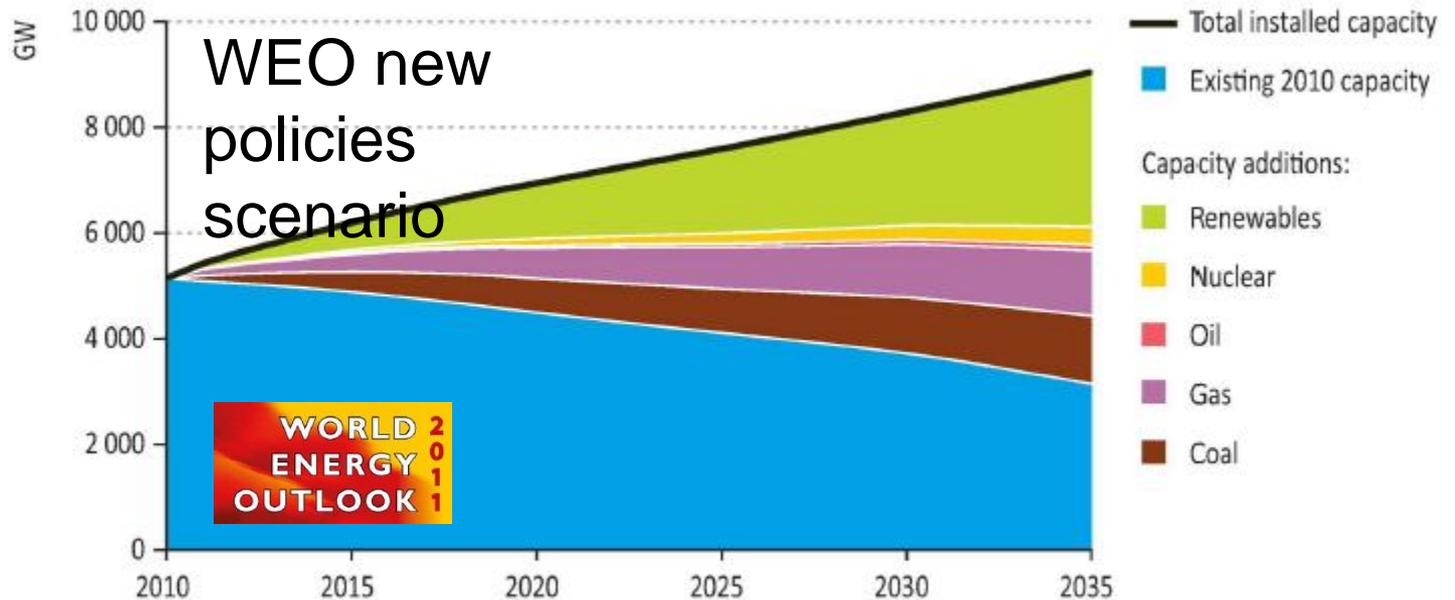




Earth observation for monitoring and assessment of the environmental impact of energy use

# Project background

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Environmental  
Impact Model  
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Output



- Worldwide demand of energy is growing and will continue to do so for the next decades to come
- Serious concern regarding the sustainability of the current and future pattern of energy consumption.
- GEOSS provides chances for enhanced input data to energy system modeling and life cycle assessment
- Create use cases for GEOSS for this purpose
- Enhance energy system modeling with respect to renewables

# Project objectives

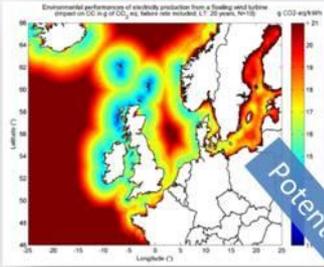
**EnerGEO** develops a strategy for a **global assessment** of current and future **impacts of the exploitation of energy resources on the environment and ecosystems** based on the use of the *Global Earth Observation System of Systems (GEOSS)* capacities. This strategy is demonstrated for a variety of energy resources worldwide (fossil fuels, biomass, solar and wind energy).

## **EnerGEO combines:**

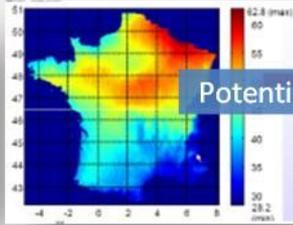
1. **Existing energy system models** and models capable of assessing and forecasting environmental impacts and costs of energy exploitation
2. **Existing global earth observation datasets** from which energy potentials as well as environmental indicators are derived in order to quantify changes to environmental quality

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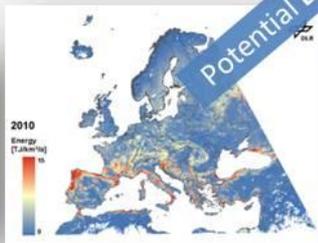
## Energy Potentials



**Wind Energy Pilot:** impact on marine ecosystems and visual perception of landscapes



**Solar Energy Pilot:** select optimum power plant locations and support electricity grid integration



**Biomass Pilot:** impact on ecosystems, biodiversity and food security

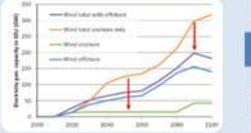
## Scenario Development and Analysis

Energy models

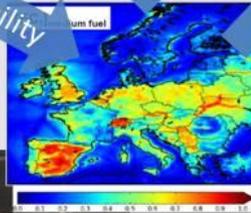
Integrated Assessment



GAINS MESSAGE



Emission variability



**Fossil Fuel Pilot:** impact on atmospheric composition and land degradation impact



## Impact Assessments

### Life Cycle Impact Indicators

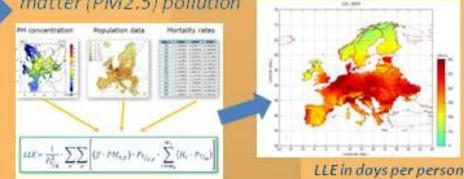
- Climate Change
- Health Impact
- Ecosystems



LCA Wind Turbines

### Damage Function

Loss of Life Expectancy due to particulate matter (PM2.5) pollution

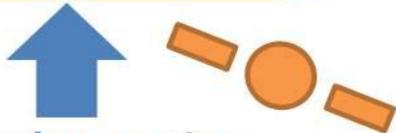


LLE in days per person

### Scenario Annual Impact Indicators

- Climate Change
- Health Impact
- Ecosystems

Earth observation



# EnerGEO portal

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The screenshot displays the EnerGEO Geoportal interface. At the top, the logo 'EnerGEO / Geoportal' is visible alongside navigation links for 'Login', 'Register', 'Help', 'About', and 'Feedback'. Below this is a main navigation bar with 'HOME', 'SEARCH', 'BROWSE', 'PILOTS', 'HELP', and 'MAP VIEWER'. The 'Search' section features a search bar with the term 'irradiance' and a 'Search' button. Below the search bar, it indicates 'Results 1-6 of 6 record(s)' and provides options to 'Expand results', 'Zoom To Results', and 'Zoom To Searched Area'. A list of search results is shown, including 'Relief shadow effect on Solar Resource' and 'PACA Region (FRANCE) 250 m. resolution Irradiation Map (WMS)'. The 'Additional Options' section includes a 'Clear' button and a 'WHERE' section with radio buttons for 'Anywhere' and 'Inter'. The 'Map Viewer' section shows a map of Europe and the Mediterranean region with a color-coded irradiation overlay. A 'Geoportal Search' window is open, displaying a list of search results with checkboxes for 'Annual BETHYDLR Theoretical Energy Potential (TEP) for agriculture, forests and grassland (Pakistan)', 'Annual BETHYDLR Theoretical Energy Potential (TEP) for agriculture, forests and grassland (Austria)', 'Helioclim 3 WMS', and 'EnerGEO GPT 931'. A 'Helioclim 3 WMS' information window is also open, providing details about the service: 'The HC3Map Web Service provides maps of 5-years average of the monthly irradiation, i.e., the mean energy received during a whole month per square meter. Irradiation is expressed in'. The map viewer includes a scale bar (0 to 1000 km / 0 to 500 mi) and a 'POWERED BY ESRI' logo.

<http://energeo.researchstudio.at/>

## **C1. Tools and Information for Impact Assessment and Energy Policy Planning**

- Develop a modelling platform that will enable planners and governments to forecast and monitor the environmental impact of changes in the energy mix
- Integrate Earth observation data with state-of-the-art modelling tools to calculate socio-economic impacts and environmental costs

## **C2. Impact Monitoring System for Geo-Resource Exploration and Exploitation**

# EN-01 Energy and Geo-Resources Management

Develop products and services required to assess countries' potential for energy production. Foster the use of Earth observation and information in energy-policy planning

Develop a Bio-Energy Atlas for Africa to provide information on the quantity, distribution, usage, and quality of biomass. Provide Net Primary Production data and bio-energy potential prognosis maps at 1 km resolution from the year 2000 onwards. Derive assessments of vegetation-cover degradation or changes (see also SB-02, SB-03)

Encourage training of decision-makers at all relevant levels for interpreting relevant data and products

# Beyond ENERGEO

- Further improve the modelling system
  - ❖ Expansion to other energy carriers
  - ❖ Further expansion to (local) impacts of renewable energy resources
  - ❖ Further expand to global scale
  - ❖ Further integrate and optimize components
  
- Integration of scenarios for power sector to those of other sectors like transport and industry
  
- Improve potential assessment and impact monitoring by further using GEOSS

# SB-05-C1

## *Expected Achievements by 2015*

- Deriving European (and global) maps of energy potentials for biomass, solar and wind.
- Building a modeling framework that incorporates the potential maps into energy models and subsequently integrated impact assessment models.
- Testing the current integrates assessment methodology for replacing fossil fuels by renewable energy sources.
- Building a platform for making a multi-indicator environmental impact assessment of alternative energy scenarios
- Applying the modeling framework to three scenarios illustrating the capacity developed in the project.
- Building economic siting applications for solar energy combining potential maps and life cycle analysis.
- Building modular site-specific model based on Life Cycle Assessment for wind energy combining potential maps and life cycle analysis.
- Contributions to the development of Bio-Energy Atlas for Africa.
- Providing a portal to disseminate data sets within GEOSS.
- Contributions to AIP-5.
- Demonstrating monitoring applications for changing atmospheric composition due to fuel combustion and land subsidence due to mining.
- Disseminating experiences through dedicated summer schools and other actions throughout the world.