# Workshop Agenda

<table>
<thead>
<tr>
<th>Time</th>
<th>Wednesday, January 15</th>
<th>Thursday, January 16</th>
<th>Friday, January 17</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:30</td>
<td>Coffee &amp; Welcome</td>
<td>Keynote: &quot;Freedom through Open Source and Open Data – Licenses as a Condition for a Free Science&quot; by Till Jaeger (JBB Lawyers)</td>
<td>Keynote: &quot;Sustainability and Energy Data, Modelling &amp; Algorithms: Obvious partners?&quot; by Swantje Gährs (IÖW)</td>
</tr>
<tr>
<td>9:00 - 10:00</td>
<td>Coffee &amp; Welcome</td>
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<tr>
<td>10:00 - 12:00</td>
<td>Orga &amp; Get-To-Know</td>
<td>Tutorials / Do-a-thons</td>
<td>Tutorials / Do-a-thons</td>
</tr>
<tr>
<td></td>
<td>Keynote: &quot;Open Data and Modeling at the Danish Energy Agency&quot; by Ulrik Vølcker Andersen (DEA)</td>
<td></td>
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<tr>
<td>12:00 - 13:00</td>
<td>Lunchbreak</td>
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<td>Lunchbreak</td>
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<tr>
<td>13:00 - 14:00</td>
<td>Tutorials / Do-a-thons</td>
<td>Lightning Talks 2.1 / 2.2 (+ Energizer)</td>
<td>Tutorials / Do-a-thons</td>
</tr>
<tr>
<td>14:00 - 15:00</td>
<td></td>
<td>Tutorials / Do-a-thons</td>
<td></td>
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<tr>
<td>15:00 - 16:00</td>
<td>Poster Session 1 (+ Vitamin break)</td>
<td>Poster Session 2 (+ Vitamin break)</td>
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<td></td>
<td></td>
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<tr>
<td>16:00 - 17:00</td>
<td>Lightning Talks 1.1 / 1.2</td>
<td>Feedback &amp; Farewell</td>
<td></td>
</tr>
<tr>
<td>17:00 - 18:00</td>
<td>Wrap-up</td>
<td>Excursions</td>
<td></td>
</tr>
<tr>
<td>19:00 - open end</td>
<td></td>
<td>Community Dinner</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>at Villa Rixdorf</td>
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<td></td>
<td>Richardplatz 6, 12055 Berlin</td>
<td></td>
</tr>
</tbody>
</table>

**Location**

- Plenary (1st floor)
- Parallel sessions (2nd floor)
- Other locations
Contents

Workshop Agenda .......................................................................................................................... 1

Keynote Speeches .......................................................................................................................... 5

Using Open Modelling for Academic Policy Advice ................................................................. 5
Open Data and Modeling at the Danish Energy Agency ............................................................... 5
Freedom through Open Source and Open Data – Licenses as a Condition for a Free Science .......... 5
Sustainability and Energy Data, Modelling & Algorithms: Obvious partners? ......................... 5

Do-a-thon and Tutorial Sessions .............................................................................................. 6

Stream A: Skill Sessions (Room 2.61) ....................................................................................... 7
   A1: Introduction in Plotly Dash (Tutorial) ............................................................................. 7
   A2: Creating datasets from OpenStreetMap (Tutorial)....................................................... 7
   A3: Comparing approaches to create variable renewable generation timeseries (Do-a-thon) .... 8
   A4: Generating wind and PV feed-in time series in windpowerlib & pvlib (Tutorial) ........... 8
   A5: Test-driven development (Tutorial) .............................................................................. 9

Stream B: Open Models (Room 2.32) ..................................................................................... 10
   B1: OMEGAalpes Energy Model Generation Tool for Optimization (Tutorial) ....................... 10
       Transmission System (Tutorial) ..................................................................................... 10
   B3: Prêt-à-môdèle - Showcase your model (Do-a-thon) ...................................................... 11
   B4: Energy modeling with R and energyRt (Tutorial) ........................................................... 12
   B5: Acquisition and processing of European gas transport network data (Tutorial) .......... 12

Stream C: Other Sectors (Room 2.34) .................................................................................. 13
   C1: Battery electric vehicles time series (Tutorial) ............................................................ 13
   C2: Charging point distribution for energy demand in the mobility sector (Do-a-thon) ........ 14
   C3: Simulating thermal engineering applications with oemof.TESPy (Tutorial) ..................... 14
   C4: Thermal demand data (Do-a-thon) ............................................................................. 15
   C5: Modelling building retrofitting (Do-a-thon) .................................................................. 15

Stream D: Openmod Initiative (Room 2.30) .......................................................................... 15
   D1: A distributed data architecture for sharing energy data (Do-a-thon) ........................... 15
   D2: Improving reproducibility of research (Do-a-thon) .................................................... 16
   D3: Towards a common data standard for integrated assessment and energy systems modelling
       (Do-a-thon) .................................................................................................................. 16
   D4: Bringing CBC to the masses (Do-a-thon) ................................................................... 17
   D5: Improve our wiki - how to open up (Do-a-thon) ....................................................... 18
Stream E: Open Space (Forum)........................................................................................................................................................18
  E3: Create Interactive Visualizations and Applications for Energy Models with pure Python (Tutorial)..................................................................................................................................................................................18
  E.4 Let’s connect: how to model social aspects?..................................................................................................................................................................................19
  E.5 EV charging modeling. Code review + harmonize planning.........................................................................................................................19

Lightning Talks........................................................................................................................................................................................................20
  Session 1.1...........................................................................................................................................................................................................20
  Session 1.2.......................................................................................................................................................................................................22
  Session 2.1.......................................................................................................................................................................................................24
  Session 2.2.......................................................................................................................................................................................................26

Poster Sessions.......................................................................................................................................................................................................29
  Session 1...........................................................................................................................................................................................................29
  Session 2...........................................................................................................................................................................................................30

Excursions.......................................................................................................................................................................................................32
  50Hertz Transmission GmbH.............................................................................................................................................................................32
  Energy Museum Berlin.......................................................................................................................................................................................32
  EUREF Campus Berlin ....................................................................................................................................................................................33
Organizers

Sponsor

Venue

Hertie School of Governance, Friedrichstraße 180, 10117 Berlin (52.5128055, 13.3893204)

Getting there: The venue is located in the heart of Berlin. You reach it by public transport (U2/U6 to U-Stadtmitte or S21/S1/S3/S7/S75/S9 to S-Bahn Friedrichstraße)

Map: OpenStreetMap

Forum thread: openmod forum

Contact: openmod@wip.tu-berlin.de
Keynote Speeches

Using Open Modelling for Academic Policy Advice
Pao-Yu Oei (Technische Universität Berlin & German Institute for Economic Research - DIW Berlin)

Abstract: Results from publicly funded research (projects) should be accessible to the general public. As a consequence, public funding organizations have increased their request for open modeling and data practices within future research projects. Open models and data have to potential to be used and verified by numerous actors and provide a reliable source for policy advise. Complying with open data principles can therefore increase the understanding as well as the transparency and thus acceptance of particular research questions of political interest.

Open Data and Modeling at the Danish Energy Agency
Ulrik Vølcker Andersen (Danish Energy Agency)

Freedom through Open Source and Open Data – Licenses as a Condition for a Free Science
Till Jaeger (JBB Lawyers)

Abstract: Research and scientific work depends on free access to data and software as well as on collaborative creation of new works and databases. In many cases software and data are protected by copyright. Without a license model that permits a collaborative creation and distribution of works the scientific output can be invalidated. The talk explains the background of free licenses and how to use them.

Sustainability and Energy Data, Modelling & Algorithms: Obvious partners?
Swantje Gährs (Institute for Ecological Economy Research - IÖW)

Abstract: Building energy models, gathering energy data and programming algorithms for optimization or smarter use of energy often has the goal of an energy transition towards a fossil-free efficient and carbon neutral system. But sustainable digitalization even starts before: Sufficiency in data and local computing not only has an effect on energy consumption but also on the resources needed. The talk will give an overview on the different aspects and effects that influence sustainability as well as interesting initiatives and projects.
## Do-a-thon and Tutorial Sessions

<table>
<thead>
<tr>
<th>Stream A</th>
<th>Stream B</th>
<th>Stream C</th>
<th>Stream D</th>
<th>Stream E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skill Sessions</td>
<td>Open Models</td>
<td>Other Sectors</td>
<td>Openmod</td>
<td>Open Space</td>
</tr>
<tr>
<td>Room 2.61</td>
<td>Room 2.32</td>
<td>Room 2.34</td>
<td>Room 2.30</td>
<td>Forum</td>
</tr>
</tbody>
</table>

**Wednesday**

13:00-15:00

- **A.1** Introduction to plotly
- **B.1** OMEGAlpes Energy Model Generation Tool for Optimization
- **C.1** Battery electric vehicles time series
- **D.1** A distributed data architecture for sharing energy data

**Thursday**

10:00-12:00

- **A.2** Creating datasets from OpenStreetMap
- **B.2** Getting Started with PyPSA-Eur (Roomchange: now in Forum!)
- **C.2** Charging point distribution for energy demand in the mobility sector
- **D.2** Improving reproducibility of research

14:00-16:00

- **A.3** Comparing approaches to create variable renewable generation time-series
- **B.3** Prêt-à-modèle - Showcase your model
- **C.3** Simulating thermal engineering applications with oemof.TESPy
- **D.3** Towards a common data standard for integrated assessment and energy systems modeling
- **E.3** Interactive Visualizations and Applications for Energy Models with pure Python

**Friday**

10:00-12:00

- **A.4** Generating wind and PV feed-in time series in windpowerlib & pvlib
- **B.4** Energy modeling with R and energyRt
- **C.4** Thermal demand data
- **D.4** Bringing CBC to the masses
- **E.4** Let’s connect: how to model social aspects?

13:00-15:00

- **A.5** Test-driven development
- **B.5** Acquisition and processing of European gas transport network data
- **C.5** Modeling building retrofitting
- **D.5** Improve our wiki - how to open up
- **E.5** EV charging modeling. Code review + harmonize planning

### Tutorials

Tutorials are structured practical session in which participants get information and exercise on their computers. The aim of a tutorial is to learn an insight or a skill, e.g. on software, models or visualization tools. Each tutorial can take up to two hours and it mostly aims to improve personal skills.

### Do-a-thons

In Do-a-thon sessions (combine do and marathon), we aim to do (or better create) something together. This can be anything. A few examples are coding (packages, extensions), writing a
text, developing strategy and preparing the next Open Mod. In contrast to tutorials this format requires participants to contribute significantly more to the success of the session.

Stream A: Skill Sessions (Room 2.61)

**A1: Introduction in Plotly Dash (Tutorial)**
Chaired by Pierre-Francois Duc

What to expect: Very often data is conveyed to the public or shared with other researchers in the form of graphs. In the case of large datasets there is often many ways to visualize the data, which ultimately depend on the end-user interests or preferences. Plotly Dash is very handy for building data visualization apps with custom user interfaces in pure Python. Since Dash apps are viewed in the web browser, Dash is inherently cross-platform and mobile ready. The apps can be deployed locally or to servers. We will build a simple Dash app together.

How to prepare: follow these “getting started” steps

**A2: Creating datasets from OpenStreetMap (Tutorial)**
Chaired by Adam Pluta

What to expect: OpenStreetMap (OSM) is the largest open source project for georeferenced objects. Lately, its database has been proven to be a valuable asset in energy system modelling. However, the extraction and filtering of (large) OSM data can be challenging with the current applications available and online tools. In this beginner hands-on tutorial, we demonstrate a very easy way to filter and store OpenStreetMap data, with a newly developed python library. The library has been created within the SciGRID_gas project to filter and extract European gas transport data. However, it can be used for any kind of OpenStreetMap data by simply adapting the customizable filter expressions. Additionally, we can also cover some of the following points:

- Creation of a network from extracted OSM data
- More advanced network algorithms
- Legal situation of the OSM ODbL license
- Analysis of current gas transport data in OSM

You can check out our SciGRID_gas website 3 for additional information.

How to prepare: All information and data sets required for this tutorial will be supplied, in addition to the tools that are written in Python. Hence limited Python coding is required,
and each participant will need to bring a laptop with Python version of 3.6 or higher ready for use.

A3: Comparing approaches to create variable renewable generation timeseries (Do-a-thon)
Chaired by Severin Ryberg

What to expect: Variable Renewable Energy Systems (VRES) such as onshore wind, offshore wind, rooftop PV, and open-field PV will play an important role in our future energy systems, and as such, they are central in our current energy system design (ESD) activities. In order to effectively incorporate VRES technologies into these ESD models, it is necessary to create realistic VRES generation time-series profiles to then serve as ESD inputs. Since VRES performance is derived from the design and configuration of these systems (i.e. the capacity, rotor diameter, and hub-height of a wind turbine, or the tilt, azimuth, and chemistry of a PV system) in addition to transient weather phenomena, determining these input VRES generation profiles is far from a trivial exercise.

Fortunately, there are many openly available weather datasets and VRES simulation tools available to help us generate generation profiles for our ESD activities. It’s time we speak about pros and cons of each of these tools, compare them against each other, and, if enough common ground can be found, think about the possibility of merging similar functionalities. Examples of such models are: Atlite (wind, solar and hydro), gsee (solar), vwf (wind), windpowerlib (wind), PVLib (solar), SAM (everything)

Short introductions could be given for each model by those who are familiar with them. Afterward, we could compare the models against each other by performing some on-the-spot simulations, and rate them against measured generation data. If anyone has open validation data they would like to share, this would be greatly appreciated (the session moderators will also bring some). I can also bring weather extracts from MERRA2, ERA5, and COSMO for us to play around with.

How to prepare: bring your laptop

A4: Generating wind and PV feed-in time series in windpowerlib & pvlib (Tutorial)
Chaired by Birgit Schachler, Sabine Haas and Severin Ryberg

What to expect: Feed-in time series of renewables are the basis for all simulations of future energy systems. In this tutorial we would like to teach you in a hands-on session how to
generate wind feed-in time series with the windpowerlib, PV feed-in time series with the pvlib and finally regional Wind/PV generation profiles with various turbine/module designs and land-eligibility restrictions using RESKit. Apart from that, we show you the new features of the feedinlib, which serves as an interface between different weather data sets and renewables models and aims at automating the whole process of downloading weather data, converting it to the right format for different feed-in models and calculating the feed-in for given set of power plants. For demonstrations we will use jupyter notebooks and you will be able to explore the libraries yourself. Depending on the participants' interests we can focus on one of these libraries or part time equally between them.

For demonstrations we will use jupyter notebooks and you will be able to explore the libraries yourself. Depending on the participants’ interests we can focus on one of these libraries or part time equally between them.

How to prepare: bring your laptop with jupyter notebook

A5: Test-driven development (Tutorial)
Chaired by Pierre-Francois Duc

What to expect: Writing code is nice, but sharing it is even nicer. In order to ensure the written code do what it is supposed to, one can write tests. However, writing tests is a task that is often left for later and can become a daunting task once the code base becomes large and when there are deadlines to meet. This workshop will guide you through the philosophy of test-driven development which can be summarized by “Test first, code later”. Throughout the workshop we will experiment this philosophy on a very simple use case in python. The philosophy is nevertheless applicable to other programming languages which have test-suites.

How to prepare: We will work with python 3.6 or higher. You can already pip install the requirements from the test-driven-development/requirements.txt file from the [github repository](#).
Stream B: Open Models (Room 2.32)

B1: OMEGAlpes Energy Model Generation Tool for Optimization (Tutorial)
Chaired by Sacha Hodencq

What to expect: The session will first introduce OMEGAlpes, a linear optimization tool designed to easily generate multi-carrier energy system models. Its purpose is to assist in developing district energy projects by integrating design and operation in pre-studies phases. OMEGAlpes is open-source and written in Python (OMEGAlpes documentation). The modeling of an energy system with OMEGAlpes will then be described, before making the participants use the tool through a Jupyter Notebook interface on an actual use case.

How to prepare: Bring your laptop with Jupyter Notebook installed

Chaired by Fabian Neumann, Martha Frysztacki, Lisa Zeyen and Fabian Hofmann

Attention: change of rooms – this session will take place in the forum

What to expect: PyPSA-Eur is an open model dataset of the European power system at the transmission network level that covers the full ENTSO-E area (pypsa-eur.readthedocs.io). It contains alternating current lines at and above 220 kV voltage level and all high voltage direct current lines, substations, an open database of conventional power plants, time series for electrical demand and variable renewable generator availability, and geographic potentials for the expansion of onshore/offshore wind and solar power at highly resolved spatial and temporal scale.

It ties in data from a variety of sources using a configurable snakemake workflow to build a PyPSA model (pypsa.readthedocs.io) that is suitable both for operational studies and generation, storage and transmission expansion planning studies.

This tutorial session intends to get you started with confidently using PyPSA-Eur by:

- guiding through the different stages of the workflow,
- showing various configuration options,
- letting you explore pre-built models in Jupyter Notebooks, and
supporting you in installing the necessary environment and building your own model with custom settings (optional).

**How to prepare:** We will provide some installation instructions in advance of the tutorial session. Check the [thread](#) for more information. Some knowledge of Python (or similar programming languages), conda environments and Jupyter Notebooks is beneficial but not a prerequisite.

**B3: Prêt-à-modèle - Showcase your model (Do-a-thon)**

Chaired by Jens Weibezahn

**What to expect:** Six minutes of Lightning Talk are too short for you? A poster is not interactive enough? Join this Do-a-thon to show your open model to the community including a short demonstration. Depending on the number of models each could use a slot of up to 30 minutes.

- **POMATO (POwer MArket TOol)** is an **easy to use tool for the comprehensive analysis of the modern power market** (Richard Weinhold):
  
  It comprises the necessary power engineering framework to account for power flow physics, thermal transport constraints and security policies of the underlying transmission infrastructure, depending on the requirements defined by the user. POMATO was specifically designed to realistically model Flow-Based Market-Coupling (FBMC) and is therefore equipped with a fast security constrained optimal power flow algorithm and allows zonal market clearing with endogenously generated flow-based parameters, and redispatch. This presentation will introduce all core elements of POMATO and aims to illustrate its practical application as a tool to provide insights in the FBMC process.

- **Introduction to anyMOD.jl** - **A Julia framework for energy system modelling** (Leonard Göke):
  
  The Do-a-thon aims to give a practical introduction on how to use the anyMOD LINK framework. The framework was designed to facilitate the creation of large-scale capacity expansion models with multiple expansion time-steps, high-levels of intermittent generation and sectoral integration. The framework's key characteristic is, that all sets (time-steps, regions, energy carriers, and technologies) are each organized within a hierarchical tree structure. Participant will learn how a model and its parameter data is defined within the csv input files, then created and solved within Julia and how final results can then be evaluated. The focus will be on how to exploit anyMODs unique feature stemming from the hierarchical tree structure.

- **Introduction to R + energyRt** capacity expansion, **reference energy system optimization framework in R with example models** (Oleg Lugovoy):
Though R was initially designed for statistics, it is also known as powerful software for data handling, visualization, GIS, and much more. Any energy model requires data; solved scenarios is also data, which has to be processed, compared, visualized. So why don't develop energy models in R? energyRt is just another package for R which designed with a goal to spend less time for model building and do more research; it facilitates development of capacity expansion/planning model in R, solve it with a solver software, process results, visualize, and compare alternative scenarios. Integration with mainstream R-packages (tibble, ggplot, sp, and more) makes the research process time-efficient, integrates the model code with an analysis, makes it tidy, transparent, and fully reproducible.

B4: Energy modeling with R and energyRt (Tutorial)
Chaired by Oleg Lugovoy

What to expect: A hands-on session on developing energy system models and conducting analysis not leaving R, with examples from basic Utopia model (up to 11 regions, flexible multilevel time-slices, thermal generation, renewable energy sources, and endogenous grid) up to the large scale open models for US and India (up to 50 regions, 1 hour time slices, weather information from NASA, endogenous grid).

How to prepare:
To follow examples, install on your laptop recent versions of R (https://www.r-project.org/), RStudio (https://rstudio.com/products/rstudio/), GAMS (https://www.gams.com/download/license is needed) or GLPK (https://www.gnu.org/software/glpk/). Required R-packages and energyRt can be installed on the session or preinstalled (more installation details are here: https://github.com/olugovoy/energyRt). You can also try-out Utopia model (https://github.com/olugovoy/energyRt/blob/master/vignettes/utopia.Rmd) before the session and prepare your questions.

B5: Acquisition and processing of European gas transport network data (Tutorial)
Chaired by Jan Diettrich

What to expect: This is a hands-on tutorial, which will demonstrate how an open source gas transport network data set can be generated from different online sources. In the following, the necessary steps to unify data sets are discussed. Hence we will introduce and
demonstrate some of the tools, that allow the user to get access to the opendata and the copyrighted data, combine the data sources and use such data for their projects. The tutorial will start off with the introduction of the SciGRID_gas project, its aims and anticipated goals. This is followed by the introduction of the Non-OSM data sets in conjunction with the OSM data set. Then, two non-OSM data sources will be introduced and the following toolset will be introduced as part of the hands-on tutorial part:

● Using the (freely) open data supplied through the SciGRID_gas project
● Introduction of the copyrighted data sets and their web-location, and some background on the copyright legislation
● Demonstration of the tools generated on how to access data sets (hands-on)
● Introduction to the processes and tools that combine above data sets and generate a single gas network data set (hands-on)
● Introduction to some of the methods used to fill data gaps (hands-on)

The participants should gain some knowledge on the available gas network data sets, how to access and combine them, and will generate their own data set of a gas transport network, to use in their own models later on. For more background information please check the thread.

How to prepare: All information and data sets required for this tutorial will be supplied prior to the workshop (please see updates on the thread). In addition tools that have been written in Python will also be supplied. Hence limited Python coding is required by the participants, and each participant will need to bring their own computer, on which a Python version of 3.6 or higher is ready for use.

Stream C: Other Sectors (Room 2.34)

C1: Battery electric vehicles time series (Tutorial)
Chaired by Carlos Gaete

What to expect: Battery-electric vehicles (BEV) are increasingly being implemented all over the world. In general, BEV can help to decarbonise the transport sector, and at the same time provide flexibility to the power system. Various types of models are used to investigate such energy system effects. Meaningful time series of electricity consumption and the charging behaviour of BEV are key input parameters for doing such analyses, but are rarely available. We thus present the open-source tool emobpy which allows generating this data in a flexible and transparent manner: emobpy is a python tool that can create vehicle time series for battery electric vehicles. Three different time series can be created: vehicle
electricity consumption time series, grid availability time series and actual charging time series. The electricity consumption time series are created based on mobility statistics.

During the presentation, I am expecting:

- to show a brief presentation of no more than 15 minutes, on how the model works, showing diagrams and some exemplary results.
- to show how to install the library
- to present examples step by step on how to create the three different time series using Jupyter notebook; and
- to discuss how we can manage the time series files and also the visualization in plotly.

How to prepare: Before the event, I am going to create and provide the jupyter notebooks in the folder "examples" at the following repository: https://gitlab.com/diw-evu/dieter_development/emobpy

C2: Charging point distribution for energy demand in the mobility sector (Do-a-thon)
Chairied by Tim Röpcke

What to expect: We're developing a tool at the moment to generate time series for future energy demand of electric vehicle on the basis of statistical mobility data. In the next step we need to include specific locations of the charging points to meet the demands. In the session we would like to present you our current development and discuss with you possible solutions to find suitable locations for the charging points. The approach should focus on public charging points and locations on streets etc.

How to prepare: Please bring a laptop

C3: Simulating thermal engineering applications with oemof.TESPy (Tutorial)
Chairied by Francesco Witte

What to expect: TESPy (Thermal Engineering Systems in Python) is part of oemof and provides a steady state simulator for thermal engineering applications, such as heat pumps, thermal power plants or district heating systems. Every application is built up from basic components like heat exchangers, pumps, pipes, solar collectors etc. provided by the TESPy library. In this tutorial I would like to give you a "learning by doing" introduction to the
software. We will create a simple model and go into details regarding the model's parameterization and options available for our simulation.

**How to prepare:** Please bring a laptop with Python 3.5 or higher installed.

**C4: Thermal demand data (Do-a-thon)**  
Chaired by Oliver Ruhnau

**What to expect:** Exchange and work on the topic of “thermal demand data” (and related modeling). Potentially follow up on previous openmod discussions on this topic. Share experiences and discuss shortcomings with existing data. Compare existing datasets (characteristics and actual data).

**C5: Modelling building retrofitting (Do-a-thon)**  
Chaired by Lisa Zeyen

**What to expect:** Renovation of the European building stock is considered to be an effective tool to reduce energy demand. In this Do-a-thon I can present my approaches to model retrofitting potential in Europe and would like to exchange ideas/ discuss the following questions in particular:

- What data is available for the European building stock (residential and non-residential)?
- How is the data quality to be assessed?
- Which factors are important to model the savings potential on a country-wide level?

**Stream D: Openmod Initiative (Room 2.30)**

**D1: A distributed data architecture for sharing energy data (Do-a-thon)**  
Chaired by Carsten Hoyer-Klick

**What to expect:** In this session we would like to discuss how a distributed architecture of data bases for energy systems modelling could look like. We have a national funded project for the development and demonstration of a distributed data sharing architecture in energy systems modelling. If we want to be successful with such an approach, we need to be inclusive and want to reach out into the community to discuss our initial thoughts how
this could work. We want to learn your perspective and jointly improve our vision how this could look like, to develop something for the benefit of all.

D2: Improving reproducibility of research (Do-a-thon)
Chaired by Oleg Lugovoy

What to expect: A brainstorming session on how to improve reproducibility of research with open models. Assuming a model and data are open, how it can be reused, recalibrated for another country/region/sector with minimal time for new users and minimal required time spent by the model developers. Reproducing deep decarbonization scenarios is the aim of Open Decarbonization project. Open models with open decarbonization scenarios are welcome to be listed on the www.opendecarbonization.org website. As a starter, energyRt project is offering help to develop zero-emissions scenarios for five pilot countries or regions (first came, first served) to build understanding of the reproducibility requirements.

How to prepare:
Anyone who is interested in sharing their models/tools/analyses or recalibrating/applying existing open models for their own research are encouraged to participate the discussion. Please also bring your ideas how to make it more productive and time-efficient.

D3: Towards a common data standard for integrated assessment and energy systems modelling (Do-a-thon)
Chaired by Daniel Huppmann and Stefan Pfenninger

What to expect: It is clear from previous discussions that not only a common standard and potentially conversion tools between data formats would make sense, but also, multiple efforts are now starting up or underway to develop such standards and tools. Jointly hosted by the Horizon 2020 projects SENTINEL and openENTRANCE, the aim of this session is to coordinate ongoing efforts on common (or at least inter-operable) data exchange formats for energy system and integrated assessment (i.e., human-earth-climate systems) models/frameworks.

Background: There are multiple ongoing projects in Europe aiming to develop the technical infrastructure (e.g., online databases) and required data standards (i.e., templates and formats) to facilitate integration and model linkage across different frameworks and tools. Each of these projects includes several (up to a dozen) research teams across Europe, working with different methodologies, focusing on different sectors, and modelling varying
spatial and temporal scales. Within each project, the infrastructure and formats should enable efficient collaboration and data exchange while supporting the FAIR principles and open, collaborative science.

**Aim:** Compare currently used implementations of data exchange formats and determine the scope for harmonization and/or development of conversion tool across these projects.

**Definition/scope of “data exchange format”:** The discussion should encompass both the technical specifications and the application/implementation aspects, i.e.:

- Which file type is used?
- What is the schema structure?
- Example: in a tabular format, what are required/optional columns?
- What is the required scope?
- For example, are aggregates required to be included in the dataset, or is there an expectation that a user computes aggregates herself?
- What are the naming conventions (ontology) to describe the data?
- Example: for the spatial dimension, which region identifiers are used?
- Which metadata fields/tags are mandatory/optional?

The intended outcomes are:

- A brief session summary which can inform further work within the projects working on this topic, including the Horizon 2020 projects openENTRANCE, SENTINEL, and Spine, as well as the OpenEnergyDatabase and Open Power System Data.
- Establishment of an ongoing discussion forum for further exchange between interested parties working on related projects, similar to the Scientific Working Group on Data Protocols and Management of the IAMC.

**D4: Bringing CBC to the masses (Do-a-thon)**

Chaired by Bryn Pickering and Stefan Pfenninger (ETHZ)

**What to expect:** As will be made apparent in a connected lightning talk, the only viable open-source linear solver is CBC; GLPK is both too slow and inaccurate.

Installing CBC on OSX or Linux is straightforward, there are built packages for both on conda forge. However, many modellers still use Windows, and have to go through a relatively confusing process to get a CBC executable on their device.

We think CBC should be as easily accessible to Windows users as it is to everyone else (even though we actually only work on MacOS!). In this session, we’ll get down and dirty with the CoinCBC conda-forge recipe, with the aim of getting a Windows executable made available.
The intended outcome is simple: a pull request on the CoinCBC conda-forge feedstock repository containing the necessary code to make CBC easily available for Windows devices.

**How to prepare:** This session targets those with software development experience, particularly with regards to creating conda-forge recipes in which an executable is compiled from c++ code.

**D5: Improve our wiki - how to open up (Do-a-thon)**

Chaired by Berit Müller

**What to expect:** I think our wiki could be improved to first make the already existing knowledge better visible and I would additionally like to gather the existing knowledge of how to open up. Main Topics for the Do-a-thon would be:

- discuss representation and linking of already existing content of our wiki
- additions to the wiki to support institutes to become more open/ to implement an open source strategy

**Stream E: Open Space (Forum)**

**E3: Create Interactive Visualizations and Applications for Energy Models with pure Python (Tutorial)**

Chaired by Lukas Nacken

Scientists increasingly use interactive visualizations and simple analytical web applications (dashboards) to support publications and discussions, e.g. public debates, informed panel discussions or decision theatres. They allow analysts or decision makers to easily present, share and explore visualizations of model input or output data from anywhere (no installation requirements). As such applications increase the accessibility of model results or input data, they are a further step towards better transparency.

Examples of simple analytical web applications that already support publications and discussions:

- model.energy 1, pypsa-eur-30-animation 2, possibility-for-electricity-autarky-map 2, wind power potential, renewables.ninja, hotmaps, riskmeter, idea-dash, energy charts, kombikraftwerk-2-animation

This will be a tutorial on how to create simple applications with pure python - no javascript required - using plotly.express and dash. Plotly.express is to plotly.py what seaborn is to matplotlib. It is a new
productive visualization package, part of plotly since version 4.0. It provides a high-level interface for complex graphs (Medium announcement article). Dash is a python framework for building web applications, built on top of flask, react.js and fully compatible with plotly.py. For simple applications, you can create a user interface around your python code in a few hours and then share the app with others.

Proposed structure of the tutorial:

- What is plotly.express and dash?
- Demo of plotly.express and dash for energy data exploration
- Pros and cons of using dash for applications
- Create your own application in 30 minutes

How to prepare: It is recommended to have a look at the plotly with python tutorial by Bryn Pickering in advance.

E.4 Let’s connect: how to model social aspects?

E.5 EV charging modeling. Code review + harmonize planning
Lightning Talks

Session 1.1
*Wednesday 16:00-17:00 (Forum)*

1. Creating the Global Energy Data Commons
   *Johannes Friedrich*

With funding from the US National Science Foundation we are currently scoping out a partnership for the Global Energy Data Commons, an open knowledge network seeking to expand on existing efforts for collecting and sharing open data and collaborative research relevant to the electricity sector. Our team includes Duke University, WRI, NREL, and the Electric Power Research Institute. The grant is for an initial explorative phase in which we are seeking to learn about data collection and curation efforts. So this is to better understand lessons learned to inform the priorities for future data collections and enhanced data interoperability as well as clearly identify what value we can add and with whom we should coordinate or partner.

2. Climate from scratch: R-toolkit to implement meteorological records into energy modelling
   *Ekaterina Fedotova*

Meteorological data are essential for energy modelling, but are difficult to work with. That is why they are often replaced by the fixed climate parameters or reanalysis datasets. I will introduce an alternative approach based on the direct use of meteorological records. An R-toolkit has been developed to prepare the original observations data for implementation into energy modelling. The developed approach allows for spatial analysis and time-series construction. Both options ensure accurate calculation of the climate change and climate variability effects on the energy-related parameters.

3. Challenges in modelling energy systems environmental impacts
   *Cristina Madrid-Lopez*

Energy modelers make a great effort to synthetize in algorithms the diverse variables that will play an important role to forecast new energy scenarios. However some variables are difficult to model in algorithms, like the diffusion of new technological or management innovations and how these will affect the environmental impacts of the energy system. The Multi-level Perspective (MLP) framework provides a useful language to model these. In this talk, we highlight the main challenges energy modelers face in the introduction of these variables and how to frame them within the MLP.

4. Fitting energy models to the real world: Quantification of Technological Diffusion and Social Constraints with QTDIAN
   *Hannes Gaschnig and Diana Süsser*

The Objective of QTDIAN is to support a new open-source modeling platform for the European energy transition with an innovative model `library`. The library is ought to make models more realistic
regarding the feasible potential and diffusion speed of new technologies by the integration of socio-technical aspects and provision of future social storylines. The QTDIAN developers would like to present the concept and some concrete ideas to the community of the modelers. And to figure out in a discussion how the demand regarding such a model library would specifically look like.

5. Open Electricity System Modeling for Public Policy

*Ingmar Schlecht*

Why, and how, open-source models of electricity systems are used to inform and evaluate public policy decisions

6. Open data on a city scale

*Jakub Jurasz*

We are running a project which aims at developing an open database on various energy-related parameters on a city scale. I would like to initiate a discussion about reasonable sharing/constraints/regulations and the following.

7. High-resolution bottom-up modelling of community and productive electricity demand in rural areas of developing countries

*Nicolò Stevanato*

Expanding electricity access in rural areas of developing countries is a key priority because of its role of an enabler for economic activities and social development. The agricultural sector - and in particular the transition from rainfed towards irrigated agriculture - represents one of the most significant sources of potential demand, together with the provision of electricity to education and healthcare facilities. Yet, most electrification modelling has hitherto focused on the residential sector only, and little research has been carried out to assess the technology and investment requirements to satisfy these sources of potential demand and, in turn, the local income generation that they could enable. We introduce PrElGen, an open-source GIS tool currently under-development for processing databases that enable a truly bottom-up, device-based evaluation of the role that productive uses of electricity play in determining the best electrification strategy. The version here presented soft-linked to the RAMP stochastic electricity load generation model and the OnSSET spatial electrification tool.

8. Journal of Open Source Software JOSS: submit your projects and become a reviewer!

*Stefan Pfenninger*

9. Presentation of the initiative - International Energy Data and Modelling Hub (IEDM)

*Mentari Pujantoro*

Driven by the mission to shape the data-driven narrative and policy making towards a sustainable energy system, Agora Energiewende is kick-starting the ‘International Energy Data and Modelling Hub’ (IEDM). The vision of IEDM is to empower civil society organizations in bringing transparency and third-party analysis to the energy policy debate in major carbon emitting countries around the world. The International Energy Data and Modeling Hub combines access to up-to-date data, open-source tools
and understanding of local policies to make sense of data. IEDM aims to close the gap between policy makers and corporate interest that often have a privileged access to data and civil society organisation that do not.

Session 1.2

Wednesday 16:00-17:00 (Foyer)

1. Fair Energy Sharing in Local Communities: Peer-to-Peer Trading under Consideration of the Prosumer's Willingness-to-Pay

Theresia Perger

In this work, a model optimizing local energy communities (ECs) is developed. A set of different buildings who share electricity through the public (local) distribution grid is considered. In this case the peer-to-peer trading goes beyond the meter, in contrast to multi-apartment buildings. The goal is not to promote self-sufficiency, but to increase the share of renewable energy on a local scale.

2. The Information Bottleneck: A Theory for Deep Learning

Mahmoud Draz

Deep Learning (DL) offers solutions for complex problems such as natural language processing, speech recognition, image processing, and many others. This makes DL a promising tool that will influence the future of many industries. The high accuracy of DL results attracted the attention of many researchers, practitioners, and engineers. It's still a subject of discussion though how exactly deep neural networks work and why they deliver such good results. A consensus on an explanation among researchers and theorists has not yet been reached. Regarding this issue, the deep learning scene has divided into two main groups. The first group tries to find a mathematical explanation for the functionality of DNN while the other group focuses on improving performance through intuition and "trial and error" approaches. The Information Bottleneck (IB) method is one of the approaches that is proposed to explain the learning dynamics. The proposed talk focuses on investigating the limitations of IB theory.

3. Beyond near-optimal solutions: Spatially-explicit Practically-Optimal RESults (SPORES)

Francesco Lombardi

The rapid decarbonisation of energy systems requires informed planning decisions, yet the typical provision of cost-minimal configurations to support such decisions hides the existence of economically sub-optimal alternatives that might be more viable for local communities and other stakeholders. Spatially-explicit practically-optimal results (SPORES) allow to unveil such alternatives at the level of political units that hold legislative power on local renewable energy regulation. The application of the method to the decarbonisation of the Italian power system by 2050 shows that, while the cost-optimal configuration has unequal distribution of wind farms and relies on potentially problematic technologies (bioenergy, off-shore wind and batteries), a number of SPORES improve spatial diversity and deployment of such technologies, opening a wider space for policy decisions.
4. Integrating IAMs/ESMs with life cycle assessment

Chris Mutel

Building on previous work integrating the Ecoinvent database with REMIND and IMAGE, this talk describes an open international effort to create generic linking libraries and accompanying metadata to create prospective life cycle assessment databases for various IAM/ESM scenarios.

5. Improving reproducibility in energy systems analysis: Introducing FAME – a framework for agent-based models

Ulrich Frey

In energy system modelling, agent-based models and simulations (ABMS) are clearly a minority. Yet, they capture the behaviour of heterogeneous actors in a changing landscape of energy technologies, policies and regulations. However, development of ABMS does not follow any standards and often happens in isolation. Root causes are a) the lack of an existing common ABMS framework, b) the lack of transparency of existing models and c) the lack of rigorously validated ABMS in energy systems analysis. To address the first point, we introduce a framework for distributed agent-based models of energy systems (FAME) that might serve as a blueprint and common starting point for further developments. A common framework might be one step towards establishing standards in the community in order to bring together isolated approaches with different methodologies. Our framework distinguishes between the framework (FAME) itself and the design of the application that is built upon it (AMIRIS). It is developed in Java, uses almost no external software dependencies and is general enough to be adaptable to many problems in energy systems analysis. It is planned to be available as open-source and has various advantages. One is speed, since FAME can take advantage of parallel computing architecture. A second one is its ease of use, since FAME has a highly configurable interface and good user documentation. Its main goal is – by using a common, already existing framework – to reduce development time considerably, enhance reproducibility and facilitate comparisons between models.

6. A tale of two tests: Why GLPK should be considered harmful

Bryn Pickering

7. Model Coupling - Optimisation and Agent-Based Simulation

Geo Kocheril

Conceptual discussion about "Why and how to couple Optimisation and Agent-Based Simulation?". Would like to present the idea of coupling Oemof and ABM.

8. Analysing variable time series through the mathematical wavelet decomposition. A new methodology to quantify intermittency for different time scales: Day, weak, season

Arthur Clerjon

The rising share of Variable Renewable Energy Sources (VRES) in the electricity generation mix leads to strong constraints on the whole energy system. It especially raises technological issues to handle variability and to match the electricity load with supply at all times. As a result, new flexibility means such as dispatchable generation or electricity storage have to be set up. In this context, we developed a new
methodology to quantify the energy capacity that has to be installed to handle the intermittency at different time scales: from hours to seasonal variability. This lightning talk will show how a wavelet decomposition applied to the electricity residual demand can size a storage need in energy, power and use factor. Especially, it provides additional information compared to a Fourier series decomposition. France is taken as an example in a scenario of a large deployment of photovoltaic and wind farms power generation.

Session 2.1

Thursday 9:00-9:45 (Forum)

1. The cannibalization effect of variable renewables in wholesale electricity markets
   Javier Lopez Prol

I will briefly introduce a 3-year research project starting in January 2020 to assess the cannibalization effect (reduction of market value as penetration increases) of variable renewables in wholesale electricity markets with high wind and solar penetration. I will mainly use ex-post econometric models but I would like to explore the possibility of comparing them with other ex-ante models (e.g. investment and dispatch)

2. Assessing the PV technical potential at a municipal-level using Calliope: case studies in Portugal
   Guilherme Luz

This Lightning Talk will focus on the work developed in the context of H2020 project PROSEU (https://proseu.eu/), focused on the mainstreaming of RE prosumers. One of the objectives is to evaluate the impacts of various levels of renewable energy penetration, in particular of solar PV, at the municipal level. This assessment will be done using Calliope, an OpenMod optimization model, to support local stakeholders when designing local energy roadmaps. The main model inputs are demand data at the feeder-level and the characteristics of the local grid, both provided by the Portuguese DSO. We will briefly present our methodology when using Calliope and some preliminary results.

3. PerMod - Detailed but easy to parameterize simulation model for market available PV-Battery Systems
   Tjarko Tjaden

The open source Performance Simulation Model for PV-Battery Systems (PerMod) is developed to assess the energy efficiency of grid-connected PV-Battery systems. PerMod primarily focuses on the better comparability of the system efficiency of different products. In addition, PerMod can be used for detailed loss analyses and evaluation of different measures to optimize the overall system efficiency. Moreover, the model can be implemented in software applications for system design and component sizing purposes. In this lightning talk I want to focus on:

• the easy process to parameterize the model with data sheet information based on the measures of "Efficiency Guideline for PV Storage Systems 2.0"
• the importance of a simulation model to compare market available products
• the need to transfer our model from Matlab to Python

Model: https://pvspeicher.htw-berlin.de/permod/

4. „pyam“ - an open-source Python package for scenario analysis and visualization
    Daniel Huppmann

The open-source Python package „pyam“ [1] was initially developed to support the assessment of quantitative scenarios in the IPCC's Special Report on Global Warming of 1.5°C (SR15), and it was used to create many figures and tables in the report [2].

The package provides a number of tools for scenario validation, analysis, visualization and statistics. It can be used with any timeseries data conforming to the tabular format developed by the Integrated Assessment Modeling Consortium (IAMC). Multiple extensions like supporting continuous time formats and sub-annual time resolution (e.g., representative days/hours) are currently in development.

This talk will highlight recent feature additions to facilitate working with hierarchical spatial data: the package supports aggregation of timeseries across regions (optionally as weighted average) as well as downscaling of a timeseries provided at a regional level to subregions using a suitable proxy.

[1] https://pyam-iamc.readthedocs.io/

    Wilko Heitkoetter

In this work we developed an open data set for the residential heat demand in all administrative districts in Germany. Using a special evaluation of census data, more than 700 building categories were defined and heating capacity size classes were assigned. We determined the installed power-to-heat capacity by calculating the share of the heat load that is covered by heat pumps and resistive heating. Time series for the space heating and domestic hot water demand are provided with a temporal resolution of 15 minutes.

6. Vehicle Energy Consumption in Python (VencoPy)
    Niklas Wulff

The model-adequate description of power demand from hypothetic future plug-in electric vehicle fleets is a pre-requisite for modelling sector-coupled energy systems and drawing respective policy-relevant conclusions. Vehicle Energy Consumption in Python (VencoPy) is a tool that provides boundary conditions for load shifting and vehicle-to-grid potentials based on travel data. It was so far applied to the German travel survey (Mobilität in Deutschland) and some examples will be show-cased in the talk.

7. Power system impacts of cheaper batteries: insights from European open-source models
    Alexander Zerrahn
8. Waste heat recovery of an electro-intensive actor: going toward an open research facility
Sacha Hodencq

9. Modeling urban street lighting infrastructure using open source data
Alaa Alhamwi

The illumination of urban streets accounts to one of major growing burdens energy consumption and cities budgets. The global energy demand for street lightning is expected to increase by 80% by 2030 as it was in 2005. This lightning talk introduces a GIS-based open source model (FlexiGIS-light) to simulate road infrastructure in cities and calculates its electricity consumption taking Berlin as a case study.

Session 2.2
Thursday 9:00-9:45 (Foyer)

1. HotMaps: the open source mapping and planning tool for heating and cooling
Pietro Zambelli

In the talk I would like to present the open-source hotmaps platform, provide a general idea of the architecture, and how to add/extend the platform capabilities.

2. Paris Agreement Compatible Scenarios: Presenting the PAC project
Antina Sander

The PAC project – “Paris Agreement Compatible Scenarios for Energy Infrastructure”– has been established to develop a future energy scenario for Europe which is compatible with the Paris Agreement. The scenario, under development by civil society organisations, shall guide European energy infrastructure planning and help to ensure that we are planning and building the infrastructure necessary for a future low carbon, renewables-based energy system. The PAC scenario will be guided by three goals: - A 65% reduction in greenhouse gas emissions by 2030 - Net-zero greenhouse gas emissions by 2040 - 100% renewables in Europe by 2040 in all sectors

3. Enabling site-tailored Design of Integrated Water, Energy, and Food Systems through Open-source Software
Julian Fleischmann

Anthropogenic activity has had unprecedented influence on Earth’s natural systems. Above all, climate change and the unfettered consumption of resources threaten the very existence of humankind and the ecosystems that sustain life. In this context, the holistic approach to managing water, energy and food presents a profound opportunity. These vital resources are inextricably linked in what is known as the water, energy, and food (WEF) nexus. Software tools can be applied to model the WEF nexus and develop comprehensive solutions. While WEF nexus tools already exist for top-down decision-making and governance, they are not yet available at the local level. In the proposed project, local water, energy, and food supply options will be identified and evaluated to compile a database of WEF solutions.
Subsequently, a bottom-up WEF configuration and sizing tool for tailored WEF system designs will be developed. The AI-based optimization tool selects, connects and sizes suitable technologies of the WEF database considering local needs, onsite conditions and the long-term ecological footprint. Made accessible as open-source software and a mobile app, the tool will enable users to create site-specific plans optimized for economic viability and environmental compatibility. The goal and motivation of this project are to support the sustainable development of local infrastructure in a manner that meets human needs while preserving the climate and environment.

4. A spatial tool to prioritize policy intervention and tackle energy poverty
Luigi Bottecchia

Develop a tool for policy maker to guide them in the prioritization process of interventions. The tool merges spatial features together with technical and behavioural ones to try to represent the complexity of a human centric positive energy district.

5. Sharable tools and analyses for decarbonization
Oleg Lugovoy

While openness is pushing frontiers in energy modeling, the learning/ knowledge barriers are still high and require considerable investment of time to make use of the tools. Unfolding Open Decarbonization project (www.opendecarbonization.org) is aiming to lower the barriers by making open models and analyses unified, even more transparent, and usable for broader public – reproducing decarbonization scenarios for number of countries and regions in the shortest time. Further discussion of how-to speed-up dissemination of the tools is needed (see do-a-thon session D2).

6. Dynamic Model Validation in Microgrid Laboratories
Christina Vogel

We are validating the dynamic stability analysis software PowerDynamics.jl in the Tecnalia microgrid testlab. We would talk about challenges of model validation in an interdisciplinary field and how we approach them.

7. Aggregated Optimized System Controls for Microgrids
Frederik Banis

In future power systems Microgrids are expected to play a key role in order to facilitate the ongoing transition towards high penetration of distributed prosumptive units - system entities that are capable of both absorption and feed-in of energy, such as Electric Vehicles. In conjunction with the digital integration of these units optimized control strategies at the aggregation level allow for the introduction of new system services. In this talk I discuss some of these control strategies.

8. Status of Spine Toolbox
Juha Kiviluoma
Spine Toolbox is an open source modelling platform that tries to help modellers to handle the modelling workflow from the data sources to the results. The talk would show what is currently possible to achieve with Spine Toolbox.
Poster Sessions

Session 1
Wednesday 15:00 – 16:00

**open_MODEX** - Comparison of five open source frameworks for energy system analysis.
Sarah Berendes

**Promoting positive energy districts through a spatial tool for policy makers within the SMART BEEJS Project**
Luigi Bottecchia

**ENVIRO: An in-development module to assess sustainable energy transition scenarios**
Laura Talens Peiró

**A new scenario resource for integrated 1.5°C research in the context of climate change and sustainable development**
Daniel Huppmann

**SpineModel – An approach for a generic open source Energy System Model Generator**
Maren Ihlemann

**Can Poland match 1.5 °C IPCC pathways in the electricity sector?**
Pawel Czyzak

**Extracting General Decision Rules for Smart Home Energy Management Systems (SHEMS)**
Lissy Langer

**SciGRID_gas: A Topological Open Source Model of the European Gas Transport Network**
Jan Dasenbrock

**Simulation Model for Optimized Operation and Topology of Hybrid Energy Systems - SMOOTH**
Laura Wienpahl

**Application of the R toolkit to quantify climate effects on heating demand and cogeneration efficiency in Russia**
Ekaterina Fedotova

**elvis: A planning and local management tool for electric vehicles charging infrastructure**
Mahmoud Draz

**Regionalised Heat Demand and Power-To-Heat Capacities in Germany - An Open Dataset for Assessing Renewable Energy Integration**
Wilko Heitkoetter

**The REEEMgame: ‘Discover the impacts of decarbonisation pathways in the EU by making decisions on the go’**
Hauke Henke

**The Dispa-SET v2.3 power system model**
Matija Pavičević
Windpowerlib – An open source library for generating wind feed-in time series
Sabine Haas

HotMaps: the open source mapping and planning tool for heating and cooling
Pietro Zambelli

Energy system planning: a methodological review of simulation and optimisation practices
Etienne Cuisinier

Session 2
Friday 15:00 – 16:00

Network Databases for Energy Systems Modelling
Carsten Hoyer-Klick

Energy related database on a regional/city level
Jakub Jurasz

Modeling framework for Simulating Energy Storage Systems in Grid Applications
Daniel Kucevic

Multi-layer energy modelling of heat decarbonisation and smart integration into the electricity system
Francesco Lombardi

Large scale energy systems modeling with energyRt
Oleg Lugovoy

Civil society, not analysts, should envision carbon neutral futures
Robbie Morrison

The Near-Optimal Feasible Space of a Renewable Power System Model
Fabian Neumann

Calliope
Bryn Pickering

Hourly vehicles usage profiles' Generator for modelling Transport and Energy sectors coupling
Francesco Davide Sanvito

Holistic MicroGrid Sizing Optimization Tools
Nicolo Stevanato

Demand side flexibility simulation of building with heat pumps using Pyomo
Gerhard Totschnig

urbs
Soner Candas

Models, methods and tools for a collaborative and open design approach to electrical components and systems at the service of energy transition
Sacha Hodencq
Spine Toolbox structure
Juha Kiviluoma

Open Climate Knowledge
Simon Worthington

feedinlib use case - Generating PV and wind feed-in time series for a transmission grid region
Birgit Schachler

resite - A framework for RES siting leveraging resource complementarity
David Radu
**Excursions**

We are offering different excursion in the afternoon of Thursday, January 16, 2020. Since all of them have a limited number of spots, prior registration is required for all of them.

**50Hertz Transmission GmbH**

As a part of Elia group, 50Hertz operates, maintains and extends the transmission grid in northern and eastern Germany and secure the electricity supply for around 18 million people. 50Hertz is a leader in the secure integration of renewable energies: More than half of the annual average consumption in our grid area comes from renewable sources - and it is constantly growing. Within the European electricity system operators, the Elia Group strives for a leading position in system operation and market facilitation.

50Hertz invites up to 40 participants to visit the 50Hertz headquarter close to Berlin Hauptbahnhof. The following programme targets young professionals with interests and background in electricity market modelling, grid optimization and big data analytics:

1. Short visit of the back-up Transmission Control Centre (TCC)
2. Presentation and discussion of market modelling and redispatch processes and activities, also focussing on issues of data availability and further research demand, e.g. GSK approximation in Flow Based Market Coupling (FBMC), cross-border redispatch optimization, TSO-DSO congestion management optimization
3. Presentation and discussion of 50Hertz activities in energy system data analytics, e.g. methods and tools for data processing, applying AI methods and neuronal networks to optimize forecasts for grid losses, load and renewables feed-in, the gateway roll-out and optimizing processes with smart meter data

Looking forward to welcome you on 16th of January. The programme will start at 16:30 and last until 18:00. Due to visitor registration, we would recommend arriving at 16:15 inside of our visitor hall.

**Address:** 50Hertz Transmission GmbH, Heidestraße 2, 10557 Berlin; next to S+U Hauptbahnhof

[www.50hertz.com](http://www.50hertz.com)

**Energy Museum Berlin**

The Energy Museum Berlin is one of the few interactive museums in the capital, with exhibits to touch and try out. The aim of the museum is to present the development of energy supply and its peripheral areas and to make clear its relation to the "Elektropolis" of Berlin. Berlin's development into an industrial metropolis is directly linked to the development of Berlin's power grids and public lighting. Follow the most important milestones on Berlin's path from the first electric lantern to digitally controlled city-wide power supply. The Energy Museum Berlin attempts to trace the development of the "Elektropolis" Berlin, the city of electrical engineering, and to give an impression of the significant innovations that have been developed here since the discovery of the electrodynamic principle, in a climate that has always been
characterized by fruitful cooperation between the electrical engineering industry, energy suppliers, energy users and science.

The "Förderkreis zur Sammlung historischer Anlagenteile und Geräte aus der Technik der Strom- und Wärmeversorgung Berlins e.V." was founded in 2001 by 30 employees and pensioners of the former Bewag AG. The non-profit association, which is open to all interested parties, operates the Energy Museum Berlin on the premises of the Steglitz transformer station of Stromnetz Berlin GmbH in the building of what was formerly the world’s largest battery storage facility.

There will be two guided tours with 15 persons each, one in English and one in German.

Address: Energie-Museum Berlin, Teltowkanalstraße 9, 12247 Berlin; from the underground station Rathaus Steglitz (U9) take bus 186 or 283 to Teltowkanalstraße or bus 380 to Mozartstraße

www.energie-museum.de

EUREF Campus Berlin

EUREF-Campus (European Energy Forum) in Berlin-Schöneberg is a place of the future. This is where more than 3,500 people work, research and study in more than 150 enterprises, institutions and start-ups in the areas of energy, mobility and sustainability – collaboratively, openly and jointly.

Since the project started in 2008, the approximately 5.5-hectare city district, which has been meeting the Federal Government’s climate targets for 2050 since 2014, has evolved into a real-world laboratory for the shift to renewable energy and is one of a kind in Europe.

We will visit the EUREF-Power Station by GASAG Solution Plus. In a guided tour adopted for visitors with expertise in the field of energy systems we experience “how the intelligent use of modern supply components and renewable energy leads to a CO₂-neutral supply of heat and cold to the EUREF campus. State-of-the-art and innovative components such as Germany’s first Power-to-Heat / Power-to-Cold plant and plant control with artificial intelligence can be experienced up close.

[Extract taken from Smart City Berlin – Projects List, 2019]”

Address: Torgauer Straße 12, 10829 Berlin; close to S Schöneberg

https://www.energiewende-erleben.de/en/energiewerkstatt/