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| Report of the Workshop on the Scoping Study on Modelling of EU Environment Policy |
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| **Brussels (Beaulieu)** |
| **19 May 2016** |

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| This report provides a summary of discussion at the Workshop on the Scoping Study on Modelling of EU Environment Policy on 19 May 2016 in Brussels. It also integrates first conclusions provided in the draft final report of the scoping study sent by the project team on 23 June 2016. |

# Participants

*The list of participants was not communicated. Participants included:*

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This report was drafted by Ybele Hoogeveen, Anita Pirc-Velkavrh, and Vincent Viaud.

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# In a nutshell…

* This scoping study is run in support of both the evaluation of the 7th EAP and the preparation of the 8th EAP;
* The study consists on a mapping and a gap analysis of modelling capabilities (strictly limited to software-based simulations) available to the Commission, and will result in recommendations for modelling development and/or improvement;
* Modelling is considered by DG ENV as an important tool to bring evidence against the narrative that “environmental policy is a barrier to growth”;
* The design of the study is strongly aligned with the 7th EAP thematic and horizontal priorities (green growth, preservation of natural capital, health and well-being, urban dimension, global dimension), the Juncker Agenda and the SDGs;
* Among the 200 models mapped, half of them relate to natural capital and one third to green growth, with few models addressing health impacts;
* Main gaps in modelling are highly related to:
  + The integration of key “soft” parameters (e.g. social aspects, behaviours of actors, management practices, social innovation, etc.),
  + The dynamics within the systems being modelled (e.g. technological change, structural change),
  + The combined effects of a set of policies (especially environmental policies in combination of other EU policies), and
  + The economic valuation of ecosystems and externalities;
* Quantitative and qualitative assessment methods should be more often used in combination (e.g. models used in the context of scenarios developed qualitatively);
* Improving the overall governance of modelling activities within the Commission is a key entry point to foster the uptake of modelling results by users:
  + A stronger and continuous dialogue between modellers and policymakers would help designing models that are fit to answer well-defined policy questions;
  + A transparent governance would help addressing ethical questions which can be raised (e.g. by citizens) on initial assumptions, level of uncertainty, data integrity, etc.;
* The design of new integrated models (which address the gaps previously mentioned) and agent-based models should be considered as a strong focus for new initiatives.

# … and some conclusions for EEA

* The need for more “integrated” modelling capabilities and for closer integration of qualitative and quantitative approaches requires more/better coordination between modellers and users -> the Environment Knowledge Community is well positioned to improve the knowledge base on this, and the EEA could bring this need into the EKC agenda;
* Integrated models and agent-based models are of particular interest for the work of IEA and the production of SOER2020 (in particular, the more systems-oriented part A) -> IEA should follow closely the development and recommendations of this study to assess which new models could be used for SOER2020;
* Modelling results are being used by all EEA programmes -> EEA should engage closely with new JRC focal point on modelling, and also specific modelling teams (e.g. JRC Sustainability Assessments unit for IEA), to ensure that all relevant and available models are used or to initiate partnerships with JRC.

# The Scoping Study on Modelling of EU Environment Policy

## Objectives of the Study

The scoping study on modelling of EU environment policy is intended to:

* Provide an overview of modelling capacities which can support EU environmental policies and which are available to the EU;
* Identify areas where there are gaps (i.e. “current models cannot answer the questions asked by environmental policy-makers”) and therefore a potential need for additional modelling initiatives that could improve the development of EU environmental policies.

The study is run in the context of the **upcoming evaluation of the 7th Environmental Action Programme** (ex-post assessment) but **also in preparation of the 8th Environmental Action Programme** (forward-looking approach focused on the 2030 horizon but up to visions for 2050).

So far it is only a scoping study and not a comprehensive and detailed review of all modelling capacities available to the EU. However, it is expected that it will give rise to further development in the short-term.

An important point – since it was a source of confusion and debate during the workshop – is that **this study deals only with modelling, i.e. software-based simulations**, and excludes other forms of models (e.g. conceptual models) as well as all other tools available to run ex-post assessments, such as other quantitative methods (accounts, surveys, statistical analysis, etc.), qualitative methods (case studies, scenarios, etc.), indicators, peer reviews, etc.

Therefore the models taken into consideration in that study are:

* Input-output models;
* Computable General Equilibrium models;
* Econometric models;
* Single-sector (e.g. on transport, energy) or single-area models (e.g. on land use, oceans);
* Microsimulation models;
* Earth System models;
* Integrated models or combination of the above-mentioned models.

According to DG ENV, modelling is considered as an important tool to **bring evidence against the narrative that “environmental policy is a barrier to growth**, placing a burden on business that dampens economic growth”. It was also mentioned by DG ENV that previous EAP assessment were too much qualitative and lacked a systematic quantitative exercise.

## Study Approach

The study follows a two-step methodological approach:

1. A **mapping of models** available to the EU where models are clustered into **five priority areas** aligned with the three thematic priorities and the two horizontal priorities of the 7th EAP, i.e.:
   1. Green growth (i.e. resource-efficient, low-carbon economy);
   2. Natural capital;
   3. Health impacts (i.e. human health and well-being);
   4. Global challenges;
   5. Sustainable urban planning and design;

The identification of models available to the EU was done using the MIDAS database of EC models run by the JRC (200 models listed), the LIAISE platform, and some literature search (in particular to identify models for urban planning).

1. A **gap analysis** on modelling capacities based on a **series of policy questions** clustered according to the standard criteria of evaluation:
   1. Effectiveness;
   2. Efficiency;
   3. Relevance;
   4. Coherence;
   5. EU added value.

On that basis, more specific policy questions have been identified; some are very general (e.g. “does the model show future trends?”) while others address the particular area under investigation by the model (e.g. “does the model identify critical resource and energy constraints in the future?” for green growth, or “does the model include the economic valuation of health benefits and the value of human life?” for health impacts).

Note that the priorities set out in the **Juncker Agenda** for Jobs, Growth, Fairness and Democratic Change as well as the **Sustainable Development Goals** have been taking into consideration when setting out the policy questions.

*The complete set of policy questions is available in Annex 1*

## Intermediary Outcomes of the Study

We propose here a summary of the intermediary outputs of the study (before the workshop) following the identification and mapping of models available as well as the gap analysis proposed by the Fraunhofer ISI team:

* **Around 200 models** (*see Annex 2 for detail*) were identified and clustered in (at least one of) the five priority areas:
  1. Natural capital: 100 models (47%) with half of them focusing on land-use and agriculture, following by clean air, fresh water, oceans/coastal areas and biodiversity/habitats model;
  2. Green growth: 70 models (33%) with a third of them on energy systems, following by transport, economics and integrated models;
  3. Health impacts: 22 models (10%) with 3 fourths of them on air pollution;
  4. Global challenges: 17 models (8%);
  5. Sustainable urban planning and design: 4 models (2%).
* It is acknowledged by the study team that there are **limitations on the identification of models available to the EU** since the databases used are probably not exhaustive or up-to-date.
* There are mainly **two kinds of models**:
  1. Detailed natural science or technology models which apply the state of the art to make the best possible assessment;
  2. Aggregated models which try to connect EU or global environmental issues and policy.
* There is **a large number of models covering the priority areas of green growth and natural capital, but very few addressing health impacts**.
* The main characteristics of the models of each priority areas are:
  1. **For natural capital**:
     + Availability of many dynamic models capable of showing historical and potential future trends;
     + Most of these models are “pure” natural science models without a representation of economic factors or social aspects;
     + Most of these models focus on agricultural production/consumption and emissions;
     + They include the trade dimension (and therefore competitiveness on the short-run);
     + They do include innovation, behaviour of actors and their drivers, social aspects, jobs, the combined effect of a set of policies, life-cycle approach;
  2. **For green growth**:
     + There are many models in the fields of economics, energy and transport.
     + Energy and transport models address the dynamics of markets and innovation;
     + An integrated approach to sustainable production and consumption (that goes beyond the LCA approach to include economic variables), systemic change, and the dynamics of technological change are missing;
     + They include the trade dimension;
     + They do not include the behaviours of actors and their drivers nor social aspects;
  3. **For health impacts**:
     + There are fewer models available but some natural capital models include impacts on the ecosystem that they study;
     + There are few models addressing resilience and adaptation ;
     + They do not include the combined effect of a set of policies, the economic valuation of health impact;
  4. **For global challenges**:
     + They do not include the behaviours of actors and their drivers, eco-innovation, and implementation issues;
  5. **For sustainable urban planning and design**:
     + They do not include the behaviours of actors and their drivers, social aspects, eco-innovation, and eco-investments;
* Overall, the following **main gaps** were identified by the study team:
  + Limited attention paid to processes of **eco-innovation**;
  + Little attempt to model possible **pathways of change towards sustainability**;
  + Limited modelling of the **positive economic impacts of environmental policies** on economic growth and jobs;
  + Limited attention paid to social sustainability, and more precisely the **positive social impacts of environmental policies** on poverty, health, and social inequality (important in the context of the SDGs);
  + Gaps in **tracing back consumption decisions** through the production chain and product-life cycles;
  + Gaps in modelling effects of **sustainable management practices**;
  + Methodological gap (or limited attention) related to **agent-based modelling**;
  + Methodological gap (or limited attention) related to **non-linear processes** (important in the context of sustainability transitions/transformations)
  + Methodological gap related to the **valuation of natural resources and ecosystem services** (very high ranges of uncertainty with current methods of valuation).
* It is in particular **recommended by the study team to develop**:
  + **Modelling of eco-innovation decisions** using the representation of multiple agents;
  + **Modelling of lead markets and strengthened competitiveness in environmental products and services**, especially in new areas of natural capital and environmental management for green growth;
  + **Modelling of sustainable production and consumption along the complete value chain**

# An Expert Workshop in support of the study

## Objectives of the Workshop

On 19 May 2016, DG Environment organised a workshop to support a scoping study on modelling of EU environmental policy by getting feedback and advice from experts from two communities:

* **Modellers** (e.g. JRC, OECD, PBL, GEUS) and;
* **Users of models** in the environmental policy field (e.g. DG ENV, DG CLIMA, EEA).

The objective of the workshop was to validate and/or complement the results of the gap analysis proposed by the study team.

The workshop was organised around a series of plenary and breakout sessions (organised around the three thematic priority areas) where the following questions were addressed to participants:

* **Policy modelling** **gaps**: Are there other environmental policy issues suitable for modelling that have not yet been included?
* **Model identification gaps**: Are there key models used for EU environmental policy modelling that have not yet been identified? What national and international modelling activities are relevant to consider?
* **Model capability gaps**: Do the modelling experts and stakeholders agree with the assessment of gaps in capability? Can the participants identify further significant gaps?

Approximately **30 participants** attended the workshop (list not communicated to participants…)

## Outputs from the Workshop

Overall, participants validated the gaps identified by the study team. The breakout sessions enabled the identification of other gaps and an interesting conversation between modellers and users on the role and added value of models for policy making.

The main points raised by the participants – generally with broad consensus – were:

* **Some important models available to the Commission were missing** and therefore the project team should complete the current list with the inputs from participants;
* DG ENV should **use in combination qualitative and quantitative methods** for ex-post assessments and forward-looking approaches. Both fields of methods have their strengths and limits. As for forward-looking approaches, models should be used **in the framework of scenarios developed qualitatively through foresight exercise**;
* **Models should be used for a relevant and specific purpose**, which means that is the responsibility of policy-makers to ask specific questions (i.e. not broad requests) and the responsibility of modellers to assess if modelling is relevant for these questions (e.g. are causal links sufficiently understood? Is data available? Under which level of uncertainty can modelling be done? With which sensitivity? What should be the initial assumptions? etc.);
* It was stressed by the two communities that it is important for modellers to get feedback from policy-makers on the way they are using models, and for policy-makers to be involved from the start in building the models. A **closer and regular dialogue between the two communities would help** improving the translation of modelling results into policy advice. The involvement of stakeholders in the design of the models would help building trust in modelling results and help modellers providing users with a good answer to their questions;
* There is – and there will be even more – **a need for DG ENV to model the combined effects of various environmental policies as well as to model the linkages between environmental policies and other EU policies** in order to improve policy coherence (e.g. in the context of green growth or the SDGs). **Environmental and socio-economic parameters need to be combined**, especially in the context of the Juncker agenda and of the SDGs.
* This raises the question of knowing which is the best option: **to use integrated models** (e.g. global integrated assessment models for climate change) **or to use various models in combination** (e.g. the OECD ENV-Linkages - a multi-sectoral, multi-regional dynamic CGE model - coupled with the IMAGE suite of ecological-environmental models operated by the Netherlands Environmental Assessment Agency, PBL). The creation of “hard” interlinkages between models is however expensive and time-consuming for modelling teams, whereas the use of “soft” interlinkages was not supported so much by participants. Overall it is probably better to **link model results with expert judgement** through Bayesian network
* The **design of new models** is needed as most existing models are very much locked in outdated logics and purpose. Current research tries to stretch existing models to answer policy questions which are of a different nature than the ones for which the model was initially developed;
* As the use of models raises ethical questions (initial assumptions, economic theory being used, level of uncertainty, data transparency, accessibility, ownership, etc.), **the governance of models should be properly addressed by DG ENV** and the Commission at large. The use of a diversity of models is probably a better safeguard than the reliance on only a few of them to advise policy-makers. Transparency criteria on methodology, assumptions and data should be a condition *sine qua non* for the funding of model development, and open-source models are also an option;
* A strong wish from policy-makers is to be able to **model technological change** – which is difficult but possible – and to predict the unknown – which is a misunderstanding of the nature and role of models which is to better understand the systems under investigation;
* The **modelling of structural change in social-environmental systems** is a very much needed but very difficult enterprise. Modelling large-scale transformations in society requires economic and techno-economic assessments beyond marginal optimising methods. Integrating non-linear analysis requires methods from complexity science;
* It should be acknowledged that **building modelling capabilities is a long-term endeavour** which requires long-term funding and stability for the modelling team;
* **Behavioural insights** are poorly used in models, e.g. their initial assumptions remain simplistic and based on standard utility maximisation;
* The **use of agent-based models** should be explored and developed to identify sources of conflicts but also synergies and multiplying effects in the implementation of environmental policies;
* Participants confirmed and completed the gap analysis of the project team regarding **under-addressed areas by models**, such as**:**
  + **Urban systems**, in particular as for the integration of the urban level of eco-innovation;
  + The **social dimension** of environmental policies (e.g. distributional equity), the interlinkages between social and environmental factors (e.g. poverty vs. environmental risk exposure), and the social dimension of sustainability (e.g. social cohesion, gender issues, etc.) in the context of the SDGs;
  + The **global dimension**;
  + The assessments of the **costs of action and non-action** as regards to environmental policies;
  + **Green growth** and the positive impact of environmental policies on the economic growth and employment;
  + **Investment decisions**;
  + The impact of **eco-innovation** on manufacturing;
  + **Sustainable production and consumption**, the extension of life-cycle analysis to include market and social assessments;
  + **Material flows and resource use** (e.g. forecasting the use of raw materials and commodities);
  + The impacts of **migration** on the environment and the impacts of climate change on migration, etc.;
  + Broad **system assessment of exposure to pollution**;
  + **Resilience and adaptation** of systems under analysis.

Other more specific comments were made during each breakout sessions:

**Sessions on natural capital:**

* There are many models available in this field but most of them are not known from policy-makers;
* There are interesting examples of the use of agent-based modelling in this field (for example for water basin management or farm management) which allows the identification of trade-offs and possible sources of conflicts;
* There are inconsistencies in the datasets used in the models;

**Sessions on green growth:**

* The concept of green growth needs to be clarified before considering the design of integrated models of this field;
* There are gaps regarding material flow accounts;
* There are few models focused on the decarbonisation of the economy;
* The distributional aspects of environmental policies should be addressed (cf. work in progress by OECD);
* There should be more attention paid to the water-energy-food nexus;
* There are few models focused at the microeconomic level;
* Behavioural aspects are rarely taken into consideration;
* There should be a stronger focus on modelling global value chains;

**Sessions on health impacts:**

* Scientific evidence is lacking for many causal links between multiple environmental stressors (already hard to model themselves) and human health and well-being endpoints. Therefore it is not always relevant yet to use modelling approaches.
* There are still major deficiencies in empirical data collection in this field, in particular in urban contexts throughout Europe, which need to be tackled before or in parallel of new modelling development;
* Referring to national policy initiatives, such as the Scottish ‘Good Places, Better Health’ programme, and the work by the FRESH consortium for EEA, it was suggested to use an approach that distinguishes between *direct* impacts of single stressors (such as chemicals, noise, air pollution etc.), that are relatively well understood, and *indirect* impacts resulting from complex environmental changes (such as climate change and biodiversity loss).
* As the knowledge base is stronger regarding individual stressors, it is recommended to develop the existing limited modelling capabilities to assess the health impacts of chemicals and toxic substances, or in the field of noise pollution;
* To assess the combine impact of multiple stressors, there is a need to combine quantitative and qualitative approaches;
* There is a similar need for integrating environmental and socio-economic parameters in the causal chain going from emissions to concentrations to exposure to impact;
* There is not enough focus on hot spots of air pollution (e.g. European megacities). Cities like London have their own modelling solutions, but a standard modelling framework – or even service with capacity building - could be developed by the Commission for cities who don’t have the resources to develop their own. The Environment Knowledge Community could address this issue. In particular, there is the need to understand how and to which extent results from a hot spot analysis can be generalised between cities (very similar vehicle technologies and infrastructure but different local urban design contexts);
* Social dimensions in general should be better addressed by models in the field of environment, e.g. to assess the socio-demographic distribution of impacts;
* There is a gap in modelling indirect impacts through changes to ecosystem services;
* Models in this field should be used in the context of scenarios developed qualitatively, in particular for areas of potential important risk such as nanomaterials and new chemicals;

# Next steps

* A draft final report has been sent by the study team to participants for comments;
* The final report of the scoping study will be sent to everyone by email and published online;
* Further development is still to be clarified but participants will be in the loop.

# Annex 1. Modelling questions

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|  | **Strategic Questions** | **General modelling questions applicable to all models** |
| Effectiveness | What progress have different actors (the EU, the Member States, cities etc.) made over time towards achieving the objectives set out in the 7th EAP? | All: Does the model show historical trends?  All: Does the model show future trends?  All: Does the model identify actors who have made improvements and their behavioral drivers/incentives?  All: Does the model identify emissions by sector?  Natural Capital: Can the model portray trends in the natural capital of interest?  Green Growth: Can the model portray trends in recycling, material flows and waste?  Green Growth: Can the model portray trends in resource efficiency?  Green Growth: Can the model portray trends in energy consumption, GHG emissions?  Health Impacts: Can the model portray human health impacts of air pollution, noise, toxic chemicals, environmental pollution, pollutants in food or consumer products? |
| What have been the (intended and unintended) effects of the 7th EAP? | All: Does the model measure environmental footprints / contain LCI-data for SPC-assessment?  All: Does the model account for social aspects of Sustainable Production and Consumption, such as CSR?  Natural Capital: Does the model cover combined economic (growth), social (jobs) and environmental effects of policies for the preservation of natural capital?  Green Growth: Does the model identify critical resource and energy constraints in the future?  Green Growth: Does the model cover combined economic (growth), social (jobs) and environmental effects of policies for resource efficiency and eco-innovation?  Green Growth: Does the model include changes in consumption and trade?  Health Impacts: Does the model cover combined economic (growth), social (jobs) and environmental effects of policies for the reduction of pollution impacts on human health and well-being?  Global Challenges: Does the model identify policy and policymaking processes at the international/global level? |
| To what extent has the 7th EAP as a strategy contributed to the implementation of the Juncker priorities and the Europe 2020 Strategy? | All: What are the impacts on growth and jobs?  All: What are the implications for investment? |
| Efficiency | What have been the costs and benefits involved with implementing the 7th EAP priorities? | All: Does the model identify the direct and indirect economic costs of the policy?  All: Does the model identify emissions by economic sector?  All: Are these costs compared to the improved environmental performance?  All: Does the model identify the economic benefit of the environmental policy?  Green Growth: Does the model cover indirect sectoral effects?  Green Growth: Does the model cover new industries, including services?  Health& Impacts: Does the model include the economic valuation of health benefits and the value of human life?  Global Challenges: Are the global external benefits of environmental action included?  Global Challenges: Are the marginal abatement costs compared across countries? |
| What have been the factors influencing the efficiency of the 7th EAP? |  |
| Are there significant differences between MS in terms of efficiency? |  |
| To what extent has the enabling framework contributed towards achieving the three thematic objectives of the 7th EAP? | All: Does the model explicitly cover investment (in new products and services that have a lower environmental impact)?  All: Does the model explicitly cover innovation (new products and services that have a lower environmental impact)?  All: Does the model explicitly consider implementation issues and rates?  Green Growth: Does the model portray eco-innovation, competitiveness (costs of sustainable production, market shares in sustainable products)?  Green Growth: Does the model include policies for eco-innovation, lead markets and learning effects? |
| Relevance | Is it relevant to still have an EU EAP? | All: Does the model output refer to at least one of the objectives of the EU EAP? |
| Is the structure of the 7th EAP still relevant? |  |
| Are the 7th EAP objectives still relevant? | All: Will the priority areas still be problematic in the future?  Does modelling tell us there are problems that the 7EAP should have focused on? |
| Coherence | To what extent is the EAP satisfactorily integrated and coherent with other parts of EU policies and strategies? | Green Growth: Does the model portray the connections between environmental policy, policies for EU-MS and regional growth, energy, transport, other policy areas?  Health Impacts: Does the model include the spatial distribution of population and the resultant distribution of exposure? |
| To what extent is the 7th EAP coherent internally in terms of its objectives and their delivery? |  |
| Are there overlaps, gaps with other EU Strategies and/or inconsistencies that significantly hamper the achievements of the objectives of the 7th EAP? |  |
| To what extent is the 7th EAP coherent with international obligations including the SDGs? | Natural Capital: Can the model portray different types of natural capital (e.g. land use and biodiversity)? |
| EU added value | What has been the EU added value of the 7th EAP compared to what Member States could do alone? | Natural Capital: Can the models address fresh water and clean air across MS boundaries?  Natural Capital: Can the models address seas and ocean environments across MS boundaries?  Green Growth: To what extent does the model cover the availability of resources across the EU?  Green Growth: Does the model cover the development of EU-wide markets for eco-innovations?  Green Growth: Does the model cover the EU-wide structure of production?  Health Impacts: Can the model address air and water pollution across MS boundaries? |
| What would be the most likely consequences of abandoning the 7th EAP initiative? | All: Can policies be compared against no-policy by the models?  Health Impacts: Can the model address pollutants along value chains for food and consumer goods across MSs? |
| To what extent do the issues addressed by the 7th EAP continue to require action at EU level? | All: Does the model demonstrate a continuing link across MSs?  Health Impacts: Can the models address international trade in waste?  Health Impacts: Can the models cover Life Cycle Assessment of products over a global life cycle? |

# Annex 2. Numbers of models reviewed (models may be in more than one category)

