

Global Status of Photovoltaic Solar Energy



ECREEE Regional Forum on the ECOWAS Solar
Energy Initiative

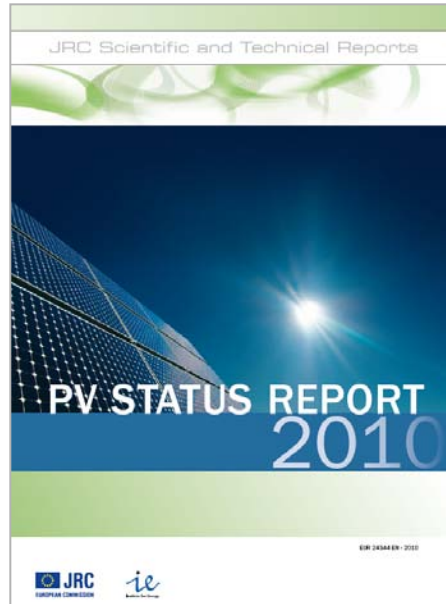
Dakar, 19th October 2010

Arnulf Jäger-Waldau
Thomas Huld
Heinz Ossenbrink
Irene Pinedo Pascua

European Commission, DG JRC, Ispra
Institute for Energy
Renewable Energy Unit



Overview



PV Status Report 2010:

- Current status.
- Near future – 2020.
- Outlook to 2050.

Just a few minutes...

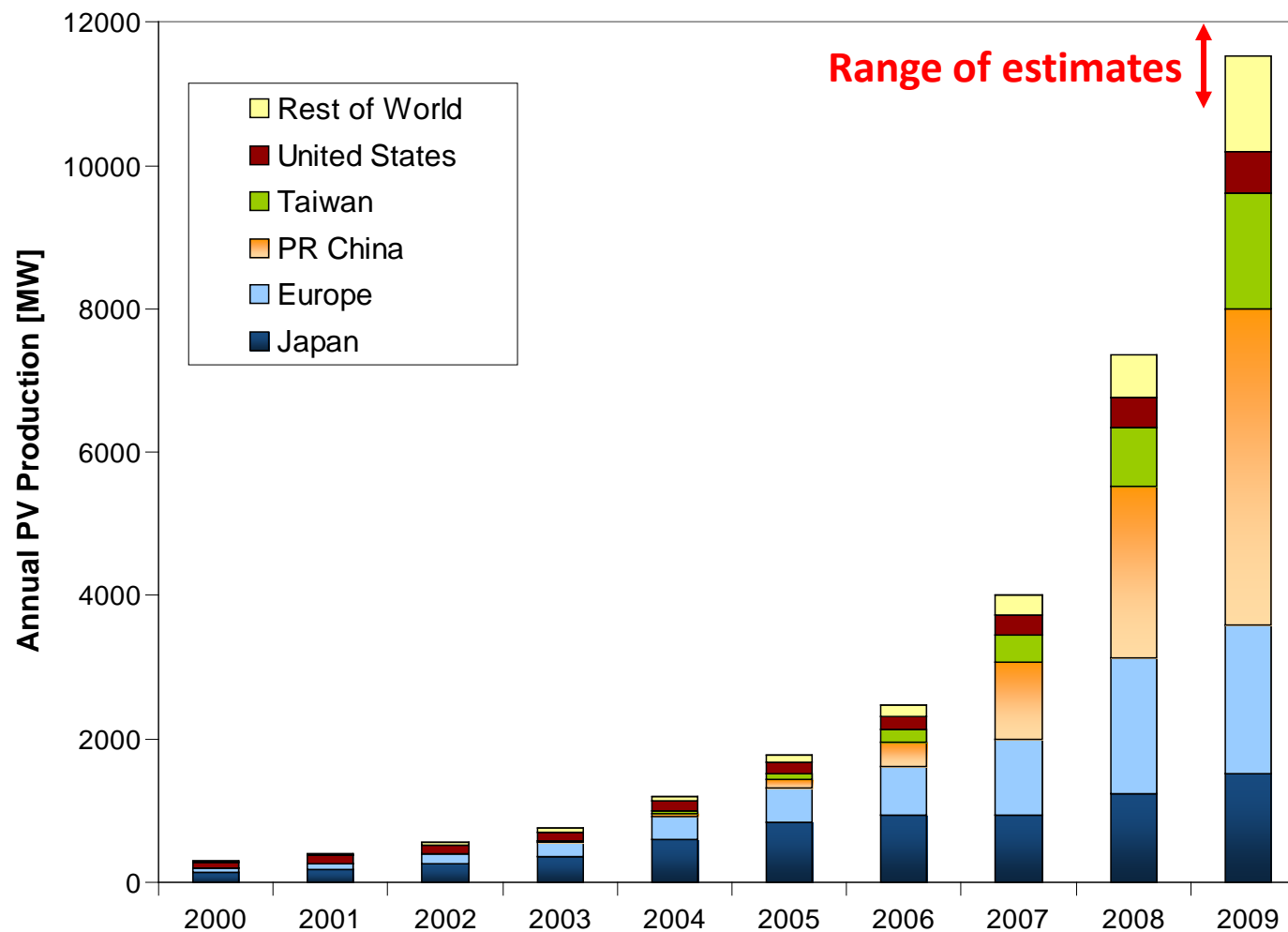
Photovoltaic Geographic Information System, PVGIS



AFRETEP project

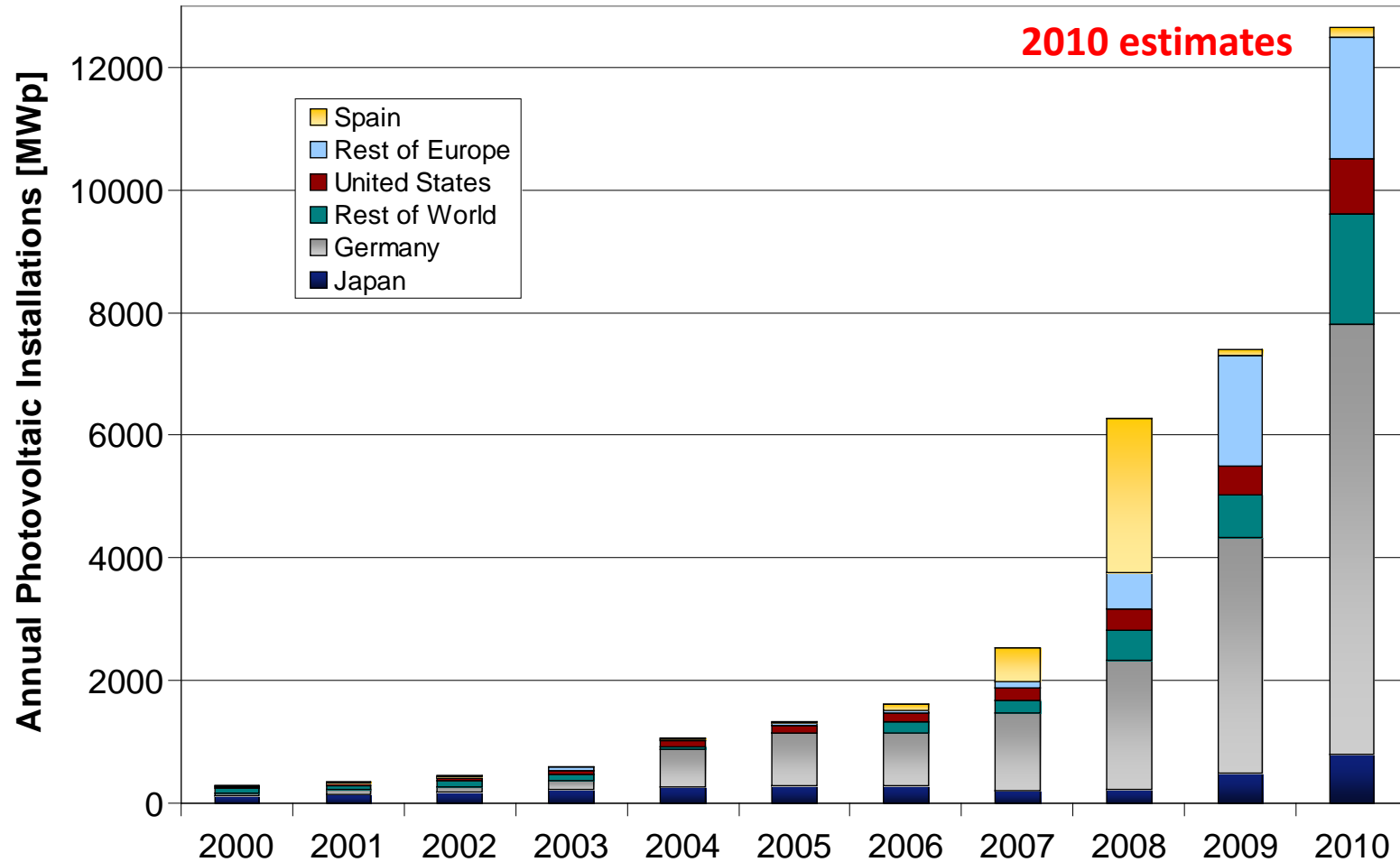


PV produced



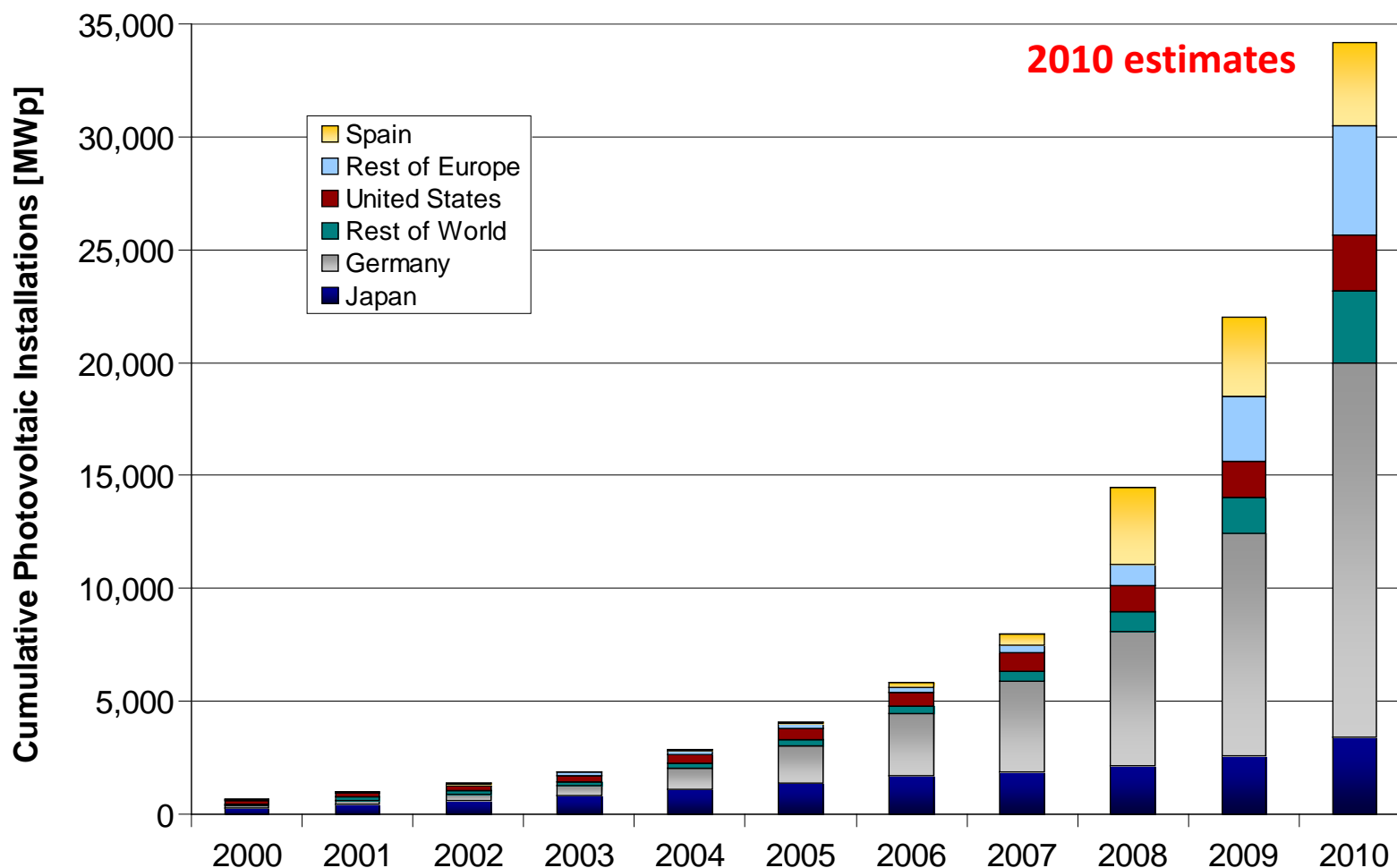
Data source: PV News, Photon International, Navigant Consulting, i-Suppli and own analysis

PV installed



Data source: PV News, Photon International, Navigant Consulting, i-Suppli and own analysis

PV cumulative installed



Data source: PV News, Photon International, Navigant Consulting, i-Suppli and own analysis

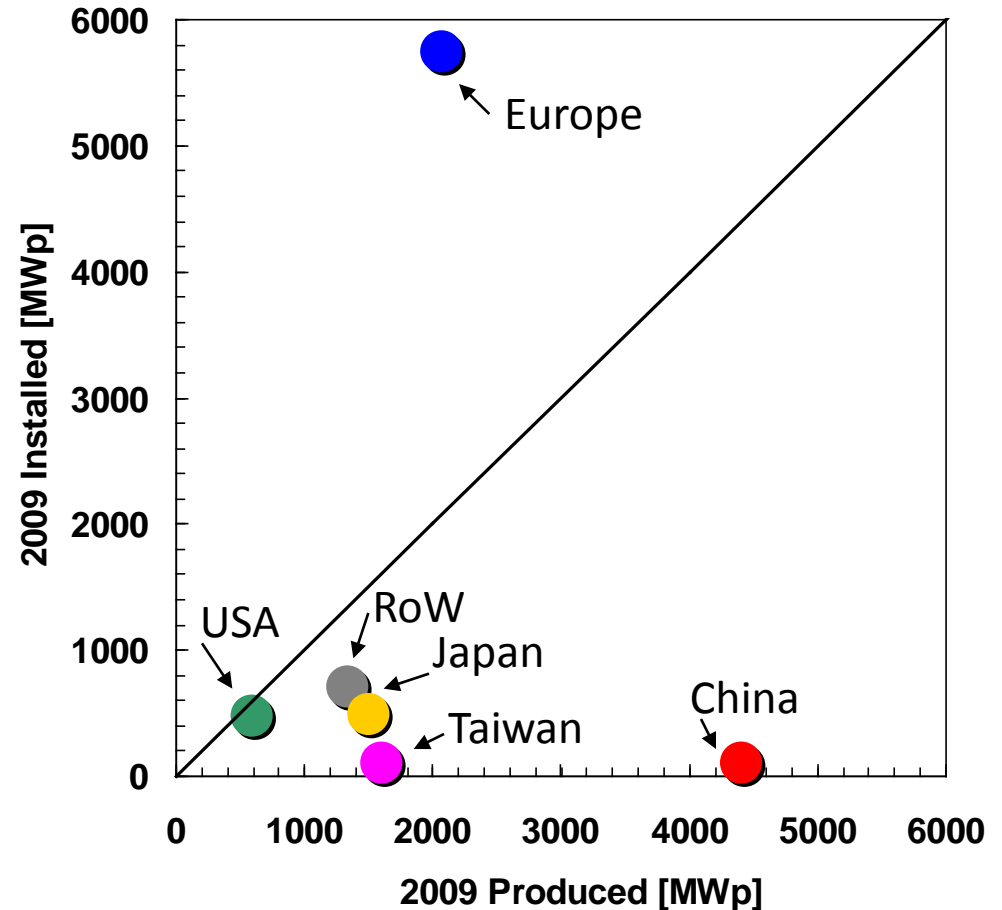
PV International Trade 2009

PV Production Champion:
China, 4.4 GW

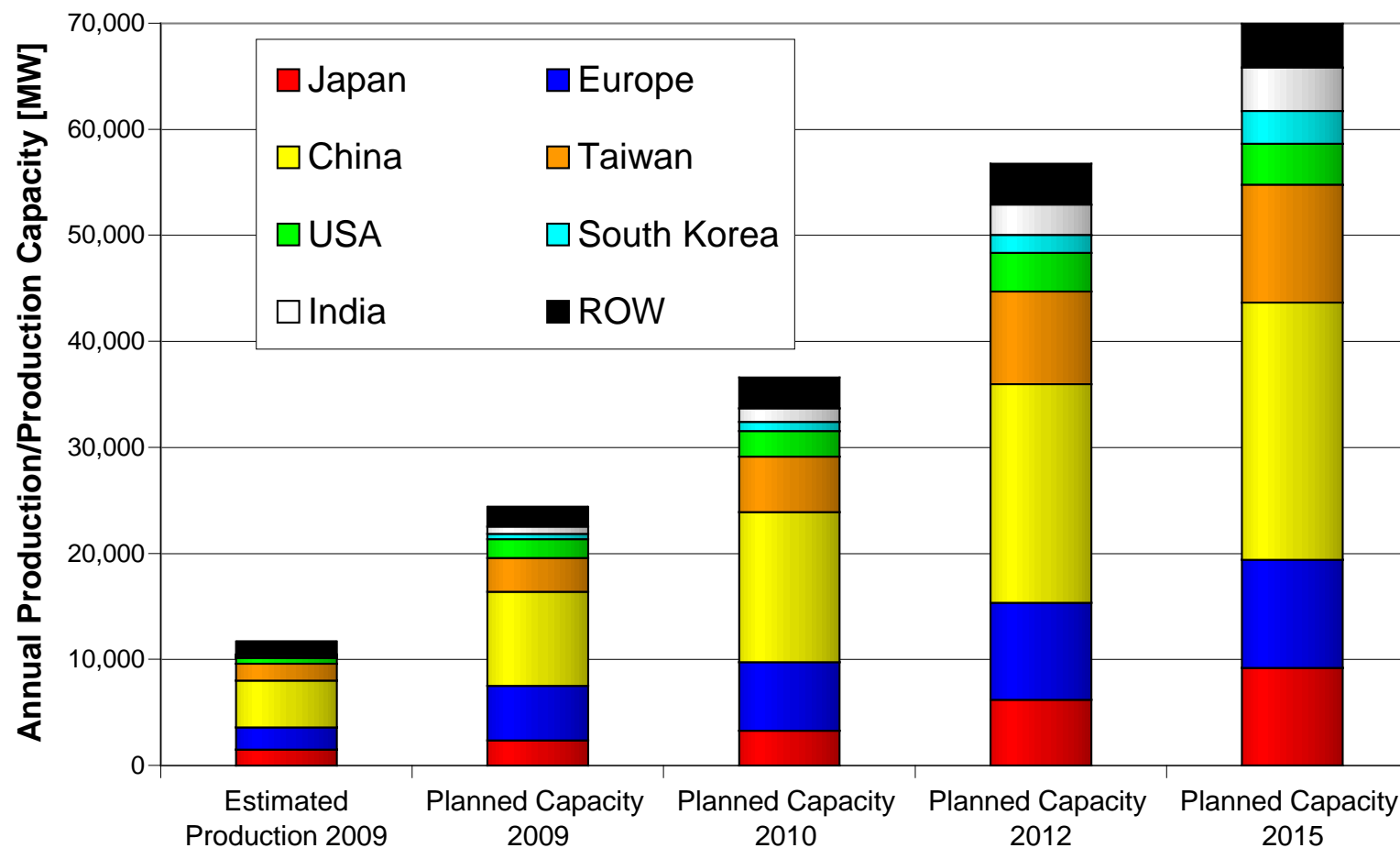
PV Installation Champion:
Europe, 5.8 GW
(16 GW cumulative)

Asia: 75% of World PV
production

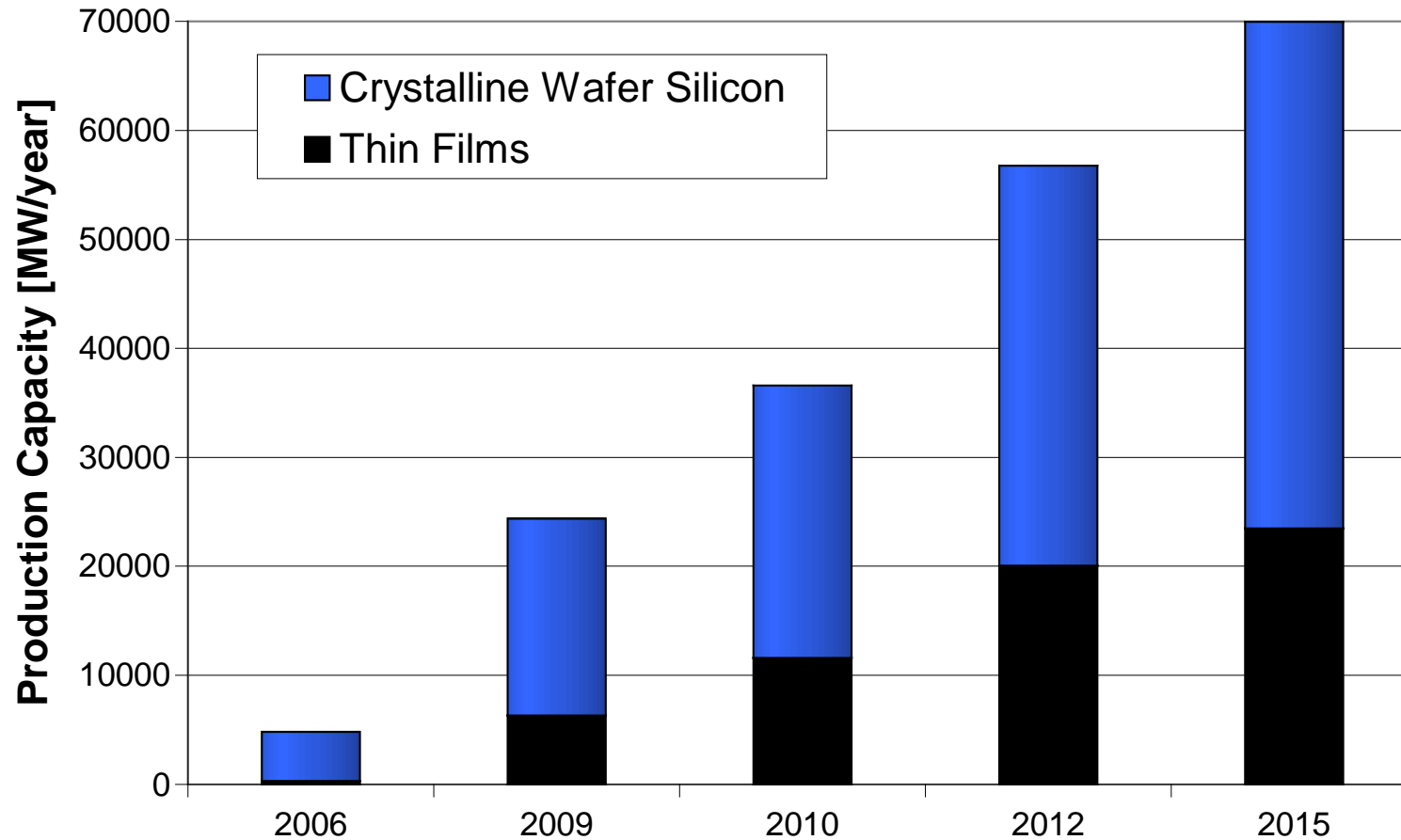
Europe: 78% of Worlds
(grid-connected)
Installation



Announced Capacity Increases

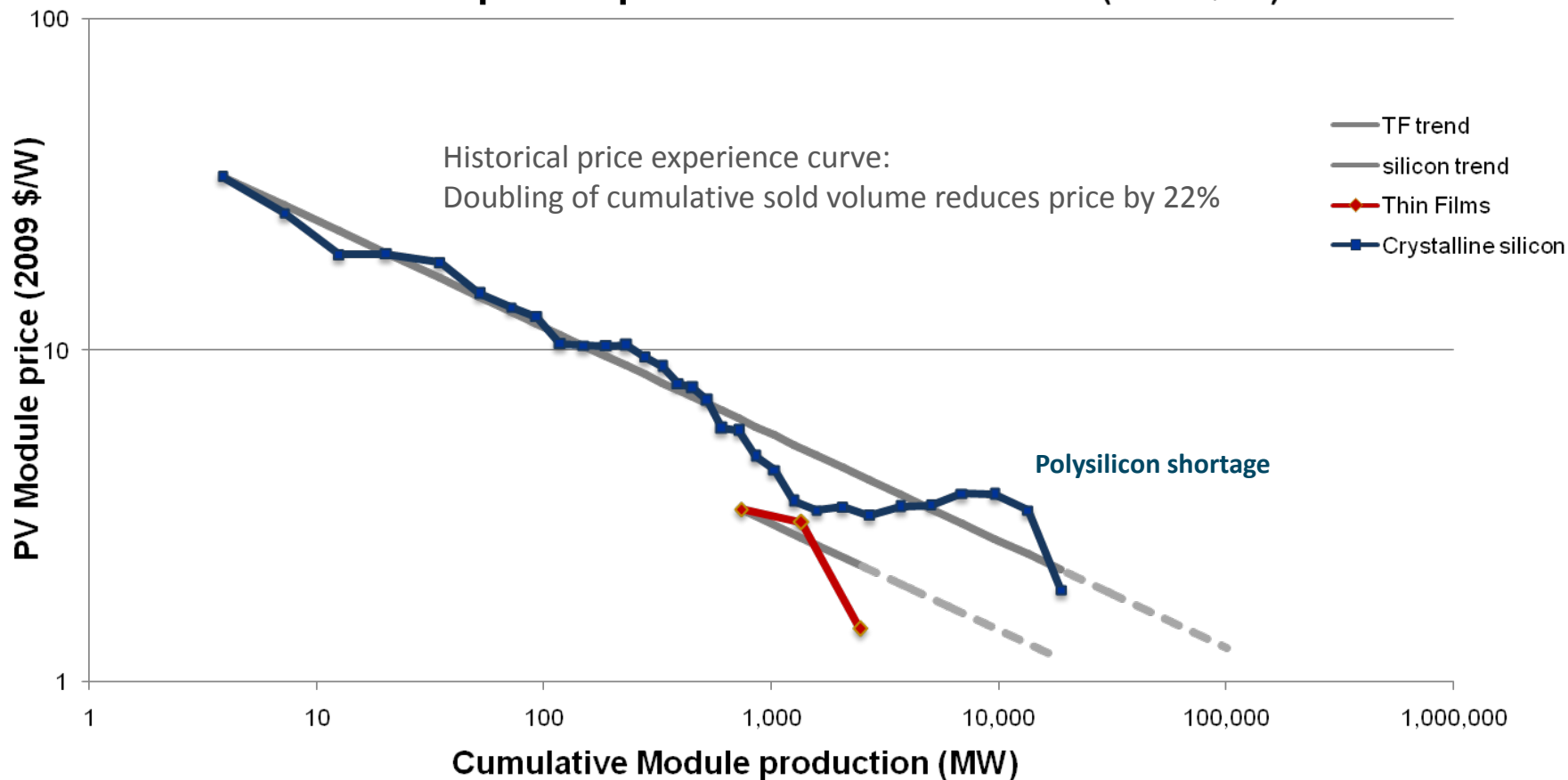


Announced Capacity Increases

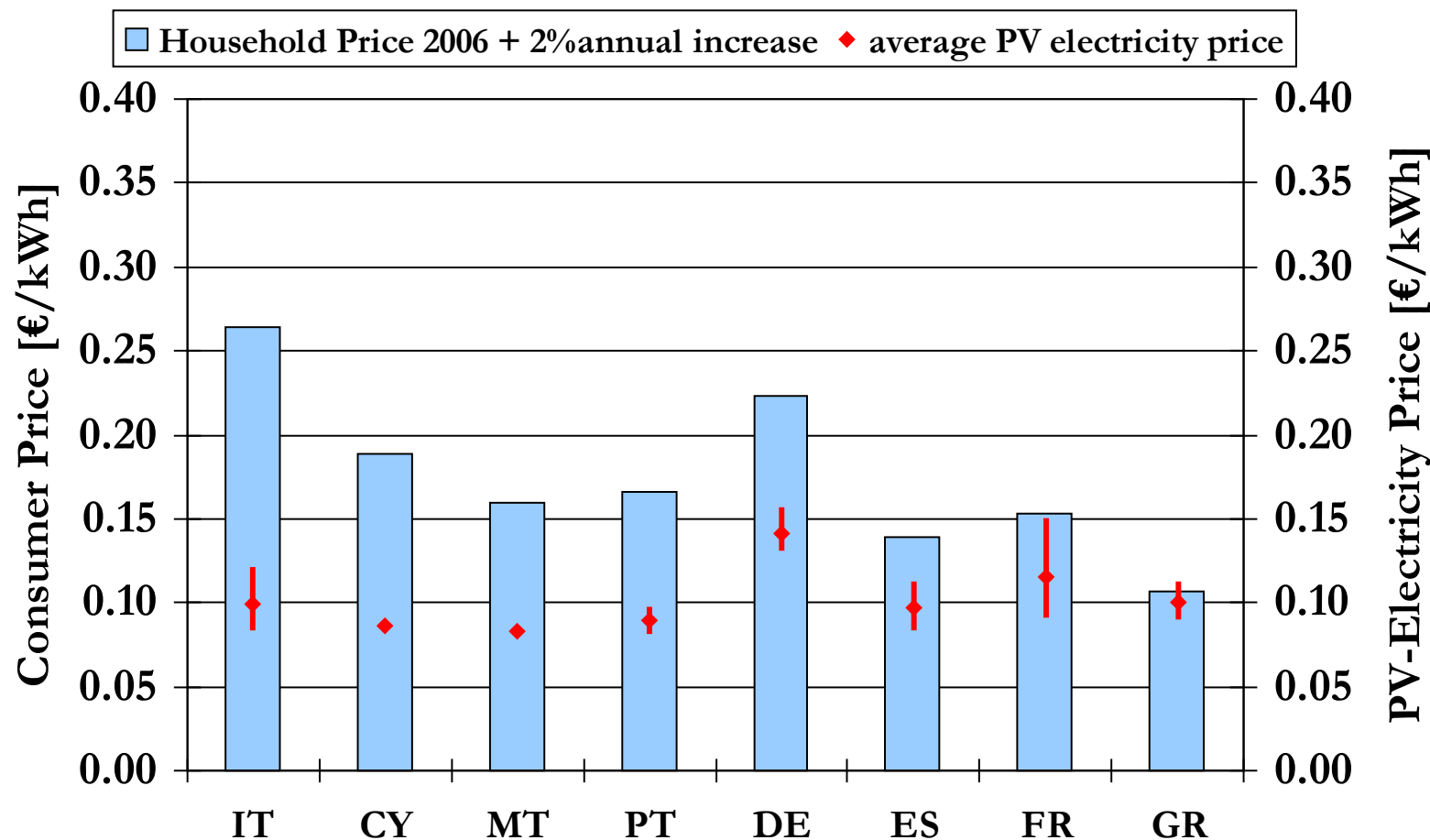


PV module price

PV Module price experience Curve since 1979 (2009 \$/W)



Photovoltaic Electricity Prices in 2020?



Assumptions: **2€/kWp**; 4% Interest; 0.5%/yr O&M; **30 yr** operational life

Source: EC Joint Research Centre, PVGIS

PV Scenarios

	2010 [GW]	2020 [GW]	2030 [GW]	2050 [GW]
Greenpeace (reference scenario)*	14	80	184	420
Greenpeace ([r]evolution scenario)*	18	355	1,036	2,968
Greenpeace (advanced scenario)*	21	439	1,330	4,318
IEA Reference Scenario	10	30	<60	Non competitive
IEA ACT Map	22	80	130	600
IEA Blue Map	27	130	230	1,150
IEA PV Technology Roadmap	27	210	870	3,155

* 2010 values are extrapolated as only 2007 and 2015 values are given

Further Outlook

- After 2020 the European Market for newly installed PV systems will represent less than the 50% anticipated until then.
- Large markets will be China, Europe, India and US.
- Africa and South-East Asia will emerge as large markets.
- Off-grid installations will grow faster than grid-connected installations.

Required:

- Grid Management.
- World-wide Emission Trading.

Conclusions

- ✓ Growth of PV electricity installations is much faster than predicted by most scenarios.
 - ! Adaptation of current grid structures to accommodate larger share of decentralised RES is needed to enable a large scale use of PV electricity.
- ✓ Only increasing markets ensure that PV electricity prices are continuously declining.
 - ! For the next decade solar PV will still need support.
- ✓ Photovoltaics is one of the most important building blocks for decentralised rural electrification.

PV electricity is an important building block to realise a decarbonised energy supply

PVGIS

What is PVGIS?

- a database of solar radiation and temperature data combined with a web interface that lets users calculate the energy output of photovoltaic (PV) systems.
- a scientific tool that allows us to do research on the performance of PV systems over large geographical areas and estimate the potential for solar energy deployment in Europe and Africa.

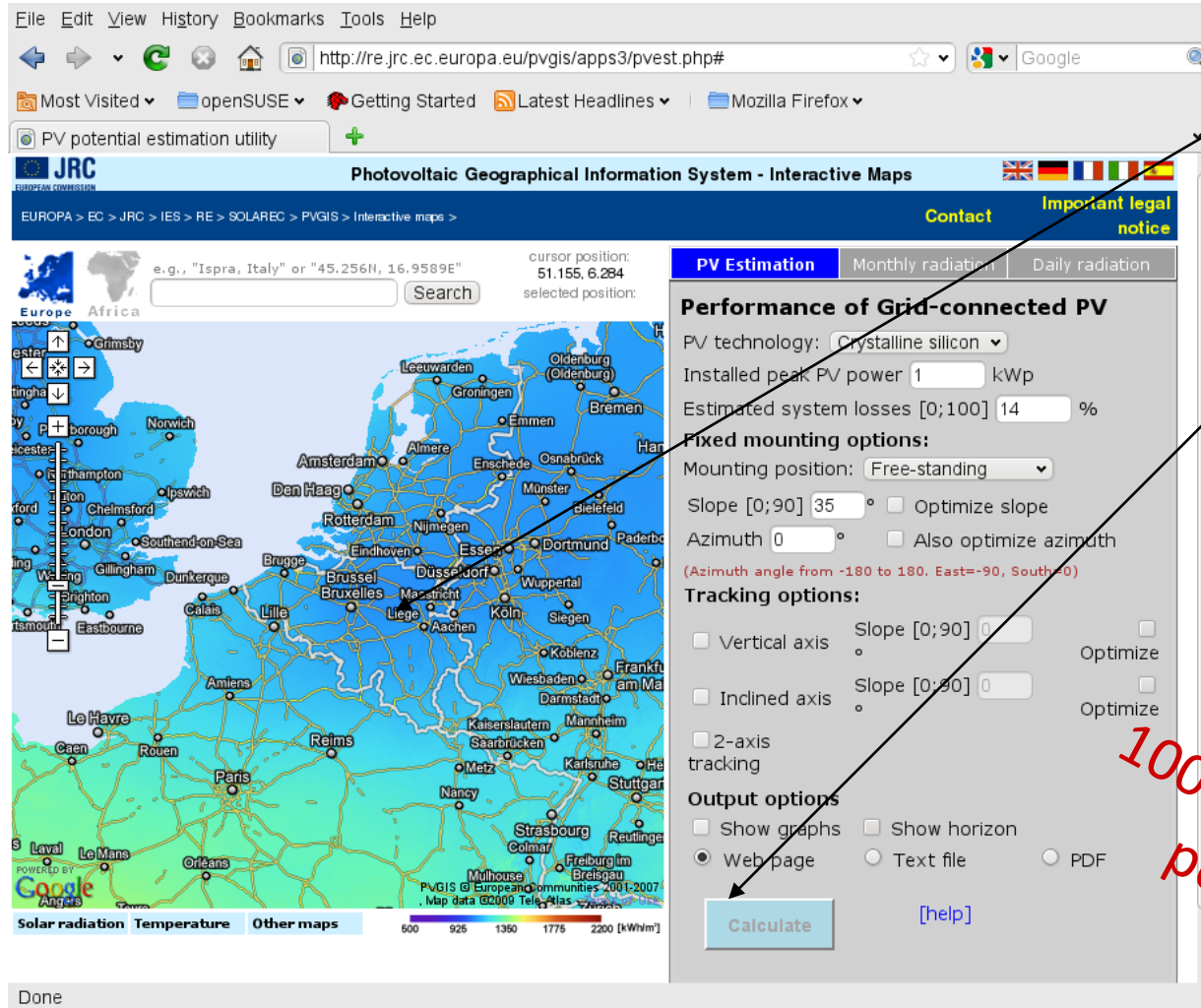
How was it obtained?

- Europe: Long-term monthly averages global and diffuse irradiation from ground stations are interpolated onto a spatial grid. Data collected by ESRA over the period 1981-1990
- Africa: Daily values of global irradiation sums from the HelioClim-1 database, estimated from MFG satellite data, with a spatial resolution of 15'. Time period 1985-2004
- The online calculation also includes the effects of shadows from nearby mountains (based on the SRTM-3 DEM, resolution of 3 arc-seconds, ~90m at the equator).

PVGIS: web interface features

- Covers Europe and Africa
- Various types of PV installations: fixed or tracking, models for different PV technologies
- Calculator for stand-alone PV applications (Africa only)
- High-resolution terrain data allows calculation of the effects of shadowing
- Google Maps interface with search and zoom facilities.

PVGIS



The screenshot shows the PVGIS web application interface. At the top, there is a navigation bar with the JRC logo and the title "Photovoltaic Geographical Information System - Interactive Maps". Below this is a search bar with a search button. The main area is divided into a map on the left and a configuration panel on the right. The map shows a color-coded solar radiation map of Europe. The configuration panel is titled "Performance of Grid-connected PV" and includes several sections: "PV Estimation" (with tabs for Monthly radiation and Daily radiation), "Performance of Grid-connected PV" (with a dropdown for PV technology set to "Crystalline silicon", a text input for "Installed peak PV power" set to "1", and a percentage input for "Estimated system losses" set to "14"), "Fixed mounting options" (with a dropdown for "Mounting position" set to "Free-standing", a degree input for "Slope" set to "35", and a degree input for "Azimuth" set to "0"), "Tracking options" (with checkboxes for "Vertical axis", "Inclined axis", and "2-axis tracking", each with a "Slope" input and an "Optimize" checkbox), and "Output options" (with checkboxes for "Show graphs", "Show horizon", "Web page", "Text file", and "PDF"). A "Calculate" button is at the bottom of the configuration panel. A "Done" button is at the bottom left of the browser window.

Click here

Then click here

1000-2000 hits per day

AFRETEP

Scientific and Technical Support to Sustainable Energy Development in Africa: rural electrification, renewable energy and communication.

Founded by: European Commission, Europe Aid Co-operation Office.

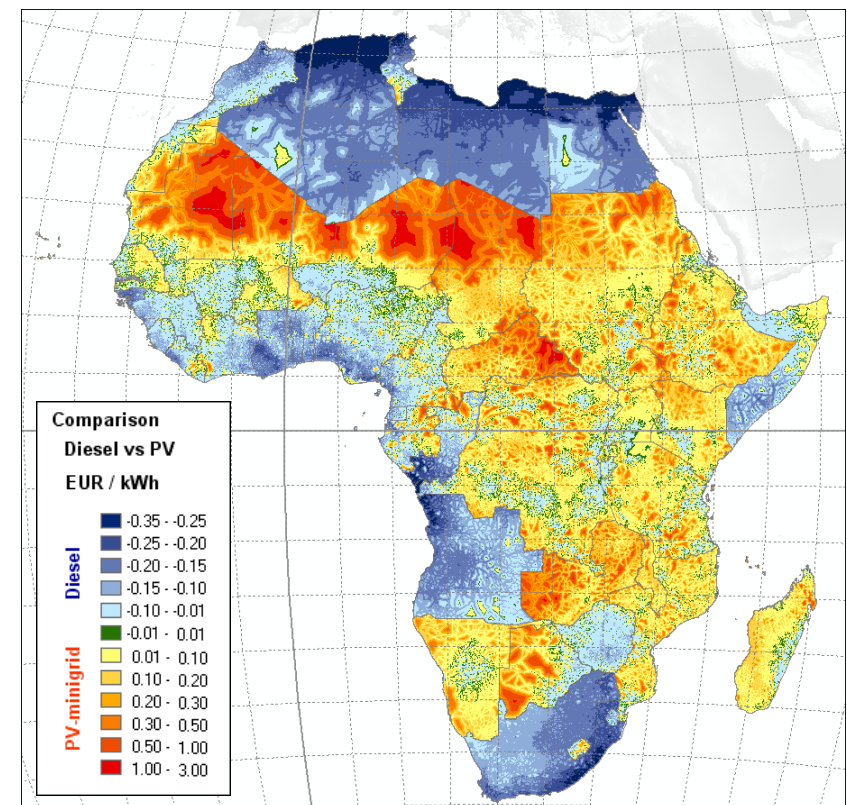
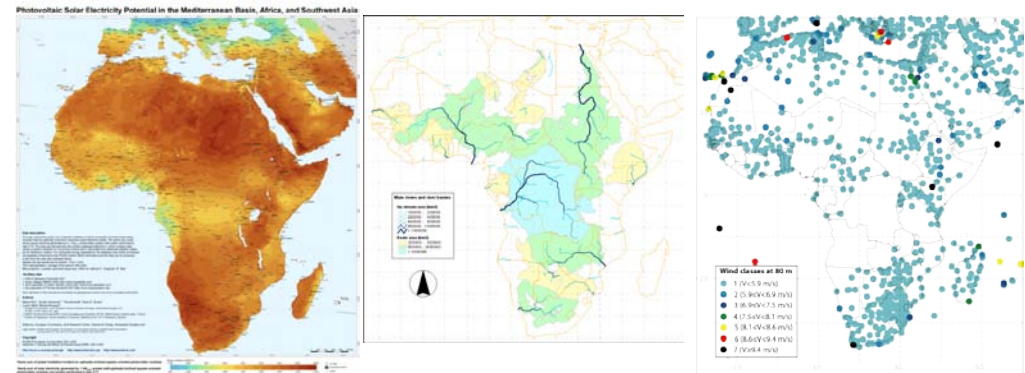
3 years.

Tasks:

- Increase Scientific and technological knowledge sharing.
- Establish a network of African Research Institutions.
- Promote cooperation and coordination.
- Provide scientific information, geographical data and appropriate tools.

AFRETEP

- 1st AFRETEP Meeting: Cameroon, Senegal, Uganda, Ethiopia, Burkina Faso, Cape Verde, Ghana, Tanzania, Botswana, EU.
- Activities:
 - Capacity building.
 - Launching a public-accessible web page , www.afretep.net.
 - Gather high quality renewable energy resource geographical information in Africa.
 - Decision support system tool.





Thanks for your attention.

For more information, please contact:

Arnulf.JAEGER-WALDAU@ec.europa.eu

(PV Status Report 2010)

Thomas.HULD@jrc.ec.europa.eu

(PVGIS)

Heinz.OSSENBRINK@ec.europa.eu

(HU Renewable Energy)

Irene.PINEDO@jrc.ec.europa.eu

(AFRETEP)