

(digital) InfraTrain 2021 Autumn School

Modeling Sustainable Energy and Transport Markets: Mobility, Hydrogen, Electricity, and Energy Systems

October 11–15, 2021, digitally (out of Berlin)

In cooperation with our academic partners, we are very glad to announce the 16th year of the InfraTrain, a series of events in **INFRA**structure research and policy **TRAIN**ing designed for graduate scholars, as well as for practitioners wanting to catch up with the recent research methodologies. **InfraTrain** thus addresses:

- Advanced Master students
- PhD students, post-docs, and other scholars from universities and research institutions
- Junior staff from ministries, regulatory agencies and other governmental bodies
- Young practitioners from industry, consulting firms and financial companies dealing with infrastructure issues

The core elements of each **InfraTrain** are the Training Sessions, which cover a specific topic. Each participant chooses one session for the entire week. Experienced faculty and practitioners lecture on a focused topic, propose exercises and computer simulations, and discuss theory and policy issues. Training Sessions are accompanied by seminars, where participants present and debate either their PhD theses or other current work in smaller groups.

Students in a Master or PhD program will receive a graded certificate corresponding to 6 ECTS (European Credit Transfer System) upon the completion of a term paper resulting from the training course. (for students of TU Berlin, this will count as module 70158 “Operations Research - Graduate Autumn School (OR-AUT)”).

Training Sessions 2021 (choose one)

1) (Global) Hydrogen market modeling

The course provides an introduction to an “old” energy carrier that plays a role in the decarbonization of energy systems: Hydrogen. Currently, demand for hydrogen is modest (~ 100 mn. tons per year) and is mainly supplied by steam methane reformation. But demand is expected to grow, and can also be met, amongst others, by renewable energies using electrolysis, and biomass using gasification. After introductory exercises, a multi-period hydrogen model is developed that includes generation, trading, transportation, and final demand. The model, programmed in GAMS, is developed on the basis of the “twin” Global Gas Model (GGM) that has been used in previous Infratrain sessions. The course also includes a discussion of regional and global hydrogen markets, applications in certain sectors, and the role of political and socio-economic constraints. Participants should have some background in energy market research and some experience in numerical modeling; an introduction to mixed-complementarity modeling and GAMS will be provided.

Trainers: *Prof. Franziska Holz* DIW Berlin, and *NTNU Trondheim*, and **Jefferson Riera**, Berlin University of Technology

Junior trainers: *Lukas Barner* and *Lennart Rathje*, Research Assistants, Berlin University of Technology.

2) Risk in Stochastic Electricity Markets

This course will overview current day-ahead and real-time electricity market practices and gradually build novel constructs to treat uncertainty and risk imposed by the stochasticity of renewable generation resources and contingencies. In particular, these constructs will include means and metrics to quantify risk of constraint violations, aggregated system risk exposure and how such risks can be mitigated by means of machine learning and risk trading. The course will be accompanied by computational exercises (implemented in Julia) that will reinforce the current practice and emerging market concepts described above.

Trainer: *Prof. Yury Dvorkin, PhD*, Assistant Professor at the Tandon School of Engineering at New York University.

Junior trainers: *Dr. Robert Mieth (NYU)*, *Richard Weinhold*, Berlin University of Technology, and *Dr. Jens Weibezahn*, Copenhagen School of Energy Infrastructure (CSEI).

3) Energy system modeling with sector coupling

This course provides an introduction to energy system modeling with a focus on renewables and sector integration, i.e., the integration of the electricity, transportation, and heating sector. After some introductory exercises, the course applies the AnyMOD.jl Julia framework to model complex macro-energy systems, based on techno-economic optimization. Applications will address investment and operation of infrastructure for conversion, storage, and transport of energy over multiple years. A specific focus is on enabling high shares of fluctuating renewables in such models. In the course, participants can build on existing models for Europe and North America or pursue novel applications of their own. Applicants should have a background in energy system analysis and some experience in numerical modelling. The necessary Julia skills will be conveyed within the course.

Trainers: *Prof. Christian von Hirschhausen and Leonard Goeke, Berlin University of Technology and DIW Berlin*

Junior trainers: *Mario Kendziorski and Elmar Zozmann, Berlin University of Technology*

4) Modeling sustainable transport and mobility for a decarbonized energy system

This course will give an introduction into challenges and relevance of the decarbonization of the transport sector. Following a brief overview on the role of transportation in the overall energy system as well as the traditional goals of transport planning and modeling, the course focuses on aggregated transport modeling. The model simulates transport decisions while taking into account measurable performance attributes of the transport system like travel time, prices and accessibility. Simulation of mobility behavior allows modelers to shed light into transport demand patterns and levers to influence these through policies, infrastructure measures, and lifestyle changes. Demand-side measures are deemed important for the decarbonization of transport within the limited period that remains and need intensified attention in the near future. Participants should have some background and interest in transportation analysis as well as some experience with Python.

Trainers: *Several experienced lecturers and practitioners in transport and mobility*

Junior trainers: *Marlin Arnz, Rainer-Lemoine Institute, and Karlo Hainsch, Berlin University of Technology*

Applications

Participation in **InfraTrain** is free of charge. Participants will be provided with course and training materials. Particular emphasis is placed on young researchers (Masters, PhD students, post-Docs) and practitioners from industry, consulting, etc. If you are interested in participating, please send your CV including fields of scientific interest and your preferred topic for the training session until August 15, 2021, via the application form. The autumn school will take place digitally October 11-15, 2021. If you are interested in presenting a paper or a research project, please add an extended abstract (one page, about 300 words). Information on acceptance will be given by early September. Please be aware of our new InfraTrain email address and website listed below.

Yours sincerely,

Christian, Franziska, Christoph, and Jens

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For registration please visit: <http://infratrains.wiptuberlin.de/>