



Implementing co-designed research: Experiences gained from expert consultation workshops

D9.7

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Short Description

This deliverable compiles "lessons learned" in the EUCalc in terms of engaging with expert stakeholders, so as to better inform future climate policy support and modelling projects. It is related to Task 9.2.

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This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgment of previously published material and of the work of others has been made through appropriate citation, quotation or both.

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List of abbreviations

AB – Advisory Board	
CSO – civil society organization	
D – Deliverable	
DG – Directorate General of the European Commission	
ENVI - European Parliament's Committee on Environment, Public Health and Food Safety	
EU – European Union	
EUSEW – European Sustainable Energy Week	
GHG – Greenhouse gas	
ITRE - European Parliament's Committee on Industry, Research and Energy	
JRC – Joint Research Centre of the European Commission	
IIASA - International Institute for Applied Systems Analysis	
TPE – Transition Pathways Explorer	
WP – Work packages	

1 Executive summary

The EUCalc's Description Of Action specifically includes a component (WP9) whose aim is "to coordinate a systematic co-creation process, including expert consultation cycles, and to develop a solid understanding of the requirements of future users of the EUCalc tool".

This report attempts to extract the lessons learned from Implementing co-designed research.

The sources for this report comprise mainly of the EUCalc deliverables - including standard setting work on stakeholder mapping and engagement, workshops reports, meeting minutes, and other documents - that capture the outcomes of multiple co-creation activities described in brief here and in more detail in the main body of the report.

Those deliverables were supplemented by efforts to engage with our sister projects the REINVENT and INNOPATH, business and EU institutions decision makers as well as with the Advisory Board and, last but not least, other Ad Hoc engagements.

These processes had at their core the intention of collecting stakeholders' inputs across all WPs in a way that would contribute to scientific soundness (credibility), relevance (saliency), and also unbiased transparent performance that allows consideration to be given to different views and positions (legitimacy).

Lessons learned presented in this report can be summarised as:

- Systematic approach to stakeholder mapping has helped to broaden thinking about the range and profile of stakeholders and to ensure that all major types of stakeholders are given the opportunity to provide input (especially in the light of very competitive environment for building a stakeholder base due to extensive demands on potential stakeholder's time).
- Systematic methodology with high level of transparency and clarity is critical for the management of inputs from multiple different stakeholders in a consistent and verifiable way.
- Having expert stakeholders in a face to face discussion
 - reveals much richer information on the levers and assumptions and improves the evidence base,
 - can point to additional research or data sources which become useful to the project (Joint Research Centre of the European Commission (JRC) a case in point),
 - creates new collaborations as a result of demands arising from the process of co-design and stakeholder engagement (International Institute for Applied Systems Analysis (IIASA) a case in point).
- Each stakeholder outreach event also acts as an information opportunity and helps to build a dissemination data base of potential future supporters and promoters.

Recommendations on the basis of lessons learned include:

- Future stakeholder engagement should include a review process to identify gaps and include planned time and budgetary resources for ad hoc follow up outreach to under-represented groups.

- Ensure that future budgets have a research contingency so that new data which surfaces as part of stakeholder engagement can comfortably be built into the modelling process.
- In a 3-year project with a large number of deliverables, the challenge may be that information and dissemination activities/opportunities may need to occur along a continuum since both opportunities may be present at different milestones in the project for different processes and events (outreach to the EU Parliament a case in point).

Policy recommendations:

- Consider in the next iteration of the project Stakeholder engagement at the National level in all EU member states and Switzerland in order to confirm the accuracy of the minutia of the model at the National level and create buy in for the model at the level which has jurisdictional sovereignty over deciding the pathways to reach EU level Targets and Goals.
- Consider in the programme design next phase proactively promote the EUCalc as a core tool in a set of Europe wide citizens assemblies¹.

¹<https://www.citizensassembly.ie/en/How-the-State-can-make-Ireland-a-leader-in-tackling-climate-change/>

2 Introduction

The European Calculator is a research project aimed at providing decision makers with a sophisticated, yet accessible and dynamic, modelling solution in quantifying greenhouse gas (GHG) emission trajectories, associated with sectoral energy demands, land use, land use change, social implications of lifestyle and energy technology choices. It takes into account both European and individual Member State levels, including Switzerland.

The original Call for Proposals - for which the EUCalc was designed to respond to - requested potential consortia to "*provide a research and innovation framework, which allows the co-design of pathways and scenarios with key economic and societal actors and addresses relevant cross-sectorial perspectives of the decarbonisation of the European economy.*"

The EUCalc's Description Of Action specifically includes a component (WP9) whose aim is "*to coordinate a systematic co-creation process, including expert consultation cycles, and to develop a solid understanding of the requirements of future users of the EUCalc tool*".

This report is based on extensive first-hand experience of the systematic co-creation undertaken by the EUCalc consortium, providing information about goals and implemented methods from which we draw the lessons learned, that may be useful to research projects designing stakeholder engagement plans, and policy recommendations.

The sources for this report comprise mainly of the EUCalc deliverables and tasks - including standard setting work on stakeholder mapping and engagement, workshops reports, meeting minutes, and other documents - that capture the outcomes of multiple co-creation activities described below :

- Deliverable 9.2 and Deliverable 9.4. Standards, methods and timeframe for co-design process, including stakeholder mapping and expert consultation workshops, were drafted collaboratively at an early stage of the project. Review and refinement of the initial co-design strategy that took place at an internal alignment workshop for consortium members is documented in Deliverable 9.3.
- Deliverables 1.6, 2.3, 2.7, 3.4, 4.2, 4.3, 5.4, 6.3, 6.4, and 7.3. Expert consultation workshops - a series of ten - were organized during the design and development phase of the EUCalc model, in order to elicit expert feedback in the different sectors and modules included in the Calculator. A process of expert feedback management and integration, following the workshops, is documented in mentioned Deliverables as well as Call for Evidence technical documentation (see Annex).
- Deliverables 1.6, 2.7 and 3.4. EUCalc team made a conscious effort to engage with, share and invite consortium members of the REINVENT and INNOPATH to key events in the EUCalc programme. In the context of co-design process several sister consortium members attended as participants or key-note speakers in 3 expert consultation workshops.
- Deliverable 9.1. To understand key decision points that various stakeholders are facing within their organisations, whilst being able to reflect that back to the outcomes of the EUCalc, two user demand workshops were organized at the onset of the project. The findings from the user demand workshops have been documented and published separately.
- Tasks 9.2 and 8.8 (concluding in the upcoming D8.8). By publishing preliminary modelling results under the public Call for Evidence (ongoing), the EUCalc project team intends to engage interested members of the public (both experts and non-experts) in online consultations, to test the user interface of the EUCalc model,

Transition Pathways Explorer, and review underlying analysis, assumptions and data used before it is released for wider application.

- Task 10.4. At the intersection of identification of user demands and future dissemination and use of the EUCalc model, the intention is to engage with relevant European Union Parliamentarians - especially Clean Energy Package Rapporteurs, ITRE, ENVI, and other relevant Committee members, Parliamentary Caucus Advisors, and Accredited Assistants. This outreach started but was suspended in mid-point due to extension of deadline for delivery of the EUCalc Transition Pathways Explorer (TPE). The suspension had the unfortunate consequence of crossing an EU Parliamentary election with 60% new members meaning a new start in late 2019 and 2020.
- Ad Hoc stakeholder engagement: Following internal reviews of the stakeholder profiles SEE Change Net made specific efforts to engage in further outreach to key civil society organizations (CSOs), Commission officials and Business actors mainly in Brussels in order to level out the representation.
- Deliverable 11.4, 11.5 and 11.6. Interactions with members of the Advisory Board (AB) of EUCalc provided important expert and policy inputs and feedback, as well as advice and access to key relevant stakeholder groups (e.g. EU Parliament interlocutors, business groups).

3 Co-Design goals

"Our aim is to put the power of the most sophisticated energy and climate models in the hands of policy and decision makers, by using co-design to build an intuitive, easy to use interface"

Jeremy Woods, Imperial College London

As a way to understand needs and considerations of policy and decision makers, to mobilize practical and tacit knowledge, and integrate this data, where possible, into the EUCalc framework, co-design has been one of the cornerstones of the EUCalc project. It entails extensive and early engagement of relevant experts and stakeholders from different segments of society (including Civil Society, Private Sector, Policy Makers and Planners, Academia and Science). It is rooted in the idea of open, transparent and inclusive research and modelling conduct, from early stage until completion, intended to facilitate accumulation of best available evidence, to improve quality and relevance of the research and to ensure greater confidence in the EUCalc model and results (Credibility, Saliency, Legitimacy framework).

4 Co-design methods and principles

At the onset of the project, in order to harmonize understanding and facilitate consequent implementation, the EUCalc consortium endeavored to set standards for mobilizing and collecting stakeholders' inputs across all WPs in a way that will contribute to scientific soundness (credibility), relevance (saliency), and also unbiased transparent performance that allows consideration to be given to different views and positions (legitimacy). This standard setting work has been published as Deliverable 9.2 Stakeholder mapping and Deliverable 9.4 Method for implementation of EUCalc co-design process with some of the key highlights presented below.

4.1 Main co-design stakeholder categories

Since the EUCalc tool is primarily intended for use by policy and decision makers in the EU institutions, business and civil society, the intention is to be able to integrate best available knowledge combined with concerns and needs of decision and policy makers, and place research within the wider societal context of decarbonization in Europe. In this context the two main broad categories of stakeholders for the co-design process were identified as i) knowledge providers and ii) end-users.

Their distinct contributions to the research outputs, scientific robustness and societal relevance respectively, were harnessed through three core mechanisms: i) 10 expert consultation workshops ii) 2 user demand workshops and iii) a Call for Evidence which is intended to engage with both categories of stakeholders.

Table 1: Main co-design stakeholder categories and mechanisms of consultations

Target group	Instrument	Goal
End users (policy and decision makers from public and private sector and civil society) as defined in the EUCalc Dissemination and Exploitation Strategy (Deliverable 10.2)	2 x End- user demand workshops	To build a better understanding of the challenges the policy and decision makers coming from public and private sector and civil society face in their decision making and to gather feedback on how best to focus the development of the EUCalc model in order to assist them in their work of developing decarbonisation pathways.
Knowledge providers (expert stakeholders)	10 x Sectoral expert consultation workshops	To elicit experts' feedback on a) key trends and challenges facing a sector in the context of net-zero transition and questions addressed by the corresponding EUCalc module; b) calculation logic and scope of module, and c) the rationale behind the choice of levers, as well as the assumptions for the range of ambition levels adopted in the module, including the trajectories by 2050, and some of the implications.
End-users and knowledge providers	Call for Evidence (online)	To test and gather insights about the user experience of the EUCalc model's user interface, Transition Pathway Explorer and to collect final round of feedback on the robustness of the analysis, assumptions and data used, before it is released for wider application.

This report is primarily focused on expert consultation workshops, since the findings from the user demand workshops have been documented and published separately (Deliverable 9.1) while the Call for Evidence is still ongoing and its results will be published in detail in upcoming D8.8.

4.2 Stakeholder mapping

Stakeholders mapping is the first and the most important step to identify the most appropriate and valuable stakeholders, how they can contribute to the project and model development and how they can benefit from the results of the EUCalc.

As described in Deliverable 9.2, the EUCalc team has made significant effort to address the stakeholder mapping in a strategic and systematic manner rather than as ad-hoc activity. The stakeholder mapping envisaged an iterative ongoing process of linking research issues and goals across sectors and modules included in the Calculator with the varied academic and non-academic actors based on their expertise and roles in creating and/or using knowledge to inform action and change.

Tailor made matrices that classify stakeholders along various dimensions have been designed as a key instrument when it comes to synthesising the data, prioritization, monitoring and correcting for observed imbalances in stakeholder engagement.

In case of the Expert consultation workshops, our two main considerations were to ensure excellence in terms of research and knowledge and to address the issue of balanced and unbiased expert involvement. In the EUCalc context, balance has been taken as an expression of variety around any given research issue, in order to allow a range of options to emerge and be discussed. Dimensions such as field of expertise, type of stakeholder, geography, have all been used as auxiliary - depending on their relevance to the research issue - to help assess areas where less evidence or diversity across the stakeholder spectrum is observed.

4.2 Expert consultations

Expert consultation workshops have been central, though not the only component of the co-design strategy. Through this process, the experts were asked to assess and communicate on a number of issues relevant to the sectors/modules included in the Calculator, as best they can, considering all the available information. The workshop methodology presented in Deliverable 9.4, has been validated in the process of implementation and can be used to highlight several critical principles of co-design deployed by the EUCalc team.

The first hurdle for the process was to recruit a diverse group of credible experts to make the consultation process as inclusive and representative (Section 3.2.1 of Deliverable 9.4). In addition to addressing it at the stage of stakeholder mapping, a set of measures has been set in place to remove possible barriers for engagement, such as early announcement of co-design workshops (3 months in advance) to allow invited stakeholders to plan accordingly or financial support for attending the workshops.

The second, is correctly setting the expectations. This includes a protocol of framing the objectives of stakeholder engagement clearly from the beginning and building the documentation which provides an overview of engagement milestones and methodology, presents examples of the types of feedback and inputs needed, as well as specifies how the collected information will be used by the EUCalc team. (Sections 3.2.2 and 3.2.3 of Deliverable 9.4).

The third is to ensure a support of a professional facilitator with experience in elicitation methodologies (Section 3.2.4 of Deliverable 9.4). The EUCalc expert consultation workshops did not necessarily involve a goal of reaching consensus on a particular issue or trajectory of development by 2050, but in order to collect a range of estimates on a number of issues involving multiple expert stakeholders, a careful design and conduct was considered required.

The fourth is the commitment to transparently manage inputs collected from expert stakeholders. While each sector/module is different, the methods used to report on findings was consistent with the project's co-design methodology that follows an evolutionary path of iterative, learning and validating, steps (Section 3.3 of D 9.4).

Finally, as we learned through the process, it is important to make sure that the initial methodology is adaptable and flexible enough to address the all uncertainties along the way which are inherent part of co-design process.

4.3 Ethical requirements

The EUCalc consortium established procedures in order to comply with the ethical requirements as stipulated in Deliverable 12.1 (Ethics requirements – procedures and criteria to identify research participants in EUCalc – H – Requirements No. 1) at all stages of the co-design process, in particular the stakeholder mapping, the facilitation and implementation of the workshops and the follow-up of the workshops. This relates to aspects such as clarity about the co-design process and purpose of the workshops, anonymity of participants' contributions, responsible data governance,etc.

5 Co-design results and lessons learned

Against the background of methods and procedures designed at the beginning of the project and briefly described above, some of the highlights and lessons learned are presented hereinafter.

5.1 An appropriate cross section of experts

The stakeholder mapping has taken place as part of the iterative research process, running continuously over the last 3 years of the EUCalc project. By shadowing the process of research - investigating sectoral drivers, trends, game-changing practices, social and environmental impacts - **the systematic approach to stakeholder mapping was instrumental in assisting the members of the consortium to broaden thinking about the profile of expert stakeholders (scientists but also experts, sustainability officers and researchers within public, and private sector and civil society), to diversify their existing networks and extend participation opportunities to a broader cross-section of expert stakeholders.**

In a **deeply interdisciplinary setting and the European context of the EUCalc, the process of stakeholder mapping has, as expected, yielded a large database of more than 1000 identified relevant contacts.** This reflects a combination of at least 2 factors: i) the scope and nature of the EUCalc co-design process - broadness in terms of a number of research questions that each sector/module aimed to address and diversity in terms of including a right variety of experts on a particular issue, and ii) the fact that there is a lot of relevant, diffusely resident knowledge around Europe.

In hindsight, **given the nature of expert stakeholders we mapped and intended to make links with (e.g. busy, geographically dispersed, etc), building an extensive database of contacts can be taken as an important measure to address possible leakages in participation.** Identification of as many experts as possible that can equally well respond to the EUCalc research needs, *can be considered as relevant and important as prioritization of expert stakeholders. For example, based on the premise that 25% of invitees would be potentially available and willing to attend, we invited 3 or 4 times as many relevant experts than ideally needed in face to face interactions with the intention of building a wider Expert Stakeholder pool.*

With regards to tailor made matrices designed to facilitate stakeholder mapping and prioritisation along initially identified dimensions (type of stakeholder, field of

expertise, geography, etc.) - **they certainly constituted useful a tool and check in order to detect and minimize our own biases and blind spots** (Figure 1). However, to be able to fully address the specific needs of different sectors/modules of the EUCalc model (e.g. issues, spatial granularity, time scale and socio-economic facets), it was also necessary for each member of the consortium to engage in multiple iterative discussions and periodic reviews on a lever by lever basis to assess the evidence needed, collected and missing as the co-design process unfolded.

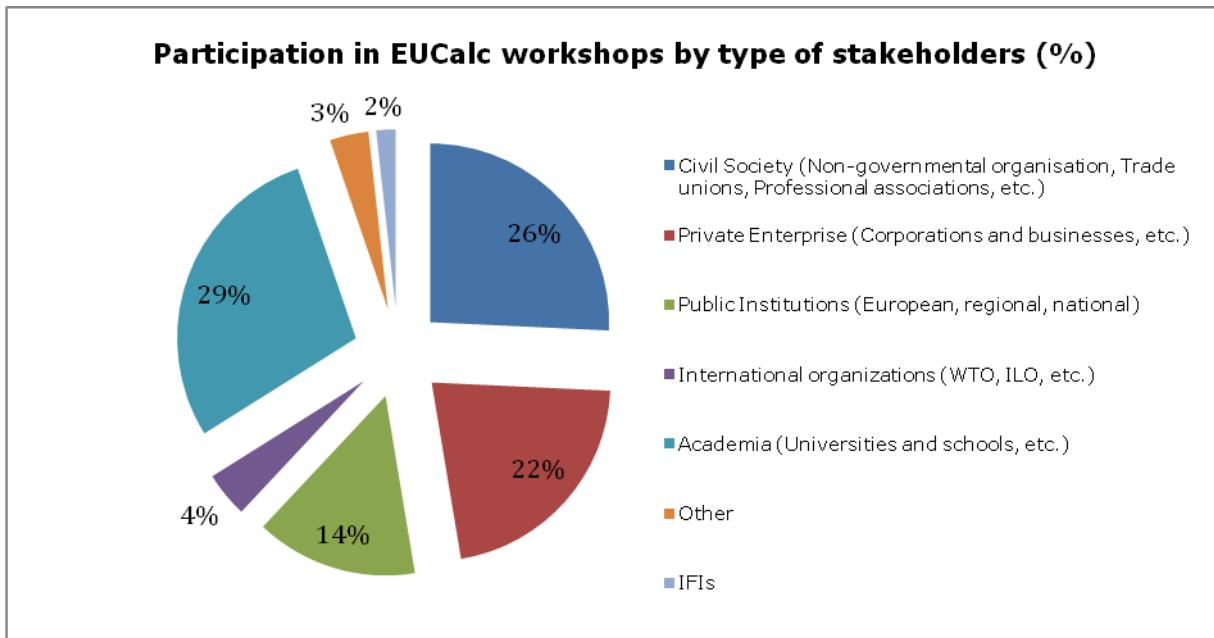


Figure 1: Type of stakeholders participating in the EUCalc expert consultation workshops (%)

Continuous reviews of expert stakeholder engagement - especially in terms assessing areas where less evidence or diversity across the stakeholder spectrum can be observed - **have necessitated alternative modes of response to be considered and additional ad-hoc consultations to be organized**. This has sometimes required a pragmatic approach to stakeholder engagement, meaning that identified knowledge from certain contexts and particular groups had to be collected through proxies and representative bodies that provide platforms and processes that enable sharing of multiple voices. (Organizing workshops back to back with the European Sustainable Energy Week (EUSEW) and other similar fora, or engaging with representative groups such professional associations).

Although offset by its benefits and advantages, it is relevant to note that the process of stakeholder mapping has demanded a **significant time and effort** from the members of the consortium.

5.2 Structure and facilitation of Expert consultations

10 expert consultation workshops were organized between June 2017 and April 2019, each engaging between 10 and 20 experts (total number 171).

In terms of process, standards and principles developed by the EUCalc team and outlined in Deliverable 9.4, at least 3 aspects and roles deserve to be highlighted as important for the success of the expert consultation workshops and they include - professional facilitators, future oriented key note speakers and skilled note takers.

The trained facilitators - Vanessa Timmer from One Earth and Adrian Taylor and Jonathan Buhl from 4sing - **were recruited to provide ongoing support to the EUCalc consortium members, in terms of securing that the process of experts consultation is formal, rigorous, transparent and designed to stimulate thoughtful and structured inputs.** The design of actual workshops evolved to include three distinct components namely: i. plenary scene setting and introduction, ii. presentation of the EUCalc model and the specific components of a sector/module and then iii. break-out group discussions to allow expert stakeholders to review and report back on key questions and topics. The logical flow of the workshop meant that the process proceeded from the general big picture scene setting elements, including a keynote speaker, through a demonstration of the EUCalc model - using the Global Calculator as a proxy - and a detailed description of the particular elements of sector/module and its specific issues. This was then followed by structured and facilitated break-out sessions, which allowed discussion and review of both pre identified key questions and any new questions which have emerged during the discussions by expert stakeholders working in smaller groups. In break-out groups, with the assistance of designated rapporteurs, the experts were encouraged to investigate and discuss sets of questions, to cross-examine reasoning and provide feedback, evidence and/or quantitative input. Full scope of inputs was facilitated through a mechanism of world cafe, while concluding plenary session created a space for aggregation of provided estimates and judgments. Analysis of the post-workshop feedback reports, indicated that participants in the workshops either Agreed or Strongly Agreed that attending the workshops was a positive experience while the most highly valued aspects of the workshop included interactivity, engagement and quality of exchange between the participants.²

In relation to the introduction of keynote speakers for each Expert Stakeholder Workshop, this was introduced as an idea to the structure of the workshop to fill 3 specific functions: a) to have an opening speaker whose work is known to be future-orientated, boundary breaking and inspirational or at least best practise in their field, in order to set the tone for a workshop, which wishes to discuss values for lever settings out to 2050, b) to be a draw for potential invitees in terms of the reputation and profile of the speaker and last but not least c) given this profile, to help with the social media profile of EUCalc by linking the Keynote speaker to the EUCalc. These speakers were not necessarily expected to give critical scientific input to the workshops.

Finally, ensuring skilled note takers to document the workshop discussions was essential in order to make the expert consultation process transparent to "outsiders". Inputs have been carefully and transparently documented in a consistent and verifiable manner in workshop related deliverables. In addition to raw expert elicitation results which importantly capture all the different narratives represented in the workshops, the reports/deliverables include also the detailed documentation - a priori analysis and material developed by the EUCalc team to brief experts beforehand, procedures for facilitated discussions, conclusions and suggestions for next steps. Experts' inputs have been published in anonymized form in line with the Informed consent procedure of the

²Some feedback from participants: "The workshop was interactive, with strong participants' engagement ", "Many insights have been proposed", "Discussions were lively", "Important project, great team and fruitful discussion with experts from different fields of interest", "The quality of participants, the depth of knowledge", "The workshop facilitator was excellent and knew how to keep people involved and on time", "Mind opening", "Very good interactions and discussions", "Very good challenges to various issues ", "The workshop was very interesting and useful, especially due to the fact that main activities of our department are related to modelling and simulation of electricity markets, including different generation technologies", "Group work; have stakeholders see each other as equally valuable contributors", "Great moderator, great pace and concrete outcomes" "I think the team did a good job of creating a welcome setting in which the participants felt comfortable in speaking their mind freely".

workshops. The originals of the signed consent forms are confidentially stored at the Coordinators' premises with no possibility of public access of these documents to externals. Scans of each of the informed consent forms are stored on the internal EUCalc file storage system.

5.3 The outputs from Experts consultations

The expert consultation workshops constituted important milestone in the research and design of the EUCalc model. They were **phased to allow experts to enter the process early enough so that they could inform the methodology and help co-design the determinants and the scope of the intended performance and output of the different modules included in the EUCalc model**. Both in the plenary and break-out discussions, a significant number of suggestions and comments was collected. This valuable input ranges from the general scope of a particular sector to the specific issues such as assumptions, levers ambition levels, sources of data used and interactions with other sectors/modules. The table below illustrates the type of inputs received based on the original questions which guided the expert consultations across WPs.

Table 2: Expert consultation workshops goals and illustrative questions

Workshop	Goals/Aspects of sector/module	Illustrative questions
Expert workshops on Lifestyles	<p>Expert consultation workshop on Lifestyles was the earliest and first in a series of workshops, designed to explore mitigation potential of lifestyle-related dimensions. Based on literature review and preliminary research analysis, experts were invited to:</p> <p>Strengthen the narrative behind some model assumptions by informing the modeling team on the existence of particular thresholds or trend reversibility in the metrics used for consumption behaviour;</p> <p>Top-down projections on the evolution of lifestyles metrics across multiple scenarios, to define a plausible envelope for the levels of changes in lifestyle and consumption behaviour;</p> <p>Inform on a "best guess" for setting the level of a particular lifestyle metric for a given European country.</p>	<p>What relevant lifestyle drivers and outcomes can be effectively measured? Are assumptions/data/rationale driving the EUCalc module on Lifestyles sound, robust and based on the best available evidence? What potential emergence of market trends/ways of living can be disruptive? How do you see issues of urbanity/ remote connectivity playing a role on travel demand? How to fill in the gaps for countries with sparse data?</p>

Expert workshops on Buildings, Transport, Manufacturing and raw materials, Land, land use and carbon stock dynamics (LULUCF), biomass provision (food, energy, materials) & minerals, Biodiversity and water impacts of biomass provision for food, feed, energy and materials, Electricity and fossil fuels.	<p>Based on literature review and preliminary research analysis, experts were asked to:</p> <p>Review and provide feedback on the sector context and questions the module addresses;</p> <p>Review and validate the modeling approach, calculation logic and scope of module;</p> <p>Review and validate Choice of mitigation options ("levers") and definition of ambition levels.</p>	What are the key drives, trends and challenges facing the sector in the context of a low carbon transition? Are the modelling dynamics (e.g. sector interactions and feedback loops covered correctly and sufficiently or is any important dynamic missing? Are there any major mitigation options ("levers") which are not currently included within the scope of the sector/module but that you consider should be in future? Does the range of levels of ambition presented for each mitigation option ("lever") cover the full range of credible futures? Do the intermediate levels of ambition (levels 2 and 3) provided for each mitigation option ("lever") illustrate a useful set of choices, or should they be moved up or down? Are the input assumptions / methodology / data underpinning the sector(s)/module(s) sound, robust and based on the best available evidence?
Expert consultation on socio-economic impacts	<p>Following the literature review - used to identify common/long list of socio-economic issues related with energy transformation and climate change - and the survey conducted online to rank their importance, experts were asked to:</p> <p>Review and validate the three most important social and socio-economic impacts/issues to be included in EUCalc model (based on the literature review and online survey);</p> <p>Review and pre-select (the list of) possible indicators based on the three criteria conceptual coherence, operational coherence and utility;</p> <p>Identify relation between the EUCalc levers and the pre-selected indicators.</p>	What social impacts can reliably be quantified and included in the EUCalc model? Which indicators can be used specifically in the EUCalc model based on specific criteria to quantify social impacts? Are their relations with sector and lifestyle pathways robust enough so that verifiable calculations to quantify social impacts can be made? What data sources are available? Are the input assumptions / methodology / data underpinning the quantifications of social impacts sound, robust and based on the best available evidence?
Expert consultation on transboundary effects	<p>Based on preliminary research results, experts were asked to:</p> <p>Review and validate underlying methodology and assumptions of the EUCalc's transboundary module;</p> <p>Provide inputs on the representative scenarios to be formulated and simulated in the transboundary effect module;</p> <p>Provide inputs on the key indicators to facilitate the display of transboundary results.</p>	What are the most relevant and representative EUCalc user-defined pathways to be simulated in a CGE model for generating the transboundary effects? What key transboundary effects and how they should be presented in EUCalc (e.g. as the trade matrix itself or in terms of key indicators)? What macro level development of trade and globalization and the underlying modeling instruments of these macro trends, as reflected in the design of the baseline and the selected scenarios.

Expert consultation meeting on air quality and health	<p>Based on preliminary research results, experts were asked to:</p> <p>Review and validate methodology to provide quantitative estimates of the air pollution impacts of different pathways across 28+1 EU countries in the EUCalc, using the IIASA's existing work with GAINS model;</p> <p>Review and validate consistency in assumptions between GAINS and EUCalc; Provide feedback to address the transboundary exposure;</p> <p>Provide inputs on the key indicators to facilitate display of health effects.</p>	<p>Are the assumptions and data that form the basis of the quantification of air pollution and health effects robust enough? Can country to country exposure factors which account for exposure in each EU state due to emissions within each other country reliably be included in the EUCalc model? How to best express health effects? What are the pros and cons of presenting them in mortality, possibly also morbidity, terms as well as economic cost?</p>
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While necessary for the EUCalc team, engaging a diverse group of experts on a number of relevant issues in each sector/module is not without challenges, as has been observed by few of the workshop participants "*I find the broad consideration of things (or sectors) to be both the most valuable and the weakest aspect of the workshop*", "*A little diverse discussion*", "*Also, although the presenters/organizers did a very good job, it would be useful if definitions could be provided (on the spot) to aid the theme-based small group discussions. Multidisciplinary groups use terms differently.*" Inside the EUCalc team similar concerns have been voiced that "*in a single workshop, time may not be sufficient to discuss in detail the various insights shared by participating experts*". Further, **as it was not always possible to ensure desired expert representation and yield required evidence for some of the questions raised at the workshops (e.g. fishing or material switch lever), necessitating additional ad-hoc consultations. The stakeholder mapping and engagement strategy was therefore redefined as a longer process of making valuable links with stakeholders through mapping, contacting, inviting, engaging and visiting.** For example, at the time of the Internal alignment training (Deliverable 9.3) it was assessed that the private sector was the stakeholder group that we needed to make most additional effort to include in the consultation process. This has consequently led to additional consultations and outreach towards European business groups. Similarly, a round of additional consultations was organized at the later stage also with some of the major Brussels based CSOs who could not attend the workshops, as well as with DG CLIMA representatives. All of this creates a basis for a lesson learned that **it is important to make sure that the initial co-design methodology is adaptable and flexible as well as that more time for consultation cycles should be accounted for in future similar projects.**

Despite mentioned hurdles, it has been a strong conviction shared by the EUCalc team **that an open and transparent research and modelling approach - praised by involved experts while thought at times cumbersome for the EUCalc consortium members – has arguably produced more robust results and contributed to higher confidence in and recognition of the model.** The workshop participants recognized the uniqueness of the EUCalc modeling approach and its potential contributions to the EU decarbonization debates, so - even though inclined towards higher modelling resolution and granularity (e.g. modelling higher number of industrial branches individually rather than aggregated under the "other") - their contributions played a critical role to arrive at the sufficient analytical depth to be considered credible while at the same time meeting the technical constraints of running in real time and responding to needs of decision and policy makers.

Information on how the EUCalc consortium endeavoured to assess, integrate and use the experts inputs in order to improve the modelling approach and the assumptions - compared to a priori analysis - has been published in WPs related deliverables: i) workshop reports, and ii) module technical documentation prepared for the next cycle of consultation under

the Call for Evidence (see Annex). In general, **the inputs management has been a responsibility of the partners working on the specific modules and topics as they have the best knowledge within the Consortium on the adequacy and goodness of inputs in their respective research fields. These integrations have been conducted and documented in line with principles outlined in Deliverable 11.7 (Data Management Plan)**. Experts inputs and follow-up improvements to the modules also constituted the subject of ongoing internal modelling online and offline meetings and workshops and project biannual meetings.

The integrations of experts' feedback will be tested and further enhanced in the light of the scientific (completed) and public (ongoing) Call for Evidence. Under the Public Call for Evidence, all products of the EUCalc research and modelling work - Transition Pathways Explorer (the user interface of the EUCalc model), technical documentation (reports) and the EUCalc model (KNIME software platform) - are published and accessible for review by interested members of the public (both experts and non-experts). An updated version of the EUCalc model and Transition Pathways Explorer, as well as the report on the Public Call for Evidence (D8.8), will be made available later in the year, to reflect some of the most pressing and well-evidenced revisions suggested during the Call for Evidence

5.4 Collaborations stemming from the Expert consultations

As a spin-off of the *Expert consultation on scenarios for land-use, water & biodiversity impacts*, **the EUCalc team visited the Joint Research Centre (JRC) of the European Commission in Ispra to continue the exchange with regards to climate, land-use and water abstraction scenarios** (more details in Deliverable 4.2 and Deliverable 4.3). As a result of these deliberations, the water module of the EUCalc model has utilised the JRC's up to-date simulations of local water availability for all relevant European regions with a monthly time-step, historical datasets covering the period 1981-2010 and projections running up to 2100(for more detail, refer to Water module documentation).

Similarly, regarding the health impacts of decarbonisation pathways, indicators for a number of identified health impacts (extreme temperatures and weather events, flood damage, indoor air pollution, biological contamination, air pollution, etc.) were validated by the participating experts during the workshop on *Socio-economic impacts of climate change mitigation in Europe* based on three criteria namely: conceptual coherence, operational coherence and utility. Taking account of large uncertainties regarding the applicability of indicators, experts have arrived at consensus regarding the selection of air pollution as this is highly linked to mitigation strategies and it provides a considerable impact on health and related costs. (Deliverable 6.3). To meet the aims of this module and to overcome the challenges posed by the aggregated country level of EUCalc, **a collaboration with the International Institute for Applied Systems Analysis (IIASA) has been established around using of their pre-existing work with the GAINS model³**. This approach enabled: (1) quantification of accurate emissions factors for each sector and country, accounting for different technological development pathways, and; (2) incorporating the spatial distribution of emissions in each country and the dispersion and transport of pollution of transport across the EU (for more detail, refer to Deliverable 6.4 and Air pollution and human health documentation).

Finally, it should be added also that in addition to providing valuable advice and support in reaching out to relevant stakeholders, **face to face interactions with members of the**

³<https://www.iiasa.ac.at/web/home/research/researchPrograms/air/GAINS.html>

EUCalc Advisory Board (AB), as well as their participation in expert consultation and user demand workshop has constituted an added value. The EUCalc has also made a conscious effort to coordinate with and integrate inputs from our sister projects INNOPATH and REINVENT especially in the expert consultation process.

5.5 Expert consultations and dissemination

Co-design with experts and stakeholders from academia, public, private and civil sectors, has not only enhanced EUCalc's evidence base and relevance, it has also helped to generate interest and trust, helping to build a dissemination data base of potential future supporters and promoters. We intentionally considered Expert Stakeholders as the basis of a network of influencers and supporters for all future steps within the project related to i) communication, ii) dissemination, and iii) the use and wide dissemination of the EUCalc tool.

For example, engagement of Business Europe Secretariat in facilitating involvement of their members, has opened up doors to key business groups in European countries where town hall meetings (Task 10.5) to showcase the EUCalc model will be organized.

6 Recommendations

While it is recognised that the EUCalc partners have extensive networks, experience in stakeholder consultations and in depth knowledge in their specialist field the main conclusion of this alignment exercise is that it has helped to broaden thinking about the range and profile of stakeholders, to create a uniform information gathering opportunity across all work packages and link specialist knowledge across WP's, between stakeholders and amongst sister INNOPATH and REINVENT partners in a way that breaks down silos and encourage comparability and common understanding around challenges and pathways.

6.1 Lessons learned

Lessons learned presented in this report can be summarised as:

- Systematic approach to stakeholder mapping has helped to broaden thinking about the range and profile of stakeholders and to ensure that all major types of stakeholders are given the opportunity to provide input (especially in the light of very competitive environment for building a stakeholder base due to extensive demands on potential stakeholder's time).
- Systematic methodology with high level of transparency and clarity is critical for the management of inputs from multiple different stakeholders in a consistent and verifiable way.
- Having expert stakeholders in a face to face discussion
 - reveals much richer information on the levers and assumptions and improves the evidence base,
 - can point to additional research or data sources which become useful to the project (Joint Research Centre of the European Commission (JRC)a case in point),
 - creates new collaborations as a result of demands arising from the process of co-design and stakeholder engagement (International Institute for Applied Systems Analysis(IIASA) a case in point).
- Each stakeholder outreach event also acts as an information opportunity and helps to build a dissemination data base of potential future supporters and promoters.

6.2 Recommendations

Recommendations on the basis of lessons learned include:

- Future stakeholder engagement should include a review process to identify gaps and include planned time and budgetary resources for ad hoc follow up outreach to under-represented groups.
- Ensure that future budgets have a research contingency so that new data which surfaces as part of stakeholder engagement can comfortably be built into the modelling process.
- In a 3-year project with a large number of deliverables, the challenge may be that information and dissemination activities/opportunities may need to occur along a continuum since both opportunities may be present at different milestones in the project for different processes and events (outreach to the EU Parliament a case in point).

Policy recommendations:

- Consider in the next iteration of the project Stakeholder engagement at the National level in all EU member states and Switzerland in order to confirm the accuracy of the minutia of the model at the National level and create buy in for the model at the level which has jurisdictional sovereignty over deciding the pathways to reach EU level Targets and Goals.
- Consider in the programme design next phase proactively promote the EUCalc as a core tool in a set of Europe wide citizens assemblies⁴.

⁴<https://www.citizensassembly.ie/en/How-the-State-can-make-Ireland-a-leader-in-tackling-climate-change/>

7 Annex - List of deliverables reporting on the outcomes of co-design activities

WP #	Deliverable #	Title	Date published
Reports on expert consultation workshops			
WP1	D 1.6	Exploring lifestyle changes in Europe to the horizon 2050: Expert consultation workshop	November 2017
WP2	D 2.3	Expert consultation on transport	April 2018
WP2	D 2.7	Expert Consultation Workshop on Scenarios for Decarbonising European Buildings	July 2018
WP3	D 3.4	Expert consultation workshop on manufacturing, material use and raw materials	September 2018
WP4	D 4.2	Expert consultation workshop on land, land use and carbon stock dynamics (LULUCF), biomass provision (food, energy, materials) & minerals	November 2018
WP4	D 4.3	Expert consultation workshop on the biodiversity and water impacts of biomass provision for food, feed, energy and materials in the EUCalc	December 2018
WP5	D 5.4	Expert consultation workshop on electricity and fossil fuels	August 2018
WP6	D 6.3	Identification of social and socioeconomic issues and relevant indicators by stakeholders' survey and experts' consultation workshop	October 2018
WP6	D 6.4	Expert consultation meeting on Air pollution and health module of the European Calculator	April 2019
WP7	D 7.3	Expert consultation workshop on transboundary effects	April 2019
Documentation for experts' review (Call for Evidence)			
WP1	NA (website)	Lifestyle module documentation	May 2019
WP1	NA (website)	Climate and emissions module documentation	May 2019
WP2	NA (website)	Transport module documentation	May 2019
WP2	NA (website)	Buildings module documentation (including households and services)	May 2019
WP3	D 3.1	Raw materials module and manufacturing and secondary raw materials module for EUCalc	August 2019
WP3	D 3.3	Carbon Capture, Use and Storage module	July 2019
WP4	NA (website)	Agriculture & land-use module documentation	May 2019
WP4	NA (website)	Biodiversity module documentation	May 2019
WP4	NA (website)	Water module documentation	May 2019
WP5	D 5.1	Energy supply module documentation	July 2019

WP6	NA (website)	Air pollution and human health documentation	May 2019
WP6	NA (website)	Employment module documentation	May 2019
WP7	NA (website)	Transboundary effects module documentation	September 2019
WP8	D 8.5	Storage requirements module	March 2019
Co-design strategy and workshop/training reports			
WP9	D 9.2	Stakeholder mapping	August 2017
WP9	D 9.4	Method for implementation of EUCalc co-design process	August 2017
WP9	D 9.3	Training and alignment workshop as kick-off of the expert consultation meetings	March 2018
WP9	D 9.1	User demand documentation	July 2019
Dissemination and exploitation strategy			
WP10	D 10.2	EUCalc Dissemination and Exploitation Strategy	November 2018
Advisory Board contributions and Data management Plan			
WP11	D 11.4	Advisory Board contributions 1st	February 2018
WP11	D 11.5	Advisory Board contributions 2nd	
WP11	D 11.6	Advisory Board contributions 3rd	October 2019
WP11	D 11.7	Data Management Plan	October 2019