Workshop Summary Report

Improving Demand-side Modelling to Inform Ambitious Climate Policies in the European Union

Thursday, 19th of May 2021 | 09:30 – 12:30 CET | Online

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 891943

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Introduction

Buildings account for nearly 40% of energy consumption and carbon emissions in the European Union (EU). Because of their significant impact on energy and climate policy goals, the EU is aiming to improve the energy efficiency of buildings and bring positive sustainable outcomes to its citizens.[1] The European Green Deal is a set of policy initiatives by the European Commission with the overarching aim of making Europe the first climate-neutral continent by 2050. Since 75% of the existing building stock in the EU is energy inefficient by current building standards, building refurbishments will be a crucial element to achieve the net zero emissions goal by 2050.[2]

The residential building sector presents their own challenges, considering individual dwellings have different personal consumption behaviours and multifamily dwellings have limited individual efficiency opportunities. The various factors that complicate the housing sector's decarbonisation translate to the need to accurately model the ambitious energy and climate policies' effect on the residential sector. To achieve this, the EU-funded H2020 project, WHY, aims to improve the assessment of energy consumption trends and policies on households by including causal models in large-scale Energy System Models (ESMs). Realisation of this key objective is essential, because until now, energy models have lacked accuracy when simulating the effects of ambitious climate policies on the residential sector.

However, designing and integrating causal models into the ESMs is not a trivial task. It requires a careful selection process to decide what kind of elements should be included while modelling the residential sector. It concerns the technical aspects of energy transition as well as behavioural elements of energy consumers and specific policy interventions, which will determine energy demand, fuel mix and low-carbon technology uptake in the medium- and long-time perspectives.

To address this challenge, we organised a participatory online workshop "Improving Demand-side Modelling to Inform Ambitious Climate Policies in the European Union". We invited several stakeholders dealing with the European Union's climate and energy policies to investigate what issues, in their opinion, should be considered when modelling the energy demand and what policy measures are the most important to drive the transition in the EU buildings sector. Moreover, by engaging external stakeholders, we wanted not only to learn about current trends and challenges from the practitioners' perspective, but also to increase the transparency and outreach of our research. This report presents the key findings from the workshop, based on the knowledge and expertise of the participating climate and energy experts, but they do not necessarily reflect the positions of the organisations, which they represent.

[1] Energy Performance of Buildings Directive (EPBD), 2019.
[2] COM(2020) 662 final on 'A Renovation Wave for Europe – greening our buildings, creating jobs, improving lives' (2020).

Stakeholder Engagement Approach and Workshop Agenda

Stakeholder engagement constitutes an essential component of the WHY project. From the project's beginning external partners provided input to determine their requirements from the WHY modelling toolkit. The event organised on the 19th of May served a different purpose – since the WHY tools will be validated in five different Use Cases, the workshop "Improving Demand-side Modelling to Inform Ambitious Climate Policies in the European Union" aimed at determining technical, behavioural and policy components, which should specifically be included in the EU's Use Case.

At the initial stage of planning, the event was planned to be a physical meeting. However, the ongoing COVID-19 pandemic required to organise the meeting in an online format using Zoom. To provide an insightful discussion and guarantee that each stakeholder will have the chance to share its opinion, we invited a selected group of European experts representing various domains related to residential energy demand. All stakeholders agreed to join the event voluntarily, and we pointed out that their inputs will be used only for the sole purpose of research and publication of the results will not disclose personal information that would allow to identify their insights. The list of participants of this workshop, including the WHY consortium participants, can be found at the end of this report.

Figure 1: Screenshot with some of the workshop's participants.

The workshop was divided into four main parts: (**1**) Opening plenary session, (**2**) Parallel thematic sessions – round 1, (**3**) Parallel thematic sessions – round 2 and (**4**) Closing plenary session. The topics of the thematic sessions can be found in the table below. Such structure allowed to give to the stakeholders the opportunity to share their perspectives concerning the themes of technical energy services and policy interventions. Table 1 displays the workshop's agenda.

One week before the workshop, we contacted the experts and shared a document describing, what objectives are behind each of the thematic session. We also asked them about their preferences regarding the session that they would like to join as the first one. Both sessions were designed in a collaborative way by the WHY consortium members. We structured them in the Miro whiteboards, trying to deliver an easy-to-use tool to work online and in a collaborative, engaging way. We guided the stakeholders through all prepared Miro frames, which allowed to collect their insights in a transparent, easy and structured way. Each performed task in Miro was accompanied by a discussion on selected aspects. The following pages present the findings of each of the thematic sessions.

Time	Agenda item	
9:30-9:55	Opening plenary session	
9:55-11:00	Parallel thematic sessions – round 1	Session 1: Energy transition: Things to consider when modelling the demand side
		Session 2: Policy Interventions: Things to consider when modelling the effects of political decision on the energy demand
11:00-11:15	Coffee break	
11:15-12:15	Parallel thematic sessions – round 2	Session 1: Energy transition: Things to consider when modelling the demand side
		Session 2: Policy Interventions: Things to consider when modelling the effects of political decision on the energy demand
12:15-12:30	Closing plenary session	

Table 1: Workshop Agenda for "Improving Demand-side Modelling to Inform Ambitious Climate Policies in the European Union".

Session 1: Energy Transition: Things to Consider when Modelling the Demand Side

The first session of the workshop was dedicated to the technical aspects of the demand side modelling. The main objective was to discuss with invited energy experts, which components relevant to household energy consumption should be included and prioritised in the WHY-toolkit, considering the European Use Case. We grouped these components into four different discussion themes: in round 1 we focused on elements related to Building Performance and Mobility, whereas in round 2 we discussed aspects concerning Flexibility and Smart Appliances.

The proceedings underpinning the exchange on those themes were the same in each round. First, we introduced the concept of scenarios, divided into: a base, a minimum, a probable, a plausible and an ideal scenario. Figure 2 illustrates[3] the main features of the scenarios mentioned above, which were presented to the stakeholders, and provides their general description.

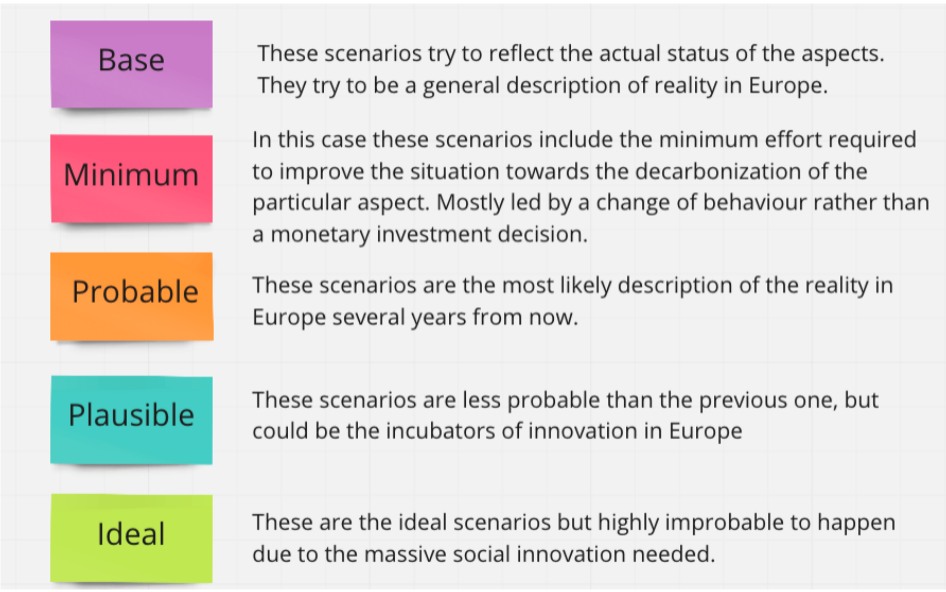

Figure 2: The scenarios applied in Session 1 one of the workshop – "Energy Transition: Things to Consider when Modelling the Demand Side".

As the next step, the stakeholders read five different scenarios related to the Building Performance aspects (a similar task concerned also other main themes), to get acquainted with the visions of the potential developments in the European demand sector (as shown in Figure 3). Afterwards, the participants of this session were asked to classify those scenarios as a base, minimum, probable, plausible, and ideal (as introduced in the previous step). Each evaluation was supposed to be done in the context of the three next decades (covering the 2020-2050 period). This is depicted in Figure 4.

[3] For a better overview on the frames and figures regarding Session 1 created in Miro, please follow this link.

Figure 3: The qualitative description of the scenarios applied in the task dedicated to the Building Performance aspects.

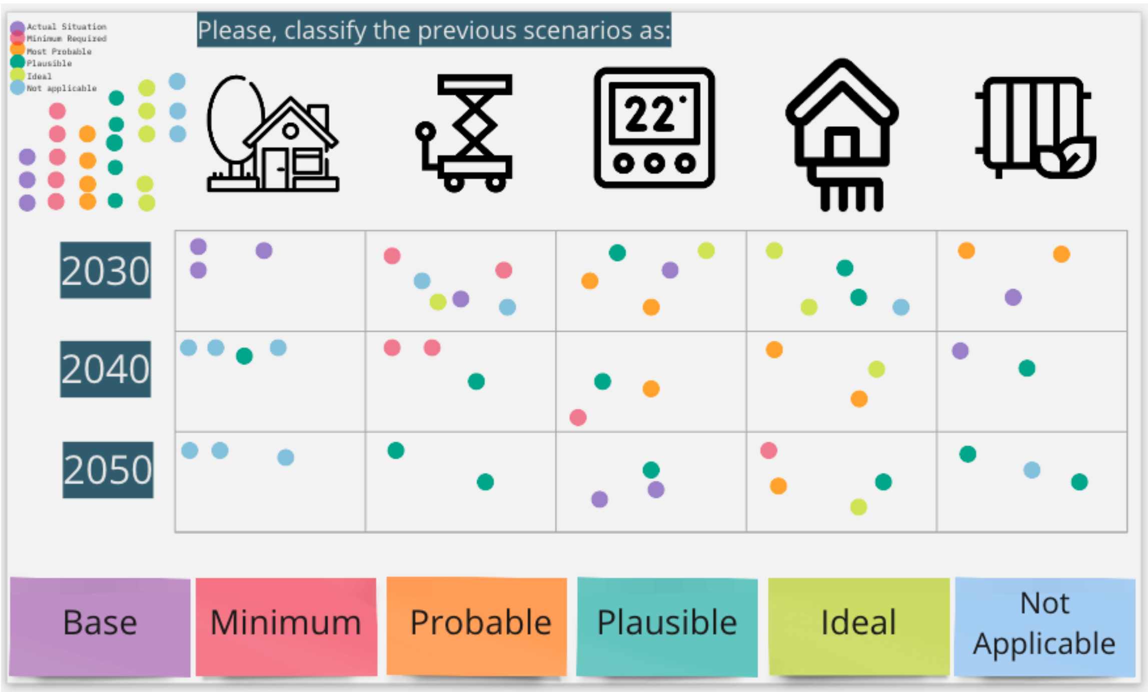

Figure 4: Classification of specific scenarios as a base, minimum, probable, plausible, and ideal in the context of the Building Performance aspects by 2030, 2040 and 2050.

At first, the realisation of this task brought ambiguous results. Stakeholders were not unanimous in estimating the character of possible scenarios to be taking place in the upcoming decades, resulting in different colours of the dots placed in the matrix. The strongest unanimity considered the fact, that the weakest decarbonisation scenarios would not be sufficient at the household level in 2040 and 2050. In general, the overall trend showed that the longer-oriented time perspective, the more agreeable stakeholders were.

In the next task, we asked the participants to write down specific technologies on the sticky notes, which, in their opinion, will be essential in implementing the aforementioned scenarios. the abovementioned scenarios. Importantly, under "technologies" we have not understood only technical solutions, but also those related to social innovation. This task is visualised in Figure 5.

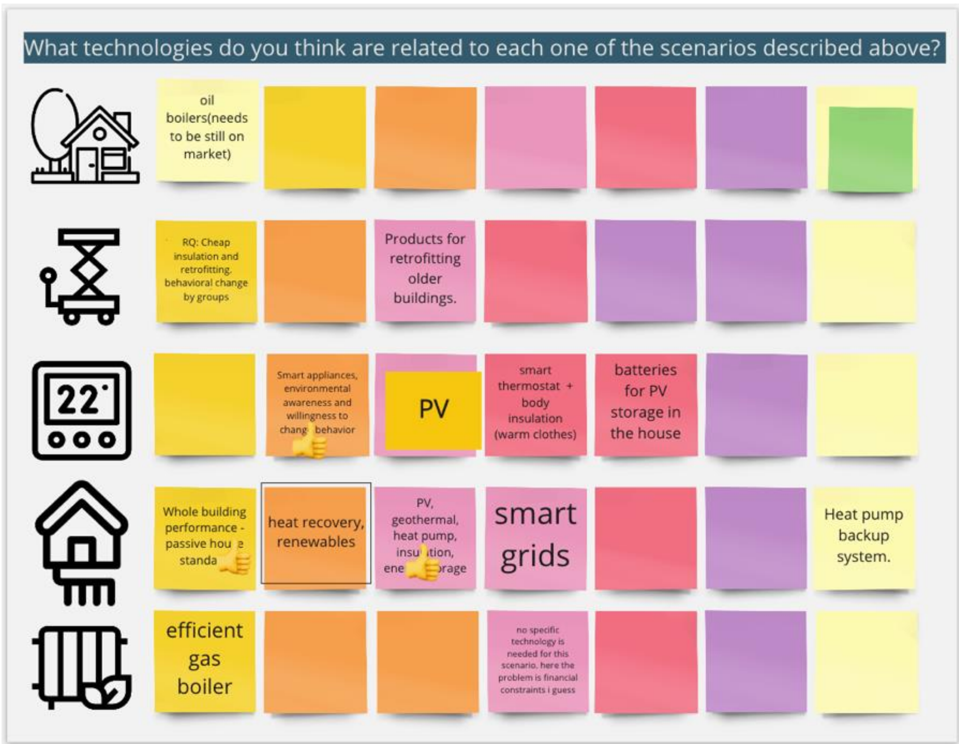

Figure 5: A set of technologies anticipated by stakeholders as relevant for the first set of the scenarios.

The last task was linked to the previous one – we asked the stakeholders to indicate, which of the previously mentioned technologies they would prioritise in the modelling of the Building Performance aspects. The range of answers varied considering two dimensions: the degree of detail (low vs. high) and the answer time (fast vs. slow). We assumed that both dimensions are interrelated – the fast answer time also means a low level of detail, and vice-versa. In that context, the participants indicated that, e.g., the gas boilers should not be given a lot of attention in the modelling runs, in contrast to renewable and renewable-related technologies, such as PV or smart grids. The results of this exercise are presented in Figure 6.

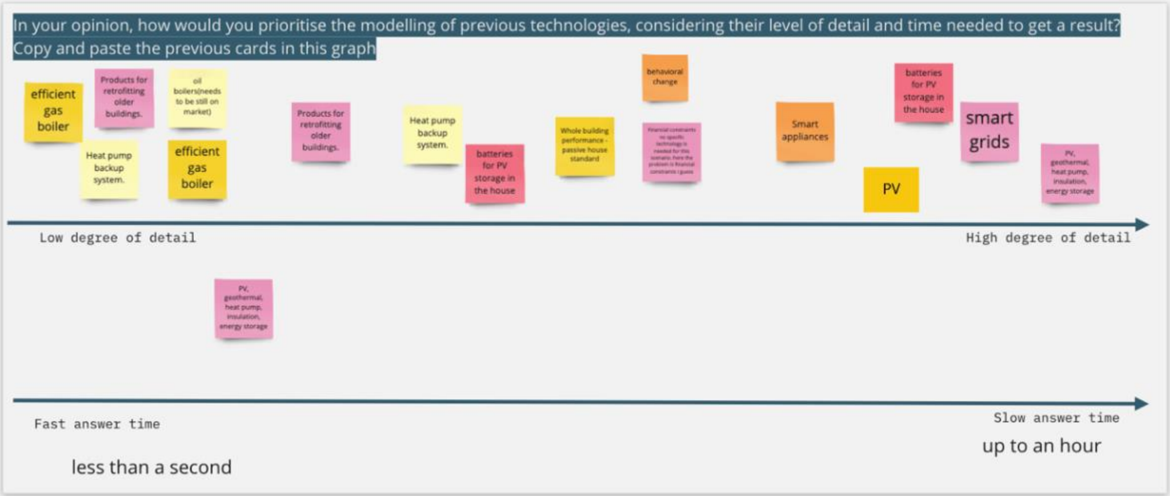

Figure 6: Technologies related to Building Performance, classified according to the level of detail and the answer time.

After completing the last task related to the Building Performance aspects, the stakeholders undertook similar exercises in relation to the Mobility aspects. First, the participants read potential future scenarios dealing with mobility and afterwards they indicated, which of them were referring to a required minimum, which of them were most probable, plausible, ideal, not applicable or presented the actual situation. The scenarios and their classification are shown in Figures 7 and 8.

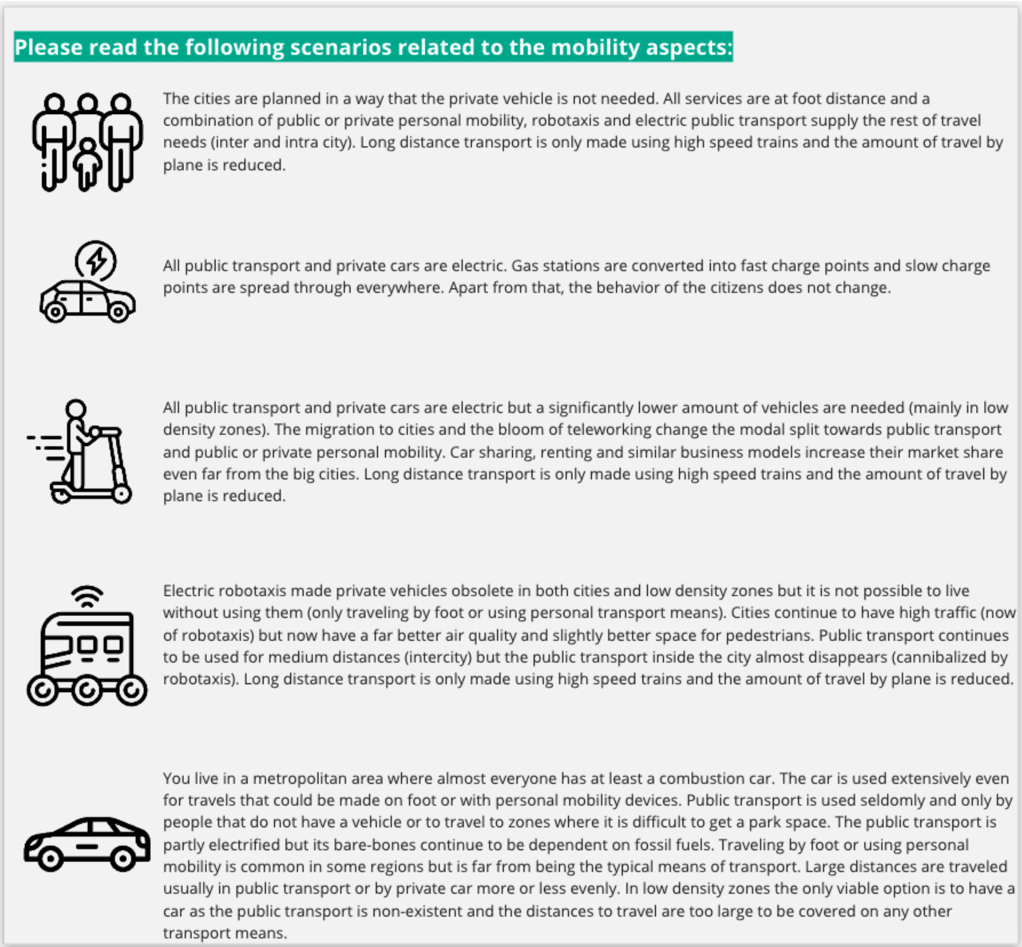

Figure 7: Scenarios related to the Mobility aspects.

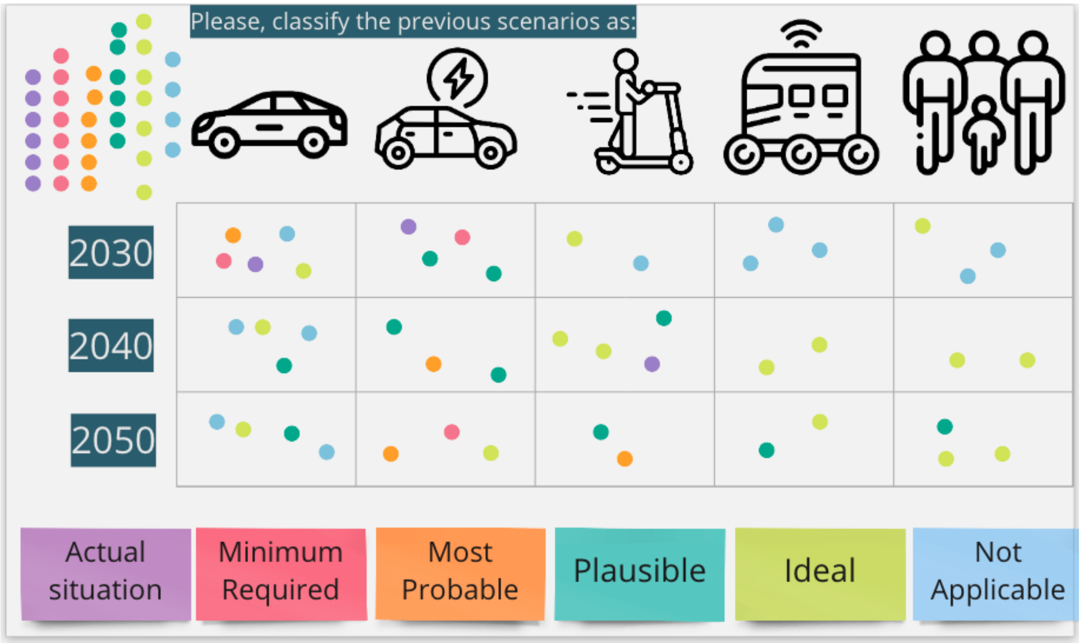

Figure 8: The classification of the Mobility scenarios based on the stakeholders' input.

In case of the Mobility aspects, the participants indicated mixed assessments of the presented scenarios, being, however, in some cases unanimous. For example, stakeholders were sure that a scenario assuming a broad use of the electro taxis will not be applicable until the end of this decade. Similarly, they assessed that it would be an ideal solution, if by 2040 the cities are planned in a way that the private vehicles are not needed.

In the following task, the workshop's participants listed numerous technologies relevant to presented mobility scenarios. Noticeably, as Figure 9 shows, they mentioned not only technological developments needed for the transformation of the mobility system, such as reliable artificial intelligence or batteries, but they have also emphasised the importance of the behavioural change and the emergence of new business models.

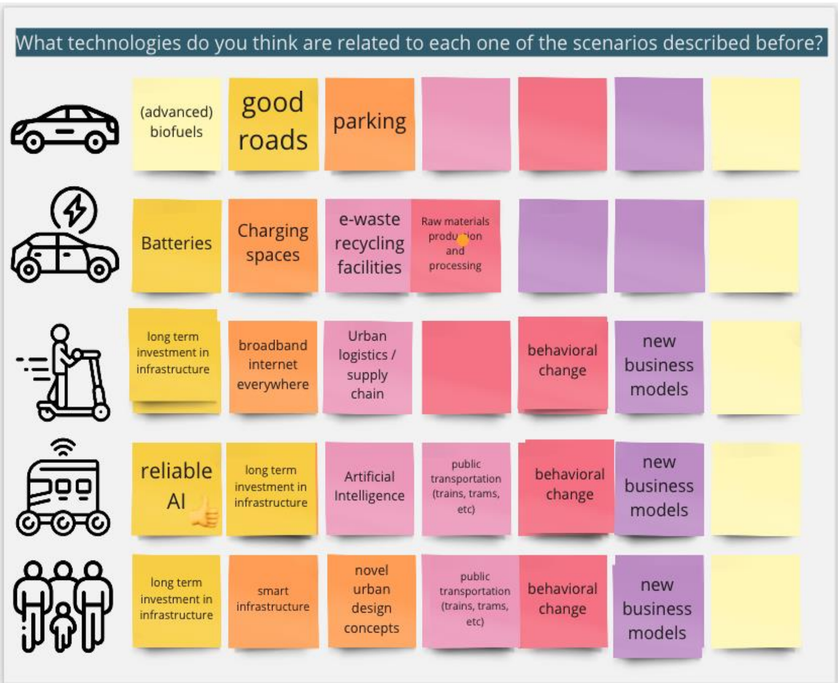

Figure 9: Technologies related to the Mobility sector as indicated by the stakeholders.

Against this backdrop, stakeholders claimed that most of those aspects should be characterised by moderate levels of detail and answering time. A visible deviation from this outcome concerned e-waste recycling facilities (low level of detail/ fast answer time) and reliable artificial intelligence (rather/ high level of details/ slow answer time). There was no clear agreement regarding the behavioural change. Figure 10 presents these results.

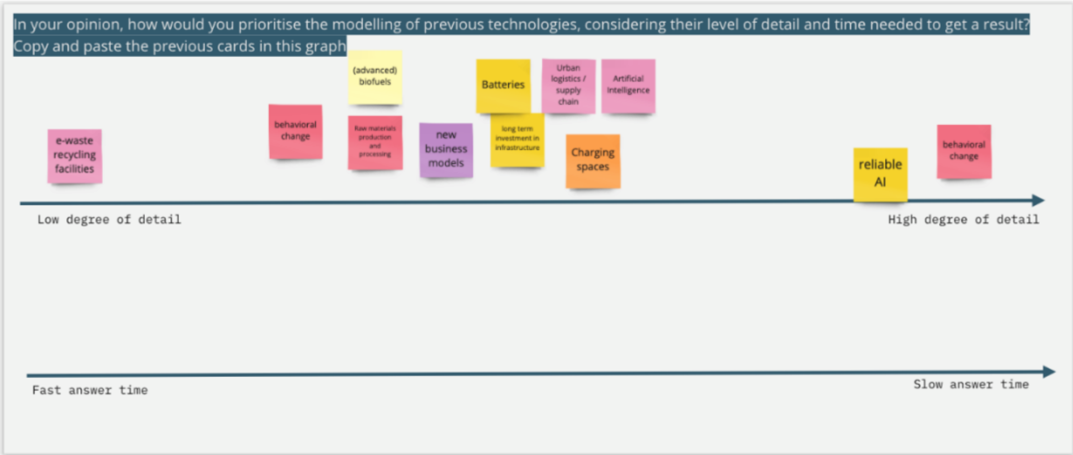

Figure 10: Technologies related to Mobility, classified according to the level of detail and the answer time.

This task finished round 1 of the parallel thematic sessions and after coffee break and re-shuffling of the stakeholders' groups, further energy demand aspects were discussed. At the beginning stakeholders read five scenarios related to Flexibility aspects, as shown in Figure 11.

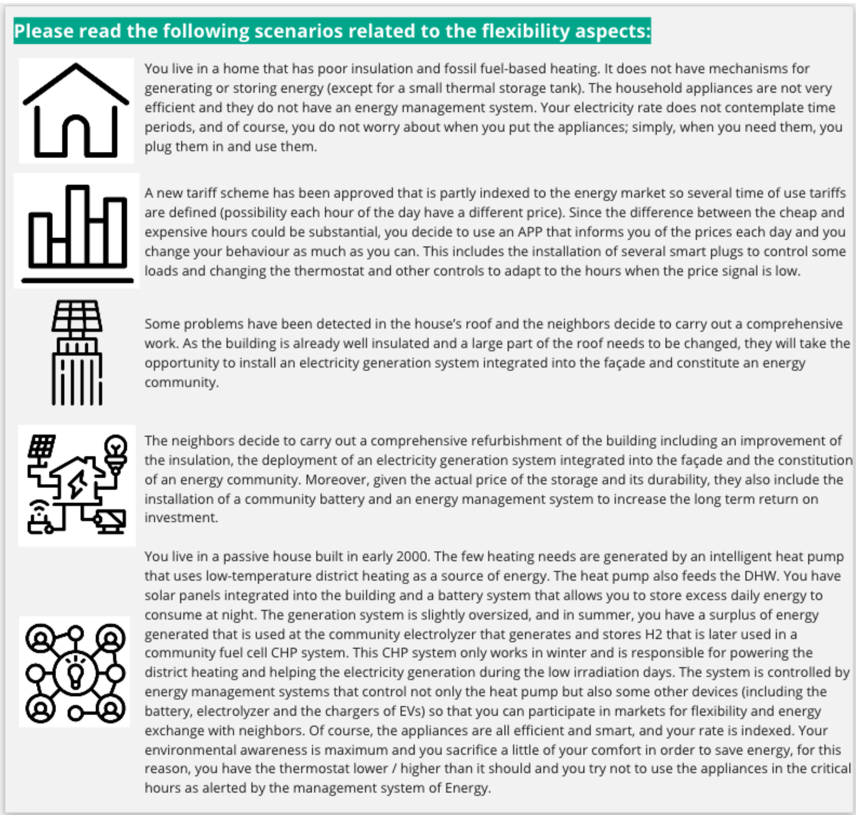

Figure 11: Scenarios related to the Flexibility aspects.

Subsequently, they classified these scenarios as minimum required, most probable, plausible, ideal, not applicable or presenting the actual situation. The experts participating in the workshop were rather consistent in their answers – they categorised the Flexibility scenarios considering the time perspective by using mostly the same colour coding. More detailed results of this exercise are presented in Figure 12.

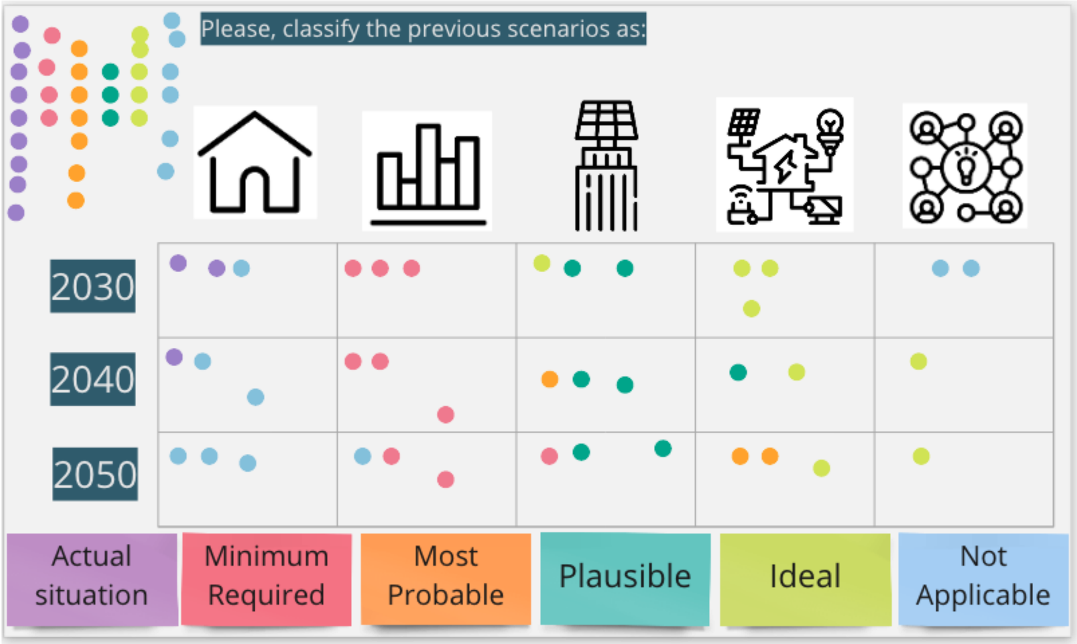

Figure 12: The classification of the Flexibility scenarios based on the stakeholders' input.

Within the following task, stakeholders did not have problems with indicating numerous technologies related to Flexibility. Interestingly, they did not mention about any of technologies related to the first scenario. It resulted from the fact that this scenario did not present any progressive decarbonisation measures and, therefore, the stakeholders recognised this scenario mostly as not applicable in the future and, hence, as a reality that will not require any technologies. Other results are depicted by Figure 13.

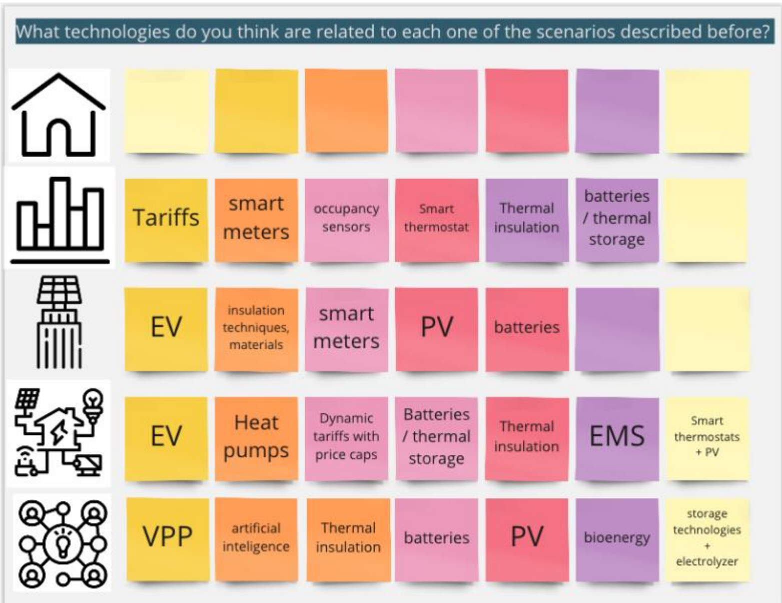

Figure 13: Technologies related to the Flexibility aspects as indicated by the stakeholders.

Finally, the stakeholders classified the previous technologies according to their preferences regarding the level of modelling detail and time for receiving the modelling result. According to their input, the most desirable in terms of high detail degree are the results of the Virtual Power Plant's (VPP) modelling. On the opposite side of this axis the workshop's participants placed smart meters. Full results of this exercise are visualised in Figure 14.

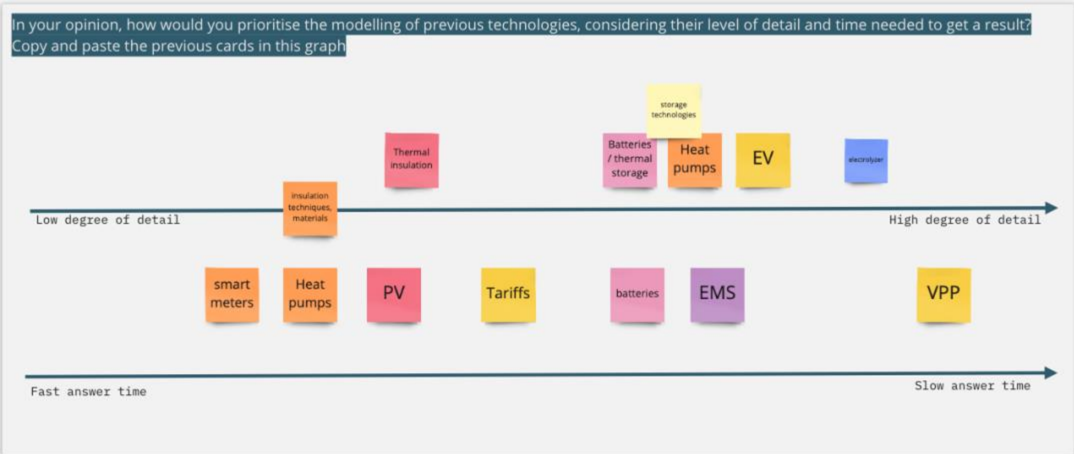

Figure 14: Technologies related to Flexibility, classified according to the level of detail and the answer time.

The last group of aspects discussed with the stakeholders concerned Smart Appliances. Similarly like in previous themes, the participants first read the descriptions of the possible future scenarios and afterwards, they categorised them as minimum required, most probable, plausible, ideal, not applicable or presenting the actual situation. This is illustrated in Figures 15 and 16.

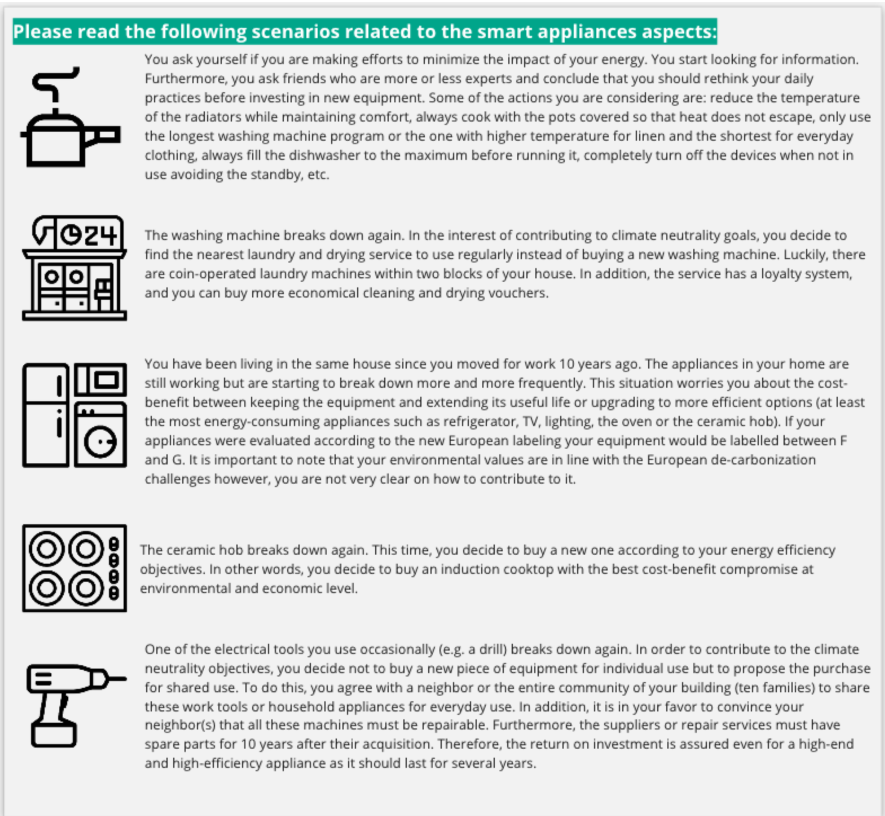

Figure 15: Scenarios related to the Smart Appliances aspects.

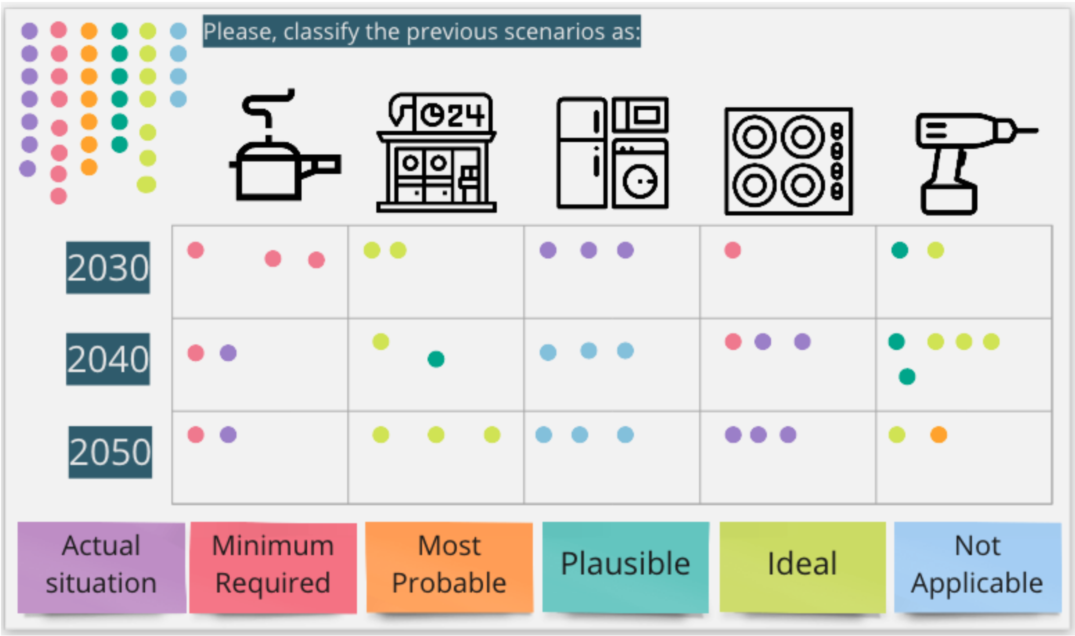

Figure 16: The classification of the Smart Appliances scenarios based on the stakeholders' input.

Again, stakeholders were quite consistent in their assessments – in most of the scenarios they agreed on their character in the context of the decades to come. The most visible discrepancy of the answers occurred in case of a scenario foreseeing a communal use of some of the appliances.

In the next exercise, the invited experts indicated few technologies related to the Smart Appliances scenarios, but clearly less as in case of previous scenarios. Additionally, all of those technologies were assessed as requiring rather a low level of detail (but delivered fast) while modelling. This is depicted in Figure 17.

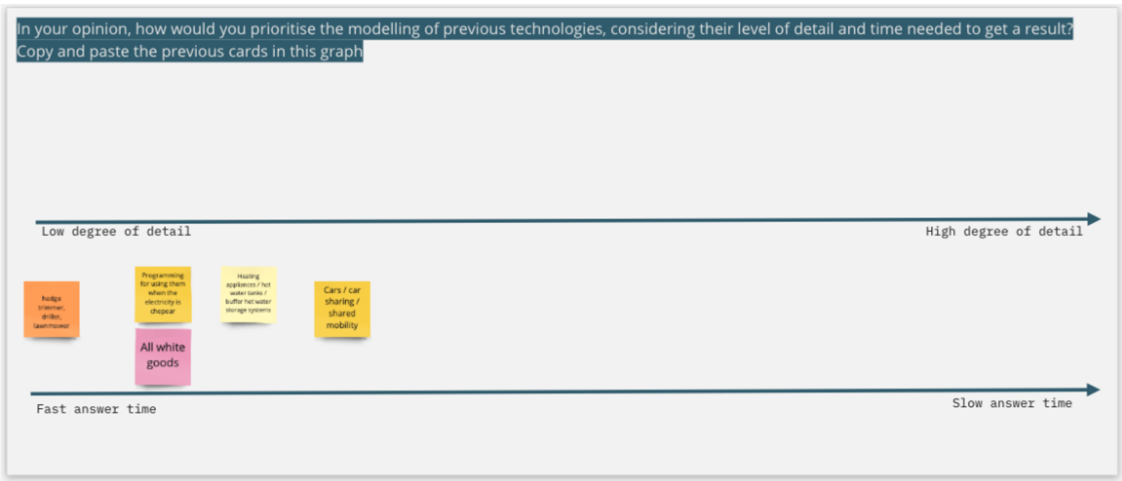

Figure 17: Technologies related to Smart Appliances, classified according to the level of detail and the answer time.

Session 2: Policy Interventions: Things to Consider when Modelling the Effects of Political Decision on Energy Demand

Session 2 centred around energy and climate policy interventions to consider when modelling energy demand in buildings. Since the 2030 and 2050 climate targets for the EU are ambitious, it is imperative to better understand how specific policy instruments will drive this transition. As the current policies are not sufficient enough to meet the climate neutrality goal by 2050, it is clear that stronger policy instruments will be required. The objective of the session was to analyse and prioritise the most important policy interventions to drive the transformation of the EU building sector, which will be assessed quantitatively in the WHY toolkit. We structured this session to allow for a discussion concerning different types of those policy interventions, such as regulatory, economic and informative measures[4]. Nevertheless, we did not explicitly share this information with the stakeholders, in order not to suggest them the answers that we would expect. Instead, at the beginning of the session, we presented the general aspects of the EU building sector transformation, which should be tackled during the discussion, as can be seen in Figure 18.

Figure 18: Aspects related to Policy Interventions aiming at decarbonising the EU building sector.

Session 2 was also divided into two separate breakout rounds. The first round focused on the themes of Building Performance and Electrification, whereas the second round concentrated on Flexibility & Smart Appliances and Socio-Economic Issues (Figure 19)[5].

[4] K. Rogge, K. Reichardt (2016) "Policy mixes for sustainability transitions: An extended concept and framework for analysis", *Research Policy*, 45(8).

[5] To have a better overlook on the frames and figures regarding Session 2 created in Miro, please follow this link.

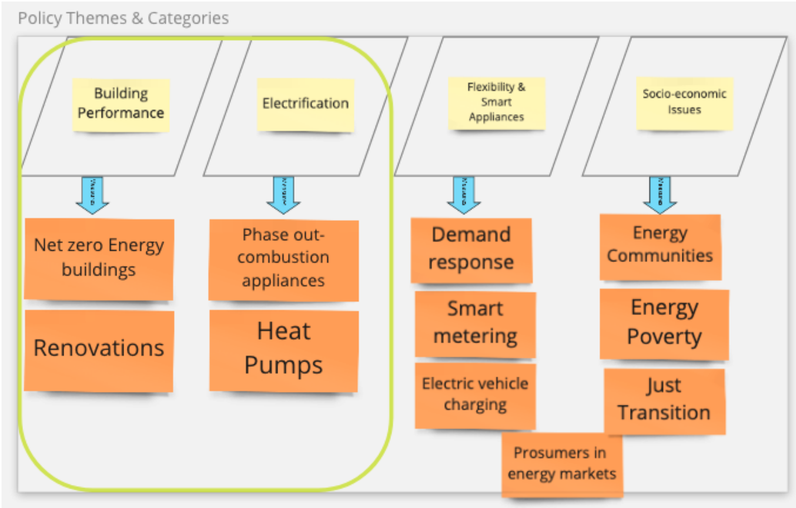

Figure 19: First Round Themes discussed.

Based on the ongoing WHY project's research review, we identified key actions and measures, serving to decarbonise the European residential sector. For Building Performance, these were: Net Zero Energy Buildings (NZEBs) and Renovations. For Electrification, we chose phasing out combustion appliances and installing heat pumps.

Starting with the Building Performance theme, the stakeholders provided additional actions and measures that should be implemented in order to improve the state of building performance (see: Figure 20).

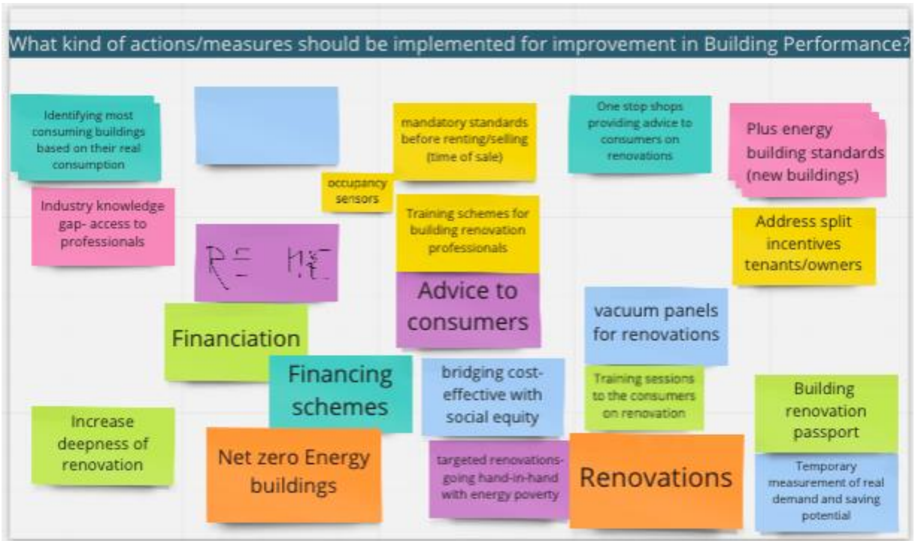

Figure 20: Further Actions/Measures for better Building Performance.

Next to Energy Plus building standards, relevant for the NZEBs, measures complementing Renovations included: Building Renovation Passports, increasing the deepness of renovation, targeting renovations of buildings with high levels of energy poverty, mandatory standards and training schemes for renovation professionals. In addition, the stakeholders addressed the industry knowledge gap, financing schemes, consumer awareness and one-stop-shops, and the split incentives between tenants and owners.

Utilising the listed measures, the stakeholders then discussed and determined what kind of interventions they would expect in order to foster the implementation of such measures. Figure 21 illustrates the results of this exercise. The interventions that the stakeholders discussed included economic, regulatory and information-based instruments. For example, regarding NZEBs, stakeholders indicated interventions like subsidies or other financial incentives being used to bring the cost of low-to-no carbon technology to an affordable level; technnical support and informational instruments regarding whole life carbon and circular design; and creating stronger building standards. Since Renovations were also a popular topic, the interventions also included: carbon pricing, tax breaks, income-based subsidies, loan repayment included on energy bills, informational resources for consumers to derisk renovation loans, renovation requirements by member states, and Energy Performance Certificates (EPCs).

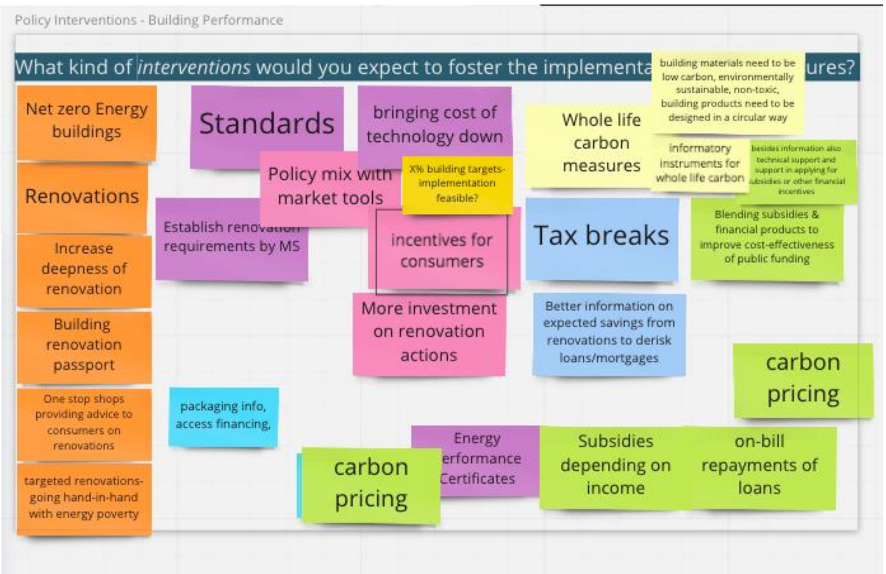

Figure 21: Interventions to Foster Building Performance Implementation.

Building on these insights, the final step involved discussing and prioritising the above policy interventions, considering both their effectiveness and their implementation barriers, related e.g. to social acceptance, political issues, technology availability and potential ramp-up, governance, policy and institutional barriers. The stakeholders collectively rated many of the interventions as equally effective (in terms of reducing carbon emissions and energy demand), though the implementation barriers were more varied across interventions. Of the economic interventions, making renovation loans convenient through an on-bill repayment scheme was viewed as highly effective and had less implementation barriers compared to a more complicated and less socially acceptable carbon pricing scheme for buildings. Stakeholders also disagreed with the level of implementation barriers that tax breaks entail, especially since tax breaks were also viewed as less effective than many other interventions. In addition to economic-based instruments, the experts also mentioned that information resources will also play a complementary role, as information campaigns are very effective, but due to the implementation barriers, they need to be paired with other options.

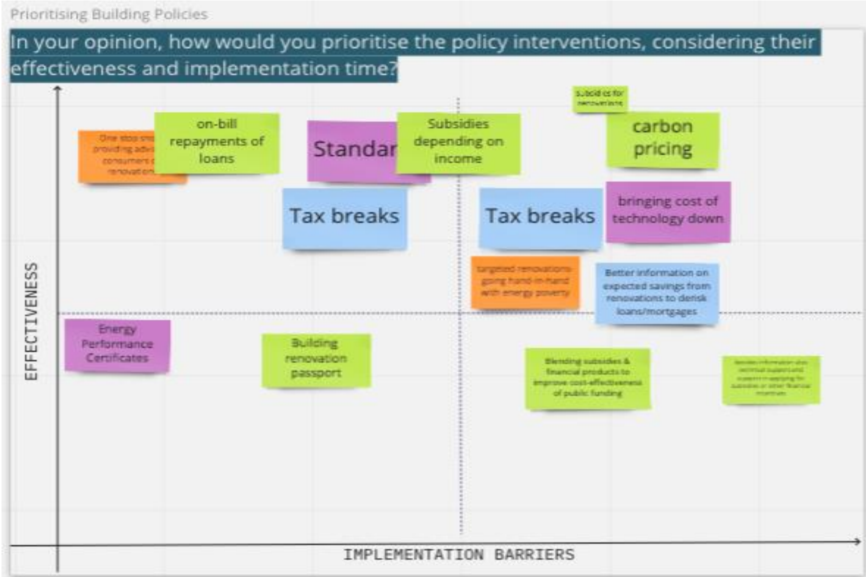

Figure 22: Prioritising Interventions for Building Performance.

The participants also discussed interventions related to electrification. Figure 23 shows the various measures considered to improve electrification of the EU buildings sector. Again, the stakeholders mentioned economic, regulatory and information-based measures, such as dynamic electricity tariffs, energy market regulation, and informational campaigns that educate citizens on the health, economic and climate benefits of removing combustion appliances, respectively. Generally, the economic interventions that the stakeholders mentioned were subsidies to enable the reduction of electricity prices to address the tax imbalanced between electricity and fossil fuels in several EU counties and give people in energy poverty a positive opportunity to participate in the energy transition. The regulatory interventions focus on prohibition of combustion appliances and encouraging standards and market design. The information interventions concentrated on public information campaigns and encouraging training and communication regarding new technology, like heat pumps, and new flexibility market solutions, like demand response.

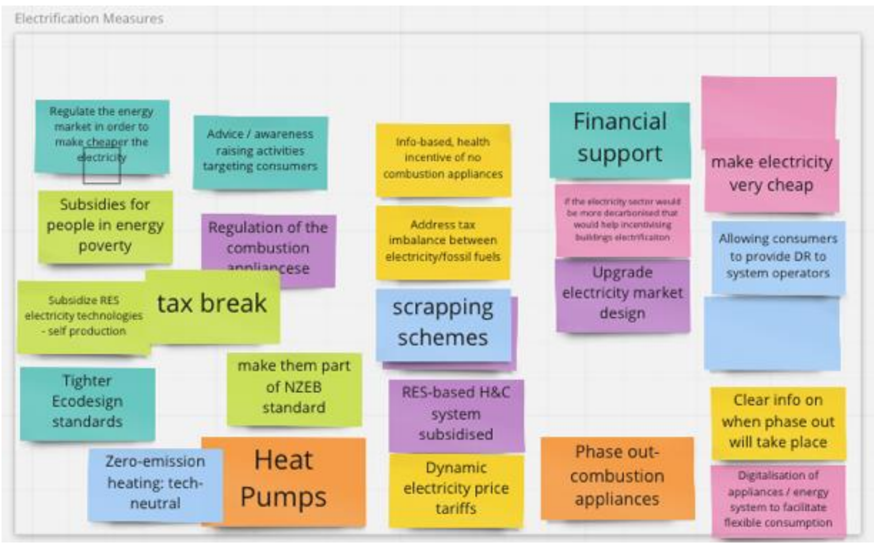

Figure 23: Policy Measures and Instruments for Electrification of Building Sector.

When the stakeholders discussed the prioritisation matrix regarding electrification, there were more effective policy interventions and less implementation barriers than the Building Performance matrix. The economic options like tighter eco-design standards and the generic financial support (though there was some disagreement among stakeholders) and more specifically, dynamic electricity price tariffs were considered quite effective, while having relatively low implementation barriers. In contrast, the regulatory phaseout of combustion appliances and the general call to make electricity very cheap were considered less effective, while encountering many implementation barriers. See Figure 24 to further investigate the prioritisation matrix.

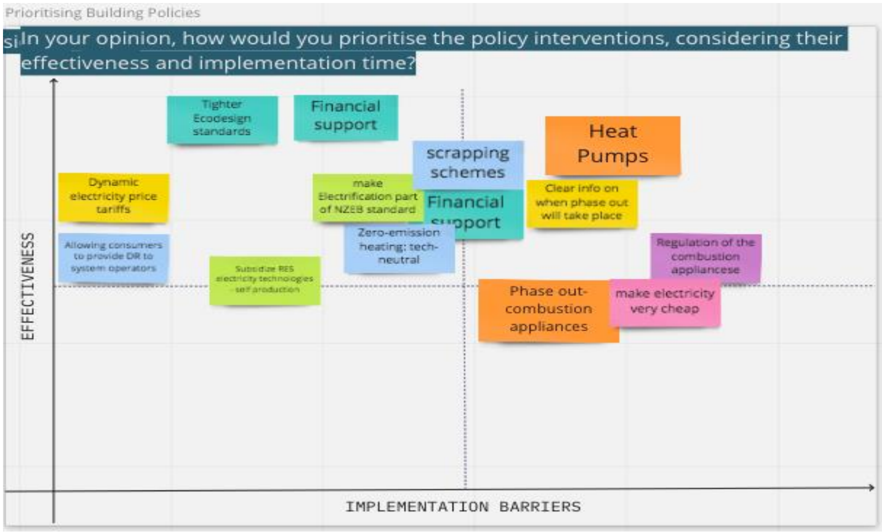

Figure 24: Prioritising Interventions for Electrification.

After the coffee break, the next group of stakeholders joined to discuss the themes of "Flexibility and Smart Appliances" and "Socio-economic issues". Stakeholders discussed many options, and while there were economic interventions like time-variable pricing, transparent tariffs, most of the interventions revolved around technology, regulatory policy, and information. Figures 25 and 26 include the measures and interventions, varying from decentralised, local planning to energy communities, new business models, information campaigns, standards for appliances, behavioural considerations and smart grid integration.

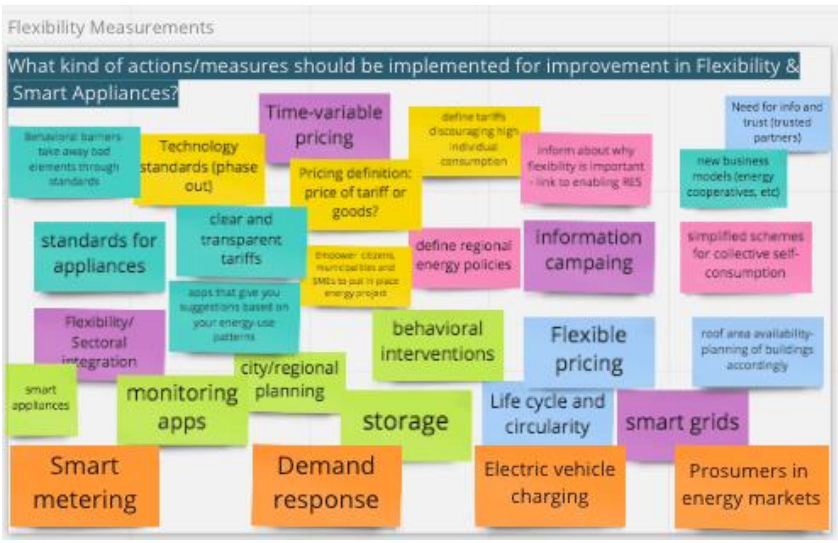

Figure 25: Policy Measures for Flexibility and Smart Appliances.

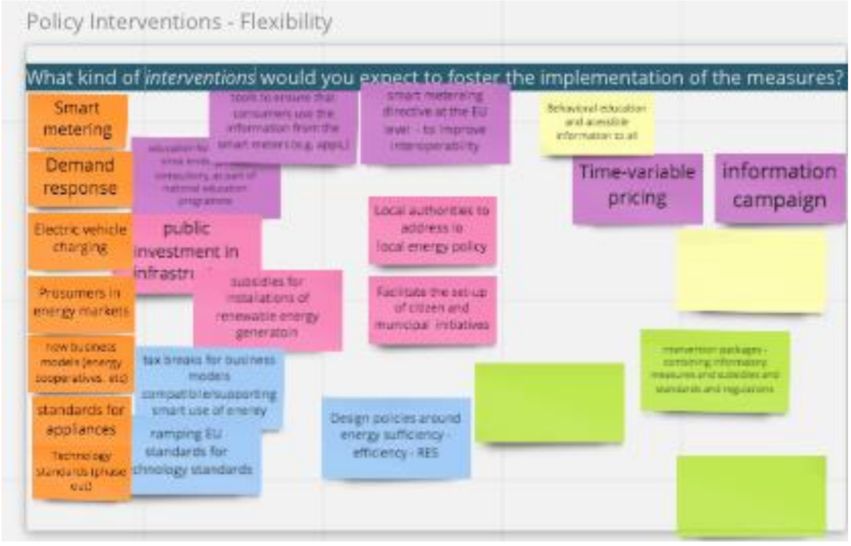

Figure 26: Interventions to foster Flexibility and Smart Appliances.

The prioritisation of Flexibility and Smart Appliances showed the importance of regulatory and information-based interventions. Information campaigns and consumer education were considered as effective interventions that had fewer implementation barriers than energy decentralisation to local authorities or public infrastructure investment. It is worth noting that there was a clarification regarding how to define "information campaigns" in order to properly prioritise them within the matrix. Another notable response combined information measures with subsidies and stricter regulations to create an intervention policy package (combining economic, regulatory, infrastructure and information interventions). While we ran out of time to discuss the feasibility of this combination, it is worthwhile to consider this in further development.

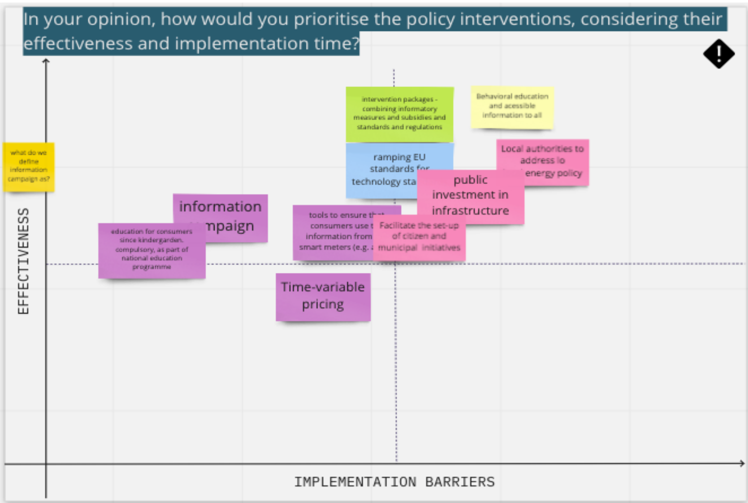

Figure 27: Prioritising Interventions for Flexibility and Smart Appliances.

The final policy theme discussed during the workshop concerned socio-economic issues relating to building decarbonisation. The policy interventions that were discussed almost naturally were grouped into two sections: energy poverty and just transition. Economic interventions included subsidy support for low-income families, progressive tariffs, and supporting business models that are low-carbon alternatives. Many responses emphasised the importance of targeting the most vulnerable populations to both tackle energy poverty and to achieve a just energy transition, in line with the EU Green Deal goals. The stakeholders also mentioned different coalition-building techniques, like participatory projects, empower citizens into energy communities, public-private partnerships with firms, and developing job retraining to raise awareness. Finally, the landlord-tenant dilemma was brought up, as it has implications on both energy poverty and just transition in many EU member states where there is a high concentration of renters. Figure 28 shows the breadth of discussion.

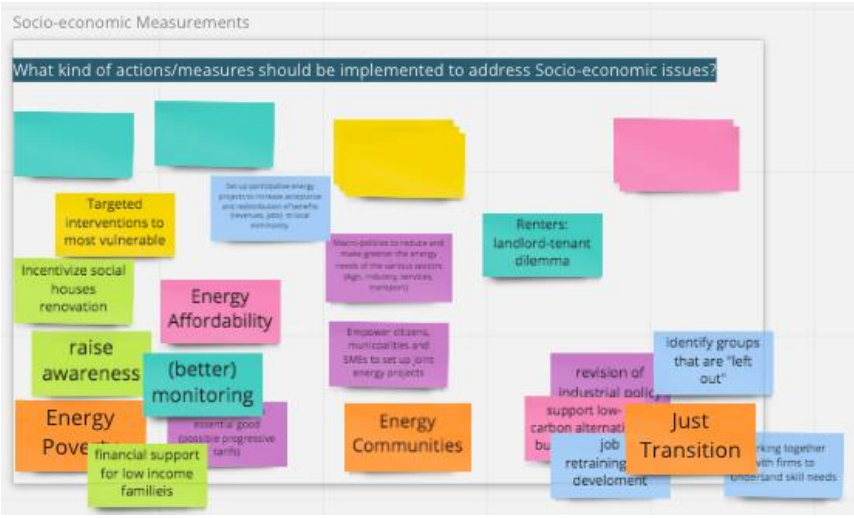

Figure 28: Policy Interventions to address Socio-economic Issues in Building Decarbonisation.

Due to the robust and lively discussion, we ran out of time to dive deep into the prioritisation of socio-economic issues, but the interventions that were added to the matrix included job training and skill development, industry policy revision, and financial support for low-income families. For future consideration, it would be extremely insightful to follow up with both sessions of stakeholders and reanalyse this aspect.

The core surprise from the collective policy intervention session was the considerable amount of consumer education and information-based interventions that the stakeholders proposed and prioritised highly. While these interventions were not always considered low-barrier, they were typically considered highly effective, as they empower more citizens to have buy-in to the energy transition, demonstrating the need for ESMs to improve the representation of these aspects.

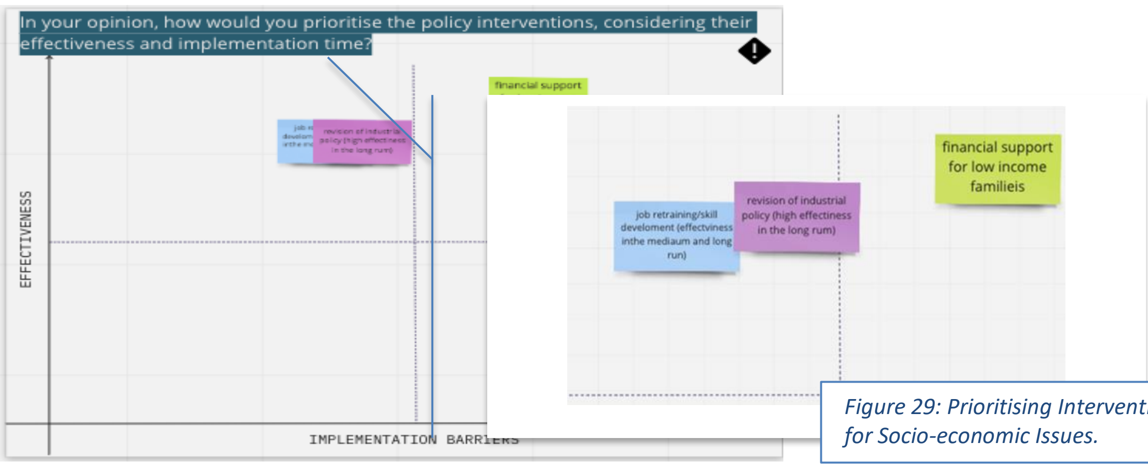

Figure 29: Prioritising Interventions for Socio-economic Issues.

Conclusions

The discussions at the workshop and the tasks completed by the invited stakeholders provided meaningful insights needed for the future developments of the WHY project and in particular for the definition and development of the European Use Case. The workshop's design proved to be highly efficient in engaging the climate and energy experts and policy makers and gaining an improved understanding and prioritisation of the technical and political aspects that should be considered in the modelling of energy demand in the buildings sector. The collected information allows us to draw the following conclusions.

First, there are numerous technical and political components to be included in the energy demand modelling, and prioritising this complexity is not always straightforward. While stakeholders shared their viewpoints on some of these aspects, a more rigorous approach should be applied to provide a clearer guidance toward which aspects should be given a high priority in applied energy system modelling.

Second, although the main themes guiding the exercises in both sessions were slightly different, all elements mentioned by stakeholders in those sessions are intertwined with each other. Thus, for the next steps in the project, it will be of a crucial importance to consider those interrelations.

Building off the previous points, the plethora and diversity of collected insights give the WHY project an opportunity to think about alternative elements that could be included in the energy demand modelling and about the most interesting and policy relevant policy interventions to be analysed. On the one hand, it encourages the WHY project to conduct follow up research to identify components that were not mentioned by the stakeholders during this workshop. On the other hand, especially in the context of policy interventions, it inspires the WHY project to develop new instruments or actions that could better advise policymakers and further advance the decarbonisation efforts in the residential sector.

Overall evaluation of this event shared by stakeholders was very positive, especially in terms of time efficiency, clear presentation of the workshop's objective and placing it in the context of the whole project. There were some elements, which could be further improved, like e.g., reducing the amount of the text to be read by the participants, as the tasks related to scenarios' description in Session 1 required. Nevertheless, the workshop turned out to be an appropriate forum to exchange information and ideas between the researchers and practitioners as well as an effective channel enabling networking and integration of the European climate and energy community.

List of Participants[6] & WHY Staff

	Last name, First name	Affiliation	Country
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5.	Chatterjee, Souran	Central European University	Hungary
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7.	Daniel, Ewelina	European Commission	Belgium
8.	Edelenbosch, Oreane	Netherlands Environmental Assessment Agency (PBL)	The Netherlands
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12.	Loffredo, Jaume	The European Consumer Organisation (BEUC)	Belgium
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Acknowledgments

We would like to thank all participating stakeholders for dedicating their time and providing us with important input during the workshop. We are also grateful to WHY partners for the commitment in organising this workshop as well as for their support in writing this report.

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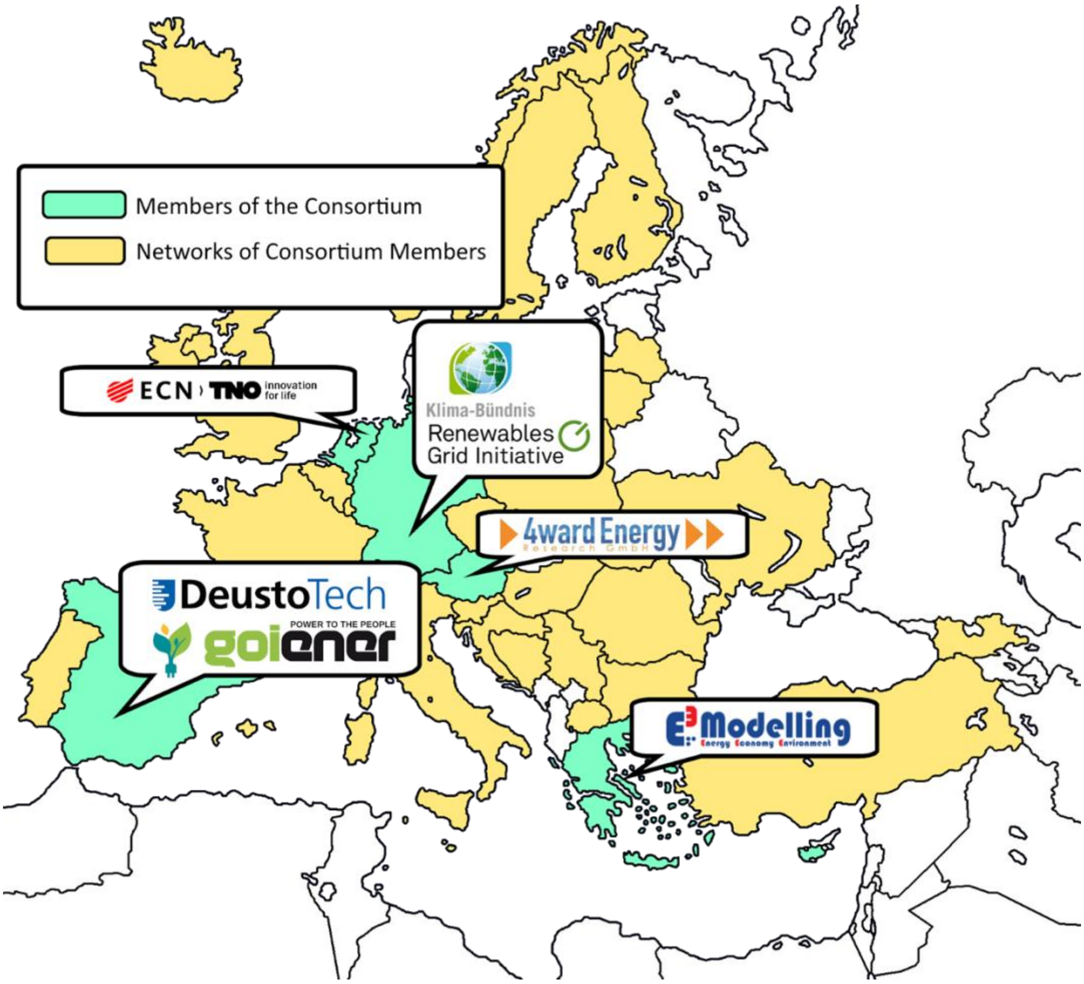
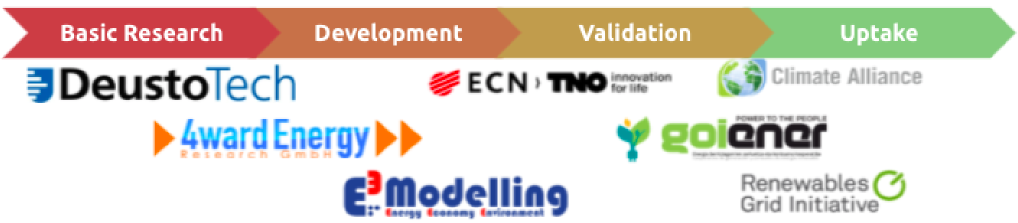
[6] This list includes the names of stakeholders, from which we have received a consent to publish their names. In case of a lacking consent, we include only the organisation that they are affiliated with.

The WHY Project



- Partners covering all the innovation value chain
    - 1 University,
    - 2 RTOs,
    - 1 SME,
    - 1 Industry and
    - 2 NGOs
- Geographically distributed across Europe and with several members of the advisory board around the globe



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