



EUROPEAN
COMMISSION

Community Research

THE PROSPECTS FOR RENEWABLES IN THE EU

**Directorate-General for Research
Unit for New and Renewable Energy Sources**

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**ICCF workshop
European Parliament
Brussels, 18 October 2005**



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COMMISSION

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RENEWABLE ENERGY SOURCES



Biomass: crops, forest-agro residues



Hydro: falling water



Geothermal: earth energy



Wind: moving air masses



Ocean: tides and waves



Solar thermal: solar to heat

Photovoltaics: solar to electricity



EU ENERGY POLICY

Aims at sustainable, secure and affordable energy supply.

û **Security of EU energy supply**

û **RES are indigenous, abundant, diverse**

û **Reduction of greenhouse gases and pollutant emissions - Kyoto**

û **RES save at present 130 million tons of CO₂ annually**

û **Increased competitiveness of EU industry**

û **RES contributes to employment and innovation**

Renewable energy sources are intermittent, seasonal, distributed, fairly expensive and do have minor environmental impact.



EU ENERGY POLICY

EU Energy Policy aims at sustainable, secure and affordable energy supply.

In particular, the goals for 2010 are:

- û Renewable share of 12% in gross energy consumption**
- û Renewable share of 22.1% in electricity consumption**
- û Biofuel share of 5.75% of gasoline and diesel used in transport**
- û Reduction of greenhouse gases emissions by 8%**



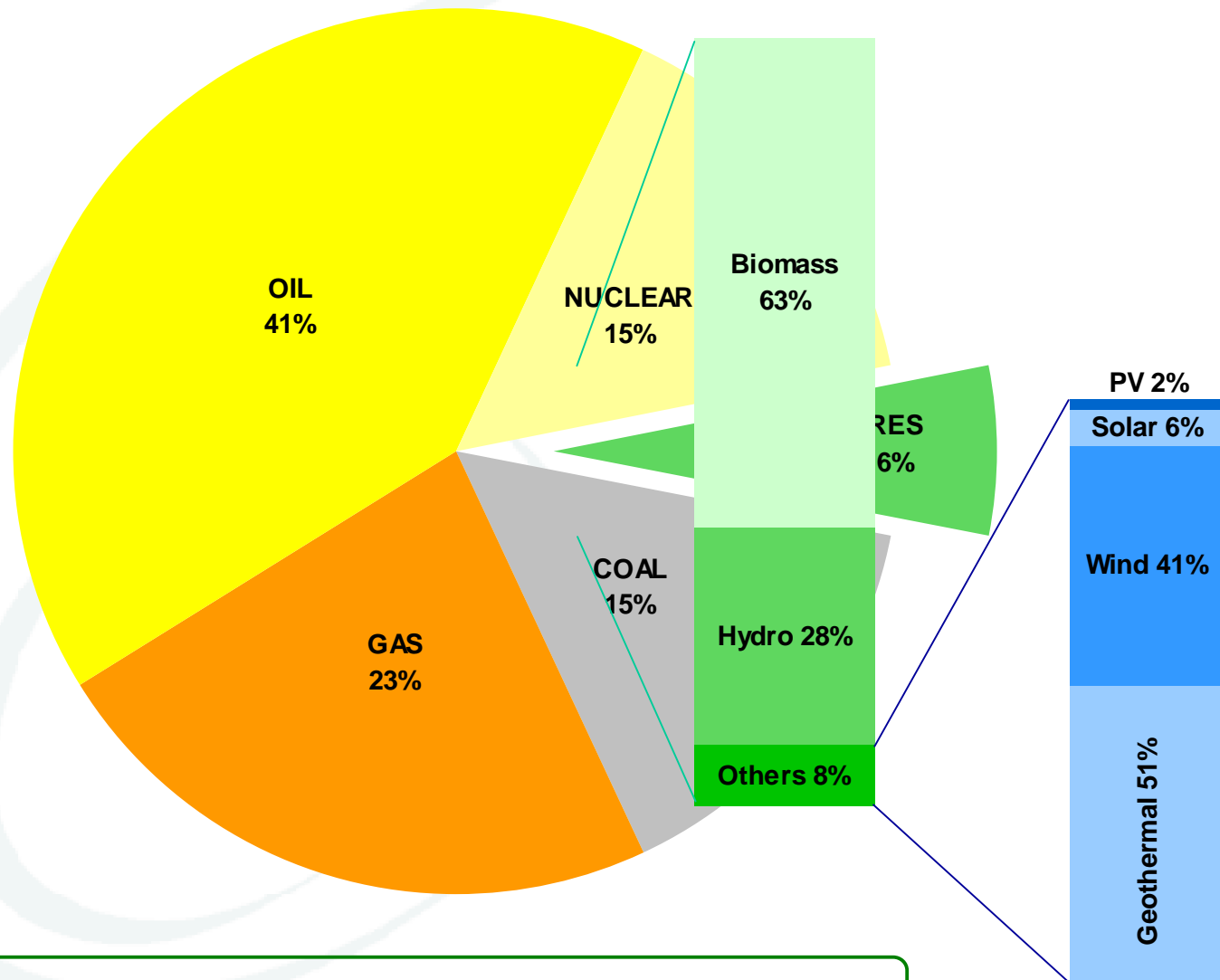
PRODUCTION COSTS (2004 estimates)

ELECTRICITY	€cents / kWh
Wind	3 – 7
Biomass	5 – 8
Geothermal	5 – 8
Solar Thermal	10 – 20
Ocean	10 – 25
Photovoltaics	20 – 42
Coal	3 – 6
Gas	2 – 4
Nuclear	4 – 7

FUEL	€cents / litre
Biofuel	40 – 70
Gasoline and diesel	25 – 40



RES IN THE ENERGY SUPPLY (EU-15,2002)

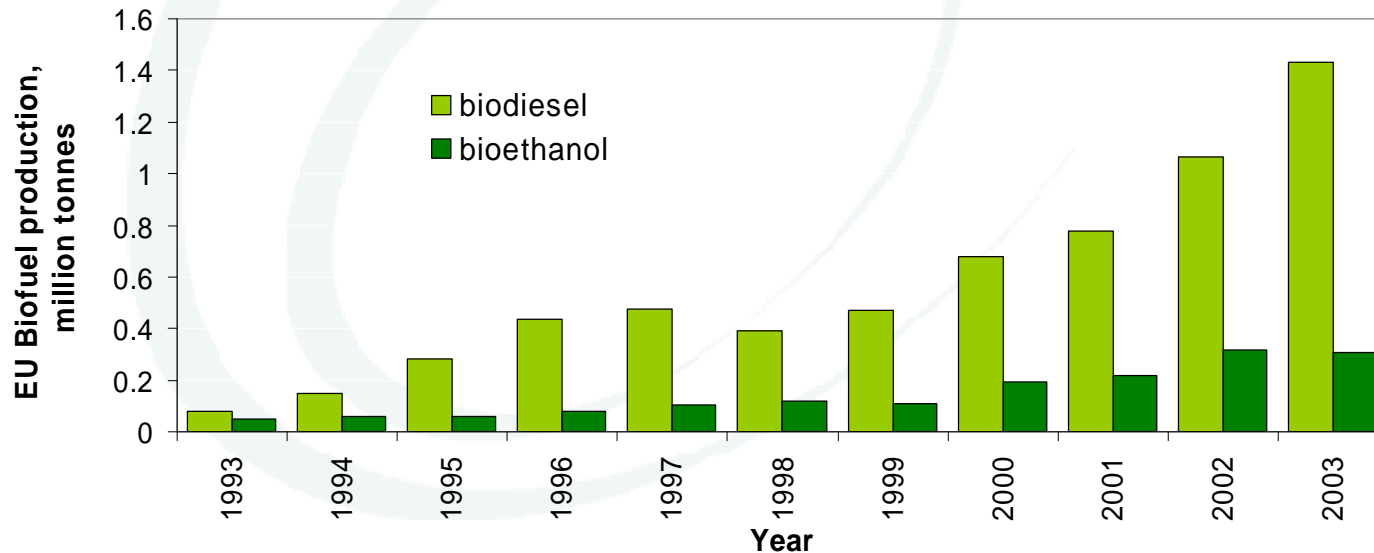


EC White paper – RES target 12% by 2010



BIOMASS

- û **Until 1700: biomass used for 80-100% of the energy needs**
- û **Versatile energy - used for heat, electricity, fuels**
- û **The only renewable energy source able to provide liquid fuels for transport**
- û **Today covers 4% of the EU energy needs**
- û **EU leading position in combustion and gasification**





BIOMASS

Current activities under FP6 and targets:

- û **Cost of electricity** **0.05 €/kWh by 2015-2020**
- û **Cost of biofuels** **0.036 €/kWh by 2020**
- û **Production of biofuels; current cost** **40 - 70 €/lt**
- û **Gasification systems**
- û **Cost-effective combustion technologies**
- û **Energy from bio-residues and energy crops**

Technological prospects

- ü **Biofuels for transport**
- ü **Biorefinery: Sustainable products and energy**

Requires large areas of land



BIOMASS



Flexi-fuel car



Domestic stove
Courtesy: RIKA Herz, Austria



Värnamo, Sweden
Integrated Gasification Combined Cycle,
6 MWe, 9MWth. CHRISGAS project

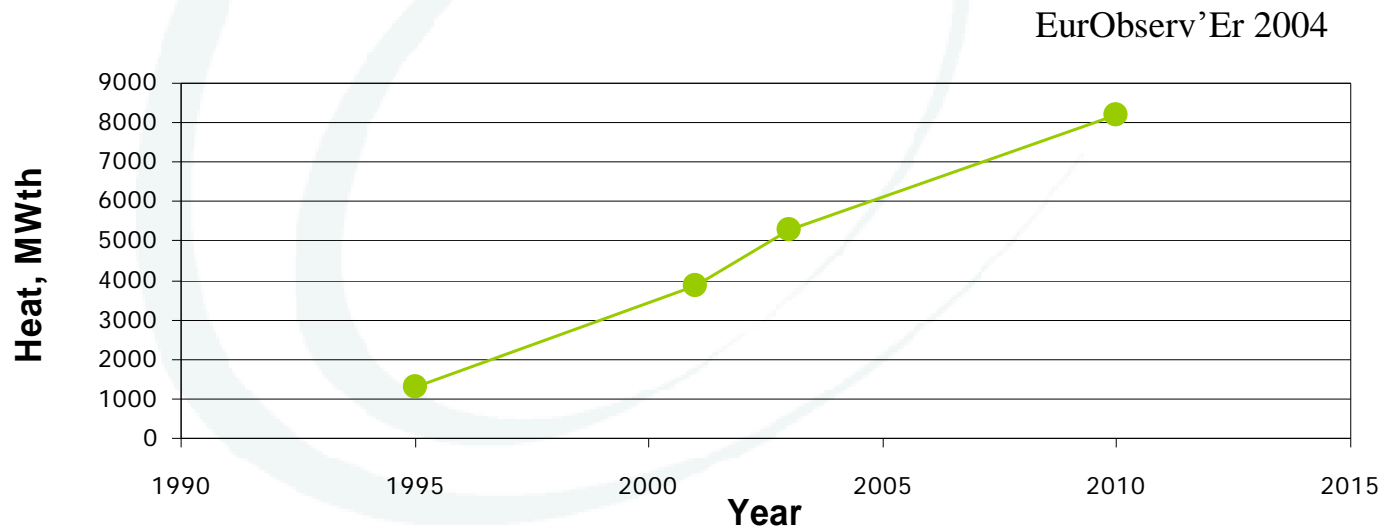


Alholmens Kraft, Finland
Combustion power plant, 240 MWe



GEO THERMAL

- û Independent of weather and climatic conditions, it delivers heat and power 24 hours a day throughout the year.
- û In EU 95 000 dwellings are heated by geothermal energy
- û More 5 TWh of electricity were produced in 2002
- û **Technological prospects**
 - ü Heat pumps
 - ü Hot dry rock





GEO THERMAL

- û **Operational without back-up; capacity factor 100% (firm power)**

Current activities under FP6 and targets:

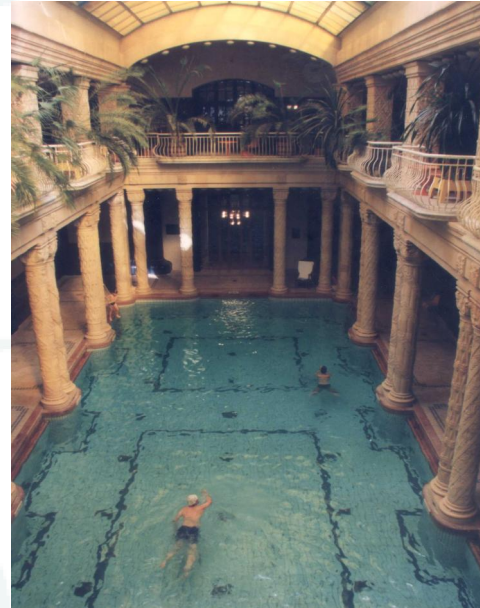
- û **Cost of electricity 0.05 €/kWh by 2015-2020**
- û **Coordination action on ongoing research**
- û **Improved exploration for deep geothermal resources**
- û **High temperature downhole tools and instruments**



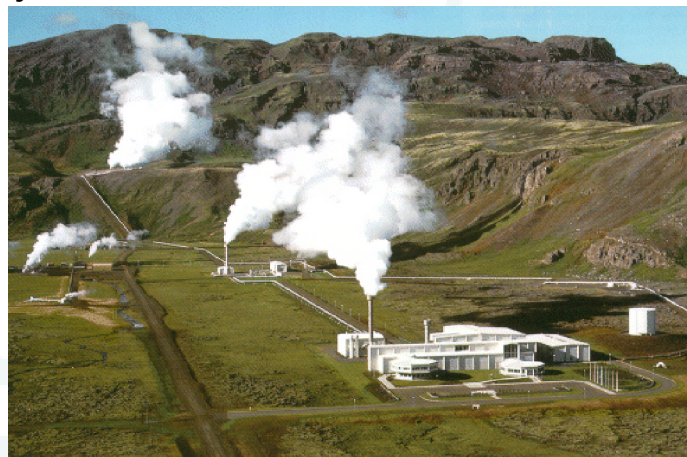
GEO THERMAL



**Rig installation in Soultz, France
Hot Dry Rock project**



Geller Hotel, Budapest



**Nesjavellir, Iceland
CHP plant 90 MWe, 500-800 l/s heating water.**



WIND

- û **1980: < 100 kW installed c 2004: > 34 GW at average rate 1450 MW/a over 24 years producing > 3.5 TWh /a**
- û **1980: 15 kW, 10m diam. c 2004: 5 MW, 126m diam.**
- û **1980: > 0.30 €/kWh c 2004: < 0.03 € at best sites and commercial turbines**
- û **Cost per kWh have fallen by 50% over the last 15 years**
- û **25 - 30% annual industrial growth since 1990**
- û **EU wind industry has 90% of the world equipment market**
- û **EU wind industry employs 72.000 people up from 25.000 in 1998 and ~ 1.000 in 1985**
- û **3% of electricity generation by 2010 (Directive 2001/77)**
- û **20% of electricity generation by 2020 (EWEA)**



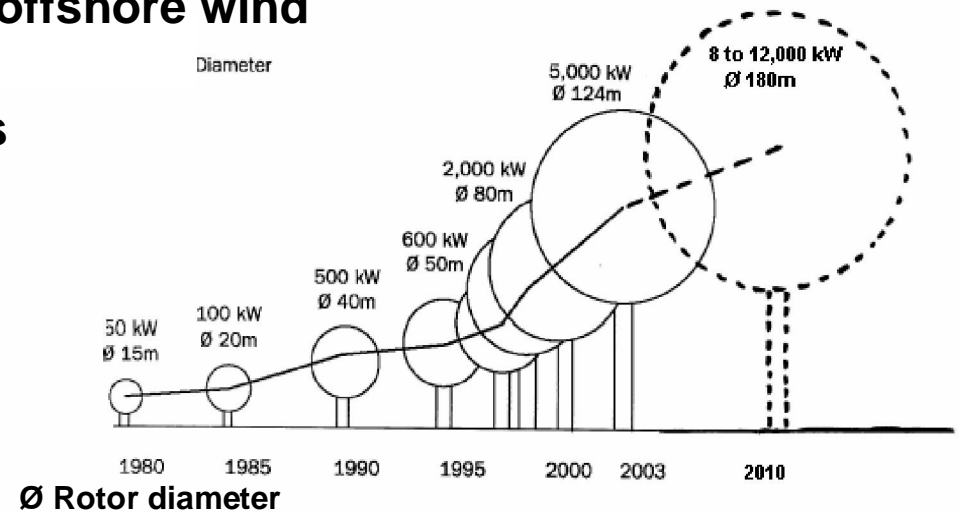
WIND

Technological prospects

- û Offshore wind
- û Up-scale turbines
- û Grid integration is becoming a challenge

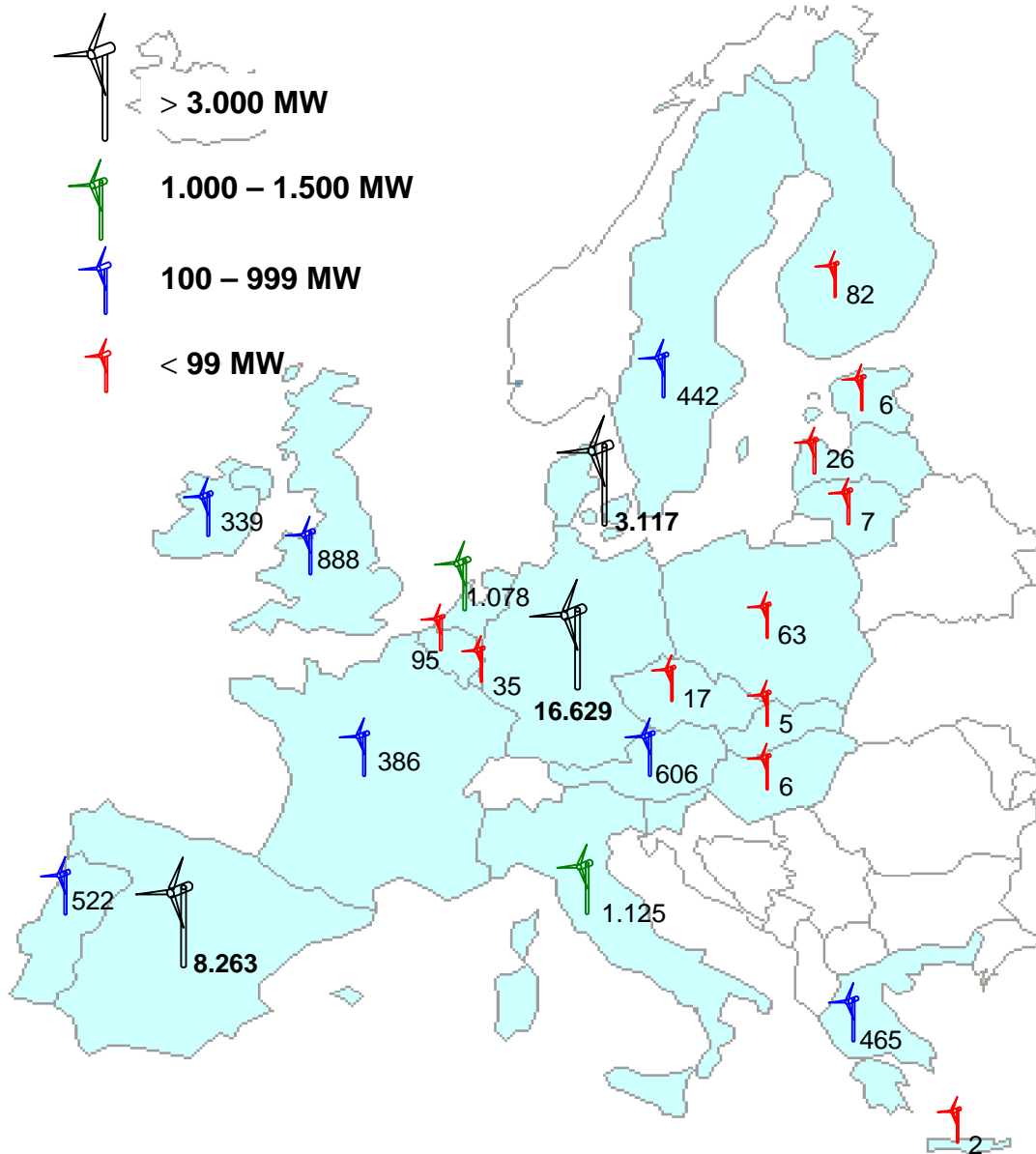
Current activities under FP6 and targets:

- û Cost of electricity 0.05 €/kWh by 2015-2020
- û Design and development of > 5 MW offshore
- û Output forecasting for multi-MW offshore wind and wave installations
- û Materials, modeling, new designs





WIND



Oberzeiring, Austria, 20MW



Horn Rev, Denmark, 160 MW

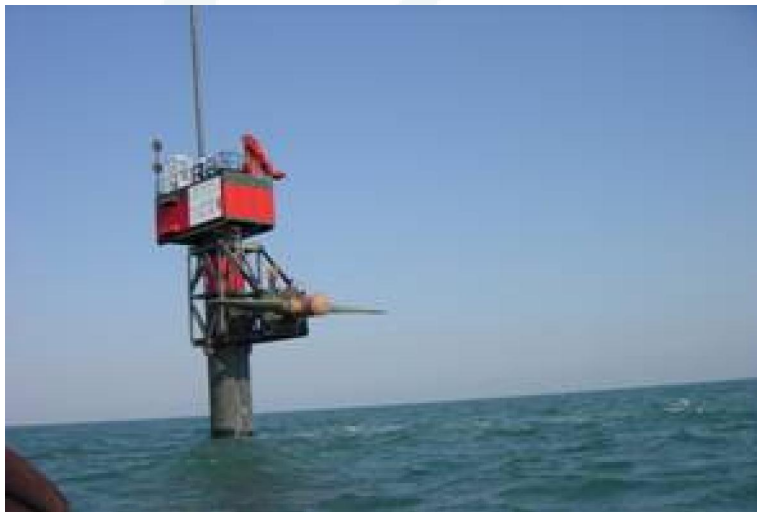


OCEAN

- û **Started in 1963 in France, La Barrage, 240 MW**
- û **Used for electricity production**
- û **First prototypes successfully operational; different concepts**
- û **Installed capacity worldwide > 245 MW of which 242 MW in EU**
- û **Actual projected cost in the range 0.10 - 0.25 €/kWh**

Current activities under FP6 and targets:

- û **Cost of electricity 0.05 €/kWh by 2015-2020**
- û **New concepts for ocean converters**
- û **Reliable, low-cost energy converters**



SEAFLOW project



**Wave energy converter, 20 kW prototype
WAVE DRAGON project**



SOLAR THERMAL

- û **1.45 million m² of solar thermal collectors were installed in 2003**
- û **Solar thermal covers 65% of the warm water needs in Greek households, in Cyprus up to 90%**
- û **Concentrated solar thermal yields temperatures of 400-1000°C (electricity).**



Solar thermal collector, Greece



Central tower test facility, Almeria, Spain



SOLAR THERMAL

Actual projected cost in the range 0.10 - 0.20 €/kWh

Current activities under FP6 and targets:

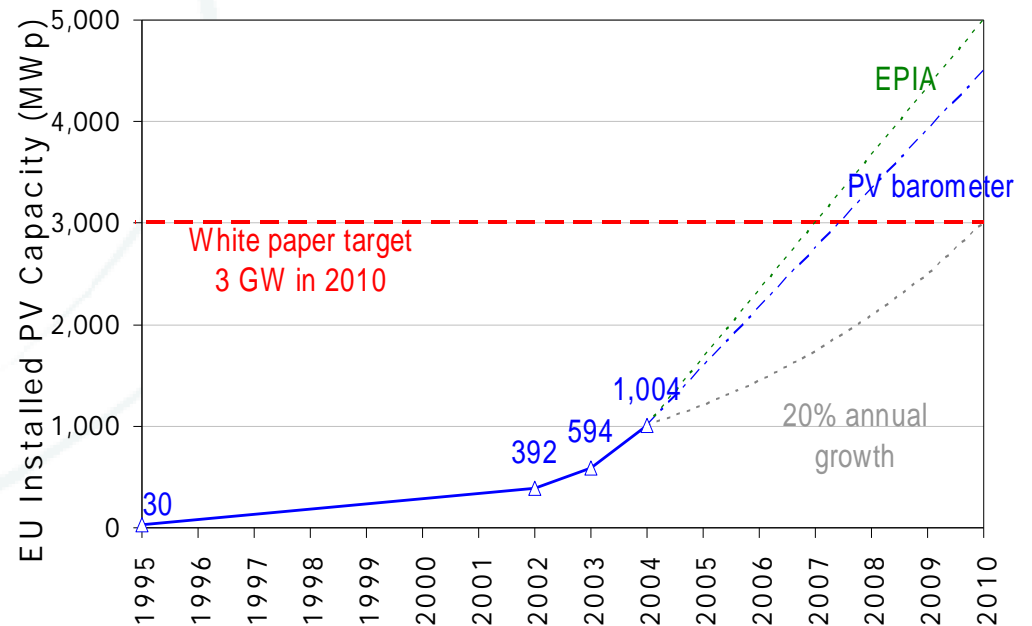
Cost of electricity 0.05 €/kWh by 2015-2020

- û **Development of solar thermal reactors for H₂ production**
- û **Solar hybrid power plants**



PHOTOVOLTAICS

- û 1980: cost > 23.000 €/kWp ◊ 2004: 3-3.500 €/kWp
- û 1980: efficiency <5% ◊ 2004: 15-16% for commercial and > 23% for laboratory operation
- û The price of PV modules has decreased by a factor of 3 since 1990
- û Actually competitive in niche applications (service provided)





PHOTOVOLTAICS

- û **35% annual growth during the last 10 years**
- û **Turnover close to 2 billion € in Europe and 5.2 worldwide in 2004**
- û **One out of every four cells produced worldwide is manufactured in the EU. Japan is the world leader.**

Current activities under FP6 and targets:

- û **Cost of PV systems to 1-2 €/Wp by 2015**
- û **Cost of electricity 0.1 €/kWh by 2015**

Technological prospects

- ü **Crystalline silicon**
- ü **Thin film materials**
- ü **New cell concepts (organic or hybrid solar cells)**



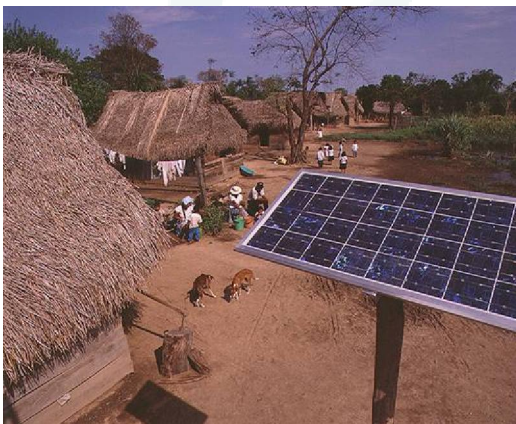
PHOTOVOLTAICS



Lehrter station, Berlin, 3311 m²



**Wesco Court, UK
41 sheltered houses**



Stand alone system, Bolivia

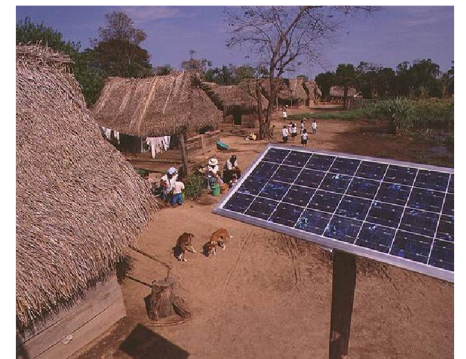
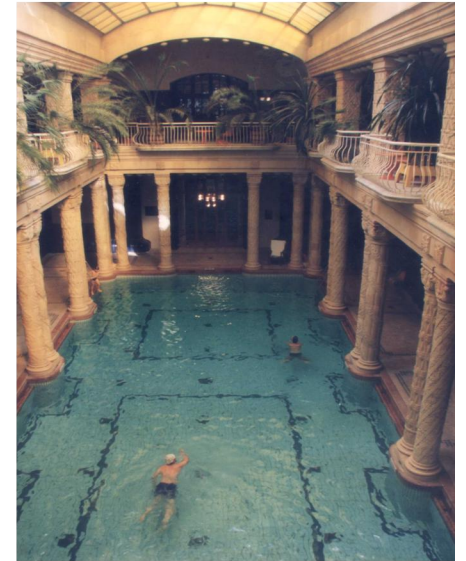


1.2 km sound barrier, A92 motorway, Germany



RES PROSPECTS

- û **The share of RES is on course to exceed 10% in 2010**
- û **EU is the pioneer in developing and implementing modern renewable energy techniques**
- û **EU average funding for R&D 1995 – 2004 : ~ 100 M€/a**
- û **The renewable energy sector has increased its turnover tenfold from 1.5 b€ in 1990 to 15 b€ in 2004, ~ 80 b€ in 2010**
- û **Renewable industry employs already more than 500.000 people in the EU.**
- û **Renewable energy is important to developing countries (2 billion people do not have access to electricity) as well as to the developed world.**
- û **The EU renewable energy sector has only begun to reveal its true potential for growth.**



Staying informed



CORDIS:

<http://www.cordis.lu/fp6/>

EUROPA:

http://europa.eu.int/comm/dgs/research/index_en.html

http://europa.eu.int/comm/research/energy/index_en.html

http://europa.eu.int/comm/energy/index_en.html

INCO and Marie Curie

<http://www.cordis.lu/inco/home.html>

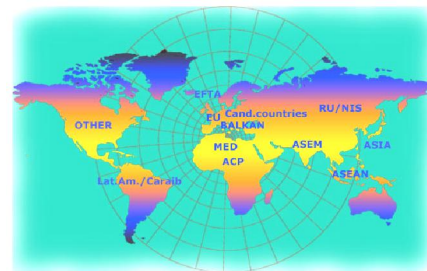
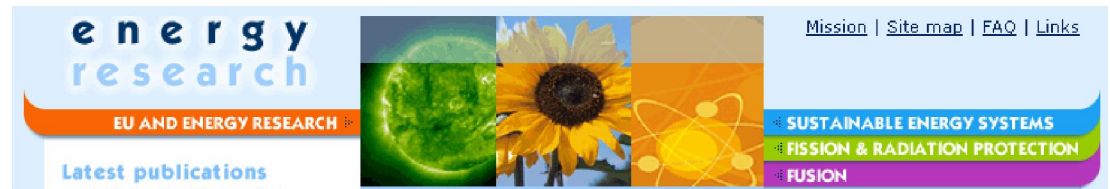
http://europa.eu.int/comm/research/fp6/mariecurie-actions/indexhtm_en.html

Renews

<http://europa.eu.int/comm/research/energy/pdf/renews3.pdf>

Information days and similar events, conferences

http://europa.eu.int/comm/research/energy/gp/gp_events/action/article_2790_en.htm



**RENEWABLE ENERGIES FOR EUROPE
RESEARCH IN ACTION**

21 –22 November 2006
Brussels