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# WHY Skills Workshops Summary Report

26-28th of October 2021 | EMP-E Conference | Online

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## Introduction

The [WHY project](#) is a Horizon 2020-funded research project, aiming to improve the representation of household electricity demand in Energy System Models (ESMs). While ESMs have traditionally provided useful supply-side results, they lack the degree of accuracy necessary on the demand-side, especially in the residential sector. WHY's aim is to develop a new Causal Model combined with an innovative profiling approach to analyse human decision making in energy consumption and human reactions to energy policy changes. The innovative methodologies for load forecasting contribute to the WHY toolkit, used to assess several scenarios around different policy measures. Therefore, WHY will contribute to a holistic understanding of household energy consumption and improved demand modelling.

The WHY project's objective of providing a better understanding of residential electricity demand from the single user to the European level helps to improve policymaking processes, operation and planning of the energy system, assessment of energy consumption trends, ensuring legitimacy and relevance of the WHY outcomes to policy, society, and enterprise. To accomplish this, WHY highly values stakeholder input by building on co-creation, co-design, and collaborative use case development. To optimise impact of the WHY project, ambitious dissemination, communication, and capacity building activities will be implemented, such as summer schools and online teaching materials.

Due to the COVID-19 pandemic and related administrative burden, WHY's intended 2021 Summer School could not take place as a traditional, physical course on the University of Deusto campus. As an innovative alternative, WHY organised an interactive, education-based workshop series as a supplementary addition to the annual [Energy Modelling Platform for Europe \(EMP-E\)](#) Conference. This "WHY Skills Workshop" idea was developed to offer hands-on skills training for aspects of energy systems models to appeal to students and current energy modellers alike.

## Approach & Agenda

The 2021 EMP-E Conference was coordinated by the [SENTINEL project](#) and took place from Tuesday, October 26 - Thursday, October 28, as a virtual conference of energy modellers in Europe. The EMP-E Conference's theme, ["Re-energising Sustainable Transitions in Europe: Energy System Modelling, Methods & Results to support the European Green Deal"](#) aimed for a deep exchange of research and practice, with discussions around energy system modelling, methods, approaches and experiences of the European energy modelling community. The 2021 EMP-E served as a forum for exchange among researchers across Europe from H2020 projects and European Commission representatives, as well as industry and civil society partners. Each day of the conference revolved around different themes. Day 1 was "Policies and Targets" for 2030, 2050, environmental policies and post-COVID recovery. Day 2 focused on "Linking Sectors and Technologies" to integrate the building sector, smart technology, digitalisation input and technological diffusion. Finally, Day 3 tackled "Modelling-specific issues" such as promoting transparency, collaboration, and capturing social and behavioural change in models.

Nine skills workshops were developed for the EMP-E to provide further interactive expertise to participants. Divided into the three tracks: “Introduction to ESMs”, “Advanced modelling techniques”, and “Quality aspects”, the skill workshops ranged from technical skills like programming energy system models, business model development, to scenario design, social engagement and behavioural outcomes. These 90-minute skills workshops complemented the EMP-E’s 2021 programme, occurring after the opening day sessions and kicking off the morning sessions on the second and third days.



TRACK 1: Intro to ESMs	TRACK 2: Advanced Modelling Techniques	TRACK 3: Quality Aspects
Day 1: October 26 from 16:00 – 17:30		
<b>Energy System Models: Basic Principles and Concepts</b>	<b>High resolution time series processing</b>	<b>What Energy System Modellers should know about open data and software licenses</b>
WHY (E3M/RGI)	WHY (GoiEner/UD)	openmod (Robbie Morrison)
Day 2: October 27 from 9:00 – 10:30		
<b>How to set up a scenario for energy system modelling</b>	<b>Technical possibilities vs. Economic Feasibility: The issue of viable business models for innovative technologies</b>	<b>Communicate and inspire: How to convince with a pitch</b>
WHY (TNO)	WHY (4ER)	WHY (Climate Alliance)
Day 3: October 28 from 9:00 – 10:30		
<b>Hands-on session with the Calliope ESM Framework</b>	<b>How to model citizens’ behaviour</b>	<b>EnerMaps: Open-access Energy Data and Calculation Modules</b>
SENTINEL (TU Delft/ETHZ)	WHY (UD)	EnerMaps (e-think)

The WHY Skills Workshops were perceived as a success, as participants experienced both unique and practical insights about the structure, techniques and social contexts of ESMs, digesting their components to lead to more optimised ESMs of the future. Compared to a physical learning course on a university campus, the participants were able to access the materials virtually, without travel and geographic constraints. The open-access registration system and broad marketing channels allowed for a diverse array of attendees and a larger magnitude of impact. The following pages present the key takeaways from the WHY Skills Workshops.<sup>1</sup>

<sup>1</sup> Video recordings and PDF presentations of the Skills Workshops are linked in each summary. For the video recording, please click on the image. For the PDF, click on the link in the captions.

## Day 1

### Energy System Models: Basic Principles and Concepts

Presented by Panagiotis Fragkos of E3 Modelling & Amanda Schibline and Andrzej Ceglaz of Renewables Grid Initiative

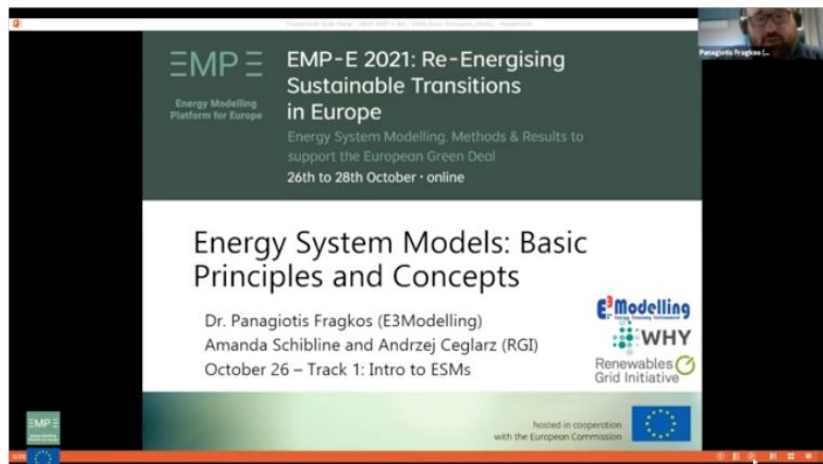
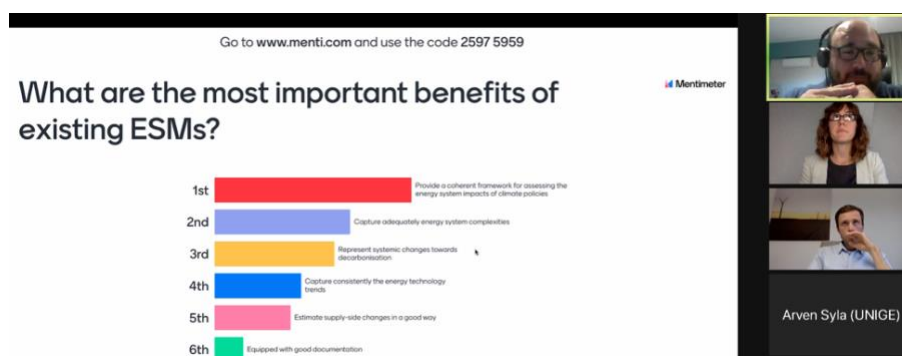


Figure 1: Title slide for WS01. To access the complete presentation, click [here](#)

This session set the stage to convey the fundamentals and basic principles of Energy System Models (ESMs) to a broad audience, from researchers and students from mathematical, economic and policy backgrounds. Divided into two themes, the first half introduced overview topics of ESMs, such as key principles, benefits, and shortcomings, and practical application of such models. The final half drew the link between ESMs and energy and climate policymaking, including recommendations on how to build an ESM and interpret results, model co-creation with stakeholders and critical insights into modelling trends and overarching challenges, especially toward modelling net-zero pathways.

In addition to learning how energy systems operate, participants gained expertise in different ESMs used by decision makers, analysing the most important modelling paradigms, and identifying linkages between climate policy and energy system developments. The workshop was successful in delivering concise and hands-on understanding of ESM principles that are relevant to experts and non-experts alike. By utilising interactive Mentimeter online polls, participants were able to interact and provide insights regarding the benefits and shortcomings of ESMs and the further challenges to consider when modelling net-zero energy systems.



## High Resolution times series processing

Presented by Carlos Quesada and Cruz Borges of Deusto University & Leire Astigarraga and Chris Merveille from GoiEner

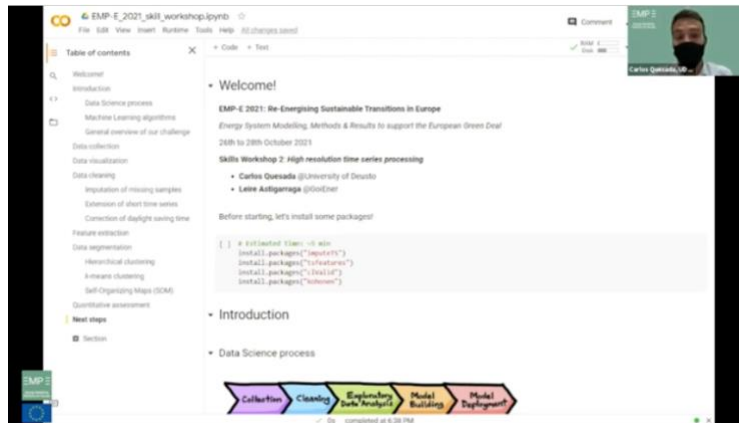
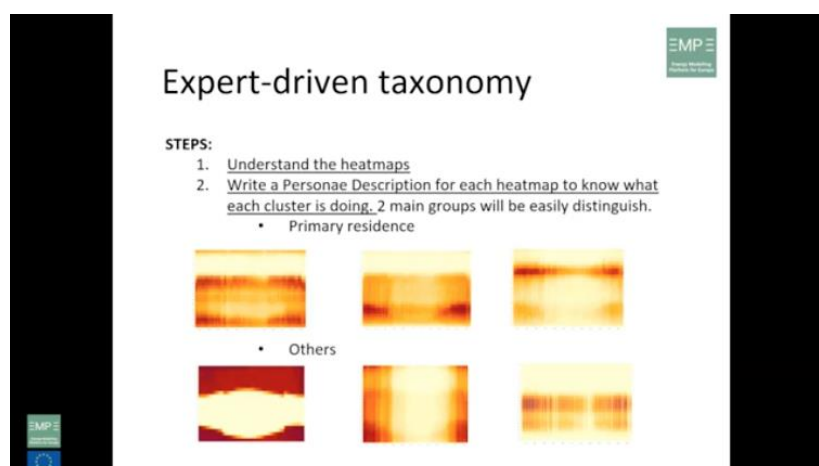


Figure 2: WS 02 Introduction. To access the complete presentation, click [here](#).

This session, designed for data scientists in the energy field, presented a methodology to assess high-resolution time series from smart meters in order to segment the population. Using Google Colaboratory to present the notebook, the presenters were able to explain a more in-depth, interactive approach.

Participants were able to follow along with the presenter and complete all phases of data processing, including data visualisation, data cleaning, feature extraction, data segmentation, quantitative assessment, qualitative results assessment of clusters to create a taxonomy, and finally, knowledge extraction to create household personas. This session used the programming language R.

Participants enjoyed learning about the data processing phases and gaining a general understanding of the basic steps to process big datasets and signify different behaviours of household electricity consumption.



## What Energy System Modellers should know about open data and software licenses

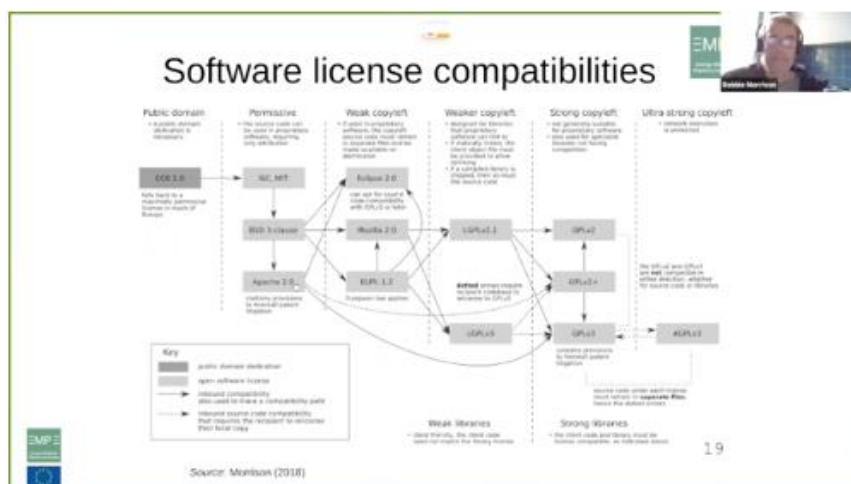
Presented by Robbie Morrison of openmod



Figure 3: Title slide for WS 03. To access the complete presentation, click [here](#).

This session investigated the legal aspects of open and closed modelling. The workshop first reviewed the default legal status of source code, datasets and databases. Additionally, the session discussed how open-source code, public licensing and the attributes of selected open licenses can facilitate transparency, inclusion and collaboration.

The session included interactive elements like quizzes that allowed participants to give some thought to the complex issues raised. A limited number of questions related to the legal context of data can imply that a structured knowledge of open data is missing in the energy system modelling community. In that context, the participants of the session were engaged and interested in the topic and appreciated the resource list of open-source lawyers and technologists shared by the presenter, especially since the modelling research projects tend to overlook this important element in ESM database management.



## Day 2

### How to set up a scenario for energy system modelling

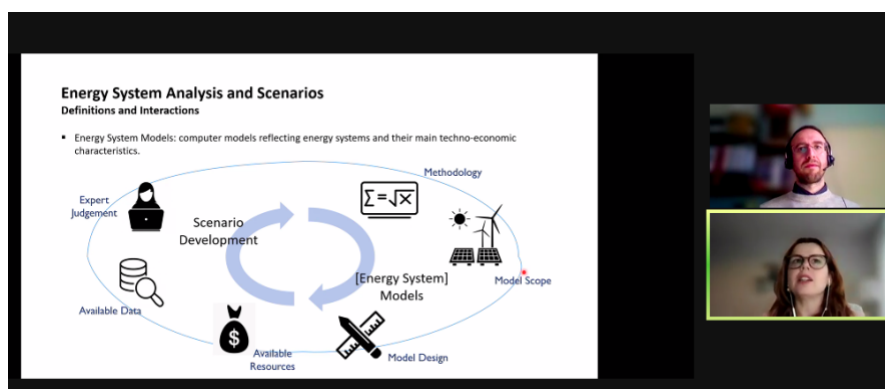
*Presented by Francesco Dalla Longa and Larissa P. Nogueira of TNO Energy Transition*



Figure 4: Title slide for WS 04.

This session discussed how to set up scenarios for energy system modelling, covering topics like how to build a consistent set of storylines, how to choose which parameters to vary, and how scenario-design can be optimised so as to establish a strong link between model outcomes and policy.

The workshop was divided into two modules – a theory-based lecture and an interactive exercise and discussion. The first module focused on setting the stage for participants who had differing levels of background knowledge. Integrating interactive exercises using Mentimeter was effective in encouraging lively discussions. The level of participation showed that there is a high level of interest about scenario development among the energy modelling community.



## Technical possibilities vs. Economic Feasibility: The issue of viable business models for innovative technologies – a modeller’s approach

*Presented by Thomas Nacht of 4ward Energy*



Figure 5: Title slide for WS 05. To access the complete presentation, click [here](#).

This session was geared toward researchers, experts and students from a technical background who are interested in how business models can be applied to technical simulation or optimisation models. Participants gained knowledge about business model development, using the business model canvas (BMC), value chains and their application to techno-economic simulation models.

There were several interactive components, utilising Mentimeter surveys to better understand the participants’ backgrounds. The presenter explained the harmonious benefits of including business models in technical simulations. Connecting the themes, the presenter highlighted a simulation model for photovoltaic (PV) generator sizing to indicate that technical parameters alone do not transfer to economic results.

A key message was that the BMC is most helpful when combining technical and economic models, especially when needing an answer to the question “who is the target for my actions?” After another interactive view of a technical simulation model describing the economic feasibility of PV generator sizes, the session concluded with a key message on the relevance of value chains in deepening technical models’ cross-sectoral and cross-company dependencies of economic parameters.



## Communicate and inspire: How to convince with a pitch

*Presented by Eva Suba and Masha Tarle of Climate Alliance*

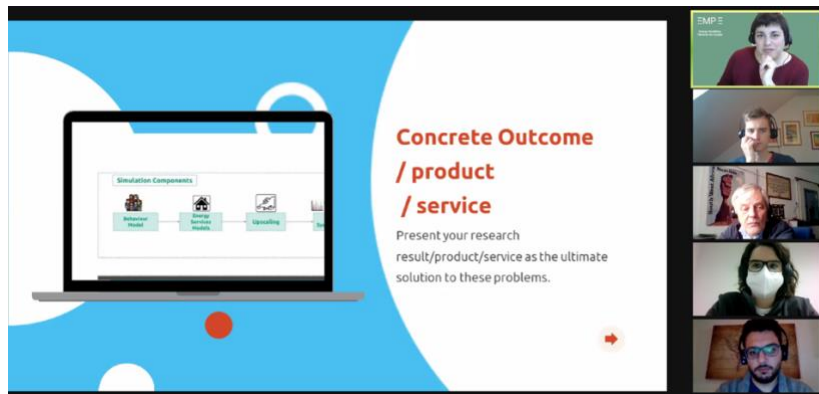
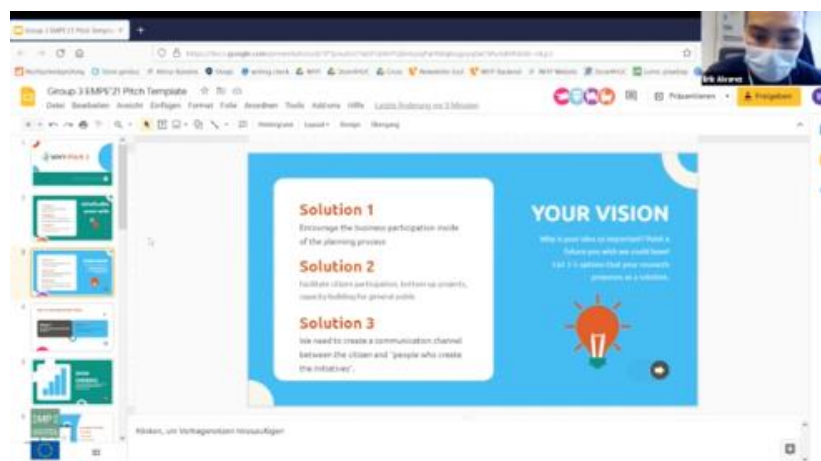


Figure 6: Concrete Outcomes slide. To access the complete presentation, click [here](#).

This session, aimed at young professionals, successfully showed participants how to improve their presentation skills to inform and inspire with your research results. The presenters showed the participants many tools to enable the researchers to have their results reach target groups ranging from potential investors, future collaborators and peers, or project leadership.

Participants learned tips about preparation, purpose, and delivery and further advice on how to effectively communicate their latest results in a concise and comprehensible way. The presentation structured around the art of presenting and the elevator pitch to explain the importance of communicating research or modelling results in a succinct, clear, and meaningful way.

The participants were broken into two smaller, moderated groups in breakout rooms, and had a limited time to collaborate to perform elevator pitches of their research result. The groups learned the challenge and importance of creating a clear and concise message when presenting research results.



## Day 3

### Hands-on session with the Calliope ESM Framework

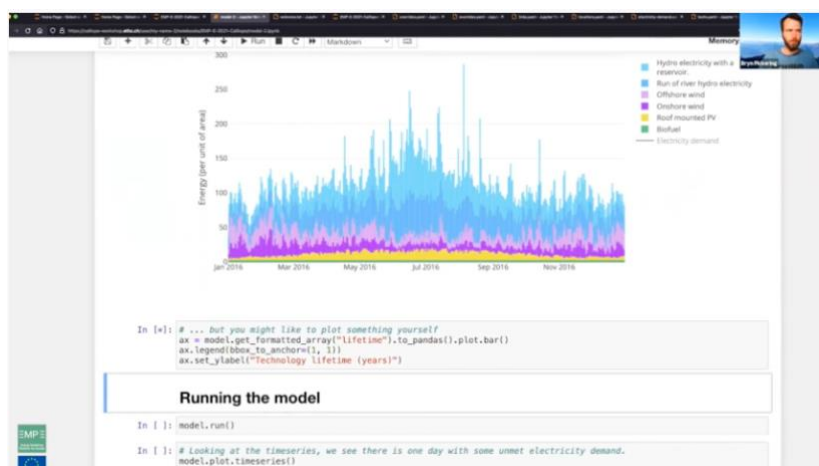
Presented by Bryn Pickering of ETH Zurich and Stefan Pfenninger of TU Delft



Figure 7: Title slide of WS 07.

This session provided participants with hands-on learning about the basics of high-resolution energy system modelling, while exploring energy planning and policy decisions. This highly interactive session allowed participants to set up, run, and analyse model results on their own devices using Jupyter Notebooks. Participants needed prerequisite knowledge of the Python programming language, and the JupyterHub software for the Calliope model needed to be installed to allow for the collaborative participation.

Participants were able to interpret inputs of the Calliope model, create a model based on energy supply and demand datasets, and compare model outputs. Finally, participants gained understanding about how energy system models balance demand and supply in a complex system. The interactive computational environment allowed participants to explore the tool at their own pace, and there were guides to help answer questions when necessary. Overall, the participants' feedback was very positive, and the high level of interaction was appreciated.



## How to model citizens' behaviour

Presented by Armando Aguayo and Diego Casado-Mansilla of Deusto University

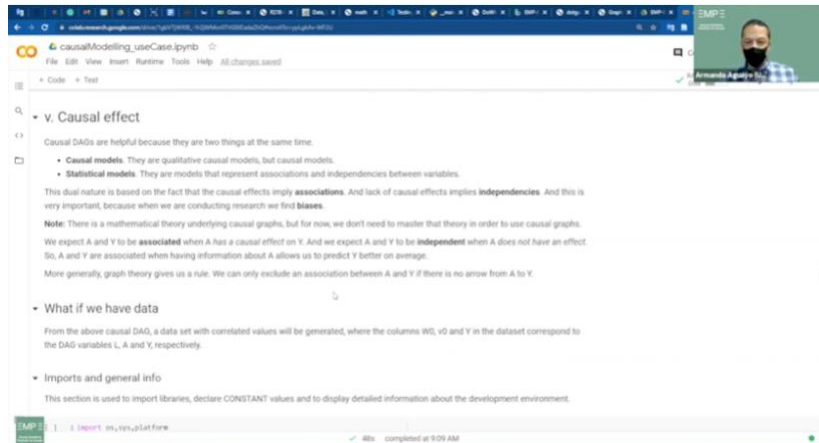
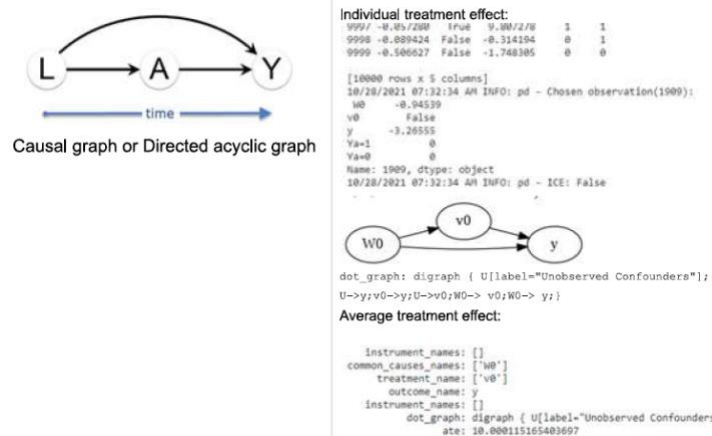


Figure 8: WS 08 Introduction

This session was geared for researchers and anyone interested in learning about causal models from qualitative and quantitative aspects. Participants needed prerequisite knowledge of the Python programming language, and Google Colaboratory was used to provide hands-on application. From this, participants were able to learn how to build and use practical causal models to extract knowledge from experts and exploit a causal diagram to better improve decision making.

Utilising interactive examples, the presenters introduced causal modelling through the lens of scientific controversies to show how causal graphs help in understanding the problem and expert knowledge. Ultimately, the use of causal graphs allows participants the ability to resolve controversies and help think about the problems better.

The design of the workshop continued with the performance of a step-by-step randomised trial. First, the trial generated random data, then continued to generate a causal graph, causal assumptions estimating the measured average causal effect (ATE) and completing with the evaluation of assumption.



## EnerMaps: Open-access Energy Data and Calculation Modules

Presented by Giulia Conforto, Marcus Hummel, Bernhard Mayr of e-think & Alessia Bardi, Gina Pavone of OpenAire & Eric Wilczynski of Eurac Research

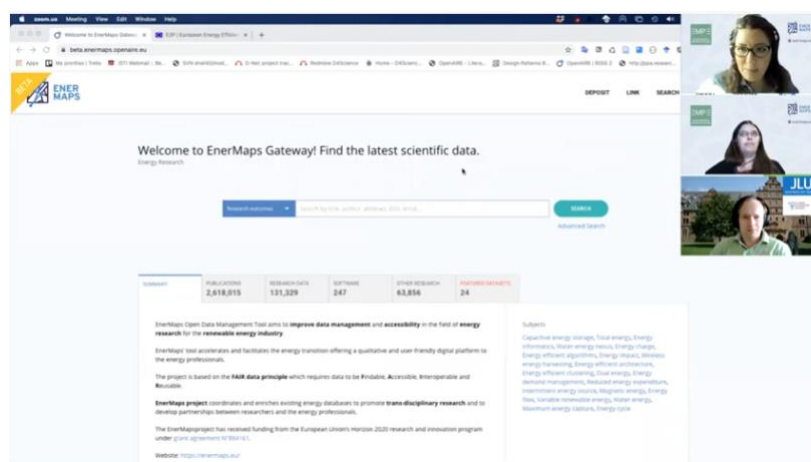


Figure 9: Title slide for WS 09. For the complete presentation, click [here](#).

This session, aimed at energy researchers, students, energy industry and public administrations with various levels of modelling experience, taught participants how to improve data management and accessibility of energy research for the renewable industry. Participants learned how to find open-access publications, FAIR (findable, accessible, interoperable, and reusable) data, and quality-checked datasets, on the [EnerMaps Gateway](#), and re-use them in open-access Calculation Modules on the EnerMaps Data Management Tool, the Hotmaps Toolbox or on own modelling systems.

The session had many interactive elements, including polls to better understand the audience and their skill level and to introduce the concepts. The poll results revealed that participants believed that sharing the data and the data management plan were the most difficult things in open science. In addition, the skills workshop broke into two breakout rooms to allow for practical application of the project tools – the EnerMaps gateway and open-access calculation modules through Hotmaps.

### Breakout room 1: EnerMaps Gateway





Feedback from our presenters also bestowed many important insights on what succeeded this year and what could be further improved if future skills workshops continue at the EMP-E conference. Principally, the organisation of the workshops was applauded, appreciating the level of communication and planning resources.

The main constructive feedback was that the projected audience for skills workshops and the actual attendees was quite different, which made the planning of the presentations a challenging task for the presenters. The COVID-19 pandemic has required conference events to go virtual, which brings pros and cons. On the one hand, it is accessible for many more people to register, attend, and potentially gain knowledge from the workshops. On the other hand, historical attendance of registrants who sign up for virtual events is considerably low – between 30-50%. For free, virtual events in 2021, this number is oftentimes even lower, with virtual event fatigue becoming a significant factor. For future skills workshops of this type, follow-up communication with registrants beforehand and conveying a more realistic expectation of attendee numbers to the workshop presenters would ease this issue.

*Table 1: Registrations vs. Attendees of WHY Skills Workshop at the 2021 EMP-E Conference*

Skills Workshop	Registrants	Attendees
SW 01: Energy System Models: Basic Principles and concepts	158	56
SW 02: High resolution time series processing	69	20
SW 03: What Energy System Modellers should know about [open] data and software licenses	82	16
SW 04: How to set up a scenario for energy system modelling?	175	56
SW 05: Technical possibilities vs. Economic feasibility: The issues of viable business models for innovative technologies – a modellers approach	84	20
SW 06: Communicate and Inspire: How to convince with a pitch	55	15
SW 07: Hands-on session with the Calliope ESM Framework	63	14
SW 08: How to model citizen’s behaviour?	100	20
SW 09: EnerMaps: Open-access Energy Data and Calculation Modules	154	27

In addition, the presenters expressed a need to know the background of the attendees who signed up for the workshops, but this data was not able to be provided beforehand. Looking to the future, this information is very important for such hands-on, interactive event structures, especially when the level of expertise can vary so greatly. To improve this for the future, it is crucial to add required survey questions about participants’ skill levels, so that the presenters can have a better feel for who will be in the room well in advance, allowing for clear messages and more interactive elements to be weaved into the workshop.

In any case, a high level of the Skills Workshops concept’s appreciation and the interest of the next EMP-E conference’s organisers to include Skills Workshops into the 2022 event’s programme, creates a unique opportunity to make them a fixed element of the EMP-E conference and the WHY’s legacy to the European energy modelling community.

## Special Acknowledgment to the WHY Skills Workshop Presenters

	WS	Last name, First name	Affiliation	Country
1.	1	Fragkos, Panagiotis	E3 Modelling	Greece
2.	1	Ceglarz, Andrzej	Renewables Grid Initiative	Germany
3.	1	Schibline, Amanda	Renewables Grid Initiative	Germany
4.	2	Borges Hernandez, Cruz	Deusto University	Spain
5.	2	Quesada Granja, Carlos	Deusto University	Spain
6.	2	Astigarraga, Leire	GoiEner	Spain
7.	2	Merveille, Chris	GoiEner	Spain
8.	3	Morrison, Robbie	openmod	Germany
9.	4	Dalla Longa, Francesco	Netherlands Organisation for Applied Scientific Research (TNO)	The Netherlands
10.	4	Pupo Nogueira, Larissa	Netherlands Organisation for Applied Scientific Research (TNO)	The Netherlands
11.	5	Nacht, Thomas	4ward Energy	Austria
12.	6	Suba, Eva	Climate Alliance	Germany
13.	6	Tarle, Masha	Climate Alliance	Belgium
14.	7	Pfenninger, Stefan	ETH Zurich	Switzerland
15.	7	Pickering, Bryn	ETH Zurich	Switzerland
16.	8	Aguayo, Armando	Deusto University	Spain
17.	8	Casado, Diego	Deusto University	Spain
18.	9	Conforto, Giulia	e-think	Austria
19.	9	Hummel, Marcus	e-think	Austria
20.	9	Mayr, Bernhard	e-think	Austria
21.	9	Bardi, Alessia	OpenAIRE	Italy
22.	9	Pavone, Gina	OpenAIRE	Italy
23.	9	Wilczynski, Eric	Eurac Research	Italy

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