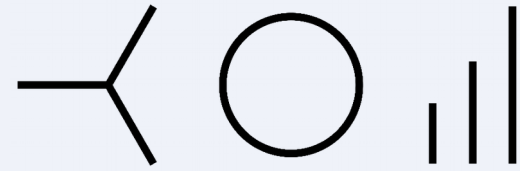


# Electricity System Modeling



## About Neon

[Neon](#) is a Berlin-based boutique consulting firm for energy economics. We advise public and private sector clients on:

- » [Market value of wind and solar power](#)
- » [\(Whole\) system costs](#)
- » [Market design](#)
- » [Balancing energy](#)
- » [Power market modeling](#)
- » [Open Data](#)
- » [Training seminars](#)

## About your instructor

Prof. Dr. Lion Hirth is founder and director of Neon. He also teaches at Hertie School of Governance. Lion is energy economist and expert in wind and solar energy, power market modeling, and electricity market design. He has five years of industry experience, holds a Ph.D. in energy economics and has published a number of highly cited academic articles.

- » [Curriculum vitae](#)
- » [Publications](#)
- » [Project references](#)

## Executive training seminar

- » For energy professionals in industry, finance, policy and think tanks
- » Extend your analytical understanding of electricity markets and energy economics
- » Understand Europe's electricity sector during crisis, transformation and decarbonization
- » Applied and relevant, yet scientifically sound and rigorous
- » More than 98% of previous participants would recommend it to a colleague

## Pricing and booking

- » Three days
- » Book individual days or the full seminar
- » Prices from EUR 900
- » 50% discount for NGOs and public sector
- » English or German language
- » In-house seminars and group discounts
- » [neon-energie.de/seminar](https://neon-energie.de/seminar)
- » [hirth@neon-energie.de](mailto:hirth@neon-energie.de)
- » [+49 1 57 55 199 715](tel:+4915755199715)

## Program overview

- I. Introduction to electricity system modeling
- II. Do it yourself: Excel modeling
- III. Do it yourself: GAMS modeling

Day 1 provides an overview of electricity market modeling. Since the best way of understanding models is to do it your self, on day 2 and day 3 we will build our own models. This is to understand the art and the science of electricity system modeling.



# Session overview

Day 1

## Introduction to electricity system modeling

1. The relevance of models in energy
2. Model classes and taxonomies
3. Crash course power market modeling
4. Open modeling and transparency
5. Data for energy system modeling

Day 2

## Do it yourself: Excel modeling

6. Cost modeling
7. Merit Order Model
8. Screening Curve Model
9. Screening Curve Model with Renewables

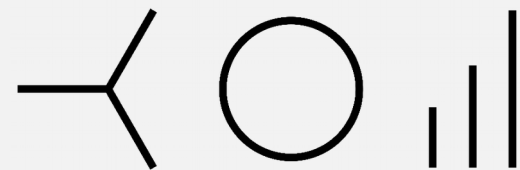
Day 3

## Do it yourself: GAMS modeling

10. The simplest GAMS model ever
11. A long-term GAMS model
12. Adding realism: storage and balancing
13. The power market model EMMA

Modeling for insights.

A three-day introduction to power system modeling for the 21<sup>st</sup> century.



A matter of choice

## Three options

- » Intro (Day 1): EUR 900 + VAT
- » Intro + Excel (Day 1-2): EUR 1400 + VAT
- » Intro + Excel + GAMS (Day 1-3): EUR 1800 + VAT
- » NGOs and public sector: 50% discount
- » Group discounts and in-house seminars

Day 1

# Introduction to electricity system modeling

1. The relevance of models in energy
2. Model classes and taxonomies
3. Crash course power market modeling
4. Open modeling
5. Data for energy system modeling

## 1. The relevance of models in energy

- » What is a “numerical model”?
- » Model-based studies
- » Modeling for investment decisions
- » Modeling for policy making

## 2. Model classes and taxonomies

- » Economic dispatch model, Unit commitment model, Integrated assessment model, Power market model, Capacity expansion model, Grid model, Load flow model, Greenfield model, etc.
- » How to make sense of this model ecosystem?

## 3. Crash course power market modeling

- » A crash course in optimization models of the electricity markets
- » The basic logic of optimization
- » Core equations and constraints
- » Important limitations and caveats

## 4. Open modeling

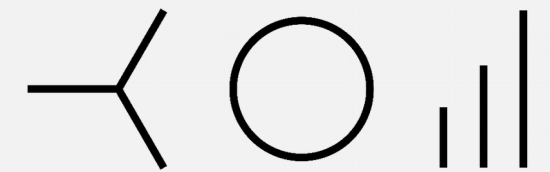
- » Transparency
- » Documentation
- » Open source models
- » I use model-based studies for decision making – How do I recognize a good model?

## 5. Data for modeling

- » Data sources
- » Tips and tricks
- » Speedy data processing
- » Open Power System Data

Models matter for decision-making – in policy, industry and finance.

A crash course in electricity system modeling.



Day 2

## Do it yourself: Excel modeling

- 6. Cost modeling
- 7. Merit-order model
- 8. Screening curve model
- 9. Screening curve model with renewables

### 6. Cost modeling

- » Cost data of generation technologies
- » Levelized cost of electricity (LCOE)
- » Screening curves

### 7. Merit-order model

- » Optimal plant dispatch
- » Generation mix
- » Price determination
- » Market value of wind and solar energy

Do it yourself!

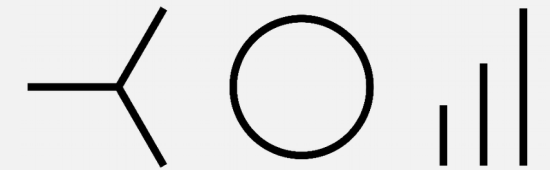
Build your own power market model in a day.

### 8. Screening curve model

- » Load duration curves
- » The optimal thermal generation mix
- » The impact of carbon pricing
- » The impact of cost shocks

### 9. SCM w/ renewables

- » Residual load duration curves
- » The impact of renewable energy



Day 3

## Do it yourself: GAMS modeling

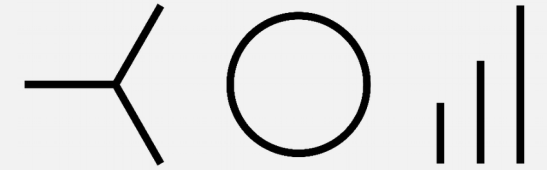
- 10. The simplest GAMS model ever
- 11. A long-term GAMS model
- 12. Adding realism: storage and balancing
- 13. The power market model EMMA

### 10. The simplest GAMS model

- » The principles of optimization
- » Getting started with GAMS
- » Building the simplest GAMS-based electricity market model in history

### 11. A long-term GAMS model

- » A screening curve-type of model in GAMS
- » Deriving the cost-optimal amount of wind and solar capacity
- » Simple yet insightful



Most professional energy system models are written in GAMS.

Welcome to the world of optimization!

### 12. Adding realism

- » Extending the GAMS model step by step
- » Peaking plants
- » Electricity storage
- » Must-run constraints and balancing energy
- » Looping for sensitivity studies

### 13. The EMMA model

- » Don't start from scratch!
- » Use a medium scale GAMS power market model
- » EMMA is free and open source
- » Tested and realistic
- » Expand the model according to your needs