PhD course 2024:
Advanced Energy Systems Analysis on the EnergyPLAN model

Again in the spring of 2024, Aalborg University, Denmark, hosts its annual EnergyPLAN PhD course. The course has been conducted every year since 2005. The course gives an introduction to advanced energy system analysis using the EnergyPLAN model. The course consists of onsite lectures taking place in Aalborg on 22-25 April and online sessions on 30 April, 7 May and 14 May 2024. Once you have completed the course, you will receive a course certificate. Registration and payment must be completed here *before 1 April.*

After the course the participants are expected to be able to understand methodologies of advanced energy system analysis and to be able to use the EnergyPLAN computer model as a tool in making energy system analysis.

The course is conducted as a combination of lectures and computer workshops of a total of 4 days (32 hours) and assignments of a total of 6-7 days (52 hours). Results of assignments will be presented by the participants.

Contents:
The course starts with an introduction to EnergyPLAN (installation, using, constructing new data sets) and proceeds to focus on the use of the model in
- sustainable cities and communities
- technical analyses of large-scale integration of wind.
- analyses of exchange with external electricity markets
- combinations of different renewable energy technologies.
- designing flexible energy systems using flexible technologies such as heat pumps, hydrogen storage, pumped storage etc.
- district heating systems versus individual houses and zero energy buildings
- designing energy systems based on multiple criteria

Organiser:	Professor Henrik Lund, e-mail: lund@plan.aau.dk
Lecturer(s):	Poul Østergaard, Henrik Lund, Jakob Zinck Thellufsen and Brian Vad Mathiesen
ECTS:	3
Time:	Onsite on 22-25 April and online on 30 April, 7 and 14 May 2024
Length:	5 days and assignments of 6-7 days (see above)
Place	In-person attendance at Aalborg University, Aalborg, Denmark followed by online Q&A sessions and online presentation of final case
Fee:	PhD fellows enrolled at a Danish university: Free PhD fellows enrolled at a university outside Denmark: 120 EUR Professionals (consultancy, industry, etc.): 1200 EUR
Registra-tion:	Registration from 25 January to 1 April 2024 via this link. Registration is binding.
Payment:	Payment upon registration. **Credit card payment is required**.
Deadline:	1 April 2024

See Sustainable Energy Planning Research Projects here.

Preparations prior to the course

1. Install EnergyPLAN from energyplan.eu
2. Consider how you wish to use EnergyPLAN – preferably in your PhD project – alternatively in independent analyses only made for the PhD course (notice that this will be on the agenda for the first morning) - fill in form on Moodle (obligatory request to finalize enrollment).
3. Read the FIDE guide (Finding and inputting data to EnergyPLAN) from energyplan.eu and consider what data you will need to do 2.
4. There are a number of training exercises at energyplan.eu. You are expected to do these beforehand as this will enable you to make more advanced independent analyses during the actual course: https://www.energyplan.eu/training/exercises/
5. Read the articles
   a. EnergyPLAN – Advanced Analysis of Smart Energy Systems https://doi.org/10.1016/j.segy.2021.100007
   b. Reviewing EnergyPLAN simulations and performance indicator applications in EnergyPLAN simulations, http://dx.doi.org/10.1016/j.apenergy.2015.05.086
   c. Reviewing optimisation criteria for energy systems analyses of renewable energy integration, http://dx.doi.org/10.1016/j.energy.2009.05.004
   d. Smart Energy Systems for coherent 100% renewable energy and transport solutions, http://dx.doi.org/10.1016/j.apenergy.2015.01.075
   e. Smart Energy Denmark … papers…
   f. Heat Roadmap Europe: Combining district heating with heat savings to decarbonise the EU energy system, http://dx.doi.org/10.1016/j.enpol.2013.10.035
   g. A renewable energy scenario for Aalborg Municipality based on low-temperature geothermal heat, wind power and biomass, http://dx.doi.org/10.1016/j.energy.2010.08.041

The course is conducted as a hand-on workshop based on each participant making an energy system analysis individually or in a group. The idea is to combine inspiration from lectures with work on your own analysis.
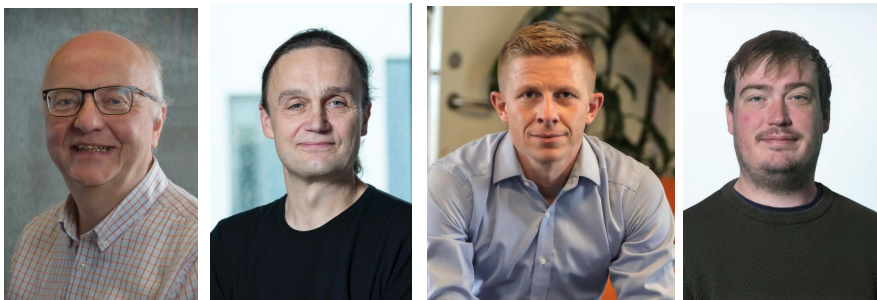
Lecturers: Henrik Lund, Poul Alberg Østergaard, Brian Vad Mathiesen and Jakob Zinck Thellufsen

Programme

Venue 22-25 April: Room 3.429, Aalborg University, Rendsburggade 14, DK-9000 Aalborg

	Monday 22 April 2024 (HL/PAØ/JZT)	Tuesday 23 April 2024 (HL/JZT)	Wednesday 24 April 2024 (JZT/HL/BVM)
09:00 - 12:00	**Introduction** Welcome and programme (HL) Introduction to Energy System Analysis and EnergyPLAN (HL) Participants' presentations of PhD projects and suggestions for energy system analysis- part 1	**How to get data and set up a model** Setting up an EnergyPLAN model and finding the data (JZT) Simulation strategies in EnergyPLAN (JZT) Workshop	**Workshop** Workshop: Work on individual analyses
13:00 - 16:00 18:00	**Study and scenario design** Optimisation Criteria in high RE systems (70m PAØ) Participants' presentations of PhD projects and suggestions for energy system analysis - part 2 **Dinner**	**Workshop** Workshop on cases Lecturers will be available	**Smart Energy Systems** Smart Energy Systems integrating electricity, heat and transport systems (BVM) Workshop: Work on individual analyses
	Thursday 25 April 2024 (HL/JZT)	**Tuesday 30 April and Tuesday 7 May – ONLINE**	**Thursday 14 May 2023 - ONLINE (HL/PAØ/JZT)**
09:00 - 12:00	**Empirical cases** **Seminar: Other models** Guest lecturer Anders Winther Rennuit-Mortensen		**Participant presentations** Presentation of analyses and results followed by questions. 20 minutes per group/person. **Feedback on the course**
13:00 - 16:00	**Climate Neutral Scenario** The IDA 70% CO2 reduction scenario using EnergyPLAN (HL/JZT) Q&A session	**Q&A online sessions (time will depend on participants time-zones) likely 12:00-15:00 CET**	