GEO’S CONTRIBUTION TO THE ACHIEVEMENT OF INTERNATIONAL ENERGY GOALS

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GWF
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Global Energy status

Main drivers of global energy demand
• Increasing population i.e. 7 bn in 2011 and 8 bn by 2030
• Growing economies i.e. BRIC and N11
• Emerging middle-class world-wide

Current status and trends
• 1.3 bn not have access to electricity
• 2.6 bn rely on wood, dung, coal and other traditional fuels inside their homes → health implications >1.5 M per year
• increasing energy demand by 2% per year
International Energy policy

UN Secretary General’s Sustainability Energy for All (SE4All) Initiative

The main objectives:
✓ double the share of renewable energy in the global energy mix,
✓ ensure universal access to modern energy services, and
✓ double the global rate of improvement in energy efficiency in buildings, industry, agriculture, and transportation sectors

Therefore, contribute to the
• energy security of countries
• reduction of the cost
• Reduction of impacts of their energy mix
• Indirectly contribute to the food, air and water security
Role of private sector

The private sector is expected to provide its
• capacity,
• knowledge,
• experience
• targeted funds
• flexibility and efficiency

These private entities include among others
• major pension funds,
• mutual funds,
• sovereign wealth funds,
• private corporations,
• development banks and
• other investors.
Missing parts

For energy planning and monitoring activities

- limited use of recent technological advancements (e.g. ICT, IoT).
- lacks the spatial dimension at sufficient resolution

Therefore, decision makers

- possess limited information for evidence-based geographically localised decisions
- does not always capture the complexity and spatial patterns of the social-economy system.

Potential Location for Production of Solar Energy
(Source: http://www.ikg.ethz.ch/geoinfo/research/GIS_for_RE/index_EN)
What is GEO and GEOSS?

Intergovernmental organisation Group on Earth Observations (GEO),

- Largest consortium of data providers in the world
- Launched in 2005, in response to calls for action by the 2002 World Summit on Sustainable Development and by the G8 (Group of Eight) leading industrialized countries
- Coordinating efforts to build a Global Earth Observation System of Systems (GEOSS)
- Provides a framework within which the partners can develop new projects and coordinate their strategies and investments in data products and services
91 Members
77 Participating Organizations
The Vision for GEOSS is...

...to realize a future wherein decisions and actions for the benefit of humankind are informed by coordinated, comprehensive and sustained Earth observations and information.

GEOSS 10-Year Implementation Plan, February 2005
## Tasks addressing Strategic Targets by 2015

### 1. Building an integrated system of systems: The GEOSS building blocks

- 1.1 Architecture
- 1.2 Data Management
- 1.3 Capacity Building
- 1.4 Science and Technology
- 1.5 User Engagement

### 2. The 9 GEOSS Societal Benefit Areas

- 2.1 Agriculture
- 2.2 Biodiversity
- 2.3 Climate
- 2.4 Disasters
- 2.5 Ecosystems
- 2.6 Energy
- 2.7 Health
- 2.8 Water
- 2.9 Weather

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![World map](image.png)
Areas of work of GEO Energy Task

GEO Energy Programme tackles energy challenges around the world by:

- Developing tools and products that provide support to energy decision makers; and
- Facilitating the provision of freely accessible data, both remotely sensed and \textit{in-situ}, that is used in these tools.
Renewable Energy

A) Global/Regional Scale

- Potentials

IRENA Global Solar and Wind Atlas supported by the GEO catalog. [IRENA]

- Forecast

Winter forecast skill of wind speed (Ensemble-mean correlation of 10-metre wind speed for ECMWF-System 4 1-month lead December-February forecasts with start date once a year on first of November from 1981 to 2010) [IC3]
Renewable Energy

A) Global/Regional Scale

• Impacts

Impact of the offshore energy installation. [EnerGEO]

• Potentials

South African contribution to the Bioenergy Atlas for Africa [BAfA]
Renewable Energy

B) National/Sub-national scale

- Solar
  
  Map of opportunities for solar energy installation in Morocco.

- Wind
  
  Annual Energy Output for on-shore wind energy policy planning and private investment.
Renewable Energy

B) National/Sub-national scale

• Bioenergy

Bioenergy assessment in Pakistan for 2000 to 2010. Scenarios based on the plant size and transportation costs. [EnerGEO]
Energy Access

• National and Sub-national scale

Global Scenario with visualized optimal locations for wind turbine, PV and biomass plant installations in 2020 [EnerGEO]

Forecasting of the electricity production by renewable energy technologies, improving the management of the grid [ENDORSE]

• Global and Regional Scale
Energy Efficiency

- Energy Efficiency in Residence

Real-time control of blinds and artificial lights and estimation of the annual lighting energy consumption and savings. [ENDORSE]
Energy Mix Scenarios

A) Global and regional scale

Power generation and CO2 emissions for the three low carbon scenarios. Left: Open Europe (i.e. import of solar power from North Africa, high biomass share, nuclear phase-out), middle: Island Europe (i.e. no electricity imports, renewable energy as in Open Europe. Expansion of nuclear, if needed), right: maximum renewable (i.e. the highest possible power generation from renewable sources). [EnerGEO]
Energy Mix Scenarios

B) National and Sub-national scale

Illustration of scenario 2: At high price of heating oil is covered by regional resources (including biomass). The percentage of heat demand coverage among different energy technologies i.e. the heat pump (deep probe), surface collector, district heating, logs, and heating oil. (http://ispacesrv008.researchstudio.at/BioSpaceOpt/index_mix.jsp)
## Data requirements

<table>
<thead>
<tr>
<th>Data requirement</th>
<th>Hydropower</th>
<th>Wind</th>
<th>Solar</th>
<th>Geothermal</th>
<th>Bioenergy</th>
<th>Marine</th>
<th>Fossil</th>
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</thead>
<tbody>
<tr>
<td>Water run-off (e.g. based on snow water equivalent, precipitation, lake/reservoir height)</td>
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<tr>
<td>Wind speed, direction and vertical profile</td>
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<tr>
<td>Land cover/Land use change</td>
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<td>x</td>
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<tr>
<td>Biomass (e.g. Normalized Difference Vegetation Index, Net Primary Productivity)</td>
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<tr>
<td>Solar radiation (e.g. Direct Normal and Global Horizontal irradiation)</td>
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<td>x</td>
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<tr>
<td>Topography/Orography/Bathymetry</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>Surface temperature, Humidity, Precipitation</td>
<td>x</td>
<td>x</td>
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<td>Geothermal fluid</td>
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<td>x</td>
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<tr>
<td>Cloud cover</td>
<td></td>
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<td></td>
<td></td>
<td>x</td>
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<tr>
<td>Sea variables (wave height, current speed, bathymetry, sea surface temperature)</td>
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<td>x</td>
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</tbody>
</table>
Policy level

- Energy – Water – Food Nexus
- Sustainability Development Goals
## Synergies with other GEO Tasks

<table>
<thead>
<tr>
<th>Use</th>
<th>Example of Datasets</th>
<th>In collaboration with the GEO Tasks</th>
</tr>
</thead>
</table>
| Infrastructure Security                  | • Early warning system datasets  
• Weather forecasts data                                                              | Disaster (Supersites)  
Weather                                                        |
| Impact Assessment                        | • Protected areas, Natural Reserves  
• Species distribution and abundance  
• Ecosystem monitoring related data                                                 | Biodiversity (GEO BON)  
Ecosystem  
Ocean (Blue Planet)  
Water                                                         |
| Energy mix scenarios/Energy Efficiency   | • Land Use and Land Use change  
• Forest carbon  
• Water quality  
• Agriculture production anomalies  
• Health  
• Urban e.g. “heat island” effect, high resolution data for urban areas of > 50,000 habitants | Land Cover and Land Use  
Forest (GFOI)  
Agriculture (GEO GLAM)  
Health  
Urban                                                      |
| Energy potential and forecasts           | • Weather forecasts data  
• Climate data series                                                                | Weather  
Climate (GCOS)                                                  |
Data Accessibility and Discoverability

- GEOSS User
- GEOSS Projects
  - Standards & Interoperability
  - User Requirements
  - Best Practices Wiki
- Discovery & Access
- Service Monitoring
- Component & Service Registry (CSR)
- Clearinghouse (CH)
- Discovery/Access Broker (DAB)
- Semantic Component*
- Associated EO Systems
  - e.g., GENESI, OWIC, FedEO*
- EO Data Catalogues & Repositories
  - e.g., IDN, INSPIRE, geo.data.gov

Prototype capabilities

Services and SW Applications
- e.g., Software, Data Access, Processing, Community Portals, Documents

Discover and Access
Potential users
International and regional organisations

• Assessment and monitoring of progress toward the achievement of international energy targets;
• Monitoring the impact of the global/regional related policies;
• Addressing complex global issues, e.g. energy-water-food(-air) nexus, SDGs;
Potential users

National decision makers

- Making evidence-based decisions both for planning in a specific area and promotion of a specific technology;
- Supporting decisions with user friendly maps illustrating the multiple benefits for society and the national economy;
- Assessment of the impact of national actions on global energy targets;
- Attracting private capital by providing a monitoring framework that will reduce the risk of investments;
Potential users
Funding agencies

• Monitoring and assessment of the contribution of funding schemes to energy targets;
• Monitoring and assessment of the cumulative impact of individual projects, including synergies and avoiding leakages;
• Applying targeted support based, for instance, on performance or improvement of potential indicators and monitoring the progress of funded projects;
Potential users
Private sector

• Improving the efficient use of resources along the entire supply chain;

• Creating new markets such as certified products, carbon credits, new resources, and insurance indexes;

• Demonstrating the results and impacts of activities on their shareholders and national authorities;

• Estimating and managing the risk of investment.
Next steps

• Further contribute to the development of the IRENA Atlas
• Closer partnership with other international organizations such as IEA, REN21, UNIDO
• Point out the importance of EO in Energy planning and monitoring at the international energy policy forums
• Develop regional and national end-to-end integrated solutions such as the Working Group on Energy for Africa
• Expand partnerships to both academic and private sectors
Acknowledgments

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Thank you for your attention
• http://geoenergy.wix.com/geoenergy
• http://www.earthobservations.org/geoss_en_ph.shtml
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