

NEWSLETTER 02

AUGUST 2017

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TRANSITION SCENARIOS

The aim of the MEDEAS project is to furnish policymakers with an open access programme they can use to figure out how their political choices could take place and could affect the future EU society in achieving a low carbon economy by 2050.

The programme will be able to trace different pathways to the 2050 goal, which is to achieve 80% of 1990 carbon emissions (see [EU decarbonisation Roadmap](#)) in 2050, depending on the different actions taken, and it will be able to analyse the resulting possible future events by also considering or suggesting alternative possible outcomes, and assessing their feasibility and desirability. The totality of these different pathways is called, in general, 'Scenarios'.

In the MEDEAS Scenarios Development Process, we focus exactly on these 'anticipatory scenarios' in which the achievement of the desired goal drives present policies and decisions, according to the aim of MEDEAS, i.e. reaching 'Energy Transition' in the EU from fossil fuels to Renewable Energy Sources (RES) as soon as possible. This is why we call the work 'Transition Scenarios'.

In particular, MEDEAS provides the development of three different levels of scenario: Business As Usual (BAU), Optimal Transition (OT) and Mid-Level Transition (MLT) scenarios.

In a BAU scenario, no new policy is introduced, so it simply preludes a future that is the projection of current environmental and economic trends.

The OT scenario is described by a set of actions that imply the employment of the maximum possible effort: the transition is accomplished taking RES deployment as a social priority in which all socio-economic sectors contribute to the renewable transition. This scenario contemplates the fastest rate of RES implementation possible, only limited by physical constraints.

The MLT scenarios are described by a set of actions detailing the alternative pathway to OT, in which the actions to reduce carbon emissions are intended to be delayed in 2020 and 2030, so that MLTs result in possibly less-efficient ways, to achieve the goal.

For each of the above classes of Scenarios, an analysis of the implications and repercussions on the main five economic sectors, named electricity, transportation, residential and commercial, industry, social welfare and environmental impact costs, are considered.



MEDEAS-WORLD: GLOBAL AGGREGATED VERSION OF MEDEAS

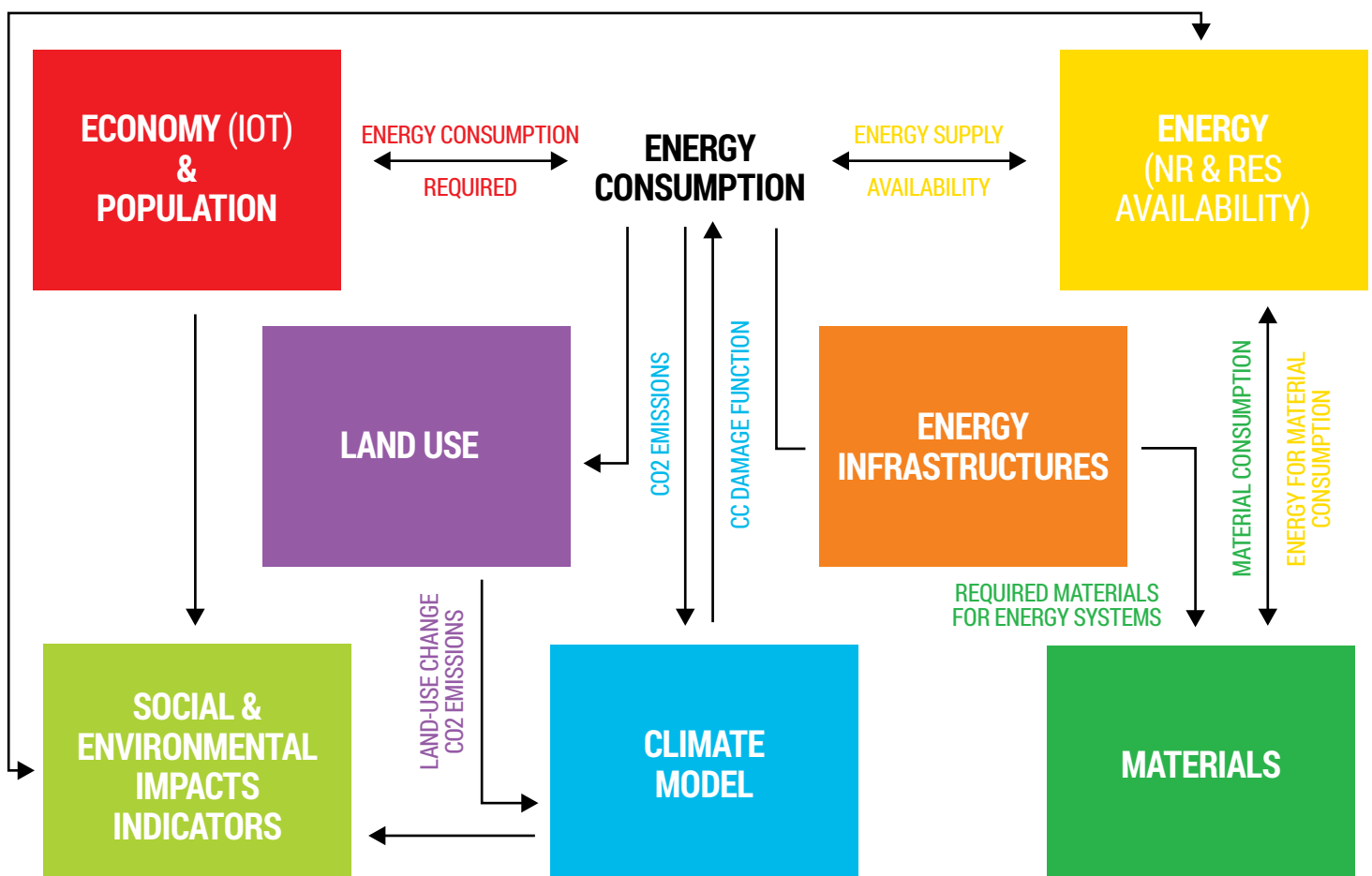
MEDEAS-World is a new global-aggregated energy-economy-environment model (or Integrated Assessment Model). Its function is to serve as a framework for the development and evolution of the European version of the model, which is the core of the MEDEAS project.

It has been designed by applying System Dynamics, which facilitates the integration of knowledge from different perspectives as well as the feedback from different subsystems. MEDEAS-World runs from 1995 to 2050 and is structured into seven submodules: Economy, Energy, Infrastructures, Materials, Land Use, Climate Model, and Social & Environmental Impacts Indicators.

Climate Change and Social and Environmental Impacts Indicators. The economy and energy modules are the most extensive and reach the highest degree of disaggregation. The model consists of a modular and flexible structure, where each module can be expanded/simplified/replaced by another version or submodule.

The model includes several innovations in relation to literature:

- Economic submodule following a post-Keynesian approach assuming disequilibrium (e.g., non-clearing markets), demand-led growth and supply constraints



An overview of MEDEAS-World by the modules and modelled linkages between them.

- Integration of Input-Output Matrices within a System Dynamics structure
- Comprehensive analysis of the techno-sustainable potential of RES for electricity and heat generation
- Consideration of the geological availability of fossil fuel resources given stock and flow limits
- Supply-demand closures model implementation. The energy shortage determines the feedback between the energy and the economic submodule
- Estimations of potential mineral scarcity
- Estimation of EROI of the system and feedback
- The effects of climate change are fed back into energy consumption
- Social and environmental impacts indicators that contextualise the implications for human societies in terms of the well-being for each simulation

This way, MEDEAS-World incorporates three limits to growth that are rarely considered in literature: energy availability taking into account biophysical and temporal constraints, declining EROI levels and consistent climate change impacts.

Preliminary results illustrate the potentiality of the model: current Green Growth scenarios, often promoted by institutions as the way for going forward

to achieve a sustainable energy transition, were found to have serious drawbacks, and fail in delivering globally satisfying outcomes by 2050. Our results show that the solution of individual problems could lead to the creation of others. These dynamics cannot be revealed in the common models typically characterised by sequential structures. Future work will identify the policies and social changes to promote a real sustainable energy transition beyond the Green Growth paradigm.

Despite the challenges encountered with the model, there are still many limitations and uncertainties. Hence, interpretation of the results must be done with caution. MEDEAS-World is not intended for predicting the future, but rather to qualitatively guide the best options for the energy transition towards a low carbon economy. It is a tool to explore strategies, not specific policies, since the latter are applied at a different (reduced) political scale.

The model obtained can still be modified and expanded, depending on the availability of new data or new information, but the current version provides a solid enough basis to serve as a framework for the European scale model.

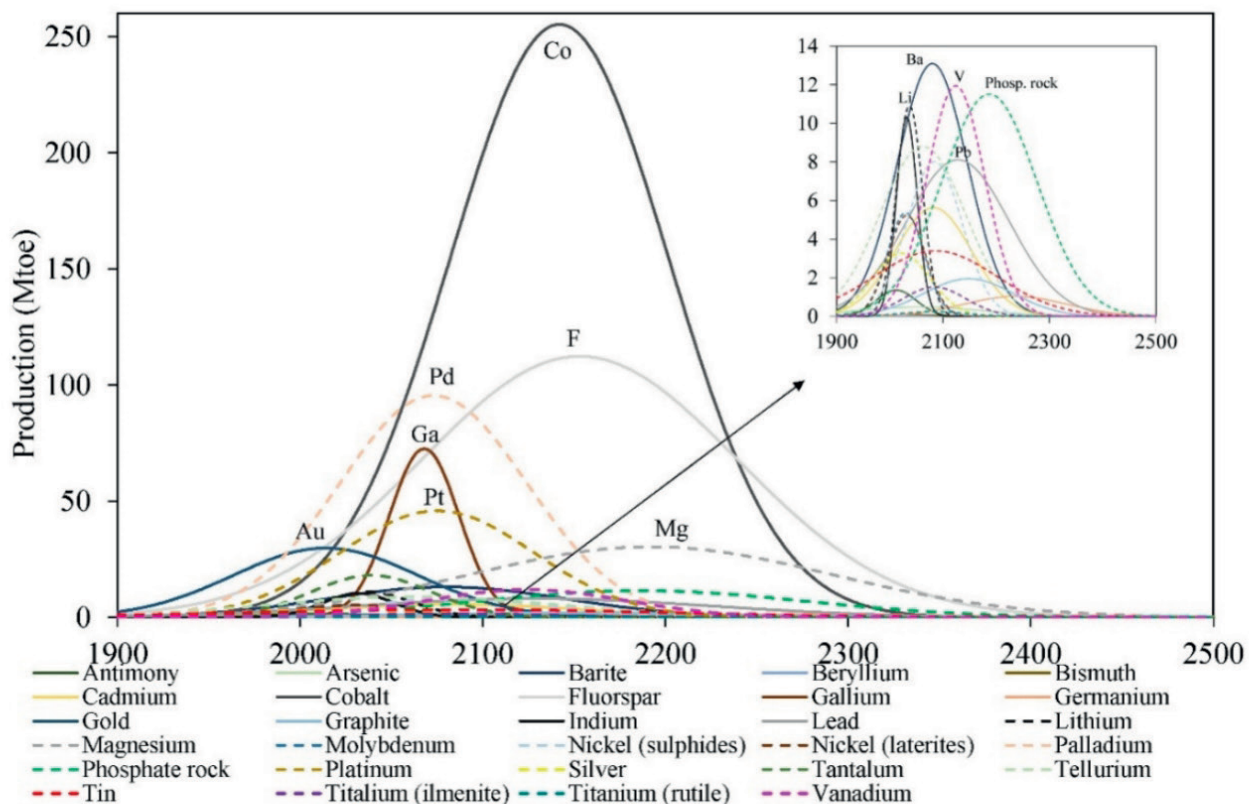
ASSESSING THE MAXIMUM PRODUCTION PEAK AND RESOURCE AVAILABILITY OF NON-FUEL MINERAL RESOURCES: ANALYSING THE INFLUENCE OF EXTRACTABLE GLOBAL RESOURCES

MEDEAS partners from CIRCE (Spain), published a scientific article in *Resources, Conservation & Recycling Journal*.

Using resources information obtained mainly from USGS data, the maximum production peak of 47 mineral commodities has been estimated. For two of them, the maximum theoretical production peak has already been reached, 12 could reach theirs in the next 50 years, and a total of 30 commodities could reach their maximum production peak in the next century. Many factors can influence these values,

changes in future extraction trends, ore grade, exploration and new discoveries and more accurate data on resources. With this information, the most crucial elements (e.g., those peaking soon) can be identified and used to place more emphasis on policies regarding the sustainable use of non-renewable commodities.

The complete article can be found [here](#) and an authorized author manuscript (AAM) is available [here](#).



The Hubbert peak applied to selected minerals using available information on resources.

ASSESSING VULNERABILITIES AND LIMITS IN THE TRANSITION TO RENEWABLE ENERGIES: LAND REQUIREMENTS UNDER 100% SOLAR ENERGY SCENARIOS

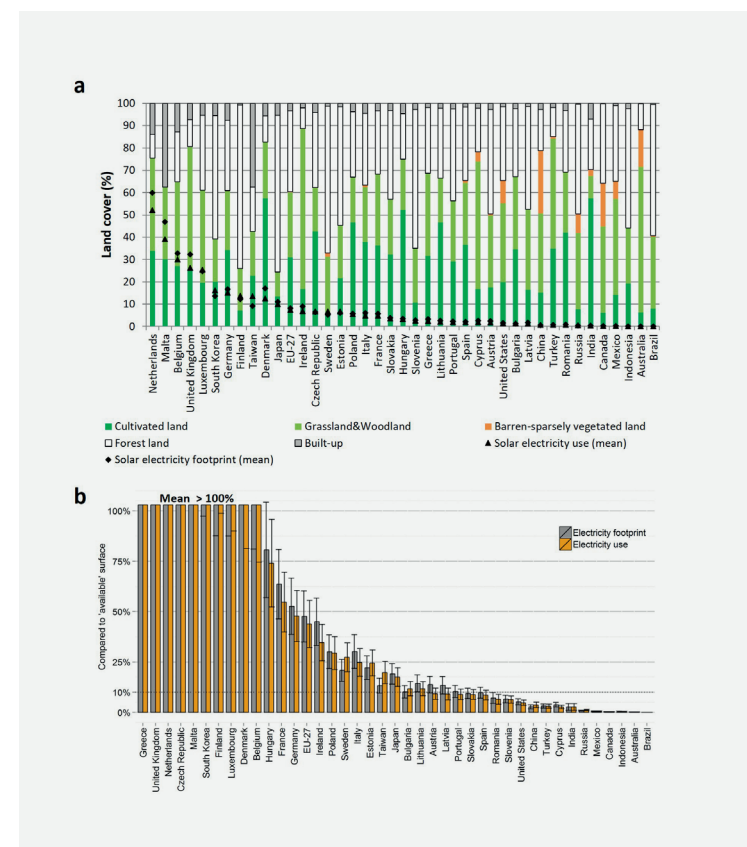
MEDEAS partners from the [University of Valladolid](#) (Spain) have published, in collaboration with Iñaki Arto from the [BC3](#), the aforementioned scientific article in the journal *Renewable and Sustainable Energy Reviews*.

While fossil fuels represent concentrated underground deposits of energy, renewable energy sources are spread and dispersed along the territory. Hence, the transition to renewable energies will intensify the global competition for land. In this analysis, we have estimated the land-use requirements to supply all currently consumed electricity and final energy with domestic solar energy for 40 countries, including the members of EU-27. We focus on solar since it has the highest power density and biophysical potential among renewables.

The results show that for many advanced capitalist economies the land requirements to cover their current electricity consumption would be substantial, the situation being especially challenging for those located in northern latitudes with high population densities and high electricity consumption per capita. Replication of the exercise to explore the land-use requirements associated with a transition to a 100% solar powered economy indicates this transition may be physically unfeasible for most of the EU-27 member states. Their vulnerability is aggravated when accounting for the electricity and final energy footprint, i.e., the net embodied energy in international trade. If current dynamics continue, emerging countries such as India might reach a similar situation in the future.

Overall, our results indicate that the transition to renewable energies maintaining the current levels of energy consumption has the potential to create new vulnerabilities and/or reinforce existing ones in terms of energy and food security and biodiversity conservation.

The complete article can be found [here](#).



MEDEAS AT ESEE 2017 CONFERENCE



Ecological economics has always aspired to have systemic impacts on human behaviour and institutional structures. The European Society for Ecological Economics (ESEE) combines diverse disciplinary concepts and tools to foster sustainability.

The 12th International Conference of ESEE held in Budapest June 20–23, 2017 aimed at generating and supporting inclusive and reflective research in ecological economics in a number of ways: as transformative science; as advocacy for non-human beings and future generations; as advocacy for environmental and social justice; as policy science;

through understanding and promotion of broadly defined well-being; and through empirical insights and real-life impacts.

MEDEAS partners participated in parallel sessions called Systemic Approaches and Social Metabolism Approaches. The outcomes of the work done or planned in WP4 were presented, with a special focus on the ways for modelling potential future technological changes in the renewable energy sector, mainly the quantification of expert opinions and the introduction of an econometric approach.

ENERGY MODELLING PLATFORM FOR EUROPE (EMP-E)

The Horizon 2020 project REEEM (a member of the LCE21 projects) organised the First Meeting of an Energy Modelling Platform for Europe (EMP-E) 2017, hosted on May 17 – 18, 2017 by the European Commission DG Research & Innovation in Brussels.

The objective of this first EMP-E meeting was to provide a peer-reviewed digest of model and policy insights for European energy scenario projects. It aimed to initiate a long-term forum for exchanging the research, development and practice of energy system modelling in Europe and, where feasible, promote the sharing of data and resources and improve the efficiency of research in the area.

The MEDEAS project's contribution in the meeting was focused on the role that openness, code sharing and models output reproducibility could have in analysing the necessary changes for the Renewable Transition in Europe. The presentation made by the project coordinator emphasised that making models accessible is not enough to ease the models' use. Most energy models are very complex, so they require a learning curve to use them. Such a learning curve depends strongly on model complexity. Moreover, policymakers and other key stakeholders require tools that focus beyond the energy sector by including other domains such as economy, society and environment. The MEDEAS project, starting from an initial code (in Python language) designed within the MEDEAS Consortium, aims at being a community based/developed model. In addition, to ease the use of the model, and to improve the user's learning curve, the user will be helped with model modularity. All in

EMPE

Energy Modelling Platform for Europe

all, MEDEAS aims at pushing forward the open source models and software community development in energy research.

For more MEDEAS dissemination activities please visit MEDEAS [News & Events](#).

UPCOMING EVENTS

SUMMER ACADEMY IN FLORENCE, ITALY



The MEDEAS project team participates in the 2017 Summer Academy "Challenging an Unsustainable Economic System" organised in collaboration with the Club of Rome and the University of Florence, in Florence, Italy, September 7 – 13, 2017.

The MEDEAS project team will have a special audience of young activists, students, and professionals in sustainability at the Summer Academy of the Club of Rome organised this year in Florence. Among the several internationally well-known names that will speak at the academy, the MEDEAS team will have a full afternoon session to illustrate their work.

The participants will be the project coordinator, Jordi Sole, as well as team members Iñigo Capellán Pérez, Ugo Bardi, Davide Natalini, Sara Falsini and Ilaria Perissi.

WORLD RESOURCES FORUM 2017



GENEVA, OCTOBER 24–25, 2017

WORLD RESOURCES FORUM 2017

ACCELERATING THE RESOURCE REVOLUTION

The MEDEAS project has been selected to organise a workshop at the World Resources Forum 2017 conference (WRF 2017).

WRF 2017 will be held in Geneva on October 24 – 25, 2017 and will focus on the actions required in view of two historic global agreements established in the last years – the 2030 Agenda for Sustainable Development and the Paris Agreement on Climate Change. Leaders and decision makers in government, business, research and NGOs will meet in Geneva to talk about how to accelerate the revolution and answer main questions regarding the management, coordination, financing, monitoring, learning, training and communicating about it.

The MEDEAS project will proudly be part of this important event with a workshop on “Modelling the Transition Towards a Low Carbon Emissions Energy System: the MEDEAS EU Project”.

This workshop will report the current results of the project stressing the requirement to keep Europe on track in the decarbonisation process to attain the objectives of the Paris agreement and correlating it with resources depletion. The discussion will focus on the global version of the model produced in the project with references to the feedback between energy sources and the economy as well as the key points for energy transition. Moreover, the open-source nature of the MEDEAS model and the need to share and reproduce information in energy models will also be addressed.

The MEDEAS workshop's description and details can be found [here](#), while all required information on this year's WRF 2017 is available on its [website](#).

UPCOMING EVENTS

THE VEOLIA INSTITUTE'S 10TH INTERNATIONAL CONFERENCE IN OXFORD, UK

On November 2 – 3, 2017, the Veolia Institute organises in Oxford, UK, its 10th international conference on "Strategic Materials in a Low-Carbon World: From Resource Scarcity to Availability", in partnership with the Oxford Martin School.

Two members of the MEDEAS group, Prof Ugo Bardi (University of Florence) and Prof Aled Jones (Anglia Ruskin University), have been invited to present the MEDEAS project as part of understanding the flow materials in Europe and the world.



UPCOMING EVENTS

FIRST MEDEAS BOARD OF STAKEHOLDERS MEETING

The first MEDEAS Board of Stakeholders meeting will be organized in October 2017 in the form of a webinar.

The main issue that will be presented and discussed will be MEDEAS global model and the first results. This meeting aims at presenting the scope and capabilities of the model, but also the limitations in the interpretation of the results and at receiving valuable feedback from the stakeholders. More information on the meeting will be soon available on MEDEAS website.



FIRST GENERAL ASSEMBLY IN BRNO

MEDEAS's first General Assembly was organised on February 14 – 17, 2017 in Brno, Czech Republic by Masaryk University (MU). The General Assembly was attended by all MEDEAS partners, who participated in fruitful discussions concerning the project's developments. Having completed the first project year, this meeting aimed at addressing major issues that had come up and specifying the future activities and challenges for the successful implementation of the foreseen tasks.

Side meetings among individual team members were organised on February 14, while the General Assembly officially started on February 15 with a welcoming speech by the Dean of MU's Faculty of Social Studies, Mr Břetislav Dančák.

Intensive discussions followed among all MEDEAS partners on the MEDEAS database's construction, links/nesting to the global, European and country

model, MEDEAS model development, scenarios definition, framework for model comparison, publishing procedures and dissemination activities.

Moreover, UVa, MEDEAS's partner responsible for the development of the MEDEAS tool, organised a short workshop demonstrating the tool's first version, focusing on its structure and main features.

Part of the meeting, including the workshop, was attended by one of MEDEAS's Czech stakeholders, Mr Lukáš Rečka, a researcher at the Charles University Environment Centre (CUEC) and a PhD candidate at the Charles University, Faculty of Social Sciences, Institute of Economic Studies. The General Assembly also included a number of cultural and social activities for the MEDEAS partners.



SHAPE-ENERGY PHD PLACEMENTS



SHAPE ENERGY

**SOCIAL SCIENCES AND HUMANITIES FOR
ADVANCING POLICY IN EUROPEAN ENERGY**

**In February 2017, SHAPE ENERGY - Social Sciences
and Humanities for Advancing Policy in European
Energy - began.**

SHAPE ENERGY is a €2m investment through the EU Horizon 2020 programme and represents a new European platform for energy related Social Sciences and Humanities (energy SSH). It is led by the GSI. SHAPE ENERGY's partner ENTPE will manage the placement of 20 energy-SSH PhD researchers into 10 Horizon 2020 energy projects before December 2017. Working in pairs (two researchers per project) they will support the project coordinators, over 2-4 week placements, to identify ways in which Social Science/Humanities can be embedded in their remaining deliverables.

Travel bursaries will be available. If you are involved in a Horizon 2020 project that might like to act as a host, or a PhD researcher interested in the programme, please contact delphine.burguet@entpe.fr and nathalie.ortar@entpe.fr.

