon usually used to make solar cells. Not on market yet.

SolarConcentrators

Solar concentrators can lower the overall cost of solar power by making it possible to use much smaller cells.

SolFocus Concentrator PV Panels

Small mirrors focus sunlight to a small PV element in the focus of the mirror. Efficiency rises from 14% in silicon modules to 40,6% in Sol Focus panels. Suntracking is however necessary. This increases total costs enormously.

High temperature electrolysis of water [1]

According to Dr. Günter Schiller from the German DLR the electrolysis of water at the present is madeat 80 to 100°C. High temperature electrolysis at 800°C reduces the voltage from 2V down to 1.3 to 1.4Volts. This leads to an enormous reduction of energy needed by the system.

[1] Die Brennstoffzelle - DLR-Beteiligung beim internationalen Fachforum "f-cell" am 24. und 25. September in Stuttgart 21. September 2007
http://www.dlr.de/desktopdefault.aspx/tabid-837/1344_read-10523/

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Financing

- Four financing modalities

Four system dimensions are suggested.
Each one is calculate isolated, not modular.
One Giga Watt system modular build is shown under IV.

Capacity	Planing expertises	PV Modules $2,30/W cost	Construction and supplements	Building	Inverters	Electrolysers Units	Electrolysers	2,500 Km HVDC grid	Cost Sum USD
1 MW	250,000	2,300,000	820,000	123,000	600,000	1	1,027,000		5,120,000
10 MW	250,000	23,000,000	8,200,000	308,000	6,000,000	4	4,108,000		41,866,000
100 MW	500,000	230,000,000	75,000,000	2,400,000	49,200,000	45	36,972,000		394,072,000
1 GW	500,000	2,300,000,000	530,000,000	20,000,000	60,300,000	450	369,720,000	680,000,000	3,960,520,000
next 1GW	500,000	2,300,000,000	720,000,000	20,000,000		900	739,440,000		3,779,940,000

Yield forecast

Capacity	Investment USD	50% H2 Gasoline Eqiv. Gallon/10 hrs/d 300 days/year	50% local Electricity use KW 10 hrs/day 300 day/year	Years to pay Investment Gasol $2,20/Gal KW USD 0,10	Total revenues In 25 years Gasol $2,20/Gal KW USD 0,10	Carry an interest /year %
1 MW	5,120,000	36,460	1,500,000	22,2	635,284	0,50
10 MW	41,866,000	364,597	15,000,000	18,2	15,686,840	1,50
100MW	394,072,000	3,645,971	150,000,000	17,1	181,456,402	1,84
1 GW	3,960,520,000	36,459,709	1,500,000,000	17,2	1,794,764,016	1,81
		100% H2				
1 GW	3,779,940,000	72,919,419		23,6	230,628,032	0,24

Suggested system I to III:
From 1 to 100MW 50% for H2 and 50% for local use.
No HVDC cable

System IV 1 GW 50% for H2 and export + HVDC cable to Grid
System V 1 GW 50% for H2 and export + HVDC cable to Grid

(100% electricity used for hydrogen)

- The price of PV module is $ 4.75 /Watt.
Bulk discount of 20% is attainable depending of the dimension of the system, therefore $3.8 was used.
- All monetary conversions are subjected to changes

The US Energy Initiative

Financing

- Emerging market for hydrogen

  Norway and Germany are strongly engaged to build an infrastructure for Hydrogen cars.

German National Development Plan for the “Hydrogen and Fuel Cell Technology Innovation Programme”
http://www.now-gmbh.de/uploads/media/Developmentplan_02.pdf

Renewable Energy made in Germany
http://www.german-renewable-energy.com/Renewables/Navigation/Englisch/solar-power,did=109916.html

Federal Ministry of Economics and Technology, Germany

Contact: RD Böhler
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European Union and German Industry: Project Zero Regio

Established the hydrogen infrastructure, the Hydrogen Ionic Compressor 900 bar and filling stations by Hoechst, Germany

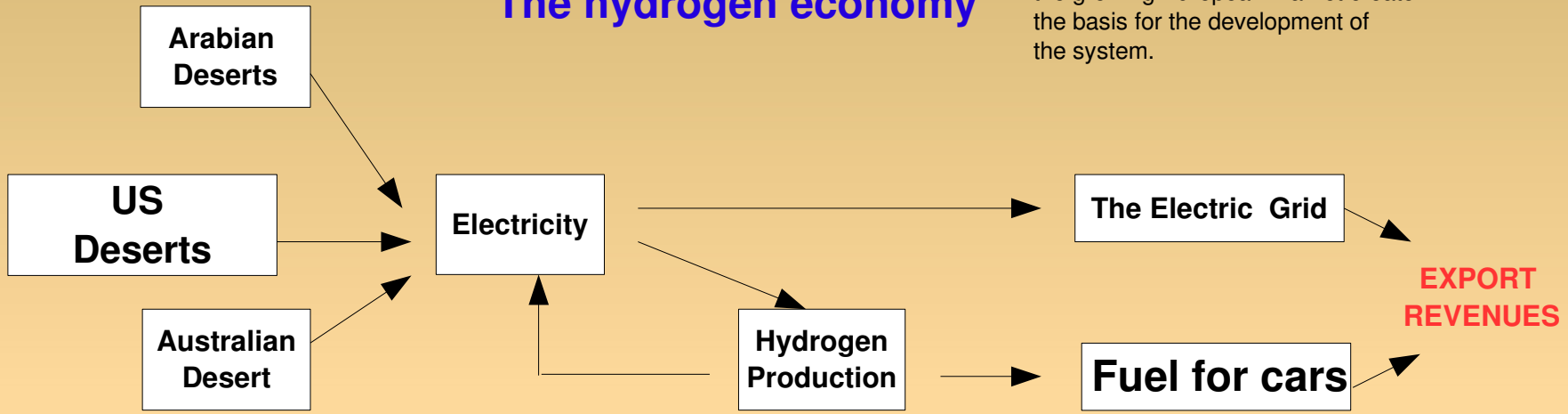
http://www.zeroregio.com/front_content.php?idcat=185

The US Energy Initiative

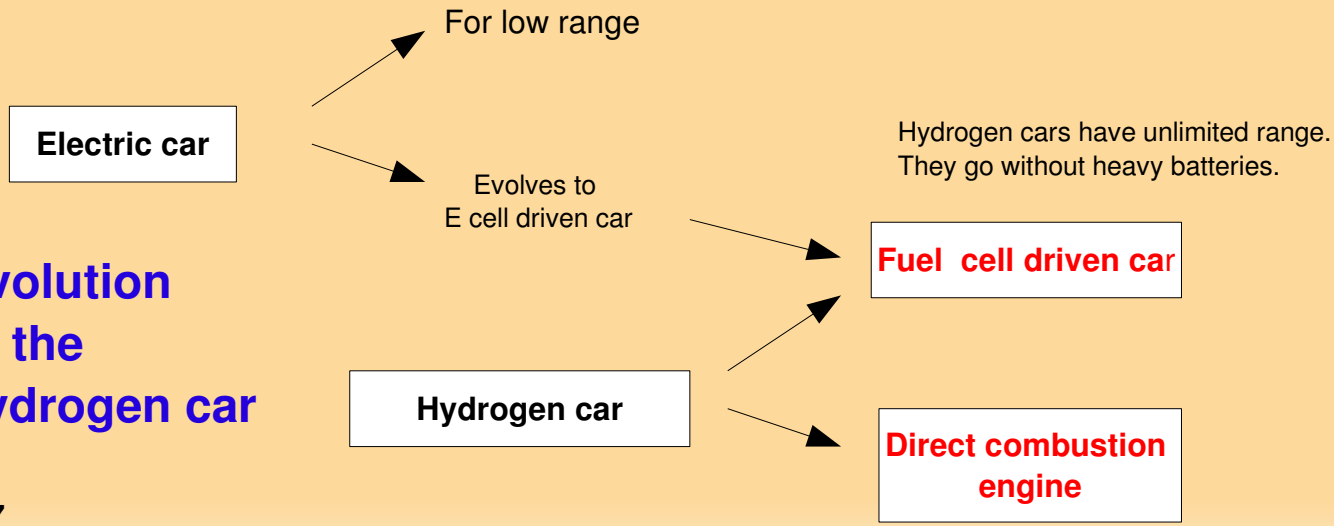
Financing

The hydrogen economy

Electricity and hydrogen export to the growing European market create the basis for the development of the system.



Evolution of the hydrogen car



The US Energy Initiative

Financing

Suggested Investment Start

1 MW Plant USD 5,1 Mio

The start

- We suggest to start with the System of 1 MW which includes one electrolyser.

The system can be quickly expanded on a modular basis to 100 MW (Investment of USD 405 Million).

Investment security

-The Photovoltaic start presents the highest level of investment security, because all parts may be easily resold should the holding be dissolved. This is a valuable argument for a no-risk start with PV arrays. Other energy investments leave a lot of ruins behind in case of an insolvency such as nuclear plants or steam power plants.

Location

- Initial location in California and the Great Lake region is strongly recommended

Potential customers of hydrogen: Shell, Aral Germany, Agip (Italy), Höchst, (Germany) Statoil (Norway), Air Liquide (France)

Potential customers of solar electricity: Vattenfal, EWE, RWE and other suppliers of clean electricity.

Interested Governments: German Government and the European Commission are strongly promoting clean energy and clean transportation fuel.

The US Energy Initiative

how to put it into action

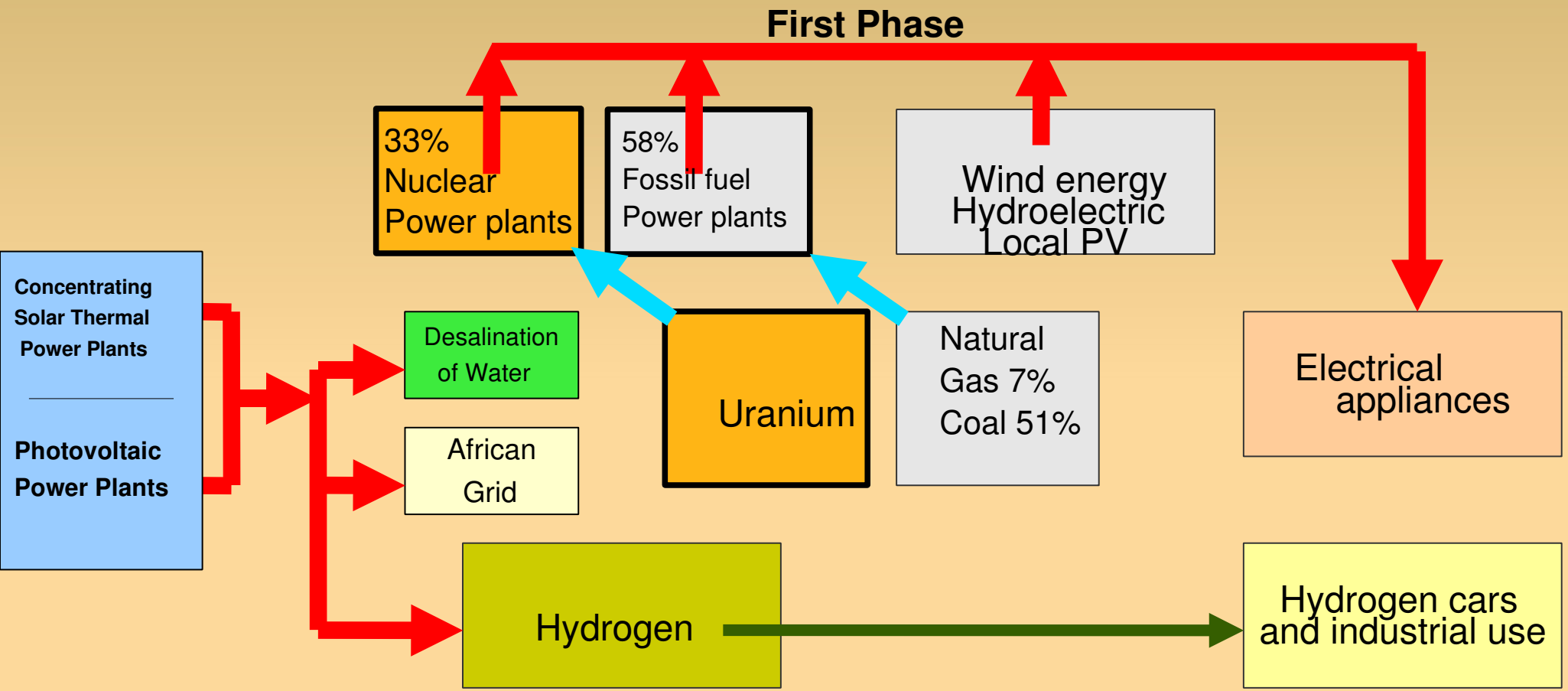
- **Looking forward**

As the system increases, the investment costs will substantially reduce due to better conditions in material buying.

After consolidation of the initial phase, solar thermal power plants may be integrated in the system. The initial start should, however be made with PV arrays because it is trouble-free, generates immediate outcomes and requires no maintenance.

The US Energy Initiative

how to put it into action

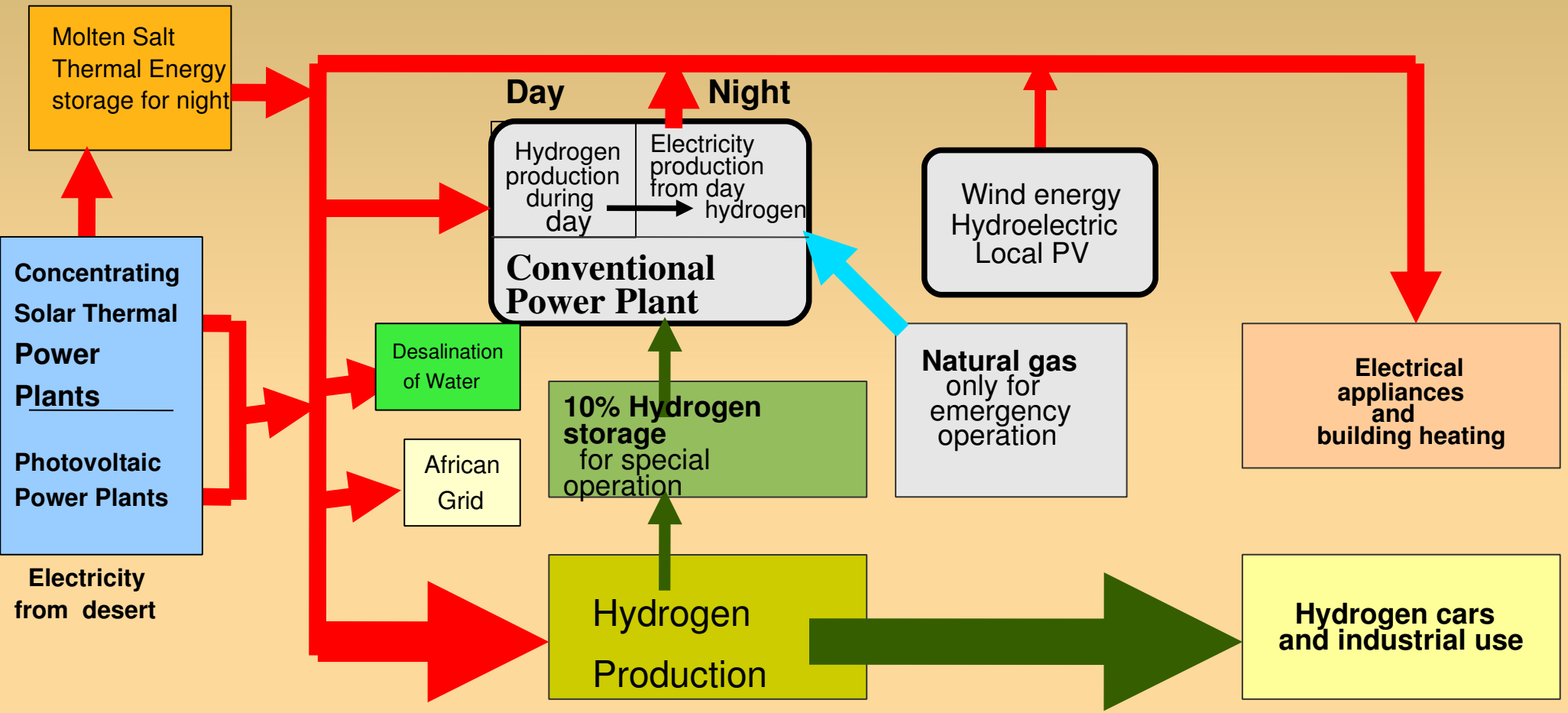


First Phase, start: The Project may begin in Africa/ Arabian Peninsula with the installation of a photovoltaic array and production of Hydrogen as fuel for cars during the construction phase of a superconducting grid to Europe.

Source:: *Science* 1 Nov. 2002: Vol. 298. no. 5595, pp. 981 - 987
DOI: 10.1126/science.1072357

The US Energy Initiative

how to put it into action



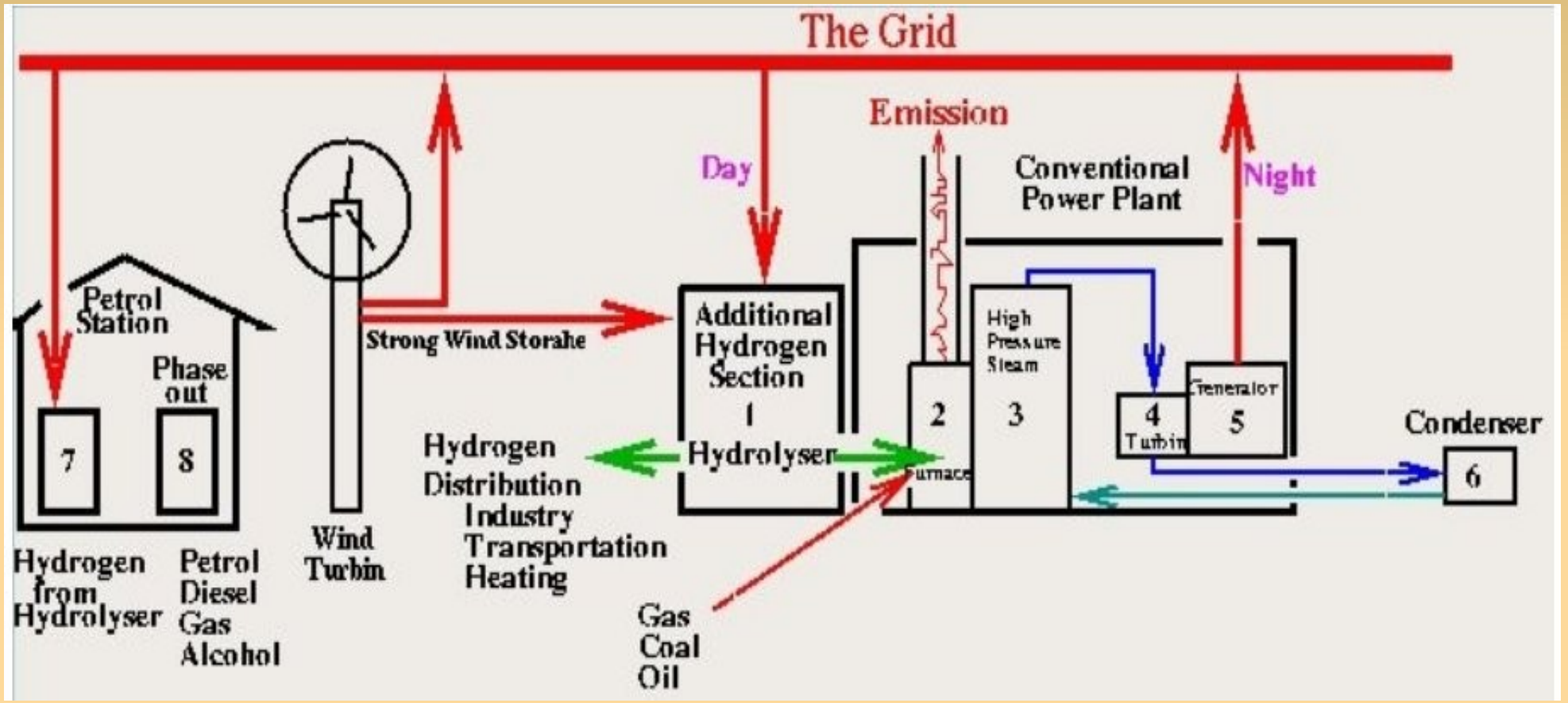
First Phase completed: Electricity from solar energy feeds the European electrical grid. During daytime the power plants accumulate energy at their plants by thermal storage and hydrolysing water . The daytime storage of heat and/or hydrogen can be used to feed the grid during the night.

Source:: *Science* 1 Nov. 2002: Vol. 298. no. 5595, pp. 981 – 987 DOI: 10.1126/science.1072357

The US Energy Initiative

how to put it into action

Storage of wind energy as hydrogen, and use as fuel for transportation



1. Hydrogen Hydrolysis
2. Furnace of Power Plant
3. High Pressure Steam
4. Turbin
5. Generator
6. Condenser
7. Hydrogen Electrolyser at Local Petrol Station
8. Phase-out of Carbon Based Fuel

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how to put it into action

First Phase

Daytime operation

During Sunshine hours there will be energy available to feed the European grid and to produce hydrogen in different European locations to provide fuel for cars.
Conventional power plants must be equipped with hydrogen production and storage facilities. The power plants produce hydrogen and no electricity during the day.

Night operation

At night solar thermal power plants use the stored heat and the conventional power plants use the hydrogen from the day as fuel to feed the grid.

Special operation

In emergencies the power plants can use natural gas. A 10% storage of hydrogen will be available for adverse weather condition or sand storms for long periods which cannot be bridged by thermal storage.

Hydrogen the solution to store energy for stable energy supplies

Storing solar energy during daytime as hydrogen at the power stations, right there where it is needed at night.

Wind Energy storage

Storing wind energy as hydrogen is the best way to cope to much energy from strong wind or to compensate for dead calm. Utsira a model for renewable energy and hydrogen economy.
Surplus power from the windmills goes to production of hydrogen, which is stored and used as fuel for a generator.
The full story:

http://www.guardian.co.uk/science/2005/jun/16/environment.society1
https://www.hfpeurope.org/uploads/699/808/UTSIRA.pdf

The US Energy Initiative

how to put it into action

The Energy Solution Roadmap

Contracting Phase

The initial Partners	Duration	Completion
Invitation and Contract Phase	**6 Month**	**July 2009**
Invitation and Contract Phase		
Oil and Gas Companies		
Power Plant Carriers		
PV Module and Equipment Producers		
Investment Business		

Source: World Map, Wikipedia
National Geographic Society.

Source:: *Science* 1 Nov. 2002: Vol. 298. no. 5595, pp. 981 - 987
DOI: 10.1126/science.1072357

The US Energy Initiative

how to put it into action

The Energy Solution Roadmap

Phase1

Phase 1	Duration 6 Month	Completion December 2009
100 Mwatt/h photovoltaic plant and Concentrating Solar Thermal Power Plants		

Source: World Map, Wikipedia
National Geographic Society.

Source:: *Science* 1 Nov. 2002: Vol. 298. no. 5595, pp. 981 - 987
DOI: 10.1126/science.1072357

The US Energy Initiative

how to put it into action

The Energy Solution Roadmap

Phase 3

Global interconnection of the grid

Phase 3	Duration unlimited	Begin 2016
Interconnection of the different sites using HVDC cable **Production of world demand of** **ground based energy consuming devices.**		

Source: World Map, Wikipedia
National Geographic Society.

Source:: *Science* 1 Nov. 2002: Vol. 298. no. 5595, pp. 981 - 987
DOI: 10.1126/science.1072357

The US Energy Initiative

how to put it into action

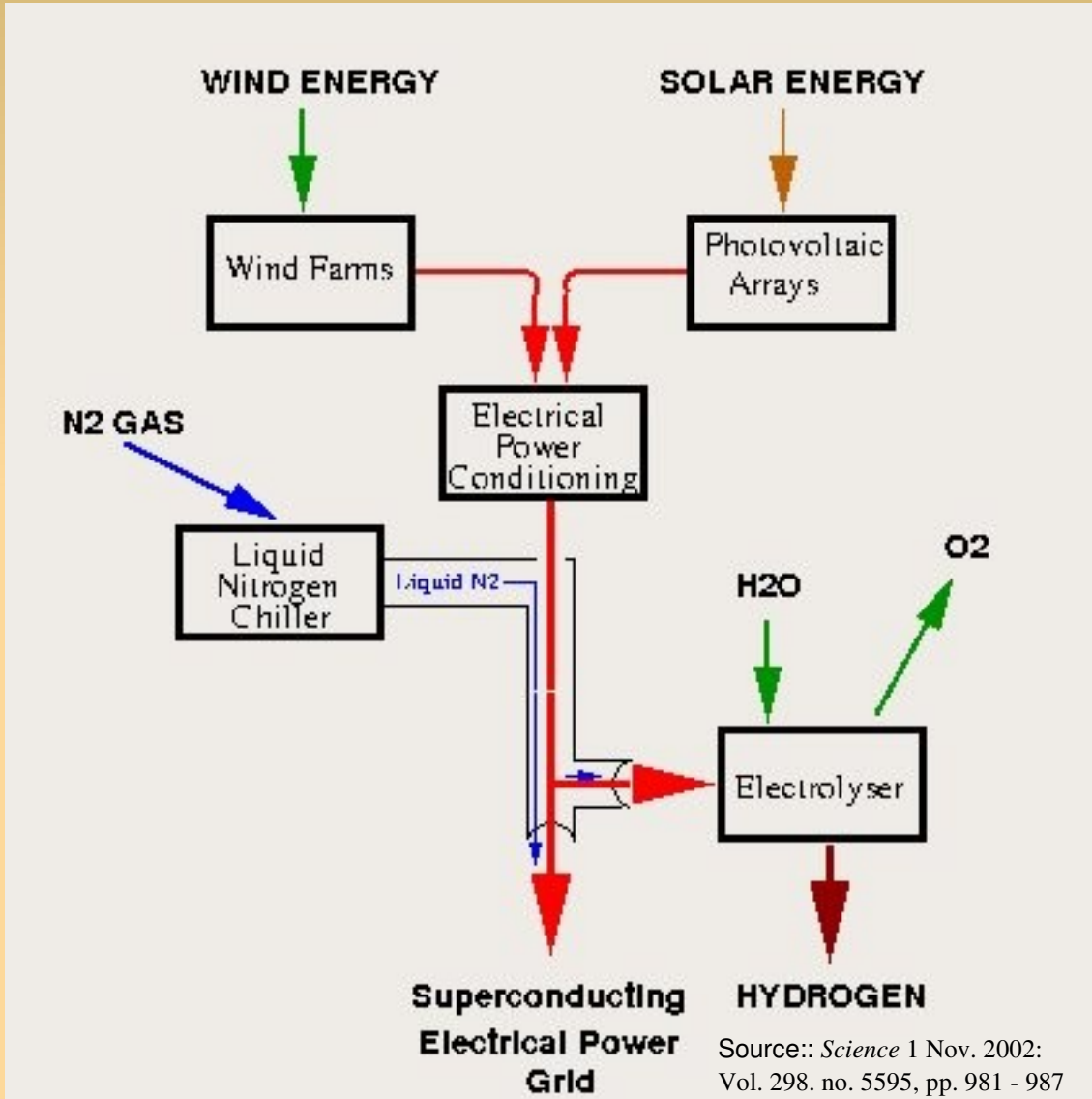
Electricity From The Grid And Hydrogen For Transportation

The Grid:

Wind and Solar Energy is conditioned and fed into superconducting electrical grid for electrical appliances.

Hydrogen:

Part of the electricity is used for the production of hydrogen for Transportation, heating and other applications where the grid does not applies.



Buckminster Fuller's Global Electrical Grid, modified

Source:: *Science* 1 Nov. 2002: Vol. 298. no. 5595, pp. 981 - 987 DOI: 10.1126/science.1072357

Desert Energy Project

The US Energy Initiative

how to put it into action

First Phase of Project:
Distribution of hydrogen with portable gas tanks.

Second Phase of Project:
Portable gas tanks and pipeline to feed some regions which are away from the grid.

Third Phase of Project:
Portable gas tanks and pipeline coverage to a full supply of distant places.

Suggested Initial Distribution of Hydrogen

The US Energy Initiative

how to put it into action

Hydrogen as 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 farms from the desert turns the production of hydrogen so inexpensive that the introduction will be feasible and emission can be reduced near zero.

Fuel	g CO2 /km Emission
Petrol	160
Diesel	139
Natural Gas	125
H2 from Gas reforming	250
H2 from Wind/solar energy	25

Hydrogen engines

The common internal combustion engine, usually fuelled with gasoline (petrol) or diesel liquids, can be converted to run on gaseous hydrogen. However, the more energy efficient use of hydrogen involves the use of fuel cells and electric motors. Researches on hydrogen storage built on metal hydrides and compression.

Hydrogen marketing

European efforts for climate protection

Hydrogen as fuel for transportation is a new market niche in the European market. The inexpensive solar electricity from the desert can open this market niche for the Arabian countries to widen their energy portfolio fit for generations to come.

Hydrogen can reduce the burden of traffic emission in crowded regions. It is where tighter regulations will force the move to a partial replacement of traditional fuel with hydrogen.

Air traffic

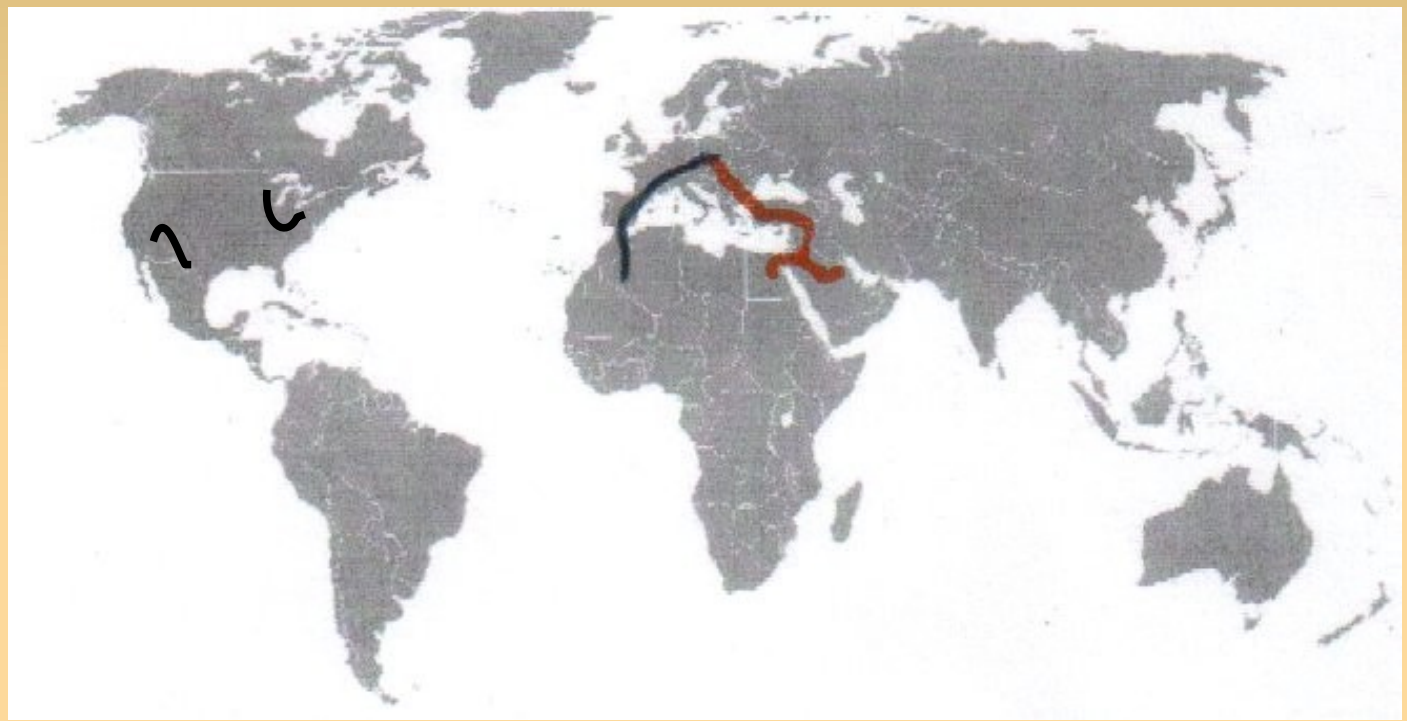
The market of jet fuel will remain unaltered strong as there is no alternative for kerosene.

The US Energy Initiative
connected to a global grid

Buckminster Fuller's Global Electrical Grid modified
Phase 1

California and the region of Detroit and Chicago as US Start

Western Sahara and/or Arabian Peninsula Supplying Europe



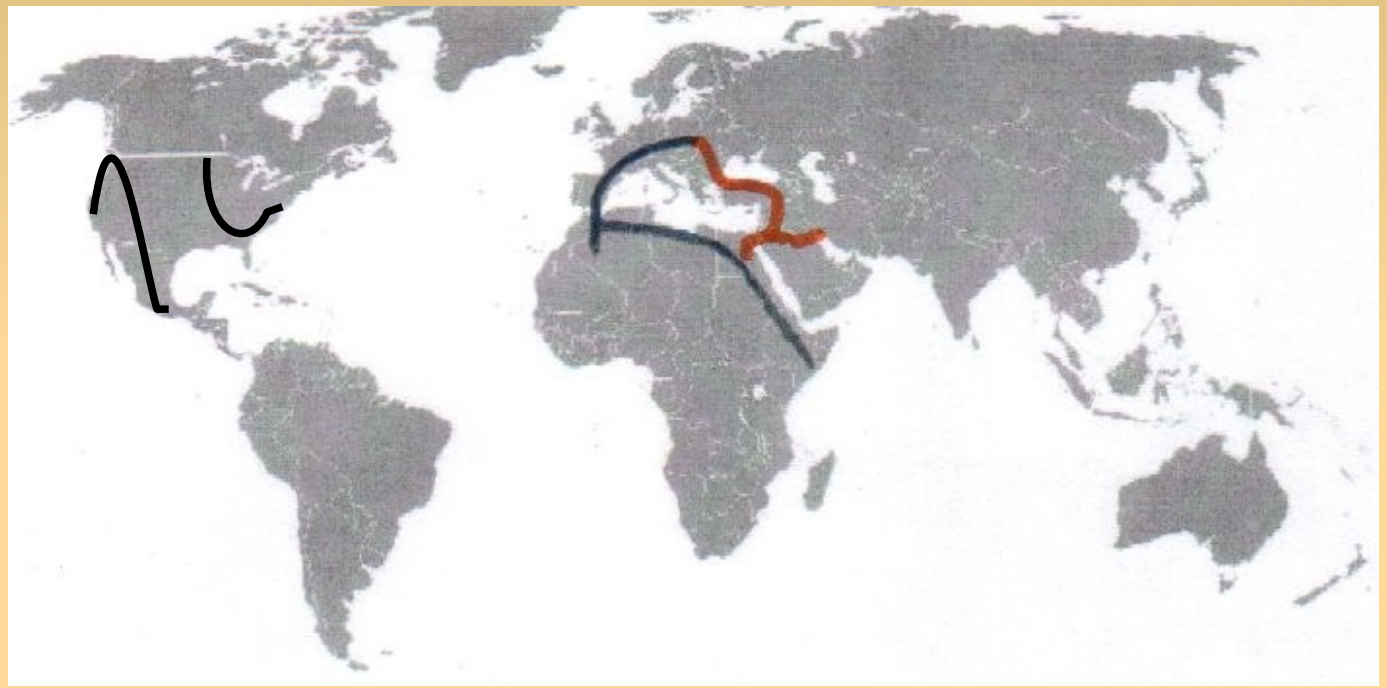
First Phase: The project may begin in U.S.A. , and Africa with the installation of a photovoltaic array and an electrical grid from Algeria to Europe. Production of hydrogen in Africa and in different places of Europe which are connected to the grid.

Source: *Science. 1* Nov. 2002. Vol. 298. No. 5595, pp 981-987. Doi: 10.1126/science.1072357

The US Energy Initiative
connected to a global grid

Buckminster Fuller's Global Electrical Grid modified

Phase 2



Western Sahara
North Sahara
Region of Red Sea
and/or Arabian Peninsula

Supplying Europe and Africa

Second Phase: Installation of photovoltaic arrays and electric grid on Northern Africa, the Red Sea area and/or Arabian Peninsula. Production of hydrogen near the array and in different places of Europe which are connected to the grid, supplying all cars of both continents.

Source: *Science. 1* Nov. 2002. Vol. 298. No. 5595, pp 981-987. Doi: 10.1126/science.1072357

Science 1 Nov. 2002: Vol. 298. no. 5595, pp. 981 - 987
DOI: 10.1126/science.1072357

The US Energy Initiative
connected to a global grid

Buckminster Fuller's Global Electrical Grid modified

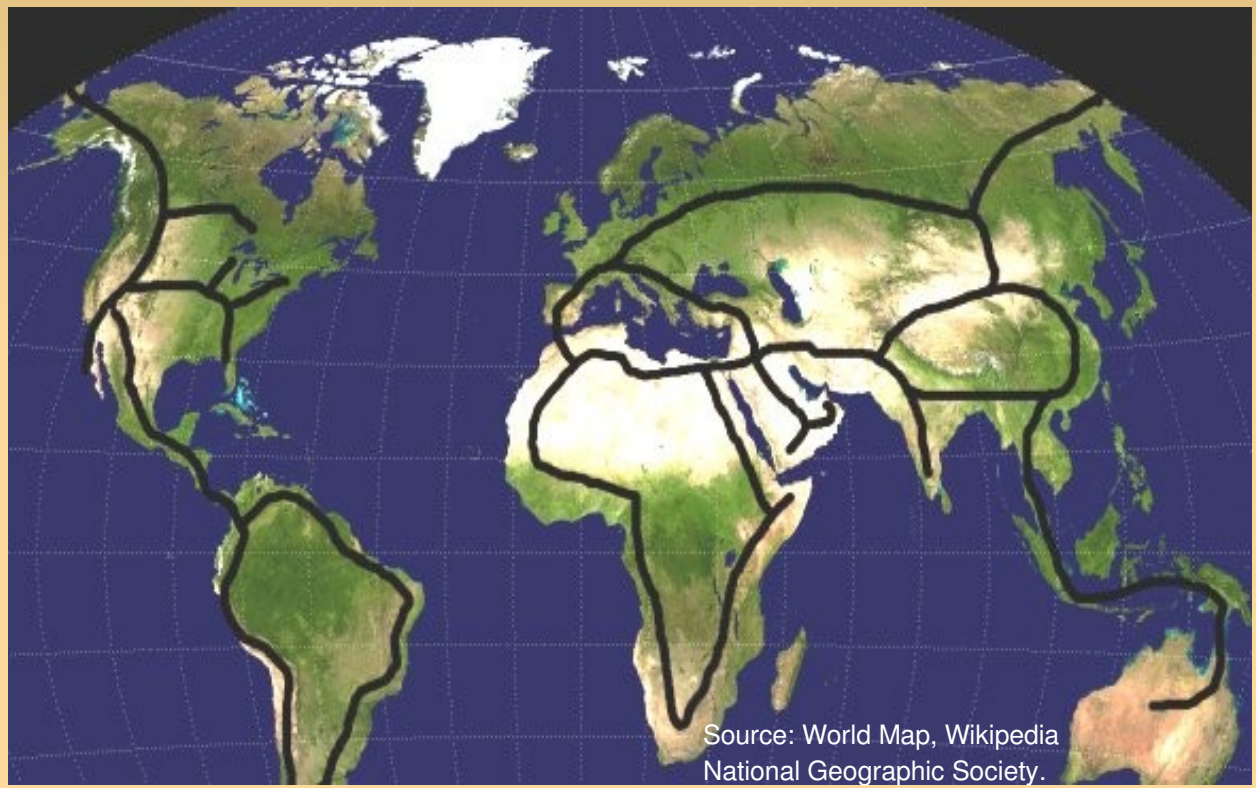
Phase 3

African Desert
For Europe,Africa Middle East .

Australia Deserts for the pacific archipelago and South Asia.

Gobi Desert for Japan, China and Siberia.

US deserts, Mexican desert and Chile Desert
For North- Middle- and South America.



Third Phase: Completion of the global electrical grid and installation of photovoltaic arrays in the different deserts. Production of hydrogen near the array in different places of the world. Supervision under UN.

Source:: *Science* 1 Nov. 2002: Vol. 298. no. 5595, pp. 981 - 987
DOI: 10.1126/science.1072357

The US Energy Initiative
and climate change

Responsibilities All small activities such as biofuel are eyewash

Governments

The governments have the responsibility to correct the poor economy leading to environmental disaster by:
Sustaining and helping the installation of a hydrogen economy to solve the problem of who comes first: "The egg or the hen".
The creation of an initial (small) PV/parabolic trough power plant, together with hydrogen production with extreme low price is the egg from which the hen can arise. The start is therefore the responsibility of the Governments.

1- Zero CO2 Emission for 2013: There must be a stiff prohibition of CO2 emission at any levels for new cars following 2013.

2- Hydrogen price: Hydrogen must be subsidized for 30 cents at the gas station in Europe to competing with 1,40 Euro/litre petrol.

3- Zero taxes: Complete exemption of any sales taxes on hydrogen cars, hydrogen fuel and electricity from solar energy used for heating home and industry.

4 – **Biofuel:** Stop of subsidies of biofuel (Bio diesel, Bio alcohol). Biofuel is an environmental disaster which supports the CO2 based car production. Even the Green Party of Germany relies on this dreadful error.

5 – **Nuclear power plants:** Stop nuclear power station madness in France, such as widening their nuclear plants, selling new nuclear plants to Libya and China and increasing nuclear waste all over the world.

The US Energy Initiative
and climate change

Suggestion of a Strategy for the
United Nations Climate Change Conference in Copenhagen
30. November – 11. December 2009

1 – The economy of solar energy
The foregoing 5 items should become a part of the strategy by parties committed to sustainable energy in Copenhagen 2009.

2 - Follow-up agreement to the Kyoto Protocol
The solar energy, such as presented here, should be proposed as binding commitment as a Follow-up agreement to the Kyoto Protocol.

More details: **www.desertenergyproject.net**

END