D6.1 | Transition Visioning Workshop Report Report

Deliverable:	**Transition Visioning Workshop Report**
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Contributors:	ENABLE.EU team is grateful to have had the commitment of a wide range of experts, coming from diverse backgrounds, who have dedicated themselves to the project with enthusiasm and patience, overcoming linguistic and cultural barriers to find common ground for moving forward.
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Executive summary

According to Loorbach, transition refers to "locked in regimes that are challenged by changing contexts, ecological stress and societal pressure for change as well as experiments and innovations in niches driven by entrepreneurial networks, and creative communities and proactive administrators".[1]

In line with this rationale, the ENABLE.EU participatory foresight process - presented in the first section of this report - focuses on energy as a "locked in" system and aims to identify experiments and innovations that represent seeds of change that could allow a transition toward a more sustainable energy model.

The second section of this report describes the findings of the Transition Visioning Workshop, held in Sofia on June 14-15, 2018, which saw the participation of fifty-five experts coming from ten European countries and representing the different areas of expertise in energy. By adopting the Three Horizon Model, three scenarios were built representing the current locked-in energy system ("a system in decline"), the future we aim at ("the vision") and the transition scenario ("a possible transition"). The insights received from participants on the current energy system – and its limitations and unfitness for the future – were consistent and are presented in form of a single storyline. On the contrary, "the vision" contains many possible sustainable futures interlinked by the assumption of a more sustainable energy consumption system. There will not be "one size fits all" futures, but rather energy sustainability will be adapted to different local contexts, climates, traditions and cultures. In this case, the project team has reported the contributions received without attempting to have a single harmonized picture of the future. More than contradictions, the inputs represent opportunities to "live well within the limits of the planet", in different but compatible ways. The "possible transition" scenario sketches seven priority areas that could be promoted today to move out from the current energy system toward a more sustainable one. The seven priority areas identified are the following:

1. New energy business models, simplification
2. Prosumers/ renewable energy production
3. Mobility as a service (MaaS), electric/smart mobility
4. Energy affordability
5. Energy education and awareness; research & innovation
6. Active houses and energy efficiency measures at home
7. Reduction of energy consumption, dematerialization/virtualization

Section 2.3 contains a detailed description of these areas: proposed targets, measures that could be promoted as well as possible opportunities and challenges. In these areas, the EU could play a key role for coordinating and upscaling local "seeds of change" and actions.

The third section describes the research findings of the different case studies conducted by ENABLE.EU's partners. The results, in some cases partial, were sent to the workshop participants before the event, and provided a scientific background for the workshop discussion as well as a common understanding of ENABLE.EU's perspective.

This report reflects the work carried out by the project team as well as the contributions and ideas elicited from experts of different disciplines and backgrounds. By combining research with participatory foresight, the ENABLE.EU scenarios and priority areas aim at stimulating the political and scientific debate on future energy consumption, offering novel insights into the range of policy options to be considered, their possible outcomes and trade-offs.

[1] Loorbach, D. et al. (Eds.) (2016). Governance of Urban Sustainability Transitions. European and Asian Experiences.

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1. ENABLE.EU

1.1 Aims and scope of the project

What drives the energy choices we make? What motivates individuals, organisations and countries to adopt and encourage more sustainable energy behaviours? ENABLE.EU embraces a bottom-up approach to changing energy behaviour: empowering consumers and citizens to make freer and better-informed energy choices - choices that reflect what they truly want.
The project is developed within the framework of the Energy Union Framework Strategy[2], designed to foster a cost-efficient energy transition able to deliver secure, sustainable and affordable energy to all European consumers. The Energy Union Framework Strategy aims at a citizen-oriented energy transition based on a low-carbon transformation of the energy system. The successful implementation of the Energy Union will materialise in a change in energy production and energy consumption choices.

ENABLE.EU will:

- ✓ Identify the key factors of energy choices in three areas: transport, heating and cooling, and electricity;
- ✓ Better grasp the interactions between individual and collective energy choices and the regulatory, technological and investment prerequisites of the Energy Union transition pillar;
- ✓ Look at the social acceptability of energy transitions using a participatory foresight and assessment process engaging key stakeholders and selected households;
- ✓ Increase the knowledge of governance and social mobilisation practices that encourage collective energy choices in line with the Energy Union objectives;
- ✓ Provide strategic policy recommendations to increase the social acceptability of energy transitions.

Concept and methodology

The key socio-economic drivers of individual and collective energy choices are determined by analysing the interrelation between various factors, such as social norms, belief systems, everyday practices and economic aspects. This analysis is enhanced through a cross-country comparison in 11 countries, to better comprehend the factors that drive or impede everyday routines and practices. The assumption here is that improved understanding of people's motivations will increase social acceptance, making citizens active participants in the consumption and production of energy.
The expected outcomes are:

- ✓ A literature review of existing qualitative and quantitative studies;
- ✓ An investigation of technological, economic and social factors affecting individual energy choices and behaviours, as well as social mobilisation and governance factors that influence the social acceptability of the energy transition;
- ✓ Participatory foresight exercises, focusing on how to change energy choices and behaviours to support the full-scale transition to a low carbon economy;
- ✓ Reference and policy scenarios, the latter based on contributions delivered in the participatory foresight exercise and assessed using quantitative modelling, to compare the outcomes with the current long-term energy targets of the EC;
- ✓ A series of policy recommendations formulated and disseminated to policy makers.

[2] https://www.eesc.europa.eu/en/our-work/opinions-information-reports/opinions/energy-union-strategic-framework

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Who benefits from ENABLE.EU?

- ✓ Policy makers and planners at the European, national and local level will receive valuable recommendations and scenarios, including measures that can help them achieve their energy transition objectives;
- ✓ The research community will receive ENABLE.EU's findings, to contribute to a better understanding of the drivers of energy choices;
- ✓ Other EU-funded projects will benefit from an improved understanding of energy choices and increased scientific knowledge on the effectiveness of policy interventions;
- ✓ Key information will be given to national and international business and branch associations, interest groups and non-governmental organisations regarding investments in sustainable energy and the challenges to their implementation;
- ✓ Awareness will be raised among the general public, so that they can fully participate in and shape the transition to clean energy.

ENABLE.EU Partners

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1.2 The foresight process: aims and results

What is participatory foresight?

With an uncertain future on the horizon, many of us wonder how our actions today might impact our world in the short and long term. Foresight is a way for us to understand our options, and how the choices we collectively make will impact us. It is not a crystal ball, showing us a definitive future, but a tool that allows us to explore a number of possible futures. It can help us identify what will affect our lives over the next few decades and envisage desirable changes in policies, strategies and behaviours, creating roadmaps that detail what we need to do today to shape our tomorrow.

Using participatory foresight to enable the energy transition

ENABLE.EU is using foresight to understand how to encourage people to make better and more sustainable energy choices. Its three transition workshops bring together experts and citizens to create a realistic roadmap for the future. To begin with, 60 experts will be asked to envision future energy scenarios. Then, citizens from 80 households will refine these scenarios based on their experiences, offering their feedback on enablers and barriers to adopting sustainable energy behaviours. Finally, we will bring these experts and citizens together to create a roadmap for the future.

This participatory vision is built in three steps:

- Transition Visioning Workshop in Sofia, Bulgaria in June 2018 (for experts)
- Transition Backcasting Workshop in Rome, Italy in November 2018 (for citizens)
- Transition Roadmapping Workshop in February 2019 (where citizens meet experts).

The transition workshops

The Transition Visioning Workshop was held on 14-15 June 2018 in Sofia, Bulgaria. Interactive work in small groups allowed all participants to speak and share their knowledge. Taking into consideration the targets set by Europe 2020 and the Energy Union Initiative, the workshop addressed the following questions:

- What are the desired end results or functions of energy practices?
- What are the emerging actions and practices that are considered marginal but could shape our energy behaviours in the future?
- What are the most promising actions related to technologies, policies, and behavioural changes that will have the highest impact on individual and collective energy practices in the future?

The Transition Backcasting Workshop will be another two-day workshop held in November 2018 in Rome, Italy. Interactive work in small groups will allow all participants to speak and share their knowledge. Taking into consideration the scenarios, the workshops will discuss the following questions:

- Which aspects of the energy scenarios do you consider most appealing? How can these aspects be improved?
- What are the main enablers and barriers for implementing practices that can support sustainable energy transitions?

The Transition Roadmapping Workshop will be held in February 2019. Participants will be invited to develop recommendations to promote the adoption of sustainable behaviours for each of the ENABLE.EU fields. The most effective complementary policy interventions (e.g. economic tools,

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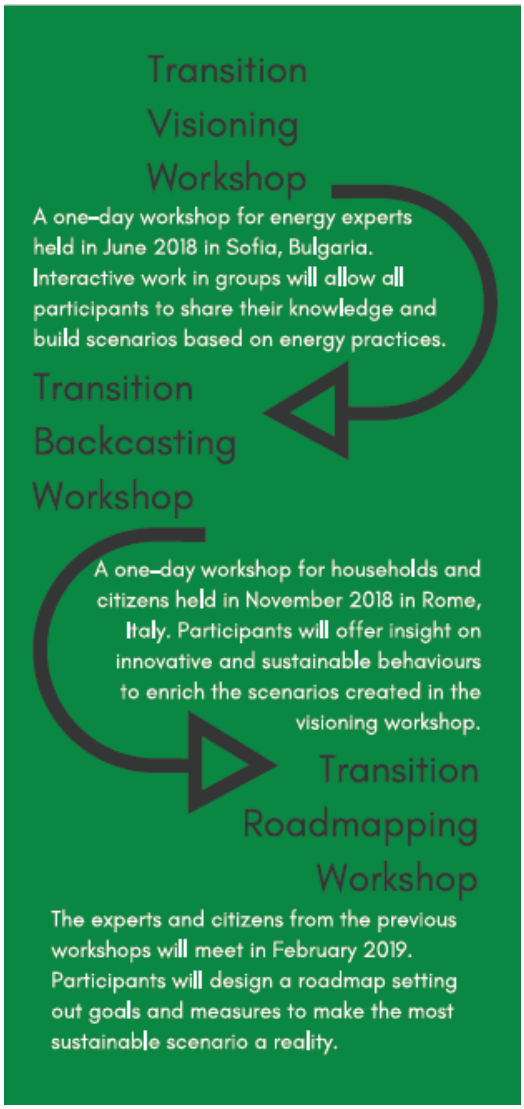
voluntary codes of practices, design and building regulation), education and engagement activities, new business models (learning programs, ICT-enabled peer-to-peer sharing initiatives), and research and development strategies will be examined, and participants will debate how the identified sustainable practices might be implemented to move towards the low carbon scenarios.

Objectives of the transition workshops



✓ Inspire a debate among European stakeholders aimed at identifying practices and possible behavioural shifts to promote the transition from a "business as usual" scenario toward a more sustainable one;
✓ Build energy scenarios by interpreting existing trends, drivers, and practices that influence individual and collective energy choices;
✓ Get input from European households on the most important enablers and barriers that could help them move toward more sustainable practices and behaviours;
✓ Refine the energy scenarios by evaluating possible changes in energy behaviour and looking at the wider implications of these changes;
✓ Engage European experts as well as households in a constructive debate to identify the most important policies, strategies, and measures to promote sustainable practices;
✓ Create a roadmap out of these scenarios, setting out goals and measures to get us where we want to be in 2030, in 2040, and in 2050.

Combining the top-down approach of the initial visioning phase with the bottom-up approach of the practice phase, the final roadmapping phase will lead to the identification of policy, commercial, and educational measures, creating a coherent strategy to promote the transition to low carbon energy.

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2. The Transition Visioning Workshop

2.1 The participants

Fifty-five experts with different backgrounds participated in the Transition Visioning Workshop, offering inputs and ideas for the development of scenarios and suggestions for policy priorities.

Registered participants included European researchers and academics, as well as representatives from the business world, local authorities, and civil society organisations. Researchers from academia and consultancies had the largest representation, accounting for 51% of the 55 participants, followed by business organisations (23%). The analysis indicates that representatives from civil society organisations and local authorities accounted for 13% each.

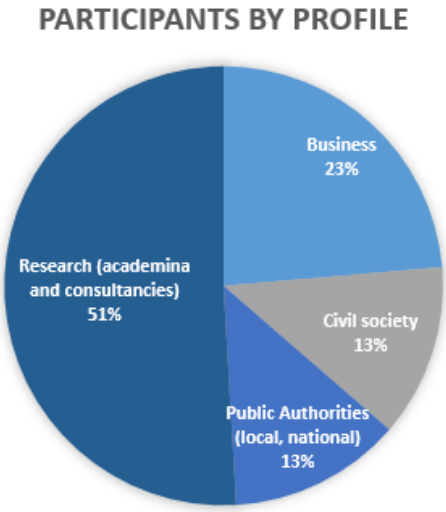

Figure 1 Conference participants by profile

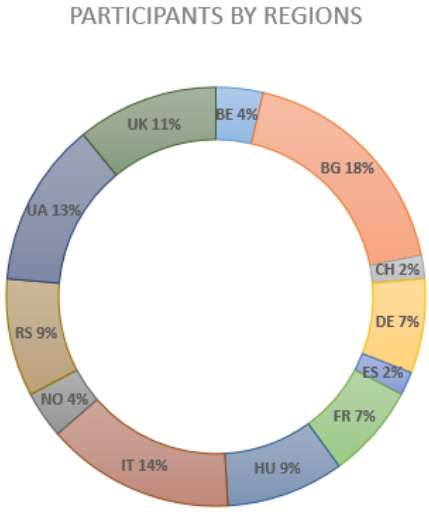

Figure 2 Participants by regions

In terms of the geographic origin of the respondents, experts from 12 European countries participated in the workshop, including 4 non-EU countries (Ukraine, the Republic of Serbia, Norway, Switzerland). The majority of participants (40%) were from Eastern Europe (Bulgaria, Hungary, and Ukraine) followed by Southern Europe with 25% (Spain, Serbia, Italy) and Western Europe with 20% (Belgium, Switzerland, Germany, France) and Northern Europe (Norway, and United Kingdom). Notwithstanding the attention placed by the organizers to ensure gender balance, there was a slight majority of men among the participants (62%).

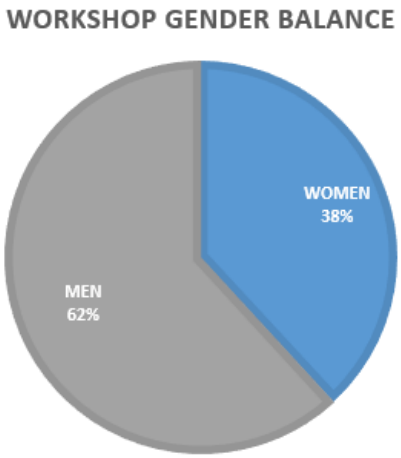

Figure 3 Conference participants by gender

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On the other hand, experts brought knowledge gained in various fields of the energy sector to the workshops, ranging from macro studies such as energy economics to sectoral experiences such as consultancy services to citizens to improve their electricity consumption.

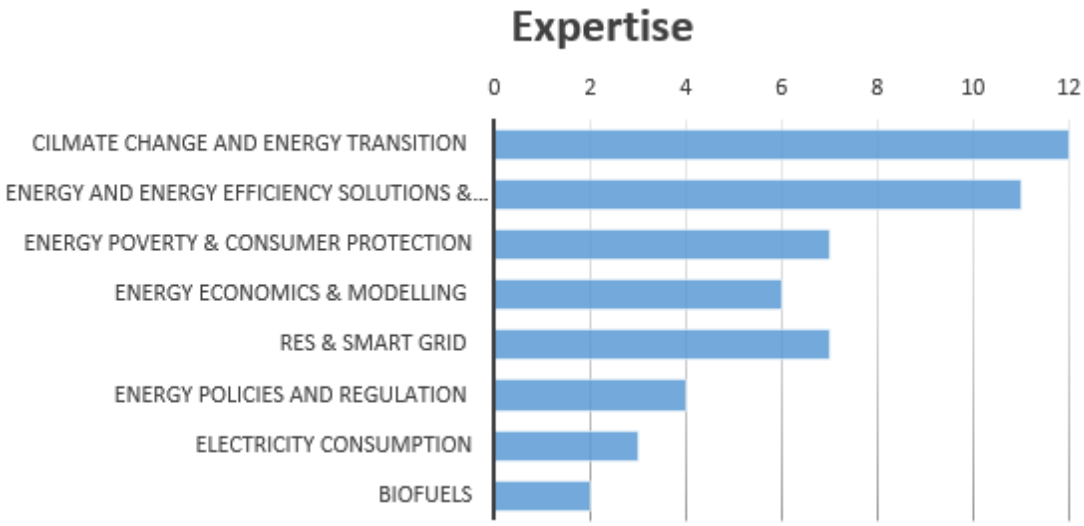

Figure 4 Conference participants by expertise

Overall, the ENABLE.EU Transition Visioning Workshop aimed to facilitate the discussion on the energy transition among experts coming from diverse realities and fields of expertise. Creating synergies among local actions and promoting understanding among experts is a key step for moving toward a more sustainable energy future. Despite language barriers and the participants' different perceptions and mind-sets, the workshop experts agreed on a shared vision of a sustainable energy future and on six priority measures that could be coordinated at the EU level to reach it.

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2.2 The agenda

The final agenda of the ENABLE.EU event, as presented below, provides an overview of the various sessions and topics addressed on June 14-15, 2018.

14.06.2018	Topic
14.00	Registration
14.30- 15:30	Looking back to look forward - interactive session Introduction and discussion moderated by Giovanna Giuffre - ISINNOVA
15.30- 15.40	Introduction to the ENABLE.EU Project By Thomas Pellerin-Carlin - JDI
15.40- 15.50	Outlook on the ENABLE.EU Transition Visioning Exercise Giovanna Giuffrè – ISINNOVA
15.50 – 16.10	Setting the scene: drivers of individual and collective energy choices Emilie Magdalinski - JDI
16.10-16.30	Coffee break
16.30-16.40	Three Horizons: What they want to say and how to use them Carlo Sessa – ISINNOVA
16.40 –17.40	Framing the horizons for energy behaviour transition Interactive group work
17.40 18.20	Building our energy futures Plenary session moderated by Carlo Sessa – ISINNOVA
18.20- 18.30	Conclusion Carlo Sessa and Giovanna Giuffrè – ISINNOVA

15.06.2018	Topic
8.30-9.00	Registration
9.00-9.10	Welcome and introduction
09.10-09.30	Experience from other projects Paul Burger – UNIBAS
09.30-09.40	Development of actions to support energy transition/behavioural change – how to do it? Giovanna Giuffrè – ISINNOVA
09.40-10.20	Working groups to develop actions to promote sustainable energy behaviours
10.20-10.40	Coffee break
10.40-11.20	Working groups to develop actions to promote sustainable energy behaviours – refinement
11.20-12.45	Presentation of results and discussion Moderated by Giovanna Giuffrè - ISINNOVA
12.45-13.00	Conclusions Carlo Sessa and Giovanna Giuffrè - ISINNOVA

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2.3 Looking back to look forward

Giovanna Giuffrè (ISINNOVA) opened the conference asking the participants to reflect on change and on what motivates individuals to adopt sustainable behaviours. In this session, participants were asked to look back at what has triggered changes in energy consumption practices over the last twenty years at a personal level, as well as the regional and European level. The goal of this exercise was to share an understanding of the evolution of energy. Participants were asked to look back at the past 20/30 years and to answer two questions:

- ✓ What has changed your energy consumption behaviour the most?
- ✓ What has influenced energy consumption behaviour in your region/country?

The results, showing what the stakeholders have in common as well as the differences in their assessments of the evolution of energy, were presented on a timeline (see Figure 5 and 6 below).
Each participant listed an important event on sticky notes, and these events were posted on a common timeline.
With regard to the first question, "What has changed your energy consumption behaviour the most?", participants acknowledged the main life events, economic opportunities as well as new technologies that have decreased or increased their energy use. As expected, tariff and prices played an important part but energy consumption is also influenced by the search for comfort (new cars), awareness and ethical decisions (dietary choices). Energy use is so intertwined with our lives and lifestyles, that often there is not just a single driver influencing our decisions but rather a combination of them. For example, the choice to shift to a more sustainable energy system at home is influenced by the possibility of owning property, family composition, awareness regarding sustainability, the availability of economic incentives and access to new solutions and skilled workers in building renovation.
The figure below shows the post-its written by the participants, organised by event. The events put forward were quite similar – reflecting the drivers that have influenced energy consumption and lifestyles over the past thirty years. The green dots represent events related to the adoption of sustainable habits whereas orange dots the opposite.

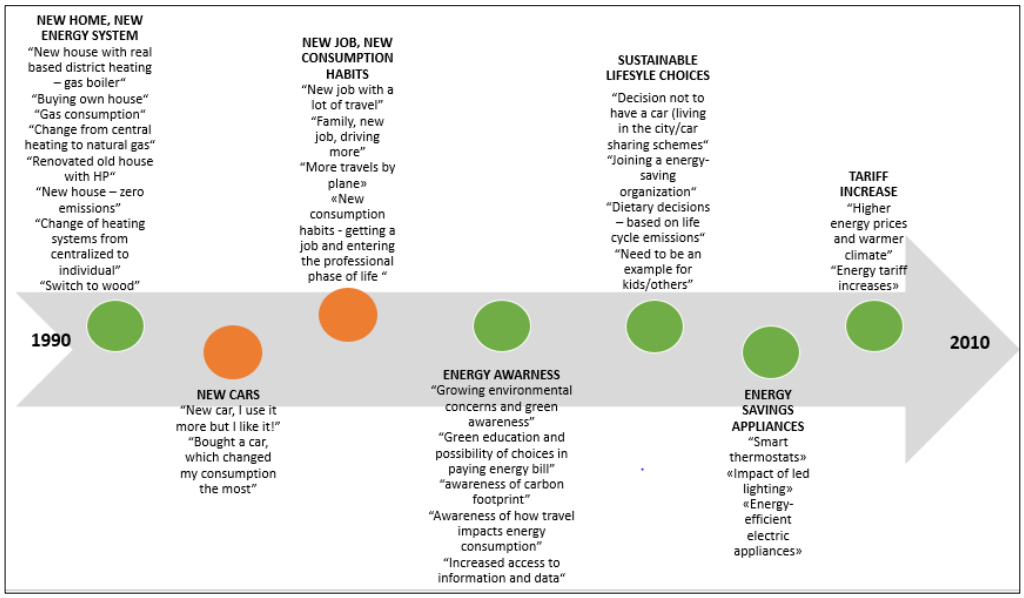

Figure 5 "What has changed your energy consumption behaviour the most? Snapshot of post-its written by participants

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Participants then discussed events and trends that have influenced energy consumption over the past thirty years at the global, EU, national and regional levels. In the figure below, EU and global trends are reported above the arrow while national and regional trends are below the arrow.

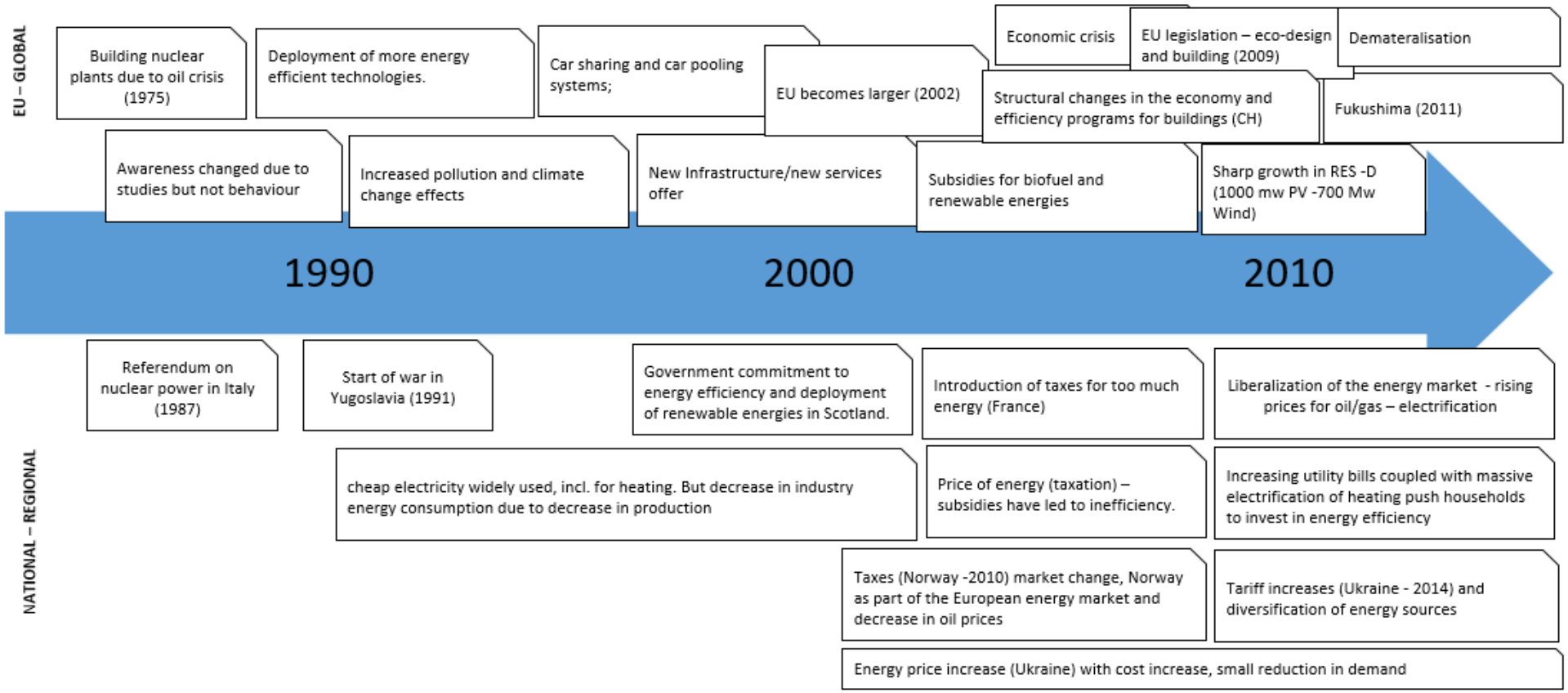

Figure 6 "What has influenced energy consumption behaviour in your region/country?" Snapshot of post-its written by participants

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Using the PEST[3] grid for analysis, the mega–trends, trends and events proposed can be cross-read as follows:

Political
• EU expansion • carbon regulation (EU Emissions Trading System). • Vehicle emission standards • RES and EE regulations, targets and subsidies • Eco-Design regulation • Energy Efficient Building regulation • Nuclear referendum in Italy • Yugoslavian war • Setting of national climate targets, programmes and measures
Economic and Ecological
• Economic crisis • Increasingly severe consequences of climate change • Growing competition for natural resources • Sharing economy: new services and products • Approval of RES incentives and tariffs • Rise of energy prices and new taxes on energy services and products or, on the opposite regulatory measure to keep them low for households – e.g. in Hungary
Technological

• Acceleration of technological change offering opportunities for:
  ○ More efficient use of energy (e.g. led lights)
  ○ More sustainable energy production and distribution (e.g. smart grids)
• Dematerialisation of products and services (e.g. 3D printing leading to new manufacturing and distribution processes that produce less waste)
• New services (e.g car sharing systems)
• New infrastructures (e.g. new interconnectors, smart solutions and alternative fuel infrastructure

Social
• Growing awareness of energy's impact on climate change • The Fukushima disaster and effects on the social perception of nuclear energy production • Community-based RES deployment in some countries, e.g. DE

The session highlighted the economic and technological trends that have influenced our energy consumption the most over the last few decades. Participants also noted the role of the EU in setting regulations and targets for sustainable energy production and consumption. The national level was acknowledged for its role in governing energy prices and incentives. Only a few social trends were proposed by the participants, possibly because social trends are considered to have only a relative impact on energy decisions in comparison with other trends, or because social trends are less known and investigated compared to other factors. In addition, looking at the experts' background, less participants with a social science expertise attended the workshop and thus there was less

[3] PEST Analysis: A classification scheme in order to analyse the political (P), economic and ecological (E), social (S) and technological (T) influences of an organisation's external environment.

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knowledge shared about these aspects.

2.4 Setting the framework

Thomas Pellerin-Carlin (JDI)[4] introduced the objectives and methodologies of the project, based on an overall approach integrating qualitative and quantitative methods. The approach will use storylines (scenario narratives) to model scenarios. These scenarios will then be used to generate policy recommendations (backcasting). The main objective is to get a better understanding of the interaction between individual and collective energy choices and the regulatory, technological and investment prerequisites of the Energy Union transition in order to provide strategic policy recommendations.

Giovanna Giuffrè (ISINNOVA)[5] introduced the transition foresight aims, process and timing. Foresight activities are not predictions of the future but aim to i) explore alternatives in the face of uncertainty; ii) uncover assumptions (mental maps) and discuss them; iii) share understanding and concerns; iv) illuminate potential problems and future opportunities; and iv) help identify choices and policy options. As described in the first section of this report, participatory activities have three main objectives in the framework of the ENABLE.EU project. First, the engagement of key stakeholders and selected groups of households aims to intuit trends and develop instruments and policies enabling the transition to a low-carbon energy system in Europe. Secondly, the process will deliver scenarios about energy-related behavioural change and enable policies that will be modelled by Cambridge Econometrics. Finally, the foresight process will gather evidence that can be used by the Jacques Delors Institute to formulate policy recommendations.

Emilie Magdalinski (JDI)[6] presented the findings of the literature review on drivers of individual and collective energy choices. Her introduction highlighted six key takeaways from research to date:

- Awareness raising is essential but insufficient on its own to encourage behavioural change related to energy use;
- There tends to be a discrepancy between values, attitudes and actual behaviour of people;
- The need for comfort and monetary considerations tend to prevail over environmental motivations;
- Research shows that social comparison and targeted policies are generally efficient strategies for triggering behavioural change;
- Nonetheless, research observes the existence of rebound effects, spillover effects and changes over time that can weaken or cancel out the impact of sustainable energy choices;
- Finally, there is the need to consider drivers of behavioural change (not only drivers and habits underpinning current behaviour) if we want to achieve more sustainable behaviours.

More developed outcomes of the literature review and of the case studies led within the ENABLE.EU project can be found in Part 3 of this report.

2.5 The three-horizon discussion

[4] Full presentation online at: http://www.enable-eu.com/wp-content/uploads/2018/06/Pellerin-Carlin_ENABLE.EU_TVW_14.06.2018.pdf

[5] Full presentation online at: http://www.enable-eu.com/wp-content/uploads/2018/06/Giuffre_ENABLE.EU_TVW_14.06.2018.pdf

[6] Full presentation online at http://www.enable-eu.com/wp-content/uploads/2018/06/Magdalinski_ENABLE.EU_TVW_JDI_LR_14.06.2018.pdf

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Carlo Sessa introduced the Three Horizon Methodology (see box below) which was used in this workshop to envision a sustainable and reduced energy consumption future as well as possible transition pathways. Carlo Sessa adopted the frame and materials proposed by H3Uni[7], a global network specialised in developing practices for participatory foresight.

The Three Horizons Method

The Three Horizons (3H) is a method to frame future thinking together, in a group of participants convened in workshops to discuss future scenarios for a given area, in our case for the future of connected and automated driving in Europe.

There is a seeming paradox in future thinking:

- It is quite difficult to do and not commonly used as either a method or skill.
- It is a natural function of the mind and parts of the brain are dedicated to it (our natural capacity for future consciousness).

There are several blockages to future consciousness, particularly when sharing it in a group of diverse people representing different stakeholders:

- Social habits and taboos that inhibit its functioning through customs, language and dominant social expectations.
- Most people try to avoid facing future uncertainty. This will show itself in denial and avoidance of questions.
- Power and security matters: nobody likes to consider a future that threatens their power or livelihood.

The 3H method helps get around some of these difficulties by providing a context in which people can both share different perspectives with each other and mull over them in their own minds. To achieve this, people are first presented with the 3H diagram and concept:

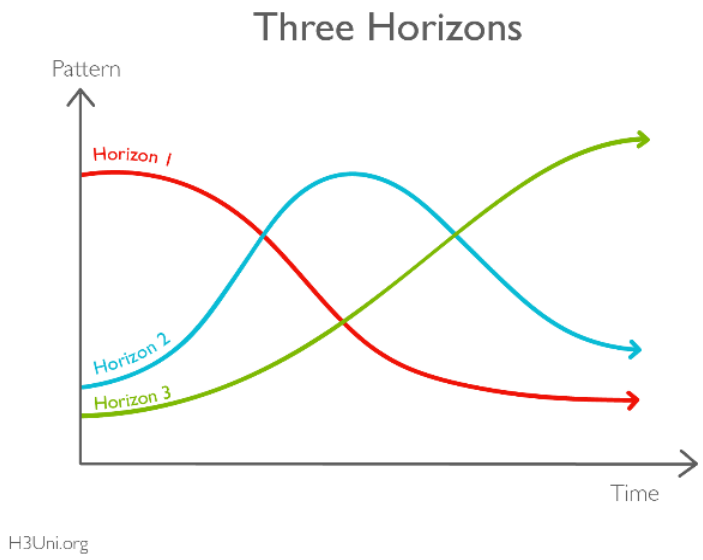

Figure 7 Three Horizons- source: Three Horizons University

The horizontal axis is "Time", from now, the present, to a long-term end point – it may be 2030 or 2050, depending on the scope of the discussion. The vertical axis is usually labelled as 'Pattern', 'Viability', 'Prevalence' or 'Strategic Fit', which capture the idea of a shift in the most dominant, or prevalent, pattern moving between the horizons over time. It is a reflection of the strategic fit to emerging conditions, and so this is an alternative labelling. Alternatively, we can think of the vertical dimension as the scale of a particular condition or variable of interest (e.g. it could be the share of Mobility as Service travel to represent a paradigm shift in passenger

[7] http://www.h3uni.org/about/

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mobility).
The First Horizon – H1 - is the dominant system at present. It represents 'business as usual'. We rely on these systems being stable and reliable but as the world changes, aspects of business as usual begin to feel out of place or no longer fit for our purposes. Eventually, business as usual will be superseded by new ways of doing things.
The Third Horizon – H3 – starts in the present (with early manifestations that are identified as "pockets of the future") and emerges as the long-term successor to business as usual. It grows from fringe activity that introduces completely new ways of doing things, which turn out to be much better adapted to the world that is emerging than the dominant H1 systems.
The Second Horizon – H2 - is a pattern of transition activities and innovations, people trying things out in response to the ways in which the landscape is changing. Some of these innovations will be taken up by H1 systems to prolong their life while some will pave the way for the emergence of the radically different H3 systems.
It is important to note that all three horizons are always present over time, from now until the long-term future:

- Aspects of H1 will persist in any new business as usual; aspects of H3 are always evident, if not obvious, in current discourse and argument and in all kinds of activity on the fringes of the dominant system; while H2, like a moving border between past and future, is all around us in examples of innovative alternative practice.
- The First Horizon's commitment is to survival. As the current system it maintains its dominance, even in a changing world, either by crushing Second and Third Horizon innovation, or by co-opting it to support the established system.
- This resistance to change impacts the transition to H3: often it leads to the innovations in H2 being 'mainstreamed' in order to prolong the life of the existing system, rather than to help move towards a new system.

For this reason, we typically introduce the horizons, and think about the way the dynamic changes between them over time, in this order: H1 – H3 – H2. This is because without a third horizon it is impossible to make the distinction between 'sustaining innovation' (H2-) and 'transformative innovation' (H2+). In the second horizon we can identify initiatives underway and how they relate to sustaining and transformative change. Moreover, as we develop the third horizon picture more, then we can also start to see the role of the first horizon in the future. Usually, once we have been able to let go of it and move to the third horizon we find there are important things that must not be lost and can be adapted to the new environment.
Bringing all three horizons together as an interrelated pattern and as a shared narrative of possibilities for navigating towards a better future, it is possible to develop with the participants a mature perspective that accepts the need to address the challenges to the First Horizon while nurturing the seeds of the Third. This is not an either/or, good/bad discussion. We need both to 'keep the lights on' today, and to find a way of keeping them on in the future under very different circumstances.

Participants were divided into tables, ensuring a balanced representation of the different countries, and were asked to answer the following questions:

- **Horizon 1**: What evidence do you see around you that suggests the current energy system is under strain, and which individual and collective energy behaviours are showing a decreasing fit to emerging conditions, knowledge, and societal requirements?
- **Horizon 3:** What might a future energy system look like and which individual and collective energy behaviours would support it?
- **Horizon 2**: What emerging new practices, actions, and solutions do you know about (pockets of the future, anywhere in the world) and/or do you propose to shape new energy behaviours in the future?

The sections below present the plenary discussion on the three Horizons and the participants' interactive group work.

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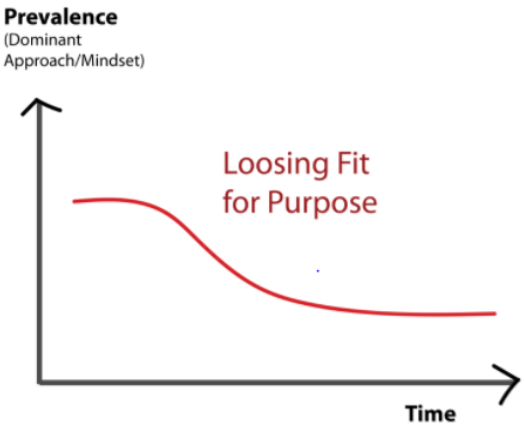
Defining Horizon 1 – The system in decline 2050

What evidence do you see around you that suggests the current energy system is under strain, and which individual and collective energy behaviours are showing a decreasing fit to emerging conditions, knowledge, and societal requirements?



Snapshot of post-its written by workshop participants

- Intensification of climate change impacts
- Rise in inequalities
- Population increase
- Resource degradation and scarcity
- Worsening of air quality
- Implementation of short-sighted policies and lack of a shared, long-term vision
- No more low-hanging fruit
- Outdated business models and heavy administrative burdens on innovation
- Low carbon pricing

Figure 8 The system in decline

The current energy system

Mobility	Internal combustion engines
Residential	poorly insulated buildings, energy-inefficient dwellings
Generation	Oil and gas, hydro, coal, nuclear, renewables
Urban planning	Centralized grids

Signals of decline

Natural ecosystems are increasingly polluted and ecosystem assets are strained. In the future, population increases coupled with limited resources and the impacts of climate change could easily lead to geopolitical instability and conflicts over access to and management of resources. "More people, more consumption, less resources". Climate change effects are already evident and changing the way people live. Air pollution is also closely related to climate change and is putting citizens' health at risk. The Paris accords recognized the need to reduce CO_2 emissions, but its implementation could be jeopardized by the current policy framework.

Today's centralized energy market and regulatory intervention might limit competition in some instances' and leads to a poor energy mix. At the same time, the higher cost of resources could increase energy prices and, consequently, the number of citizens suffering from energy poverty.
Current energy policies are not leading toward the expected outcomes and there are wide contradictions between targets and practices.

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For example, a fossil energy-based heating system is not compatible with the need to decarbonize, but subsidies supporting such systems still exist and distort the market.
Companies are afraid of changing due to the high transaction costs and the investments needed and there is a replication of outdated business models. The system is dominated by vested economic interests and citizens make decisions based mostly on economic reasons and personal comfort. There is a policy framework in which economic interests and short-term financial choices dominate. However, oil will become scarse and coal-fired power plants/nuclear plants will no longer be profitable. The pressure is increasing to find new business models, also in relation with maturity to market of emerging technologies. There is more and more of a need for accountability and transparency, and concerns are rising regarding energy impacts on health and environmental issues. The use of private cars has reached its limit, and in urban areas individual transport is no longer able to meet citizens' needs. There is a risk of "lock-in", as many citizens live far away from work as well as from essential and recreational services and using car becomes unavoidable.

Obstacles to change
Diverse regulations make it hard for citizens to see opportunities. There is the feeling that "we will be saturated with regulations". Administrative hurdles often discourage citizens from taking the initiative to produce their own energy.
In addition, in some places there the legacy of fossil fuels infrastructures ("dump network") and the transition is not favoured by investment or information on decarbonation opportunities. The lack of information makes unhealthy/destructive practices more common, and energy is still considered by citizens to be "a given: whatever, wherever, however".
The decreasing marginal return in investing in energy efficiency and renewable energies, and the cost of low carbon, is slowing down the shift. The current network allows limited flexibility and interconnection.

Indicators of change
- Countries are setting deadlines for phasing out combustion engines;
- Renewables are sometimes causing to negative electricity prices on the wholesales market;
- There is growing mistrust toward large energy companies.

An example from the UK – network constraints stop new projects started by communities/investors. Network charging rules are regressive and favour those who have the means to engage. Regulation on prosumption does not encourage P2P sharing, monitoring and exporting. New technologies and business models storage aggregators are still in the margins. The regulatory network does not support innovative approaches.

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Horizon 3: Description of a Vision 2050

What might a future energy system look like and what individual and collective energy behaviours would support it?

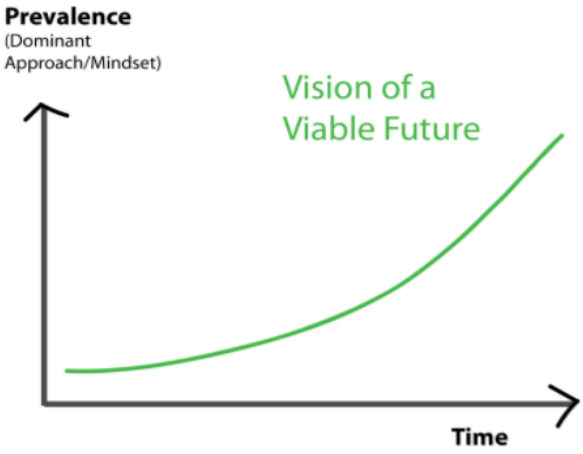

Figure 9 The vision

Snapshot of post-its written by workshop participants

- Circular economy and sharing behaviors
- Increasing interconnection
- Flexibility of energy production & consumption
- Decentralized, connected smart grids.
- Advanced batteries and energy storage
- Mix gas network & Carbon Capture and Storage
- New role of cities/regions on energy policies
- Energy as a human right
- Energy as a service or commodity
- Active/net zero emissions houses
- Less mobility more connectivity

The Vision 2050

Mobility	Gas and renewables, Hydrogen
Residential	Active architecture, design
Generation	Photovoltaic panels, wind
Urban planning	Fully self-sufficient building, smart cities

Community-led Horizon 3

Many participants proposed a shift toward a decentralized and interconnected energy system managed by the local community and based on renewable energy systems. A participant suggested the possibility of "reinforcement of the role of communities – not necessarily based on geographical aspects- a gang of people who have beliefs, values, and priorities with a common feeling of belonging". It was put forward the possibility of "everybody producing their own energy from renewable energy sources". It is imagined a vision of "a fully decentralized system in which every household is the producer as well as the trader of power – proactive withdrawal from grids" and in which there will be "Intermittent power producers, a lot of prosumers, a lot of actors in the energy market, consumption and production will merge, decentralization of energy production". "The system will be fully decentralised, every consumer is also a producer. Grids will be obsolete, consumers become shareholders of common assets such as grids". In this context, "smart grids connect assets and flexibility improves resilience and reduces enforcement costs". For some experts, it is the time of "energy democracy", often at the local level, in which there will be "self-sufficient energy communities – at the local, even building scale". However, the new framework could run the

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risk of creating new type of "energy poverty: citizens will need to buy energy from other households (switch of power compared to today)".
For the UK, a "hybrid system with centralized and decentralized solutions" was imagined. "The semi-autonomous local systems would promote decarbonized heating, energy efficiency measures and electrification produced by renewables" sentence 'according to a participant from the UK'.
Horizon 3 is dominated by what participants called "real green - sobriety efficiency" and "sufficiency behaviours mixed with solidarity (regions/countries) as drivers/triggers of compromise". Recurrent notes relate to the "higher knowledge and responsibility" of citizens able to induce lifestyle changes. One expert highlighted that the change will come from the "reduced demand for energy".

Technology-led Horizon 3
Other participants imagined technological fixes, such as "new technologies: thermal-nuclear", "H2 molecule-based storage" or "something we don't expect" and even "going to Mars to find new sources". One suggested that "people accept external control" from technologies that will make their energy consumption more efficient and sustainable. "It will be normal to have information about energy production or consumption via smart watch".

Behavioural shift coupled with technology - Mix Horizon 3
Other experts imagined that innovation will lead to greater opportunities for citizens to choose and that the application of the "polluter pays" principle will promote the adoption of sustainable behaviours. It is the time of RES, smart grids and "smart consumption – citizens will use energy when energy is free of impacts". "Companies will offer two types of energies: i) free – when available; and ii) on demand for those who can afford it". "Engaged consumers will actively participate and the lower cost of technologies and solutions will allow consumer adoption of smart/efficient behaviours". For one expert, "the power system will be the same. The way we consume will make the difference – an advanced and intuitive way of consumption with ancillary services".

Mobility is the area that received the most contributions. Many notes were related to the shift from "ownership to services" thanks to autonomous vehicles, sharing systems (car/bike sharing), and new social practices (teleworking). Experts had diverging opinions on what will fuel mobility in the future. For some, "transportation still [will be] fossil fuel based, no total electricity supplied (thinking of development countries)" and "transport remains the only sector with a carbon footprint". For others, there will be a "fully electrical mobility system" but one expert noted as "electric cars manufacturing also employ rare earths, which are scarce and with geo-political issues to consider, thus without a change in behaviour/mentalities we will face the same problems as before". For energy consumption at home, participants tend to agree more, envisioning that there will be "totally new architectures: no need to be heated or cooled", "homes are very efficient and near zero thanks to innovation and energy efficiency measures" and "any building will be self-sufficient in energy".

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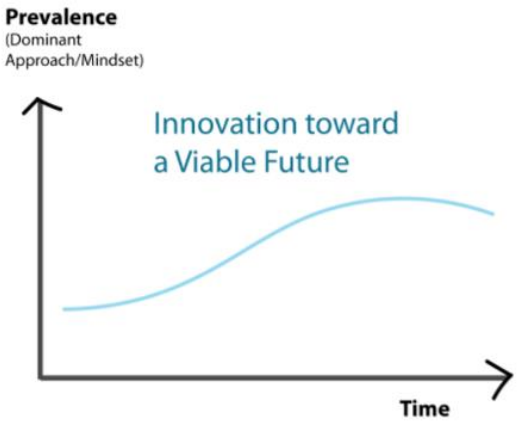
What will the new energy system look like?
The following words have been suggested to describe it:

- Multi-dimensional – multi-level supply systems
- Individual demand management – based on consumer choices
- Decarbonized –efficient - clean sources
- 100% renewables - electric
- Decentralized - democratic - resilient
- Flexible - customized for different needs
- Affordable –liberalized – with no operational costs - transparent
- European net

H2: A possible transition

Horizon 2: What emerging new practices, actions, or solutions do you know about (pockets of the future, anywhere in the world) and/or do you propose to shape new energy behaviours in the future?



Snapshot of post-its written by workshop participants

- Technology
- Cooperation & networking
- Young generation education and awareness
- More R&D expenditure
- Public funds
- Interconnection between different power units
- More accountability - fining companies
- Automated vehicles

Possible transition

Mobility	Gas as key resource, electric vehicles, Hydrogen
Residential	New materials for better performance
Generation	RES, CCS – energy storage; new energy sources - nuclear
Urban planning	Hybrid system

The "pockets of the future" proposed by participants and aggregated by organizers are reported below. Some of these measures were selected for further development on the second day of the workshop.

New energy business models, simplification. The transition from a centralized to a distributed production system requires new business models. Experts called for EU and governmental "engagement with innovators" and for public support for community energy projects, to test new

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ways of distributing energy produced by citizens. Global and EU support will be needed to coordinate local actions and practices in different energy-related fields.

Prosumers/ renewable energy production. The energy transition will necessitate the rise of "independent energy producers and energy communities". Experts reported similar examples and practices: "energy cooperative: groups produce their own energy together", "production of own energy: prosumers, independent from energy companies" or "hybrid system of consumers/producers", "production of own energy - prosumer approach" and "improved technology allowing households to trade energy bills to renewable integration". One expert put forward the idea of "local energy trading block-chain technology. No retail supplies". Like with mobility, the service of providing energy becomes more important than its production: it is the time of "energy as a service".

Mobility as a service (MaaS), electric/smart mobility. Many experts suggested that the future will have "shared, green mobility" and that individual transport modes will be negligible. The shift is imagined in a "sharing economy", currently in its infancy, in which cooperation will prevail over individualism. Current "seeds of change" can be observed in many EU cities which have effectively implemented inter-modal services: combining public transport with car and bike sharing services and the promotion of cycling and walking. Experts mentioned the "flourishing of shared services: carpooling will be more utilized, peer-to-peer car-sharing" and one proposed "Mobility as a service: local transportation is working on it, buy a package and travel from A to B (not caring about the company)". One participant recalled the role of electric vehicles while another remarked that EV batteries can be used to provide flexibility thanks to optimal charging management. Many experts also mentioned the opportunities that will be opened by the future automatization of vehicles.

Energy affordability. Experts raised the question of how to combine energy sustainability with affordability. In EU countries, the economic crisis has led to an increase in the number of citizens suffering from energy poverty. At the global level, access to energy is the recognized basis for economic and social development and targets and indicators by 2030 are set in the Agenda for Sustainable Development[8].

Energy education and awareness; research & innovation: Many experts considered the role of education and communication in changing energy consumption patterns. The shift toward new forms of cooperation and sharing is based on citizens' awareness of their environmental impacts and this awareness is awakened with education. Energy education could lead to "informed societies and decisions" and "greater awareness of the need for energy: no image of life without energy, no forgetting to turn off the lights, etc." One expert mentioned that "greater awareness of health and climate problems could lead to changes in investment and litigation", while one participant proposed the need for change in citizens' "expectations regarding quality of life".

Active houses and energy efficiency measures at home. Homes in the future will not just be energy efficient but "active" in producing energy. Experts proposed different "seeds of change" that, if implemented on a larger scale, could make this future a reality. It will be possible to create "building passports - 100% renewable electricity with batteries and energy storage: kinetic, chemical". In line with this, another expert mentioned "fully electric houses through Heat Pump, photovoltaics, batteries and thermal storage" whereas another saw opportunities for "passive houses - use of local biomass inside sustainability boundaries". The example of Energy Sprong[9] was submitted. Energy Sprong is an initiative started in the Netherlands and now carried out in France, the UK and Germany.

[8] Sustainable Development Goal 7 Ensure access to affordable, reliable, sustainable and modern energy for all - https://sustainabledevelopment.un.org/sdg7
[9] http://energiesprong.eu/about/

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It provides solutions for deep energy-efficient refurbishments done in a week, commercially financeable and that can be massively replicated. The company has also introduced a new financing approach and works with governments to improve regulations for these solutions.

Reduction of energy consumption, dematerialisation/virtualisation. The question was raised to what extent it would be possible to provide the same level of services and comfort we are used to with less energy – thanks to new technologies, digitalisation and dematerialisation. The thorny question is how to avoid "rebound effects" produced by new lifestyles and services, which could increase rather than decrease our energy needs.

Example proposed by a participant: Ectogrid "Today, our energy systems are designed to do only one thing at a time. But it's possible to build a much more efficient system by taking an integrated approach. A building with a need for heating can deliver a cooled energy flow to another and vice versa. ectogrid connects these thermal energy flows and lets buildings benefit from each other. Sharing energy flows reduces both your and your neighbour's environmental impact and lowers the energy costs".

Behavioural insights and seven priorities to promote a sustainable energy transition

On the morning of the second day of the workshop, participants were asked to focus on the solutions for the energy transition that emerged from the discussion held on the afternoon of the first day. The solutions are clustered under seven themes:

1. New energy business models, simplification
2. Prosumers/ Renewable energy production
3. Mobility as a service (MAAS), electric/smart mobility
4. Energy affordability
5. Energy education and awareness; research & innovation
6. Active houses and energy efficiency measures at home
7. Reduction of energy consumption, dematerialization/virtualization

Each theme was associated with a discussion table, applying a variant of the Pro-Action Café methodology, by which:

- Each table (theme) was assigned to one leader who summarised the results of the discussion at the end of the session.
- While the leader stayed at the table, the other participants rotated for two rounds.
- In the first round, participants were asked to draft a mission statement related to the theme, detailing targets and actions along the following lines:
    - What you want to achieve and how
    - Mission statement
    - Implications for behavioural change
    - How to do it, what are the obstacles and what is your solution
    - What is missing?
    - What is next?
- In the second round, participants were asked to look at the outcomes of the first round – written down on a poster by the table leader – to respond to the question: What is missing? – and to see what could be added or modified to complete or improve the solutions.

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At the end, the table discussions were summarised on posters and presented in a plenary session by the table leaders.

Figure 10 Participant working groups and plenary discussion

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Carbon neutrality by 2050 Presented by Madeline Werthschulte, Research Assistant Chair of Microeconomics with a focus on energy and resource economics, University of Münster, Germany	
What you want to achieve and how Mission statement	Less CO_2 emissions – carbon neutrality by 2050
How to do it, what are the obstacles and what is your solution	New business model: supply services able to offer solutions (B2C): a business connecting demand and supply as a commodity. The model should be combined with: - Variable tariffs; - Simplification for consumers by automation; - Payment for services/lump sum; - Benefits from shifting demand to RES; - Guarantee consumers security of supply and that there will be no loss of comfort and no interruption of service supply.
What is missing?	- Sufficient storage/ flexible resources; - Access to markets and market flexibility for new services; - Risk prevention: data protection.
What is next?	- Liberalized trading at the consumer level; - Incentives for companies to upgrade the grid – at the EU scale no local micro-grid; - Awareness that flexibility can be profitable to consumers.

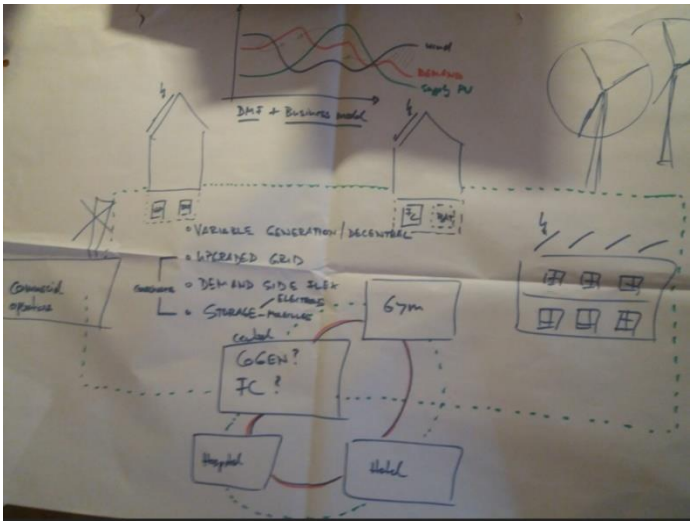

Figure 11 Working group graphic explanation of the new energy system

Prosumers/ Renewable energy production Presented by Martin Vladimirov, energy analyst, Economic Program, CSD	
What you want to achieve and how	100% democratisation of power consumption. Full separation of power generation/trade and grid ownership/management.
Mission statement	Prosumers become producers and traders without an intermediary. Basically,

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	prosumers will trade electricity via a network to consumers/prosumers that need electricity.
Implications for behavioural change	- In rural areas, most people live in individual buildings where it is easier to install solar panels/RES systems, forecast balancing factors and produce/sell energy. - In urban areas, most people live in flats/complexes with shared ownership of common areas. In these cases, a kind of "building board" should invest in self-consumption (e.g. solar panels or heat pump systems) and then sell the produced energy. The proceeds of this selling would then be redistributed among flat owners according to ownership percentage.
How to do it, what are the obstacles and what is your solution	To promote this wide energy production from citizens, the following measures are foreseen: - Cheaper costs of RES technologies; - No administrative burdens – making installing PV systems as easy as buying an air conditioning unit; - Incentives, e.g. Romania is already implementing incentive programs to cover even small fixed costs for RES.
What is missing?	Financial incentives are not enough to change behaviours, the measures should be coupled with non-financial incentives: - Awareness of climate change while ensuring the same level of comfort; - Regulation of owner/tenant relations. How you will convince owners/tenants to invest in such a system? Owners can decide whether to produce energy on their own or be part of the grid; if they sell electricity to others, prices should be regulated to avoid market distortion. If you don't want to be a self-producer, you will need to pay the grid to supply you with electricity. Then, there is an economic incentive from owners to invest instead of shifting the costs to the tenants. - Regulation should also ensure trust among the parties as well as among the users of the systems. - Effective communication campaigns: the opportunities in some cases, e.g. in Eastern Europe are already available but citizens don't trust/believe in it enough to invest/change. - Better city planning and new solutions/designs to include RES in historical centres e.g. RES for small places, such as a flat in Paris. - Technological advancement in batteries.
What is next?	Integration of electricity with other sub-sectors (e.g. heating and cooling, transportation, passive houses). There should be a comprehensive strategy for balancing production and consumption. Macro balancing between the individual production/selling of energy and the overall market system. What is proposed is that, instead of having the region/nation regulate the energy market, there should be a kind of artificial intelligence technology. For this change, enormous market innovation as well as the building of trust regarding robotics will be required. Very utopian but we can already see some seeds of the future.

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Mobility as a service (MaaS), electric/smart mobility Presented by Alessandro Luè - Poliedra, Politecnico di Milano	
What you want to achieve and how	The ultimate goal is to reduce car ownership and the use of private vehicles. MaaS is basically the integration and optimisation of already existing transport systems: - Integration of all means of transport. - Integration of information and data – so that I can easily know what mobility opportunities are available. - Integration of payment methods – one pass for all mobility modes. Citizens should not worry about how to pay to easily and access soft modes (cycling, walking). A single pass integrating all means of transport (public transport, bike sharing, car sharing, etc.) should be created.
Mission statement	By 2025, Mobility as a Service will be effective in all cities with more than 250 000 inhabitants.
Implications for behavioural change	Give citizens effective and suitable mobility options. MaaS reduces the time and effort needed by citizens to organize their trips. It is a way to make sustainable mobility options effective, simple, and accessible to everybody.
How to do it, what are the obstacles and what is your solution	- The creation of a strong public authority able to supervise and manage this integration process, providing rules that set the framework for the integration of data & information and promoting new synergies and partnerships. - The implementation of new business models and new forms of public-private partnerships and cooperation– allowing different actors to enter the market. - Attention should be dedicated to avoiding the danger of the "Google effect", i.e. where private entities intervene, setting their own rules given the lack of a regulatory framework.
What is missing?	The action will create "good mobility soft infrastructure", aimed at reaching publicly agreed-on goals, e.g. accessibility for all, better air quality and avoiding increased traffic through the pricing of different modes. What is missing is: - The integration of mobility plans and measures at different levels (national, regional and municipal); - A new mobility culture beyond private cars; - Technologies for new means of propulsion: not just electric, but also other sources (biofuels, liquid gas, etc.). An assessment should be done considering all the mobility externalities (social, environmental). - Convergence between public and private transport is needed, because software infrastructure is increasingly more important than hardware infrastructure. MaaS will be really effective when software becomes the predominant component.
What is next?	Autonomous driving is coming, and it will not make economic sense to buy

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	a car as sharing systems will be more effective. This change has already taken place, with the introduction of sharing services such as BlaBlaCar. Mobility is considered a service when the software to offer services is more important than the hardware.

Energy affordability Presented by Rosie McGlynn, Director, Independent Consultancy UK	
What you want to achieve and how Mission statement	Eradicate fuel poverty by 2035 without increasing carbon emissions and make energy affordable for all
Implications for behavioural change	- The risk is that if you take people out from fuel poverty, they might become energy lazy. It is really important from a behavioural point of view to take steps to ensure that affordable energy is not then wasted. Advocacy around information.
How to do it, what are the obstacles and what is your solution	- Improve energy understanding. Advocacy around energy information-segmented approaches. Now, when energy is available, understanding its cost is very difficult for an average consumer. Through smart metering, home displays, apps with a visual display, you have a visual demonstration of energy costs in almost real time. Even if these devices do not show the full costs, including charges and taxes, at least they offer an indication in the moment of how much the different facilities can cost you. - Improving building materials and providing targeted information and skills training. At the moment, there are different cultures, attitudes and skills. Some countries are more advanced in energy efficiency refurbishment, and so any contractor can effectively carry out the work. In others, there is the question of training skilled people and ensuring access to the market. - Financial mechanisms should be provided to communities to eradicate fuel poverty by providing upfront costs for the installation of PV systems, heat pumps, etc. The UK is currently implementing a program for providing direct financing to install new technologies that act as aggregators and connect to the national grid or local DSO. The existing market in the UK allows for energy production. - Implement a smart technology framework to reduce consumption: build a baseline and modulate it. - Enable communities to develop smart renewable systems to drive revenues – how to finance it?
What is missing?	- European fuel poverty definition and strategy that would allow more targeted actions, collection of harmonised data and indicators to make sure that the measures are somehow "objective". - New actors. Who pays for/carries out the refurbishment program are often the retailers (UK). However, this might not be the best solution as it is often not done street by street, and the program and density criteria are often not taken into consideration. - Funding for energy should come back under taxes and not in bills

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	- Mechanisms should be set to avoid cross subsidies between the middle class and the poor.
What is next?	By 2035, all citizens and the community should be able to access the energy market. Smart communities and smart buildings should be able to optimise their assets and make money from them, and to support the grids so that energy can be cheaper.

Energy education and awareness; research & innovation Presented by Daire McCoy - Research Officer, Grantham Research Institute, LSE, UK	
What you want to achieve and how	Three clear goals by 2050: 1. Greater energy literacy/understanding for all people. It was mentioned how people intuitively understand units of time and money but not energy. We want to change this. 2. People need to know specifically what they can do themselves. Children might not pay energy bills and understand costs, but they can still limit their use of hot water, not turn the heating on too much, turn off TVs, etc. 3. People need to know why this is important and believe in the message. There is no point in having this information unless people understand why they need to change their behaviour.
Mission statement	We need a clear strategy for how to get there. It was agreed that learning should be focused on all ages and that it does not just apply to people in full-time education.
Implications for behavioural change	Simplify information - Web apps. Online calculators for energy similar to FX converters. Google maps could display the energy usage associated with a journey along with the time it takes. - People respond to stories and anecdotes more than statistics. We need to personalise energy and climate change more.
How to do it, what are the obstacles and what is your solution	Junior high school and high school - Energy learning could be built into existing curricula. For example, in maths class, children could learn how much energy an iPad uses in an hour. In history class, children could learn about the Industrial Revolution and how energy usage has changed over time. In geography class, children could learn about energy usage per capita and how this varies by country and is linked to our standards of living. - Gamification – this could be made more fun by developing games for children to play. - In Belgium there are programmes funding energy efficiency refurbs for schools. It is important for children to learn in an environment that reflects where we want to be regarding energy efficiency, etc. - To involve parents, homework exercises could be designed for children to share learning about energy with their parents. University/third level

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	- Sustainability could be built into other courses, such as economics and engineering. For example, the CORE curriculum. - New Masters programmes focusing on sustainability. - Ivano-Frankivsk University in Ukraine works with an NGO to provide training and learning for tradespeople and practitioners working in areas relating to energy efficiency. For people not in education - Science museums and other organisations can hold events on energy efficiency. - Sports clubs, church groups, and other organisations can be used as channels for people who do not use social media or watch TV. - Festivals and other events can be used to target younger 20-somethings, etc.
What is missing?	- A clear strategy for how to get there. - The necessary education programmes to make people energy literate - Better use of psychological tests and awareness of how to differentially target various groups of people – young vs old, etc. - Filtering of information: Lots of info but much of it is noise. - Systems can be difficult to operate – no point in having heating controls if they are complicated and you can't use them. - More funding for education programmes. Carbon taxes or other levies on companies or on household fuel bills, or general taxation could be directed towards energy education.

Active houses and energy efficiency measures at home Amy O'Mahoney, Ofgem	
What you want to achieve and how Mission statement	Zero emission home by 2050

How to do it, what are the obstacles and what is your solution?
Implications for behavioural change?
	The discussion started by recognizing the difference between the rural vs urban approach and from new buildings vs old homes.
	- There is the need to be very strict now on regulations for new buildings – setting very high standards and requiring the implementation of all the technologies that are available on the market.
	- The refurbishment should be reviewed, and the minimum thresholds increased to take into account new opportunities offered by these technologies. It emerged that standards should be reviewed more frequently as technologies improve and are made available on the market. It is not a one-off solution and should be reviewed over time.
	- Technological solutions such as:
	  o Smart meters going into all homes
	  o Systems to use energy at home in effective ways e.g. check if appliances are on/off from a distance
	  o Aggregators to control and make the best of energy produced at

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	the local level - Price responsiveness: economic incentives to promote citizens' interest in making their energy consumption more efficient and effective. - In the urban environment, there is the need to carry out policies in a more holistic way: not just for individual homes/buildings but at the district level. Systemic changes can be made to promote individual changes, e.g. renewable energies at the district level more than individual houses.
What is missing?	- Motivation and transparency: it is not enough to know how much you consume, more information should be provided on how individual home consumption could be improved. Education is needed to know which devices consume the most and how you can save energy and money. - Social acceptability and affordability – how do we get people to do this? While for vehicles the available incentives are clear, this is not true for home efficiency. - Bureaucracy: slows down those willing to change and discourages citizens from improving the efficiency of their homes. Differences among regions should be considered, e.g. Norway is different from France. These differences need to be taken into consideration, without assuming there are one-size-fits-all solutions

Reduction of energy consumption, dematerialisation/virtualisation Stijn Van Hummelen, Project Manager, Cambridge Econometrics	
What you want to achieve and how? Mission statement	Consumption of energy in the future should be CO_2 neutral, and it should allow for a decent life and be affordable by all.
How to do it, what are the obstacles and what is your solution	- Energy consumption should be waste free – the waste along the chain of producing energy is reduced to the minimum - Efficient technologies - Decarbonised digital footprint - Sharing as a driver for reducing energy consumption
What is missing?	- Active reduction of energy consumption - Changing habits - Knowledge regarding how to use technology - Energy saving
What is next?	- Championing/awards - Access to information/awareness - Energy saving games - EU Citizen awards - Finding innovative ways for reducing energy consumption at home

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2.6 The way forward

ENABLE.EU stands on the shoulders of giants, as many well-known foresight exercises have been carried out in the energy field. However, the ENABLE.EU foresight process has two distinct characteristics:

- First, the whole exercise is focused on the identification of possible transition pathways and policy measures, rather than on the long-term evolution and effects of energy drivers and trends;
- Secondly, ENABLE.EU has set out a highly participatory process, as the contributions and insights offered by energy experts in the first workshop will be discussed and enriched with the contributions of citizens during the "Transition Practice Workshop" (Rome, November 2018) and submitted to experts, citizens, and policy-makers for a final review in the "Transition Roadmapping workshop".

The Transition Visioning Workshop looked back to identify past events and trends that have influenced the energy sectors as well as forward to imagine three distinct scenarios. Most importantly, seven priority areas with measures that could be promoted today to move from the current energy system toward a more sustainable one have been identified, laying the basis for the discussion with citizens. The second workshop will aim to validate these areas and investigate what citizens perceive as the most important obstacles and opportunities in order to adopt and realize the measures proposed.

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3. Background information

3.1 Setting the scene: mapping drivers of individual and collective energy choices

Lead project partner: Jacques Delors Institute

In the project's literature review[10], we analysed research led to date on the drivers of energy choices, pointing out their contributions as well as their limits. This review testifies to the abundance of explanatory elements and findings through various disciplines. It first explores the economic and socio-behavioural drivers of individual energy choices, then analyses governance choices, and takes stock of the overarching models of energy choices in the literature.

Economic drivers of energy choices

Price-based interventions are a more appealing solution than imposed standards in encouraging consumers to reduce their energy consumption. Nonetheless, they do not necessarily stimulate high-return energy efficiency investments, as outcomes can differ depending on the manner in which households reduce their consumption and on the choice of instrument (e.g. carbon tax). Underinvestment in energy efficient technology is often explained in the literature by market failures (e.g. asymmetric information, liquidity constraints) and behavioural anomalies (e.g. consumer inattentiveness, bounded rationality).

Context is critically important when examining consumer responses to energy prices. The wide range of demand elasticities reported in the literature reflects the numerous methodologies, geographies, fuels and sectors considered. The measurement of price responses can be improved through randomised controlled trials and smart metering.

Low responsiveness to energy prices may be due to inefficiently low energy prices which do not fully take environmental externalities into account, or regulatory mechanisms resulting in prices that do not fully reflect production costs. A range of behavioural biases and management failures may also impede information processing and ultimately result in sub-optimal decision making.

Socio-cultural, demographic and behavioural factors influencing energy choices

Energy choices are also shaped by social, cultural, demographic and behavioural aspects. This approach can be useful in attempts to predict people's behaviour in particular situations and to identify specific groups that might be more responsive to certain policies.

Culturally determined social dynamics can affect not only people's response to specific policies, but also their daily routines and practices. The social risks of not complying with the established norm can often be more important than new technology in shaping behaviour. New technology can, however, redefine social conventions. Such drivers played a decisive role in the diffusion of cars and air conditioning, which moved from desired novelties to normal objects of mass consumption.

Demographic variables like income and age affect energy behaviours differently, depending on the energy service and the empirical setting. Income, considered a determinant of social status, strongly shapes households' energy behaviours, but based on different motivations – e.g. improving one's comfort, affording basic energy needs or producing one's own energy. It appears that early adopters

[10] The literature review can be found on the project's website in the "Downloads and deliverables" section. http://www.enable-eu.com/downloads-and-deliverables/

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of new technologies come mainly from higher income groups. Last but not least, gender is given particular attention within ENABLE.EU as research shows that the motivations for and barriers to taking up energy-saving technologies can be gendered.

Behavioural aspects tend to be neglected in the study of energy choices. Yet, the routinized nature of many energy behaviours might make them difficult to change. Successful habit-breaking strategies can use policies that involve direct experience, such as trial periods. Furthermore, consumers' engagement with electricity generation might also lead to the increased visibility of this consumption, and this could positively affect household energy practices. Finally, environmental awareness and values have an uncertain impact on behaviour as there are often discrepancies between people's attitudes and their actual energy behaviour.

Drivers of energy-related governance choices

There are also several drivers and bottlenecks at the governance level. A low carbon energy transition requires disrupting the current energy system. This raises the challenge of consistent policy-making based on a long-term strategy that cannot be easily overturned in the future and that takes into account obstacles to the liberalisation of markets, path dependency, regulatory barriers to technological diffusion, support for R&D, the active engagement of stakeholders and consumer acceptance.

Synthesis of factors driving energy choices

Although it is difficult to generalise the findings and draw an accurate picture of the drivers of energy choices based on a portion of the literature, our review attempts to highlight points of consensus and areas where findings have been mixed. For instance, strategies like social comparison and the targeting of specific groups seem to positively influence energy conservation, while studies differ on the impact of different types of information provision. That said, the combination of several strategies (e.g. information provision and social norms) can be particularly effective. Nonetheless, beyond the effectiveness of a specific strategy, the design of a policy should not neglect several essential aspects, such as synergies between factors and strategies, policy cost, timing, consistency with other policies and the institutional context.

ENABLE.EU's empirical approach builds on the existing theories and findings, as well as on identified gaps and problematic areas in the research to date in order to maximise its added value. The project approaches the question of what drives energy choices through the lens of several energy services and activities, namely electricity consumption, mobility, heating and cooling, and prosumers.

3.2 The case studies

3.2.1 Economic factors influencing household electricity consumption

Lead Project partner: Westfaelische Wilhelms-Universitaet Muenster (WWU)

a) Aims

With the energy transition towards a low-carbon system, the integration of renewable energies into the energy market is becoming increasingly important. In order to avoid overloading the grid, the supply of electricity must always correspond to demand. Fluctuating generation and grid feed-in from renewable energies combined with relatively rigid demand present problems that can be addressed with various options on both sides. This case study deals with the demand for energy services by private households. By understanding the drivers of electricity consumption, policies can directly target these drivers and implement corresponding strategies. Adding flexibility to electricity

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demand avoids grid overloads, as it can be adapted to the supply-dependent feed-in. Lower energy consumption allows a higher share of renewable energies in total electricity consumption. However, these opportunities go hand in hand with the question: "What factors influence household behaviour related to electricity demand?".

We are trying to identify the effect of different policy interventions on electricity consumed. The countries involved in this case study are: Bulgaria, Serbia, UK and Germany. Each of the countries focusses on a different intervention that best suits its needs:

- In Bulgaria, the research question is: "What is the effect of appliance-specific real-time consumption feedback on electricity consumption?" Utility bills are often difficult to understand, and consumption is only presented as an aggregated measure. By providing a cost breakdown for different appliances, households are able to understand their consumption. As a consequence, consumers are empowered to adopt energy saving measures.
- Because the Serbian energy market is not liberalised and energy prices are the lowest in Europe, information provision, rather than financial incentives, was selected as a potential policy intervention. In particular, the research aims to shed light on whether energy saving instructions are a fruitful strategy to incentivise a reduction in electricity consumption. The study is being conducted in cooperation with the national electricity supplier EPS Supply. For EPS Supply, energy saving instructions are a measure to provide support as a socially responsible business, which includes the education of consumers.
- In the UK, the maximization of smart meter adoption was selected as a potential policy intervention. The smart meter rollout is perhaps the single biggest energy policy initiative in the UK at present. The government has mandated that every household should be offered a smart electricity and gas meter by 2020. This would require installation of 53 million gas and electricity meters. Currently the total installed is less than 5 million. Therefore, researchers are working with a large energy company (more than 5 million customers) to design and implement a robust study aimed at maximising smart meter adoption.
- The payment of electricity consumption usually occurs some time after consumption has taken place. In Germany the time lag is particularly severe: consumption is immediate, whereas billing occurs once a year. This lag has two consequences: future costs are discounted when making decisions and information on consumption behaviour is given only once a year. Technological progress in the form of smart meters would allow for real-time billing. However, the benefits of real-time billing have not yet been explored. The research aims to disentangle and estimate the effects of real-time billing on energy consumption.

b) Methods

The case study is being implemented in the form of randomized controlled trials (RCTs), also known as A/B Testing. A RCT is a quantitative method that allows the identification of the causal effects of inventions by instrumenting randomization. Participants are randomly placed in either an intervention or a control group, and only the intervention group has access to the intervention (e.g. the energy-saving instructions). Because of this randomization, the participants in both groups are expected to be equal in all of their observable and unobservable characteristics, except of the intervention. By using randomization, instead of relying on before and after comparisons, also time effects, such as a change in the weather, are controlled for. This is how the causal effect of the intervention can be isolated, without the contamination of any other characteristics. To measure household electricity consumption, it is usually necessary to cooperate with an electric utility.

c) Preliminary results

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The case studies in the different countries are either currently running or are to be implemented shortly. The first results are expected in autumn 2018.

3.2.2 The shift to low-carbon mobility

Lead project partner: Asociacion BC3 Basque Centre for Climate Change (BC3)

a) Aims

The aim of the Low-Carbon Mobility (LCM) case study is to investigate what facilitates the use of low-carbon shared mobility options in urban areas across Europe. A specific focus has been given to the carsharing and electric carsharing options.
Moreover, the study puts forward a comprehensive analysis in which carsharing options are compared with other transport modes. Thus, it also focuses on how the use of this option is related to the ownership of a personal vehicle (past and future) and other transport alternatives such as public transport.

b) Methods

The LCM case study consists of semi-structured in-depth interviews with both carsharing users and stakeholders in Hungary, Italy, Norway, Poland and Spain. In each country, specific users have been identified by age, gender and whether or not they have children. Moreover, a preference towards electric carsharing was considered, if possible, according to each country's level of carsharing development.
Interviews with stakeholders have been conducted with representatives of the business sector, the public administration and associations. In all cases, flexibility towards the specific national context was granted and comparability of methods has been ensured.

c) Preliminary results

- Carsharing can be a driver of the transition from property-based to access-based mobility; it can complement a lack of public transportation and give access to new and alternatively fuelled vehicles, especially electric vehicles.
- Carsharing services seem to be more popular among young, medium-highly educated and medium-high income people.
- Carsharing is mainly used for short leisure trips, especially on weekends or at night.
- The main motivations for using this service are:
  - Convenience: Carsharing is highly valued for its flexibility and speed compared to public transportation.
  - Economic advantages: It allows users to avoid the purchasing and maintenance costs of a vehicle and pay based on their use.
  - New technology: The service is appreciated for its innovative aspects, its new, technologically advanced electric vehicles and app-based systems.
  - Environmental awareness: For electric vehicles, many users cited environmental aspects as relevant, although maybe less important than convenience and economic advantages.
- Users appear in general to have a good opinion of electric vehicles and have a preference for carsharing services that provide such vehicles.
- Carsharing services seem to help users live without a vehicle or limit the number of vehicles in a household.

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- From a societal point of view, carsharing is considered to be a good complement to public transportation and a good way to promote electric cars and electro-mobility.
- In all participating countries, carsharing appears to be a developing and increasing sector, in which the electrification of vehicles is present or expected for the future depending on the level of technological development.
- Free-floating (one-way) and station-based are the two main carsharing business models, along with peer-to-peer carsharing, which are platforms where users can share their private vehicles. The free-floating model allows vehicles to be picked up and parked in any place within a certain area, it is normally paid per minute of use and it targets trips within the city. Station-based carsharing requires the vehicle to be picked up and parked in a specific area, it is normally paid by the hour and targets daily trips outside the city. Free-floating carsharing often involves electric vehicles, while station-based carsharing seems to be sticking to conventional or hybrid ones due to higher requirements for vehicle autonomy.
- Both free-floating and station-based carsharing bring benefits for low-carbon mobility: the former model allows for the reduction of the number of conventional vehicles in urban areas and let users experience electro-mobility; users of the latter model seem to use more public transport (metro/tram, bus and taxi) in their daily routine, complementing this with carsharing when they need to go outside the city.

This is a preliminary summary of the results, focusing on the common methodology and results, although other insights may depend on the specific national contexts.

3.2.3 Factors influencing decisions related to heating & cooling

Lead Project partner Rekk Energiapiaci Tanacsado KFT (REKK)

a) Aims

Exploiting the huge energy efficiency potential represented by residential buildings depends not only on the availability of appropriate technological solutions but also on the investment decisions and energy-saving behaviour of households, which depend on their socio-economic conditions, habits, attitude, norms and values. The aim of this case study is to gain insight into the heating/cooling habits of households, their motivation and experiences related to energy efficiency improvements, their views on the barriers to reducing heating and cooling energy use, and their ideas on the possible regulatory measures and policies that could help overcome those barriers.

b) Methods

The case study builds on the methodology of focus group discussions combined with participatory systems mapping. Focus group discussions were conducted in France, Germany, Hungary, Spain and Ukraine, composed of homogenous groups in terms of expertise, location or social status. The method provided an opportunity for the involvement of citizens in generating ideas and devising recommendations on how to decrease heating and cooling energy consumption and related energy costs.

c) Preliminary results

The following problems and possible solutions were identified by participants in most of the countries involved:

- There is a need for easily understandable, clear information related to simple everyday measures, such as how to set thermostats, proper ventilation and how to avoid mould

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formation, the hydraulic adjustment of radiators, etc.
    - Possible solution: Communication strategies on energy consumption and everyday good practices developed by public authorities. Organising discussion groups by local authorities or civil society organisations to help the exchange of good practices among people facing similar problems.

- It is challenging to provide information on renovation and heating system refurbishment, as information sources often contradict each other and there is a lack of trust in renovation professionals.
    - Possible solution: Information exchange on platforms related to energy efficiency is helping to identify reliable professionals and independent experts. Good practices for renovation could be shared through an EU platform, e.g. one linked to the EU Energy Poverty Observatory.
- Information provided on bills is complicated and not easily understandable. Some consumers already find there is too much information.
    - Possible solution: Energy savings could be expressed in monetary terms on the bill. Easily understandable, eye-catching graphs comparing consumption to that of other time periods and/or neighbours could induce energy saving.
- Conflicts exist among neighbours when heating needs take neighbouring tenants into consideration, especially when it is not possible to control the heat individually, as in the case of district heated dwellings.
    - Possible solution: Installing controllable heating equipment and individual meters to ensure the just division of costs.
- District heating is not necessarily more efficient, due to the bad quality of heat distribution systems, high room temperatures because of non-controllable radiators and the resulting need for more ventilation by opening windows.
    - Possible solution: Installing controllable heating equipment and individual meters to ensure the just division of costs. Refurbishment of heat pipelines.
- It is difficult to find solutions to the tenant/owner problem: conflicting interests hinder renovation activities.
    - Possible solution: Incentives should be provided for owners to improve the energy efficiency performance of the dwellings they own. It is a question whether incentives or obligations would work better.
- Questions related to comfort: There is a difference in the behaviour of household members regarding the appropriate temperature (e.g. thermostats set high, wearing T-shirts instead of putting on warmer clothes).
    - Possible solution: Education on how to program thermostats, making wearing warmer clothes at home fashionable, and making the right behaviour 'trendy'. An awareness-raising campaign regarding healthy indoor temperatures. Presenting calculations on how much energy/money citizens can save by lowering the temperature by 1 degree Celsius.
- Distorted prices for final consumers and/or subsidising energy bills for the disadvantaged decrease the motivation to save energy.
    - Possible solution: Consumers pay more attention to their level of consumption if they are made at least partially responsible for their energy costs. Higher prices lead to

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more energy savings.

- Cost awareness is not always connected to environmental awareness, and the desire to decrease costs may also result in unsustainable practices (e.g. heating with lignite or garbage).
    - Possible solution: Information campaigns on beneficial and on unsafe/polluting energy-related practices could raise awareness among citizens. Education should combine economic and environmental thinking.
- Old, damp houses in historic districts are difficult to renovate, as there is a risk of ruining the architectural style. In rural areas, especially in Eastern Europe, the bad condition and low housing values compared to the cost of renovation makes refurbishment economically unfeasible.
    - Possible solution: There is a need for solutions that enable the improvement of the energy performance of old houses. There is also a need to subsidize the renovation of old houses and help disadvantaged people move to modern buildings.
- There is a lack of initial capital, even where available subsidies cover some part of the overall costs of renovation.
    - Possible solution: Information should be provided on how to find and how to apply for funding and support. Funding should be offered to help low-income people renovate their flats.

3.2.4 Case-study: "From consumer to prosumer"

Lead Project partner: Cicero Senter for Klimaforskning (CICERO)

a) Aims

This case study addresses the process of transformation in households that go from being conventional electricity consumers and invest in solar technology systems in order to produce their own electricity and sell the excess electricity produced back to the main electricity grid. The objective of this case study is twofold: 1) Provide a mapping of prosumers and related gender ideologies in the case study partner countries of Italy, Norway, Serbia, UK and Ukraine; 2) Provide an analysis of prosumers' motivations, experiences, and energy use. The purpose of this analysis is to understand gender relations, and how and why energy practices and behaviours differ within and across households as well as societies, and the implications this may have in the countries involved. This case study emphasizes the importance of forward-looking policymaking and planning to understand and promote prosuming and people's choice to opt for environmentally friendly energy solutions.

b) Methods

The analysis of the case study is based on qualitative methods. The mapping of prosumers and related gender ideologies is based on a selection of campaign material for household solar PV systems; media articles and interviews with prosumers; and media articles on policies and prosuming regulations. The material was found by searching in national or international databases for news articles and through Google searches. The analysis of prosumers' motivations, experiences, energy use and the significance of gender relations is based on in-depth semi-structured interviews with households. The material was gathered from both rural and urban areas across the countries to the greatest possible extent. Interviews were scheduled with women and men separately (with a few exceptions) so that all adult members of the household would have an equal opportunity to inform the researchers about their motives, experiences and gender relations. Most households also kept

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journals detailing their everyday energy use and practices, as well as energy-related negotiations within the household during the week prior to the scheduled interviews.

c) Preliminary results

There is great variation in the contexts of becoming a prosumer among the samples from the different countries. The UK and Italy have a long history of incentive tariff schemes, which has resulted in high uptake of PV systems in private homes. In Ukraine and Norway, on the other hand, the number of prosumers is still relatively low - between 1000-3000 - and subsidies and incentive tariffs are more recent and/or lower. In Serbia, the regulations regarding prosumers have not yet been implemented in practice, and no households and persons fit the definition of prosumers (selling excess produced electricity back to the main grid). Estimates indicate that about 385 households in Serbia are producing electricity for their own needs from PV systems.
What prosumers in all countries have in common is that they are predominantly middle to upper class and at least 30 years old. In the UK, Norway and Italy, the majority of prosumers are above 50, while in Ukraine and Serbia the majority are between 30-50. Most also own their own house and live in suburban or rural areas, meaning they have the financial means to invest in their own solar PV systems. In Norway, Italy and Ukraine, the sample shows that prosumers often have a higher level of education and several work in the energy sector or a similar area.
Another thing that all countries have in common is that prosumers, with very few exceptions, have only had positive experiences of becoming prosumers. Some noted that the bureaucracy and lack of subsidies are a problem In Norway, there is a lack of skilled enterprises in certain regions, which makes the process more difficult. In the UK, many interviewees mentioned that their installer or other installers in their area had gone bankrupt or quit the solar sector, making it more difficult to obtain guarantees and build trust. In Serbia, one family had a security issue due to a system malfunction.

Prosumers' motivations also vary. In Italy, the UK, Ukraine and Serbia, investing in solar PV systems is driven by financial reasons. In Ukraine, some households have opted for this instead of banking saving, as this would provide a 'passive income; for others this entails lower energy consumption costs. In Norway, the upfront costs are still too high (even with a national subsidy scheme) to be seen as a good economic investment, but many stressed that if and when electricity prices go up they will be in a good position and the repayment period will be significantly shortened. In all countries, environmental reasons are seen as an important motivation (along with financial reasons), though many in the UK, Ukraine and Serbia are only motivated by financial reasons. In Norway and Ukraine, several of the prosumers interviewed became prosumers because of professional or technological interests. Both this study, and a previous study of prosumers in Norway show that a significant number of them work in the energy sector. In Serbia, most of the prosumers interviewed live in or have second homes in rural areas where there is no central grid and therefore few other options for electricity. It is difficult to discern any particular gender difference in motivation, though there are indications that women are more concerned with environmental aspects, while men focus on technological aspects.
This case study focused particularly on gender and gender relations concerning the process of going from consumer to prosumer. For most prosumers, the decision to invest in solar PV was taken jointly by husband and wife, but, more often than not, the husband or male relatives in all country samples drove the process (in terms of research, practicalities and bureaucracy). In Norway and Ukraine, a significant number of prosumers work in the energy sector or are professionally interested in the technology and therefore had higher levels of motivation, interest and skill than their spouse. In Norway, two of the prosumers working in the energy sector are women (and they drove the process),

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while six are men. In Norway and Serbia, some prosumers did the installation themselves and consulted with male family or networks in this process. In the Norwegian sample, two of the prosumers interviewed - who also work with household PV systems - noted that when the upfront costs are high, family members weigh the investment in solar PV systems against other priorities and therefore it is necessary to engage women as well when selling such systems.

Over the course of interviews and the collection of diary journal notes from the interviewed prosumers, this case study looked at how household space and household work is gendered and how this influences decisions regarding the implementation of new technology in the household. Most households stressed that they perceive themselves as gender equal, though some would point to the washing room (for washing clothes) and kitchen as female spaces and workshops as a male space. Several also see solar technology as a 'male' thing as men are perceived as more interested in technology, or because household renovation is seen as their responsibility. The diary journals illustrated that it is predominantly women who do the cooking and washing of clothes, though men participate more with cooking.

Several prosumers noted that they had changed their energy consumption habits after becoming prosumers. They now monitor their production and consumption more closely and have shifted their load to daytime energy use as much as possible to use the electricity they produce. Still, as noted in the UK and Norway, prosumers can be categorised into identifiable groups: Either the prosumers are unwilling to modify their habits, or they are already very energy-conscious and use energy carefully, making it difficult to achieve additional savings. In the first situation, the households decided to become prosumers mainly in order to accommodate their habits and make them cheaper. This is also the case for the prosumers in Italy, Serbia and Ukraine.

The preliminary findings of the case study indicate that incentive tariff and subsidy schemes are vital to scale up PV solar systems for domestic use (and the business sector) in Europe. The case study also indicates that gender relations play an important role in this, as women often do not take an active part in the process of becoming prosumers. If women lack 'ownership' in these processes it is likely that they will prioritise other investments.

3.3 Scenario and model development

The literature review, surveys, randomized control trials and participatory foresight exercises produce findings about the economic, behavioural, cultural and socio-demographic factors that drive the take up of energy technologies, which in turn give us an insight into the types of policies that could influence these drivers. On the basis of these findings, CE is developing an outline for a series of models that will assess macro-level outcomes from micro-level scenarios, which will be developed as part of the transition visioning workshops.

Changes in individual behaviour lead to changes in individual energy demand. To model the economy-wide (macro) energy demand from changes in individual demand, we need to aggregate the energy demands of individuals. Data on individual demand is not available, so our modelling approach focuses on the take up of specific technologies in each of the four areas under investigation in the ENABLE.EU project (mobility, electricity consumption, heating and cooling, and prosumers), from which reductions or increases in aggregate energy demand can be derived.

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To do this we will develop a suite of technology diffusion models based on our in-house FTT (Future Technology Transformations) model. Certain aspects of the model will be altered to reflect the decision process of individuals. For example, some individuals may not be well-informed about the long-term economic and environmental benefits of a technology or may attach a negative bias to the future revenue of energy technology investments. They would therefore be far less likely to invest in the technology than, say, someone who is very environmentally aware.

FTT: Power is a technology diffusion model initially developed by J.F. Mercure for the power sector. It is the first of a family of FTT models; FTT: Heat and FTT: Transport. It models the decision-making process of investors/consumers who want to invest in new technologies but face a number of different decisions and constraints.

Based on what we know from the research carried out as part of ENABLE.EU, we can design policies to influence these drivers and assess their impact on the take-up of a technology/technologies. In other words, the modelling scenarios will be developed to influence the behavioural characteristics (or other important factors) of individuals to have a strong positive effect on energy technology take-up. A different combination of policies or higher levels of the same policy can be put together to get a comprehensive set of results, which we can then compare in the final stages of the project to enable critical analysis and policy recommendations.

The take-up of these technologies and the resulting changes to aggregate energy demand have significant socio-economic impacts. A higher take-up of EV vehicles could reduce oil imports in many economies, but at the same time there may - under certain conditions - be some job losses in the car manufacturing industry of Europe, for example. The massive rollout of solar panels could result in considerable energy savings for households, but further socioeconomic benefits for the economy would depend on where the solar panels are being manufactured.

Such impacts will be assessed in a second phase of the modelling, when the results from the technology diffusion modelling will be used to provide inputs to CE's E3ME model and REKK's energy market models (EEMM and EGMM). This will provide insight as to the role economic, sociocultural, demographic and behavioural factors play in meeting the goals of the Energy Union and will allow for a quantitative assessment of the outcomes of the scenarios against the goals of the Energy Union.

E3ME is a computer-based model of the world's economic and energy systems and the environment. It was originally developed through the European Commission's research framework programmes and is now used globally for policy assessment, forecasting and research purposes.

The European Gas Market Model (EGMM) has been used since 2010. The model simulates the workings of 33 European markets, considering network infrastructure constraints, long term contracts, domestic production, international LNG (liquefied natural gas) markets and underground gas storage markets.

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Annex I Participant golden paragraphs

BELGIUM

Thomas Nowak
European Heat Pump Association
I have a profound interest in moving the energy system to 0 CO2 emission. Apart from deep knowledge in the heat pump and heating industries, I also am a strong believer in the joint benefits of sector coupling and digitalization of heat. In my private life, I own a building with heat pump, PV and ventilation and do experience every day how well these work together.

Pierre Serkine
Energy and Innovation Advisor, EIT InnoEnergy, Belgium

Pierre Serkine is Energy and Innovation Adviser in the EU Business Unit of EIT InnoEnergy in Brussels. He joined EIT InnoEnergy in 2014 and worked on the development and implementation of the societal appropriation strategy of the company to accelerate the shift toward a consumer-centric European energy system, dealing with consumer empowerment (behavioural change, prosumers, active consumers) and digitalisation of energy matters.
Prior to that, he worked for the European diplomacy on energy, climate change and raw materials issues, on adaptation to Climate Change for the French Ministry of Environment and Energy, and as an analyst in cleantech in Private Equity funds.
He graduated from an engineering school (Arts & Métiers ParisTech, France), he holds an MSc in Aerospace Dynamics (Cranfield Univ., UK), a M. Econ in Energy and Climate Economics (Paris-Dauphine Univ., France), and a MA in European Studies (College of Europe, Belgium).

BULGARIA

Dr. Stefan Apostolov
Member of Executive Board, Electric Vehicles Industrial Cluster, Bulgaria
Dr. Apostolov has versatile professional technical and management experience in energy transmission and distribution. As CEO of CEZ Distribution Bulgaria (2012-2014), Dr. Apostolov managed 2700 personnel and over 56 000 km distribution network length, 261 thousand business customers and 1,8 million household customers. In his capacity as COO of CEZ Distribution Bulgaria (2015-2016), he managed the divisions of Metering and Data Management, Network Operations and Management, Network Management, Logistics and Business Services, Non-technical Losses with 1500 personnel and also implemented innovation projects with drones and worked on projects for company's transition to the open electricity market.
His current focus is organizing and leading startup companies within the Electric Vehicles and Industrial Cluster with regard to building and managing IT systems for electric

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automobile charging infrastructure, as well as stimulating business growth in the electric mobility and electric grid industries.

Dr. Vesselin Chobanov
Associate Professor, Technical University of Sofia, Bulgaria
Dr. Chobanov works in the field of grid integration challenges of renewable energy sources and prospective solutions.
His areas of interest include: Complexity of Power System Processes; On-going Transformation of Power Systems (impacts of renewable energies; energy transformation; impacts of prosumers and electrical vehicles; impacts of liberalization and power markets; reducing carbon footprint; amendment of legislation), Grid Integration Challenges for Power Systems with High Shares of Fluctuating Renewable Energy Sources (RES): trends & challenges in power system operation; role of operational flexibility in power systems; modeling and analysis of power systems and their operation.

Dr. Todor Galev
Senior analyst, Economic Program, Center for the Study of Democracy, Bulgaria
Todor Galev works on consultancy and policy-research projects in the field of socio-economic and sociological studies on energy sector governance and energy security policy, and innovation policy and competitiveness in SEE and EU. He has over 15-year experience in managing and carrying out research and analytical tasks, incl. research design of surveys and qualitative studies, implementation of complex statistical analyses, large database processing, modeling and analysis, preparation of policy-research reports, and consulting policy makers. He specialized also in policy/program evaluation and impact assessment and feasibility studies.
Todor has participated in various national and international projects, supported by the EC (DG Research, FP5, FP6, FP7, H2020, IPTS, IPA), World Bank, the US German Marshal Fund, EBRD, CIPE, the U.S. State Department, national ministries, private multinational companies, etc.

Dr. Atanas Georgiev
Head of the Industrial Economics and Management Department, Energy Master's Program Director, Sofia University Kliment Ohrisdki, Bulgaria
Associate Professor Dr. Atanas Georgiev is Vice-Dean and Head of the Industrial Economics and Management Department at the Sofia University Kliment Ohrisdki. He is also the publisher and editor-in-chief of the Utilities magazine and Publics.bg. He has defended a PhD dissertation on the topic of Institutional Independence of Energy Regulatory Authorities and Master's degrees in Energy Economics and in Finance and Banking at the Sofia University. He is a frequent guest-lecturer at the Diplomatic Institute (part of the Ministry of Foreign Affairs) and author of many energy-related publications. Dr. Georgiev has specialized at IVLP/Global Energy Security (US State Department), Generation Next (Rossotrudnichestvo); the Public Utility Research Center (Florida, USA), the Florence School of Regulation, etc.
He is also a member of the International Association for Energy Economics and a member

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of the Management Board of the National Committee of Bulgaria to the World Energy Council.

Marko Hajdinjak
Senior Analyst, Applied Research and Communications Fund, Bulgaria
Marko Hajdinjak is a Senior Analyst at ARC Fund in Sofia. He has 17 years of experience in participation in international research projects and management of practical and financial aspects of their implementation.
Some of the projects he currently participates in are:

- RRI-PRACTICE (Responsible Research and Innovation in Practice): participates in analytical work and drafting of policy recommendations, and is responsible for project's dissemination activities.
- ResInfra@DR (Facilitating Macro-Regional Scope and Link Up to Socio-Economic Actors of Research Infrastructure in the Danube Region): coordinator of ARC Fund's activities in the project, and responsible for the work package on capacity building of research infrastructure stakeholders.
- ENERGISE (European Network for Research, Good Practice and Innovation for Sustainable Energy): coordination of work and responsibilities within the research team, research work and writing and editing of outputs Mr. Stoyanov is an engineer with more than 10 years of professional experience in the energy field (including nuclear energy), with expertise in the area of energy efficiency, smart grids, e -mobility, energy security, as well as local, national and EU energy policies.

dr. Teodora Peneva,
Bulgarian Academy of Science, Institute for the Study of Society and Knowledge
Dr. Peneva is a MA graduate in Economics from Peking University and PhD graduate in Economics of Energy, Infrastructure and Public Services from Sofia University, the Faculty of Economics and Business Administration. She is currently working as a Chief Assistant Professor at the Public Policies and Social Changes Department in ISSK of the Bulgarian Academy of Sciences, exploring the energy poverty field. Her current research focuses on the methods of measuring energy poverty and the factors impacting it in Bulgaria in specific. Her work also includes measurement of the effects of public policies on energy poverty, and modelling of multipliers for the main demographic, income and housing factors impacting final residential energy consumption

Ruslan Stefanov
Director, Economic Program, Center for the Study of Democracy, Bulgaria
Ruslan Stefanov has more than ten years of experience in project development, analysis and research in international and European economic development projects.
In the past five years he has been managing a team of in-house and external experts delivering policy research and advocacy on good governance and transparency in the Bulgarian energy sector. More specifically he has done research on public procurement transparency in the energy sector, state-owned energy companies' management, gas transit transparency and the economics of large-scale energy projects (gas and nuclear).

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He has experience in implementing multi-country (EU-27) benchmarking and evaluation projects in the areas of competitiveness, EU funds and RTDI. He advised the Bulgarian government on its energy strategy 2020 and has had more than 20 articles in local media on energy related topics.

Dimitar Stoyanov
Advisor to Member of European Parliament, Bulgaria
Mr. Stoyanov is an engineer with more than 10 years of professional experience in the energy field (including nuclear energy), with expertise in the area of energy efficiency, smart grids, e -mobility, energy security, as well as local, national and EU energy policies.

Milena Tasheva
Associate professor, University of Architecture, Civil Engineering and Geodesy, Sofia
Has more than 15 years of professional practice and competences in strategic, integrated and development spatial (regional, comprehensive and detailed) planning. Member of the Bulgarian union of Architects and the Chamber of Architects (full design capacity); registered expert on EIA and SA statements, Ministry of Environment and Waters; member of The Association of European Schools of Planning (AESOP). Participated as an expert in research and EU educational projects funded by national ministries, the EU Directorate General "Education and Culture", the European Territorial Cooperation Programme (2012) and the EIB. Member of the Bulgarian team in Horizon2020 project ECHOES ("Energy CHOices supporting the Energy Union and the Set-Plan"-2016-2019). Contact person and leader for the Bulgarian team in Horizon2020 project URBiNAT "Healthy corridors as drivers of social housing neighborhoods for the co-creation of social, environmental and marketable NBS" 2018-2023). Graduated MA (architecture) from Faculty of Architecture, UACEG and received MSc in Urban Planning and housing (University of Lincolnshire); Attended IFHP Summer School, obtained certificate on "Developing Local Economies through Inclusive Policies and Planning" from the Central European University (Budapest); participated as trainee in FP7 EYE project "Empowering Young Researchers".

Tsvetomira Kulevska
Director Directorate General "Coordination and Management of EE and RES", Sustainable Energy Development Agency, Bulgaria
Ms. Kulevska is an engineer with high level of expertise in the analysis of energy consumption and implemented energy efficiency policy measures, evaluation of improvements of energy efficiency and achieved energy savings. Provides methodological assistance in the implementation of obligations under the Energy Efficiency Act of the public and the local authorities, industrial systems and the energy suppliers. Interacts with the obligated parties under the Energy Efficiency Act and provides assistance in the implementation of activities and measures to improve energy efficiency at National and local level. She has experience of long standing in drafting national reports, standpoints and positions on the implementation of EU directives in the field of energy efficiency and promotion the use of renewable energy. Organizes and participates in the preparation of the annual reports on the implementation of National Energy Efficiency Action Plan and

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National Energy Efficiency Target according to Directive 2012/27/EC.

Martin Vladimirov

Energy analyst, Economic Program, Center for the Study of Democracy, Bulgaria

Martin Vladimirov has 7 years of academic and professional experience in analyzing energy security risks in Europe and Eurasia with a special focus on Central and Southeast Europe. Mr. Vladimirov is also the co-author of the seminal Kremlin Playbook, jointly written with the Washington D.C.-based Center for Strategic and International Studies, which assesses the Russian economic footprint in Central and Eastern Europe and the mechanisms for its transformation of political influence. Before joining CSD, he worked as an energy analyst for The Oil and Gas Year, which produces in-depth overviews of the energy sectors of the major oil and gas producers around the world. Previously, he has worked as an energy and economic analyst for CEE Market Watch, where he was producing short intra-daily analysis of economic and energy issues for Iran and Central Asia. He has also been a remote political and energy risk analyst for IHS and Argus Media writing assessment briefs for Bulgaria, the Balkans, South Caucasus and Central Asia. During his M.A. studies at the School for Advanced International Studies at Johns Hopkins University, Mr. Vladimirov taught seminars in theory of international relations

FRANCE

Christophe Beguinet,

RTE- CFDT

In the company Enedis and in the Trade Union CFDT, I am involved in both strategy and sustainable development. I also focus on regulation for the Distribution System Operator and on the French market design for electricity.

Danyel Dubreuil,

Rénovons!

Having coordinated campaigns in the field of international solidarity for five years, Danyel DUBREUIL chose to focus on energy campaigns in 2013, to support his fellow citizens' empowerment over this issue. Since 2016, he coordinates the Renovons ! initiative to support the implementation by decision makers of an ambitious programme to renovate the least efficient buildings and to durably reduce energy poverty

Emilie Magdalinski

Research Fellow, Jacques Delors Institute, France

Emilie Magdalinski is a research fellow at the Jacques Delors Institute, working on European energy and transport policy. After experiences in public affairs in Brussels and Paris, she joined the German think tank Adelphi where her research focused on energy innovation and climate change-related conflicts. Emilie graduated from Sciences Po Paris with a master degree in European affairs and studied environmental studies at the University of Boulder-Colorado, USA.

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Thomas Pellerin-Carlin
Research Fellow, Jacques Delors Institute, France
Thomas Pellerin-Carlin is a research fellow at the Jacques Delors Institute. His work focuses on creating and advocating the Jacques Delors Institute's proposals aiming at influencing the major trends of the EU and national energy policies, with a particular focus on clean energy innovation. He previously worked on States Aids for the energy and transport sectors in Italy, the French Army, the French Administration for European Affairs and the European Energy Policy Chair of the College of Europe. Thomas is a graduate of the College of Europe's Master in European Political and Administrative Studies, Bruges and of the Lille Institute of Political Studies.

Axel Perignon
Croix-Rouge - LogisCité
After working during 3 years in the Oil&Gas industry as business engineer, I joined Croix-Rouge insertion's team to help fighting fuel poverty in France. I am training and managing our technical team on the field, dealing with clients and partners relationships and leading our impact studies. My job allowed me to be confronted with many different cases of fuel poverty, whether it is in social housings, private rents or landlords' houses.

GERMANY

Dr. Eckehard Büscher
Energy Agency Northrhine-Westphalia, Germany
Active in water and energy supply since 30 years. Worked as managing director of public utilities, as consultant in several national and international projects in more than 25 countries and as professor for energy supply.
The energy supply network of the Energy Agency Northrhine-Westphalia accompanies some 700 members including the 160 public utilities in NRW.
http://www.energieagentur.nrw/netzwerk/energiewirtschaft/

Leslie Nielsen
Lampenwelt GmbH
I'm Leslie Nielsen, conversion rate manager at Lampenwelt GmbH. With over 10-years of experience in selling lighting products and with online shops in 15 different European countries, we are the largest lighting retailer and manufacturer in all of Europe. Since customer satisfaction is one of the key points of our success story we're always aiming to understand the customers need and provide the expected product and service. With the growing importance and awareness and of energy efficiency among our customers, this field has become more and more important to us as the company behind the products we sell (e.g. the big transformation from traditional light bulbs to led over the past years).

Sven Schneider

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Head of Public Relations, Energy Division, Verbraucherzentrale NRW (Consumer Association of North Rhine-Westphalia), Germany
Born in 1974, German scholar Sven Schneider has been working for Verbraucherzentrale NRW in the field of energy since 2003 and is currently head of the public relations department with more than 20 employees. The NGO represents the interests of consumers towards politics and the economy. Throughout the state of NRW, with a population of approximately 18 million, it offers neutral advice and help for consumers in the energy field. The energy experts of the Verbraucherzentrale NRW advise about 50.000 households every year - at home or in one of more than 100 contact points. Through large information campaigns on energy issues, the organisation reaches many millions of citizens.
Thanks to the EU- and state-funded project Energie2020 the Verbraucherzentrale NRW is able to design information materials, lectures, events and educational offers and creates insight in an increasingly digital and prosumer-oriented energy world in which electricity, heat and mobility grow together.

Madeline Werthschulte
MSc. Research Assistant Chair of Microeconomics with a Focus on Energy and Resource Economics, University of Münster, Germany
Since 2016, Madeline Werthschulte has been a PhD student and research assistant at the University of Münster, Germany. She holds a M.Sc. in Economics from the University of Münster. In the context of the ENABLE.EU project, she is particularly working on the psychological and economic drivers of households' energy demand by applying experimental and empirical methods.
Before working on the ENABLE.EU project, she was involved in the research group Smart Energy.NRW, which focusses on the digitalization on the energy sector. She gained further professional experience at the Cologne Institute for Economic Research (IW), the Institute of Labor Economics (IZA) and the Centre for European Economic Research (ZEW).

HUNGARY

Maria Bartek-Lesi
Senior Research Associate, REKK, Hungary
Mária Bartek-Lesi is a senior research associate at REKK. She received her PhD from the Corvinus University of Budapest. She leads projects related to climate and environmental policy, renewable energy, and distributed generation. Previously, Dr. Bartek-Lesi worked as an assistant professor at the Institute of Business Economics at the Corvinus University of Budapest, participated in the work of the Department of Economic Analysis and Environmental Protection of the Hungarian Energy Office, and was involved in research on economic transition at the Central European University. She is a lecturer at the Renewable Energy Course of the Energy Regulators Regional Association and teaches at the REKK Energy Economics course.

Monika Besenyei,
National University of Public Service

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My main focus is human factor and the role of education in the sustainability transition. Since I have participated in the Climate-KIC program (Decarbonizing Frankfurt PhD summer school) I am committed to the Multi-Level Perspective and Transition thinking methodology. My point is that technological and social transition can only work together. The energy transition difficulty is besides the technological lock-in, the social (etc.: cultural, policy making) circumstances. So my research focusing on the "software", the users of the system. Among the lot of social aspects my topics are the higher educational initiatives, and the competences needed for the successful career in the future.

Katalin Dobák,
ELMŰ Ltd. (DSO)

2007-2009	Andrássy Gyula University Budapest / International Economy and Business / International Entrepreneurships - Master of International Economic Relations
2011-2013	Szent István University / Faculty of Economics and Social Sciences / Postgraduate Professional Course on Climate Change Expert - Climate Change Expert
2009-	Department of Corporate Development ELMŰ-ÉMÁSZ Group (RWE) Job description: participation in the development of corporate strategy, preparation of the Board of Directors and the Supervisory Board submissions, CSR, renewable energy and energy efficiency project management, coordination of tendering.
2014-	PhD Programme / Corvinus University of Budapest / Faculty of Management and Business Administration / Department of Environmental Economics and Technology. Research area: Energy efficiency in heating and cooling

Zoltan Kapros,
Hungarian Ministry of Development

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Zoltán Kapros was born in Budapest (Hungary), on October 13, 1971. He graduated at the University of Miskolc, at the Branch of Energy Utilization and Furnaces of the Faculty of Metallurgical Engineering in Miskolc (Hungary), in 1996 as a MsC. engineer. He has post graduated as an economist at the University of Miskolc. He has got the PhD degree in 2017 from the Szent István University of Gödöllő (Hungary). The dissertation: "Autonomous and grid collaborative photovoltaic system optimization" is available at http://phd.szie.hu/?docId=15660. He is member by the International Solar Energy Society (ISES). His professional experiences: 3 years (1996-1999) as a project engineer by an engineering company. Main tasks: national and international projects on field of renewable energies and industrial energy efficiency. 5 years (1999-2004) as a research engineer by the Budapest District Heating Co. 7 years (2004-2011) as independent engineering expert (project preparations and implementations, creating studies and analyzes and energy engineering by an industrial medium enterprise). 6 years (2011-2017) as an advisor officer by the Hungarian Energy and Public Utility Regulatory Authority (energy efficiency, renewable energies, regional development). Since February 2018 he has worked as an advisor officer by Ministry of National Development, Department for Green Economy Development. His main priorities of works by the Ministry are the current energy efficiency policies in Hungary and the new EED. He is a governmental delegated member by the Energy Efficiency Directive Committee (managed by European Commission DG Energy) and the Energy Efficiency Working Party (managed by International Energy Agency).

Lajos Kerekes

Senior Research Associate, REKK, Hungary

Lajos Kerekes has been with REKK since 2010. He received his degree from the Budapest University of Economic Sciences in 1998. Before joining REKK he worked 8 years for the Hungarian Energy Office, where he gained extensive experience with the liberalization of the electricity and natural gas sector and headed the Department for Economic Analysis and Environmental Protection (2009-10). Lajos is an expert in regulatory issues of electricity, natural gas and district heating sector, and with REKK he has led several projects related to these fields. Besides his research and consulting activities he teaches Economics of Electricity Markets at the REKK Energy Economics course, and he is a regular instructor of ERRA trainings related to electricity, natural gas and water sectors.

Márton Zsótér, Infrastructure,

Energy and Utilities Advisory Services KPMG Advisory Ltd.

I have been working on the field of energy, e-mobility, transportation and infrastructure since 2012 as a consultant. Currently, I am part of KPMG's Energy, Infrastructure and Transportation Advisory practice as a Manager. I have gained relevant experience on several projects including energy efficiency, e-mobility markets, electric vehicle charging equipment deployment, transportation infrastructure, etc. I have also participated in several international projects in cooperation with other KPMG offices in the

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energy/transport sector. At KPMG Hungary, I am the lead expert and project manager in e-mobility.

ITALY

Marine Corneliseu
Energy network
Marine Cornelis is an expert and independent consultant in legal and policy developments regarding Energy, Consumer Protection, Energy Poverty and Dispute Resolution, at EU and international levels. She got into consumer protection and Alternative Dispute Resolution (ADR) through her 6-year experience as the Secretary-General of NEON, the Network of Energy Ombudsmen and ADR bodies. Marine was leading the association in its advocacy, lobbying and European public affairs activities. Prior to joining NEON, Marine worked as a complaint manager for the Belgian energy ombudsman and completed a traineeship at the European Parliament, as well as other work experiences focused on the variety of energy issues and public affairs. Marine was born in France, but she has lived in Belgium, Bulgaria and Hungary, and is currently living in Italy. She is fluent in French, Italian and English, and has good knowledge of Spanish and basis in Dutch and Bulgarian.

Giovanna Giuffrè
Project Manager at ISINNOVA, Institute of Studies for the Integration of Systems
Giovanna Giuffrè has been with ISINNOVA since 2008 and a partner there since 2010. Giovanna has worked on the research and management of several IEE, FP7 and Horizon 2020 projects. In her work on forward-looking projects, Giovanna has gained knowledge of trends and policy analysis, workshop facilitation and redaction of policy recommendations. These projects include BOHEMIA – Future scenarios for Research and Innovation policies in Europe, FRESHER – Foresight and modelling for European Health policy and regulation, FLAGSHIP - Forward Looking analysis of grand societal challenges and innovative policies, PASHMINA - Paradigm Shift Modelling and Innovative approaches, URBACHINA, and PACT - Pathways for Carbon Transition. Her previous experience includes working for networks of local authorities on European sustainable procurement projects (EUROCITIES) and for a network of non-governmental organisations (Medlink - Mediterranean links) on a project aimed at enhancing NGO cooperation in the Mediterranean area. Giovanna holds a law degree from La Sapienza University in Rome, Italy and has a master's in European Studies from the College of Europe, Warsaw.

Prof. Arturo Lorenzoni,
Professor of Energy Economics and Electricity Market Economics
Prof. Arturo Lorenzoni (1966) is professor of Energy Economics and Electricity Market Economics at the Department of Industrial Engineering of the University of Padova, Italy. His scientific interests are related to the technical, economic and regulatory aspects of the energy sector and to its overall efficiency, with particular attention to the electric power system, the utilities and the development of renewable energy sources.

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Since July 2017 he is vice- Mayor of the municipality of Padova, with responsibility on Urban Development, Mobility, Private Buildings, Digital Agenda, Disability and Independent Life.

Alessandro Luè
Poliedra, Politecnico di Milano
Alessandro Luè works at Poliedra, a research center of Politecnico di Milano. During his career, he pursued a multidisciplinary approach, with a Master in Environmental and land planning engineer and a PhD in Service Design at Politecnico di Milano, working as research associate at the Intelligent Transportation Lab at the Massachusetts Institute of Technology and as professor for the course "Methods and models for decision-making in transportation" at Politecnico di Milano.
He has been involved in national and international projects concerning decision aiding systems, multi criteria evaluation of infrastructures and plans, optimization models, innovative services for sustainable mobility, environmental and energy planning.
Among his activities, he is/has been responsible of the following projects: i) APPROVE (Advancing Public Participation and stakeholdeR engagement fOr the improVement of renewable Energy policies, Interreg Europe), Sharing Cities (H2020 Lighthouse Smart City and communities), PROMETEUS (PROMotion of EmobiliTy in EU regionS, Interreg Europe), INSPIRE-Grid (Improved and eNhanced Stakeholders Participation In Reinforcement of Electricity Grid, FP7).

Dr. Lorenzo Maggioni
Consortium Italian Biogas
Lorenzo Maggioni (male, Dr.) received his Ph.D. from the Faculty of Agriculture of Milan, with a thesis on Agricultural Ecology. He has an excellent knowledge of multifunctional agriculture and, in particular, of the production of energy from renewable sources. Since 2011 he is Head of Research and Development of Consortium Italian Biogas and he is an expert in the biomethane sector. In the last few years he led the projects "Boosting the European market for biogas production, upgrade and feed-in into the natural gas grid - the GreenGasGrids project" (IEE); BIOSURF (BIOmethane as SUstainable and Renewable Fuel); ISAAC (Increasing Social Awareness and ACceptance of biogas and biomethane) project and other regional projects (for example, "Development of best practice low emission into the atmosphere for the management and agronomic use of manure"; Lombardy Region). He was a board member of the NGVA Europe; member of the Working Group of the Italian Gas Committee "EU Mandate M475- biomethane"; of the Working Group "Research, Development and Statistics Surveys" of the Italian Ministry of Agriculture, Food and Forestry; of the Working Group for Biomethane of the "Consorzio Italiano Biogas". Currently he is participating in the Horizon 2020 project SABANA ("Sustainable Algae Biorefinery for Agriculture aNd Aquaculture"). He has participated, as a speaker, in numerous international conferences and workshops.

Alberto Pincherle
Associazione Italiana Economisti dell'Energia

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I am an energy expert specialized in energy efficiency, renewable energy, natural gas, energy policies and regulation. As a consultant, I have worked on energy efficiency, renewable energies, energy policies, energy regulation, transports, bio-fuels, natural gas, and regulatory issues for Public Institutions and Authorities as well as private clients, both in Italy and abroad (several EU countries, Brazil, Egypt, China, Georgia, Turkey and Thailand). I have published several articles and papers on environmental and energy policies, energy governance, energy efficiency, natural gas. On the same topics I held several presentations at national and international congresses, both at a national and EU level. I have a broad project management experience gained over a wide number of project management assignments in over 20 years. I cooperate in the scientific activities of the Italian Association of Energy Economist and I teach at university and in vocational energy courses.
After a full university degree obtained in Chemical Engineering (5 years), I obtained a II-level post-graduate Master on Management of Energy and Environment and a Certificate of Excellence qualification as Expert in Regulation of the Power Sector by the Florence School of Regulation. I'm a chartered Engineer and a qualified ISO 50001:2011 Energy Management System Auditor and ISO 14001/EMAS Environmental Management System. Born in Brussels, I speak fluently Italian, French, English and has a working knowledge of Brazilian Portuguese. My current focus of interest, both for research and consulting, lies in consumers' behavior, and in particular prosumage, demand-response and in general on how to motivate consumers towards a more energy efficient behavior.

Stefano Proietti
Project Manager at ISINNOVA, Institute of Studies for the Integration of Systems
Stefano joined ISINNOVA in 2002. With a degree in Political Science from La Sapienza University (Rome, Italy), he earned a European Master in Environmental Management (EAEME) in 1999. His professional experience includes employment at Brussels Institute for the Management of the Environment (IBGE), as part of the Information Society DG's project Ernet (European Recycling Network), a traineeship at the European Parliament in Brussels (Committee on Environment, Public Health and Consumer Protection) and a traineeship at the Association of Cities and Regions for Recycling (ACRR) in Brussels, where he focused on competencies of local authorities on taxes and tariffs for waste collection. He has contributed to several research and consultancy projects for ISINNOVA, such as METEOR, BEACON, BIOGASMAX, SPICYCLES, ECO BUILD, CIVITAS MIMOSA, QUEST, and BIOMASTER (as coordinator of the project).

Carlo Sessa
Leading Researcher at ISINNOVA, Institute of Studies for the Integration of Systems, Italy
Carlo Sessa holds a degree in Statistical and Demographic Sciences from La Sapienza University (Rome, Italy). Before joining ISINNOVA in 1983, he conducted research at NYU, where he worked with Nobel Prize winner Wassily Leontieff. He coordinated several EU research projects, in the 5th, 6th and 7th Framework Programmes, mostly in the fields of transport, environment and urban governance issues. In this context, he organised several

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participatory foresight exercises, raising citizens' awareness of sustainable urban development, transport and water management (RAISE, MOVE TOGETHER and AWARE projects). Carlo was also a leading researcher in the FP7 Social Sciences and Humanities projects PASHMINA, GLOBAL-IQ, and MEDPRO – Prospective analysis for the Mediterranean region.

NORWAY

Elisabeth Schøyen Jensen

Research Assistant, CICERO Center for International Climate and Environmental Research, Norway

Ms. Jensen holds a Master's degree in Sociology from the University of Bergen and Postgraduate Diploma in Science and Technology in Society (STS) from the University of Edinburgh. Her particular focus of interest is how knowledge is developed and used in politics and management. Methodically, she is qualitative and case-oriented. Her Master Project, "How to Create a Knowledge Base? - A journey in Norwegian government ", was an ANT-inspired case study of the case of mining operations in Engebøfjellet.

At the Center for International Climate and Environmental Research she participates in two projects: SHAREON - sharing economy - motivations, barriers and climate effects and ENABLE.EU.

Dr. Hege Westskog

Research Director for the Climate Transformation Unit, CICERO Center for International Climate and Environmental Research, Norway

Hege Westskog, PhD in economics is Research Director for the Climate Transformation Unit at CICERO. Her research interests are focused on the design of policy instruments. She has worked on the design of traditional economic instruments like emission trading and non-economic instruments like information to change behaviour. Her research on behavioural change is both theoretical and empirical, and conducted within interdisciplinary teams. Dr. Westskog has gradually focused her research towards being solution oriented resulting in an increased interest in using field experiment and transdisciplinary approaches in research. She experience from using both quantitative and qualitative methods and mixing those to provide a better foundation for the research conducted.

Arne Sandbakken

Nord-Østerdals Kraftlag

Projecting, sell and install solar PV for private houses, farms and industry. General consumer advice for use of energy. SmartHouse systems. I also work in a company with powerplants and powergrid.

POLAND

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Lidia Puka-Kjøde
Senior Research Fellow, Polish Institute of International Affairs in Warsaw, Poland
Lidia Puka-Kjøde is EU energy and climate researcher and a lawyer. She is a Senior Research Fellow at the Polish Institute of International Affairs in Warsaw. The main focus of her interest is development of the European energy markets and regulations. She is a graduate of the University of Warsaw, and University of Cambridge, a member of the Polish and the Norwegian Bar Associations, and "Energy Policy" reviewer.

SERBIA

Dr. Sanja Filipovic
EI - Economics Institute, Serbia
Sanja Filipovic is a senior research associate/full professor at the Economics Institute, Belgrade, Serbia. She received PhD degree in Energy Economics at the University of Belgrade, Faculty of Economics. She has strong expertise in EU energy policy and sustainable development. Fields of her professional interest are: electricity prices, energy vulnerability, enhancement of energy efficiency and green economics. She has been engaged on many national strategic documents and more than 60 projects prepared for the Government of the RS and international organisations (OECD, EC, WB, GIZ, etc.). Dr. Filipovic published 5 books and more than 80 scientific papers including and the leading international scientific journals (Energy, Journal of Cleaner Production). Her book "The challenges of the liberalisation process on electricity market" is used at master studies on University of Belgrade, Faculty of Economics and a few universities in the region.

Sanja Korać,
Local Community
I have many years of experience in the field of energy efficiency in local self-government. I am a licensed energy efficiency engineer. Within the software system, that our municipality possesses, there are 80 public facilities whose energy consumption is continuously monitored. The users of public facilities are obligated to input their energy consumption bills on monthly basis to the software system. All our facilities have energy certificates. We have also implemented energy management standard ISO 50001 among the first municipalities in Europe.

Dr. Branislava Lepotić Kovačević
Independent Expert for Energy Regulation, Serbia
Dr. Branislava Lepotić Kovačević is an energy lawyer. Her education in the field of EU law has been acquired in Berlin and Brussels, and in the field of energy law at the CEPMLP, University of Dundee, United Kingdom. She taught at the Faculty of Law, University of Belgrade.
For over twenty years she has been working in the field of energy on various expert and

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managerial affairs in the area of economic law and energy law. She was engaged and cooperated with government and regulatory institutions and bodies of the UN, the EU, the Energy Community, USAID, GIZ and others. She participated in drafting a series of legislation in energy sector in the region. Author of over 50 works in the field of commercial law, energy law, European Union law and other related fields of law.

Jelena Milosavljević,
Public Enterprise Electric Power Industry of Serbia /JP Elektroprivreda Srbije/
M. Sc.in Electrical Engineering and M. Sc. in Organizational Science, working in a field of energy, in the Electric Power Industry of Serbia for more than 20 years. Six years working experience in the Government administration, as an advisor in the Ministry of Mining and Energy and on multisectoral projects. Now engaged in the Electric Power Industry of Serbia as a Head of Regulatory Relation Division.
Areas of expertise: business development, smart grids, EU policy, energy, environment, strategic planning, regulatory relations, infrastructure project cycle management skills

Aleksandar Popovic
Ministry of Environment
I am a junior advisor in the Ministry of Environmental Protection, Department of Climate Change. Mitigation part of climate change is the key for preventing dangerous consequences of climate change in future and therefor reduction of GHG emissions from all sectors is important. Energy sector as the biggest emitter of GHG in Serbia, deserves more attention than other sectors, because of the huge potential of emission reduction. Sustainable energy uses in households lead to higher energy efficiency and less use of electricity and heat energy, which lowers the emissions. The workshop is a great opportunity to learn about new technologies and sustainable energy practices in order to formulate new energy policies and encourage people to save energy and reduce environmental impact.

Željko Zečević
Energy Consultant, RES Foundation, Serbia
Mr. Zečević has many years of experience in energy management and energy efficiency. He participated in establishing an energy management system in the local self-government Vrbas, which is well known in the region. In that system there are 80 public buildings, public lighting, district heating, water supply and transportation. Energy audits for all public buildings were carried out and energy certificates were created for them. Energy consumption is continuously being monitored with specialized software. The user of each public building has access to the software and enters its energy and water consumption on a monthly basis. Only with the help of low-budget and non-investment measures it has been managed to reduce energy consumption by 17% over the period 2010-2016. The implementation of the ISO 50001 system in this community (one of the first in Europe) is particularly noteworthy as an achievement.

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SPAIN

Marta Irene Feria Cerrada, Universirty of Comillas,
Delegate of the Junior members of Spanish Association for Energy Economics.
I received a Bachelor of Electromechanical Engineering and a M.Sc. in Industrial Engineering from Universidad Pontificia Comillas (Madrid, Spain). Currently I work at the Institute for Research and Technology in the area "Energy Systems Modeling". My research focuses on the development of modelling tools to support the analysis of electricity systems expansion and operation in a context of increasing penetration of renewables and regulatory uncertainty.

Alessandro Silvestri
Research Assistant, Basque Centre for Climate Change, Spain
Alessandro Silvestri joined the Basque Centre for Climate Change in February 2017 to work as research assistant on the ENABLE.EU project. Meanwhile he is conducting a Ph.D. at the University of the Basque Country.
Between 2014 and 2016 he has been collaborating with the International Center for Climate Governance (ICCG) as assistant in the Think Tank Map project.
Since November 2014, he holds a B.Sc. degree in Business and Economics at the Ca' Foscari University of Venice and, from August 2016, a M.Sc. degree in Spatial, Transport and Environmental Economics at Vrije Universireit Amsterdam.

SWITZERLAND

Professor Paul Burger
Head Sustainability Research Group, University of Basel, Switzerland

Head Sustainability Research Group within the University of Basel's Department of Social Sciences. Head of SCCER-CREST's work package 2 (https://www.sccer-crest.ch/) on change of behavior. Head of Directorate of Upper Rhine Cluster for Sustainability Research (https://www.sustainability-upperrhine.info/de/home/).
Expertise in governance of change (with a special focus on energy), in analyzing energy related behavior in households and its change with a focus on integrating socio-economic, psychological and social factors (cf. Burger et al. 2015 in Frontiers). Co-head of Swiss Household Energy Demand Survey (cf. Weber et al. 2017, CREST Working Paper). Lead author of CREST White Paper on non-monetary instruments for changing households' energy demand (only available in German). Special interest in segmentation (types of consumers), subjective quality of life criteria as determinants of behavior, social norms, and sufficiency.

UKRAINE

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Andrii Chubyk

Executive Director, CGS21– Centre for Global Studies "Strategy XXI", Ukraine

Andrii Chubyk is the Executive Director of the Centre "Strategy XXI", responsible for research and project activities. Master of Economic Sciences, graduated from the Ivano-Frankivsk National Technical University of oil and gas with area of expertise in business economics of energy complex. Mr. Chubyk participated at internship programmes in Bundestag (Germany), Delegation of the EU to Ukraine, WEASA (Poland), fellowships (Goerdeller College for Good Governance, V4 Think Visegrad), dedicated to energy sector development issues.

Expert and coordinator of projects for energy issues: energy sector developments in Ukraine, Europe and global, international energy policies and relations, unconventional hydrocarbons, energy transparency, energy security, energy efficiency and renewable energy. Member of the Multi-Stakeholder Group of Interested Parties on implementation of the Extractive Industries Transparency Initiative in Ukraine, expert and advisor to the platform "Energy Security" of the Eastern Partnership Programme.

Author of several research papers and articles on Ukraine-EU energy relations, including Eastern Partnership, Energy Community and Energy Union framework, energy security issues, promotion of energy efficiency and renewable. Fluent in English, German and Russian languages.

Dr. Vitalii Fylenko

Head of NEW Energy Public Organization, Ukraine

Specialization: Small and Medium Sized Self-Sufficient PV-H2 Alternative Energy Objects.

Coordinator of the Energy Efficient Village project (USAID 2014 SPA grant) and of the EU Energy Managers for the Eastern Mayors project (E4EM) in Ukraine (2013-2015).

Senior lecturer in the Department of Physics of Non-Traditional Energy Technologies and Ecology at the Physics and Energy Faculty with the V.N. Karazin Kharkiv National University.

Project coordinator in the A.N. Podgorny Institute for Mechanical Engineering Problems with the National Academy of Science in Ukraine

Mykola Hramazhora,

Precarpathian Foundation for Sustainable Development

Recently I joined the civil society activist team, as the researcher and expert, promoting regional sustainable development in different dimensions. I get experience in working with different stakeholders and target groups, providing support to the team and consumers. Now I'm engaged researching of energy efficiency and renewables' issues and I'm responsible for preparation of articles on energy efficiency and renewable energy in Ivano-Frankivsk oblast.

Oksana Ishchuk

Energy Analyst, CGS21– Centre for Global Studies "Strategy XXI", Ukraine

Analyst (energy security and international relations) in the Centre for Global Studies "Strategy XXI". Has over five years of experience in research of energy field. She is involved in the Enable.eu project as a junior expert (energy studies) of the CGSS21. Her focus of

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research is focused on energy sector of Ukraine and Europe, mainly oil and gas sector, global energy market, energy efficiency and alternative energy sources. Before, she had participated as a junior analyst in the projects financed by the European Commission and International Renaissance Foundation, devoted to monitoring of resources and finance flows from exploration of conventional and unconventional hydrocarbons in Ukraine, establishment of the sovereign wealth fund based on the incomes of oil and gas production in Ukraine, etc. She is a co-author of several publications on energy security in Ukrainian and foreign journals.

Prof. Maksym Karpash
Vice-Rector for International Affairs, Professor at the Department of Energy Management and Technical Diagnostics, Ivano-Frankivsk National Technical University of Oil and Gas, Ukraine
Besides his academic position, Professor Karpash is consultant of Nordic Environment Finance Corporation (NEFCO) funded projects in Ivano-Frankivsk and Chernivtsi aimed at achieving energy-efficiency in public buildings. He participates in the development of sustainable energy action plans for Ivano-Frankivsk and a number of smaller municipalities and manages energy audits for a variety of consumers. Professor Karpash holds an expert position in a number of international energy projects, such as HETES (Tempus programme), Innover-EAST (FP7), BUSOZE (ERDF), etc. He is in the management of the Science City New Energy, where kids, youth and adults may get acquainted with existing and new energy phenomena, technologies etc. Focal area of the project is the role of energy in human life on different levels, from domestic use to global tendencies. Professor Karpash is holding seminars and trainings in energy-efficiency and RES and is a member of multi-stakeholder group (MSG) for the Ukrainian Extractive Industries Transparency Initiative (EITI). He is a local media expert (internet, newspaper and TV).

Dr. Yuliia Shyshko
Assistant Professor, Metallurgy Academy of Ukraine, Dnipro, Ukraine
Dr. Yuliia Shyshko is an Assistant Professor at the Industrial Heat-Power Engineering Department of the National Metallurgy Academy of Ukraine, Dnipro and a candidate of engineering science. Dr. Shyshko has defended a thesis on Energy saving technology of reception of fuel gas from biomass and its incineration in furnace units. Her scientific interests include the thermal processing of wastes of biomass and solar energy. At the Metallurgy Academy of Ukraine she reads a course in energy management. Participated in the German Programme on Energy Saving “EUREM “European Energy Manager”.

Dr. Andrii Yavorskyi
Associate Professor, Department of Energy Management and Technical Diagnostics, Ivano-Frankivsk National Technical University of Oil and Gas, Ukraine
Dr. Andrii Yavorskyi I combines teaching and professional activities in the energy field, such as lectures, laboratory and practical studies on energy efficiency, and renewable energy; seminars and trainings (energy saving, energy efficiency, energy audit, renewable energy). He is a participant in international energy projects (Building a more effective

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pathway leading from research to innovation through cooperation between the European Union and Eastern Partnership countries in the field of energy efficiency, The introduction of solutions using renewable energy sources and improving energy efficiency in the Tlumach region, Higher engineering training for environmentally sustainable industrial development). Dr. Yavorskyi conducts energy audits works for different objects, such as buildings, equipment, pipelines etc., as well as design and installation of small demonstration solar power plants. He is also a participant in research energy projects (Development of the new method to control the energy characteristics of natural gas, Development of Sustainable Energy Action Plan (SEAP) for Ivano-Frankivsk city). Consultant in international projects for improving of energy efficiency of cities.

UNITED KINGDOM

Sachin Babbar

Economist , Cambridge Econometrics, UK

Sachin Babbar is an economist within the energy-environment team at Cambridge Econometrics. His focus is vehicle stock modelling, data processing, data analysis and econometric estimation. He has contributed to two projects for the European Climate Foundation developing vehicle stock models to assess the impact of decarbonising; freight transport in EU28; and passenger transport in Poland, and a project for Transport & Environment calculating the net five-year fuel saving for European haulier of deployment of fuel-efficient technologies. He has also worked on a project for DG Justice assessing the benefits to prosumers of self-generation subsidies of renewable electricity and a project for the Transport System Catapult to calculate the impact of growth in Connected Autonomous Vehicles on the UK supply chain. In both these projects he developed an excel model to perform the analysis. Sachin's current projects include: estimating the value of imports and exports of renewable technologies in Member States for a DG Research project.

Ashley Frank Gordon

Policy Manager**,** Renewable Energy Association, REA, UK

Policy Manager at the UK's Renewable Energy Association (REA). Particular expertise in large scale power, grid and networks, and energy storage, from a policy and markets perspective.

The REA has helped inform and influence the development of renewable energy and energy storage policy and regulation in the UK and is a not for profit trade body organisation.

Dr. Daire McCoy

Research Officer, Grantham Research Institute, LSE, UK

Dr. McCoy's research focuses on energy efficiency and demand modelling, technology adoption, fuel poverty, and policy design and evaluation. He is currently principal investigator of a European Investment Bank funded project evaluating energy efficiency policy in the residential sector in the UK, France, and Germany. This is an LSE-led project

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involving colleagues at CIRED in Paris and DIW in Berlin.
He was a member of the Science Foundation Ireland (SFI) Sustainable Electrical Energy Systems (SEES) cluster from 2012-2016, a collaboration between engineers, economists and mathematicians, with significant industry and government involvement. Following this he was affiliated with the SFI Marine Renewable Energy Ireland (MaREI) Centre, a cluster of key academic and industrial partners dedicated to solving the main scientific, technical and socio-economic challenges related to marine renewable energy. He holds undergraduate and master's degrees in Statistics and Economics, respectively, and a PhD in energy economics. Prior to joining academic he worked as Head of Finance for First Mile in London and in Client Financial Management for Accenture in Dublin.

Rosie McGlynn
Director, Independent Consultancy UK
I have over seventeen years' experience in the energy industry and have a deep understanding of the UK policy and regulatory framework. I have programme managed smart metering projects which involved developing insight into consumer protection legislation, data privacy legislation as well as the commercial and regulatory framework. I led technological work streams to develop low powered radio solutions as well as an accessible in home display for blind or partially sighted people. I set up a new division to develop strategic positions on the options for decarbonising heat and transport in the UK. I engaged directly with vehicle manufacturers and electricity network operators to progress understanding into the impact of electric vehicles onto the network. I led engagement with multiple stakeholders for the options for decarbonising heat including assessing options for customers who are off the gas network. This is a crucial area for innovation especially in high density urban areas and low density rural areas. I have progressed work on the different business models needed to support a heat services market.

Amy O'Mahoney
Ofgem
Amy is the Head of Research and Horizon Scanning in Ofgem's Office of the Chief Economist. In 2016/17 the team undertook a large horizon scanning project to understand better the impacts of energy system change. Building on this work, the team launched a Research Hub in September 2017, to establish Ofgems' research priorities, develop Ofgem-led research reports and engage more effectively with external research and academic institutions. Amy's team have produced reports looking at transport and heat decarbonisation, the future energy consumer, regulating in uncertainty and local energy; future projects will consider information asymmetry in regulated markets and how large commercial consumers might respond to price signals.
Amy has published several academic papers relating to issues in energy markets in journals such as Energy Policy and Renewable Energy. She has a PhD in Economics from Trinity College Dublin and a M.Sc. and B.Comm from the National University of Ireland, Galway.

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Jon Stenning

Associate Director, Cambridge Econometrics, UK

Jon Stenning is an associate director at Cambridge Econometrics. He specialises in distilling complex economic and econometric analysis into policy-relevant messages across a number of fields. He has eleven years' experience managing and delivering projects for a wide range of clients and presenting technical content to both technical and non-technical audiences. Recent studies that Jon has led include designing and implementing scenarios modelling the macroeconomic and welfare impacts of large-scale renewables deployment for IRENA, developing circular economy indicators for London for the London Waste & Recycling Board, assessing the links between production, the environment and environmental policy for the European Commission (DG Environment), measuring the impact of UK government policy on household energy bills for OFGEM, assessing the potential for future emissions reductions within Europe's passenger car and HGV fleets and modelling the macroeconomic impact of technology deployment on emissions from road transport in individual Member States, including Poland, Italy and Spain (all for the European Climate Foundation) and an assessment of energy efficiency trends in the Swedish transport sector, for the Swedish Energy Agency.

Stijn Van Hummelen

Project Manager, Cambridge Econometrics, UK

Stijn Van Hummelen works in the modelling team at Cambridge Econometrics. As Project Manager he manages and delivers CE's contribution to consultancy and research projects in the fields of innovation, climate, energy and the circular economy. Stijn manages CE's inputs to the H2020 MONROE project and has developed a strong familiarity with the E3ME model. He is also working on assessing specific energy transitions in renewables (for IRENA) and electric vehicles (for the European Climate Foundation). Stijn has over 8 years of experience successfully conducting policy research for several government bodies, think tanks and development agencies, such as the UNDP, the Belgian Development Agency and the Foundation for European Progressive Studies. Before joining CE, he worked as Senior Economist for a London-based economics consultancy, conducting analysis and contributing to technical, conceptual and financial project work.

Anna Wieckowska,

Hitachi Europe Ltd. (currently being supported by EU - Smart Energy Islands)

My background is in environmental policy and my experience includes both customer behavior research and practical demonstration projects involving the rollout of low carbon heating, demand response and generation technologies in the UK. I have also worked with Local Authorities in the UK developing carbon reduction plans for their local areas and advising on change management and embedding of low carbon cultures within their organisations.

My role within Hitachi Europe involves developing propositions combining technology and business model innovation to enable our clients (Local Authorities and Communities) to achieve their objectives of more affordable and sustainable energy supply.

I am currently leading the commercial modelling work package on the Smart Energy

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Islands project on the Isles of Scilly which aims to develop business models and customer propositions promoting the adoption of low carbon technologies, individual and community prosumption models, and improving the affordability of electricity on the islands.

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