Issue V—October 2012

EnerGEO / News

Earth Observation For Monitoring and Assessment of the Environmental Impact of Energy Use

Foreword

The EnerGEO consortium proudly presents the 5th issue of the project's newsletter. This newsletter focuses on results of the EnerGEO pilots, the EnerGEO portal as well as an outlook concerning the scenarios to be assessed within the project. It also features our project partner RSA.

The pilots are central in testing the EnerGEO workflow from Earth observation to scenario forming and associated impact assessment. They encompass the major energy production forms, being fossil fuels, biomass, solar and wind power, and enable to consider various energy mix scenarios. The design of the EnerGEO modeling cluster, which is the engine of the workflow, is now being applied for the first time. Three scenarios are assessed linking the different models within the framework. Both cost and environmental impact optimization are driving the scenario building towards a resource-efficient future energy use. The first scenario analysis does not encompass an update of the energy potentials from the pilots. After finalization of the pilots the same scenarios will be assessed using updated information from the pilots to be able to quantify the impact of the improved use of earth observation data to derive energy potentials. Applications and data will become available through the EnerGEO portal. The portal is fully functional and can be accessed. Moreover, the portal will be extended to become a knowledge portal including all documentation of the datasets available.

EnerGEO has a clear presence in the latest draft of the GEO Work Plan through its EC contribution in the so-called social benefit area, SB-05 Impact Assessment of Human Activities, and through its contribution to the Bioenergy Atlas for Africa. We also have a presence at the next GEO Plenary in Foz do Iguaçu, Brazil. I hope to see you in Brazil coming November!

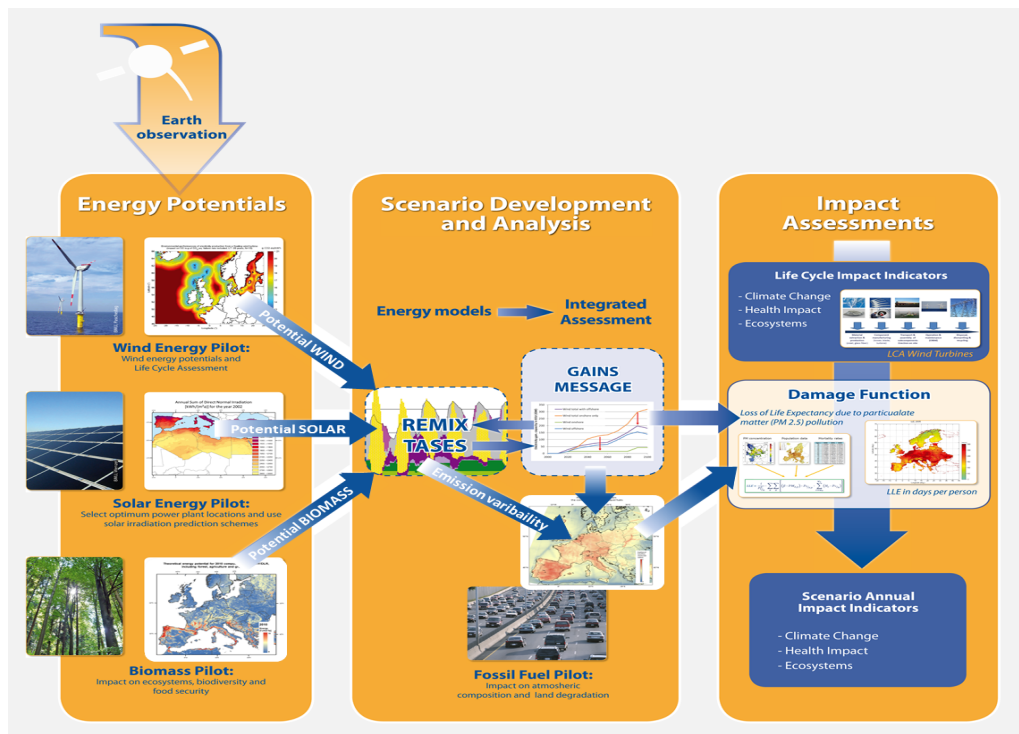Martijn Schaap - Coordinator EnerGEO

Figure 1. EnerGEO's workflow

EnerGEO scenarios for Europe

The EnerGEO project aims to assess the impact of energy use on the environment, for a large scale transition towards renewable energies. To prove that the Integrated Assessment Framework which is developed in the project does work project partners IIASA and DLR have been developing hypothetical scenarios to be used in the Framework.

The aim of developing the scenarios is to identify how inclusion of potentials for renewable electricity can influence the structure of power generation and which effects the new structure will have on:

- Emissions of air pollutants and greenhouse gases
- Human health
- Ecosystems
- Other impacts (to be identified within pilots)

When a scenario is developed, the start is an exogenous baseline for energy demand. The uptake of renewable energy is modified according to DLR´s energy model ´REMix´ results, and the fossil fuel consumption is modified accordingly, keeping the total electricity demand the same. Then, the scenario can be implemented in the impact model ´GAINS´ to calculate the impacts.

Three scenarios have been defined to illustrate the capability of the modelling cluster to assess the impact of contrasting energy mixes:

1) "Open Europe": Solar import to Europe from North Africa, high biomass share, nuclear phase-out
2) "Island Europe": no electricity imports from outside Europe, renewable energy use like in "Open Europe" or higher, nuclear energy use continued / extended
3) "Maximum Renewable Energy: renewable energy penetration close to 100%

Currently, the energy mix of the scenarios is determined using the REMix model. The results will be published together with the results of the impact assessment of these scenarios calculated in the GAINS model in the next newsletter.

Pilots

In the last newsletter the wind and biomass pilot were introduced. In this newsletter the focus is on the other two pilots "Fossil Fuel" and "Solar". In the next newsletter some of the results from all pilots will be presented.

Fossil Fuel Pilot

Fossil fuels are the most important source for energy currently used in society. The impact of the exploitation of fossil fuels on the environment and ecosystems are many. For example, the use of fossil fuels, mainly through combustion, causes a vast amount of air pollutants emitted into the atmosphere. Pollutants include CO_2, CO, carbonaceous particles, NOx, SOx, POP's, dioxins and mercury. These emissions alter the composition of the atmosphere and have impact on different scales. For example, poor air quality through particulate matter and ozone are associated with health effects, greenhouse gases and particles impact the climate system and nitrogen and sulfur oxides are associated with acidification and eutrophication of ecosystems. To assess the impact of a reduction in fossil fuel use, a thorough knowledge is needed on the actual impacts of energy resources on the environment as well as the benefits or drawbacks associated with potential shifts in resources. The central goal of the fossil fuel pilot is to test and demonstrate an observing system and a scenario capability relating to atmospheric composition and land degradation through the use of fossil fuels.

Health effects of air pollution are largely associated with particulate matter (PM). To assess the health impact of shifts in energy resources its origin needs to be known and validated. Unfortunately, current understanding is limited to about two thirds of the total mass. Moreover, the origin is hardly evaluated in detail as air quality models that predict PM distributions lose the information on origin in their calculations. Hence, a new module was developed for the LOTOS-EUROS model to trace the source contribution throughout the model simulations. Complementary, detailed data sets on the chemical composition of PM were collected to assess source contributions using a statistical decomposition of the time series of the individual components using a technique called PMF. For the first time, modeled source contributions were evaluated using these profiles as well as specific source tracers. First results show that the model correctly reflects the spatial gradient in crude oil combustion particles.

The developed source apportionment tool can be used to calculate source receptor matrices (SRMs) as used in GAINS to link environmental impacts to activities. The new tool is used to evaluate these SRMs in case the timing of the use of fossil fuels will change significantly, as expected when renewable sources will produce a large share of total electricity demand.
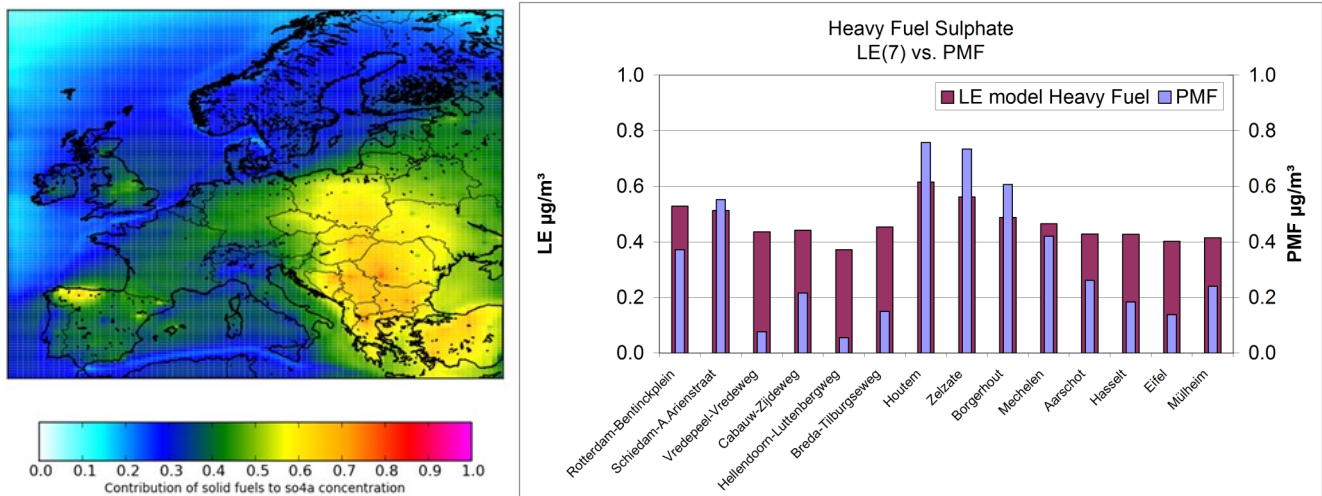

Figure 2. Modeled contributions of solid fuels to particulate sulphate (left) and the corresponding comparison between the heavy fuel sulphate (LE7) vs. sulphate in heavy fuel oil factor PMF (Basic Model Run, BMR).

Solar Energy Pilot

Environmental impacts in solar energy use are mainly related to the reduction of fossil fuel use through integration of solar energy into the electricity grid. Additionally, the visual impacts of large photovoltaic systems in a landscape and land use effects are currently discussed. The focus within this pilot will be on:

- Electricity production by solar plants
- Grid integration and fossil fuel replacement

One of the major challenges in renewable energy use is the integration of renewable electricity generation into existing energy grids. In this pilot activity we will analyze solar energy as an important example for an intermittent energy resource. Techniques as solar power prediction for the upcoming few hours up to one day for the day-ahead markets and the use of recently developed storage technologies are promising. It has been shown in case studies, that the combination of solar power prediction and storage capabilities at concentration power plants will increase solar energy yield integrated into the electricity supply. This allows increased base load capabilities, reduction of reserve power capacities and therefore reduce environmental impacts of fossil fuel use.

The use of existing solar power prediction schemes based on the METEOSAT satellite series, numerical weather prediction and data-assimilation of various atmospheric EO measurements (METOP, MSG, sounding sensors) will be assessed using larger datasets. Analyzing larger datasets (e.g. up to 1 year duration of realistic weather information based on ECMWF modeling) instead of artificial test data or single days will allow quantification and statistical analysis of such effects and give feedback to GEOSS data providers from the meteorological communities about deficiencies and strengths in existing numerical weather prediction for this purpose.

Goals of the Solar Pilot are:

- An application for investors and electricity producers in order to define the best site for solar energy production and options for grid integration and fossil fuel replacement
- Assess the use of existing solar power prediction schemes based on the METEOSAT satellite series, numerical weather prediction and data-assimilation of various atmospheric EO measurements allowing the quantification of increased base load capabilities and reduction of reserve power capacities in energy grids
- Model time-dependent averaging effects and cross-border energy flows over larger time periods and regional areas

EnerGEO GEOportal

The Energeo Geoportal solution opens the versatile EnerGEO modelling platform to planners, environmentalists and governments to calculate, forecast and monitor the environmental impact of changes in the energy mix on local, regional and global scales. As part of the project EnerGEO, the Geoportal is created fulfilling the purpose of providing information on EnerGEO's pilot resources provided by the project partners to a broad audience using open standards for technical interoperability as well as efficient discovery mechanisms. It serves as Energy FP7 Community Hub to the GEOSS Geoportal. The Geoportal resource discovery provides enhanced functionality for distributed search, auto-suggestion lists, recommender-enhanced discovery and semantic matching of spatial and non-spatial content.

There is a number of things you can do with the EnerGEO Geoportal like:
- You can share and discover energy domain related resources through the Geoportal discovery and get additional meta information about the resource.
- With Online Services Users can preview the spatial resource with an online Map Viewer.
- The Energeo portal offers also a comprehensive way for accessing Energeo pilot partners' applications that intend to disseminate usable knowledge in energy questions.
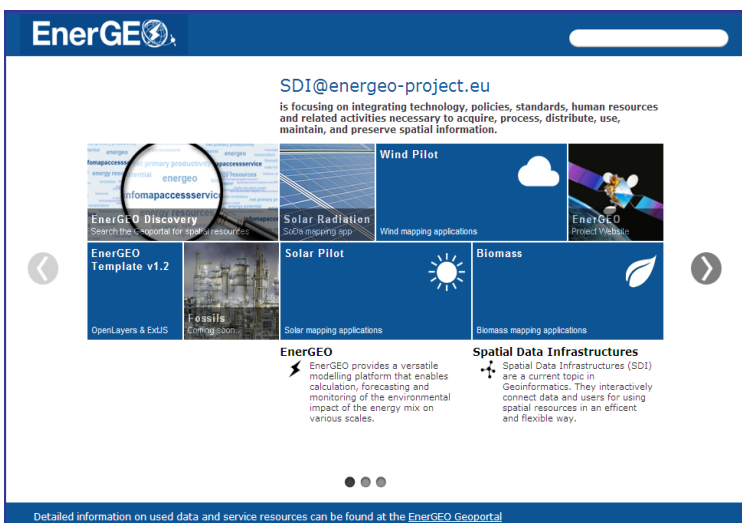

What is a Geoportal?
A Geoportal is a gateway to web-based geospatial resources that enables users to discover, view and access geospatial information, services and applications made available by their providing organizations. Likewise, data providers use the Geoportal to make their geospatial resources discoverable, viewable, and accessible to others.

What is a Resource?
A resource, in geoportal terms, is data, a service, an application or any other repository that hosts information. Resources can be metadata records, web services, Wikipedia articles, Flickr® content, YouTube videos, SharePoint® documents, RSS feeds, KML documents, REST URLs, metadata catalogs, and more.
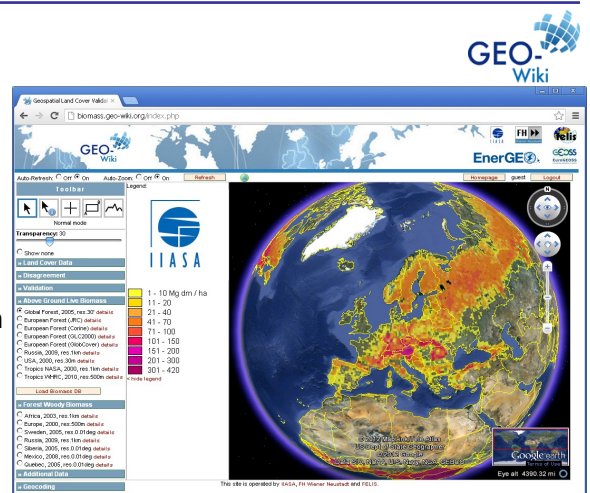
Figure 3. EnerGEO Geoportal – geoportal.energeo-project.eu

GEO Wiki Project

The Geo-Wiki Project is a global network of volunteers who wish to help improve the quality of global land cover maps. Since large differences occur between existing global land cover maps, current ecosystem and land-use science lacks crucial accurate data (e.g. to determine the potential of additional agricultural land available to grow crops in Africa). Volunteers are asked to review hotspot maps of global land cover disagreement and determine, based on what they actually see in Google Earth and their local knowledge, if the land cover maps are correct or incorrect. Their input is recorded in a database, along with uploaded photos, to be used in the future for the creation of a new and improved global land cover map.

Figure 4. Global Biomass on Biomass Geo-Wiki

Two GEO-Wikis of special interest within this Wiki are the Biomass Geo-Wiki (biomass.geo-wiki.org) and the NPP Geo-Wiki (npp.geo-wiki.org) where EnerGEO data (Net Primary Productivity from Europe and Southern Africa) can be found.

About the Biomass Geo-Wiki:
The Biomass Geo-Wiki has collected a comprehensive set of recent biomass data (by IIASA among others) from around the globe, and makes it freely available for visualization. Users are provided with an instant global overview of available datasets, overlaid on the Google Earth platform with comparable units. This provides an instant gap analysis of global data. Additional data to be uploaded could include geo-tagged pictures, in-situ measurements and more. Finally it would be possible with a critical mass of data to produce a global mosaic of terrestrial biomass.

20th Biomass Conference, June 2012, Milan

Markus Tum (DLR) and Markus Biberacher (RSA) represented EnerGEO during the 20th Biomass Conference in Milan, Italy this June. Around 1500 attendees from more than 60 countries coming from business, science and authorities discussed about recent developments in the biomass sector. The EnerGEO project was well accepted and found good attraction from the audience.
For more information please visit:
www.conference-biomass.com/

Partner profile RSA

rsa Research Studios Austria Forschungsgesellschaft mbH

RSA is a large non-university research institution in Austria. RSA has 40% of the revenues from industrial research and development services, the remainder from national funding and research grants. RSA has a long history of EU project participation. Present relevant projects in FP6 and FP7 include DECOS, SECOQC, S@NY, ORCHESTRA, GEOLAND, GEOLAND II or REACCESS. Within RSA, the studio iSPACE is part of the Research Studios division, with the specific mission of accelerating the transfer of research results into industrial technologies. iSPACE specialises in Geographic Information for decision support in the areas energy, urban and regional planning and GMES.

Within EnerGEO, RSA is mainly involved in Systems Engineering. RSA is responsible for the work package in which the EnerGEO GEOportal is designed, developed and implemented. RSA also designs the system architecture to incorporate contributed components, services and data which come from other work packages in the project, confirming interoperability using international standards and interoperability arrangements based on the upcoming GEOSS architecture.

RSA is further involved in the modelling task within the EnerGEO project. With the TASES model global energy system scenarios are calculated by RSA which utilises earth observation data provided within the project.

Meetings and events

Project meetings (only for project partners):
- Fourth Annual meeting on 19-20 November 2012 / Laxenburg-Austria
- Technical meeting in May 2013

Other meetings and events:

GEO IX Plenary meeting	Foz do Iguaçu, Brazil	22 Nov —23 Nov 2012
9th AARSE Conference 2012	El Jadida, Morocco	29 Oct—02 Nov 2012
EnviroInfo Conference 2013	Hamburg, Germany	2 Sep— 4 Sep 2013

Partners

TNO DLR **rsa** Research Studios Austria Forschungsgesellschaft mbH UNIRESEARCH AGH SUPARCO iuta

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The EnerGEO project is closely working together with:

GEO
www.earthobservations.org