Next Generation Challenges in Energy-Climate Modelling

A 2-day online workshop

22nd and 23rd June 2020

Supported by the PRIMAVERA project under the European Union's Horizon 2020 programme, Grant Agreement no. 641727

(https://uip.primavera-h2020.eu).

Recent years have seen a growing appreciation of the risks posed by climate variability, change and uncertainty in power system operations and planning. There remain, however, many scientific and technical questions to be addressed in order to fully understand climate risk in power systems. This workshop brings together an international group of researchers working at the interface between climate science and energy applications with the aim of stimulating an active and ongoing discussion around the use of both historic and future climate datasets in energy system analysis. A fuller description of the workshop concept is provided below.

The workshop received enormous interest with over 140 applications from around the globe. The organising committee would therefore like to extend our gratitude to all those who contributed in the many and varied discussions that took place and, in particular, to our keynote speakers. Further details (e.g., slide decks and workshop outputs) will be published on the energy-met website in due course (https://research.reading.ac.uk/met-energy).

The following pages outline some of the research interests and featured publications from the researchers involved in the workshop. We hope this information can be useful to promote future collaboration!

Best wishes,

David Brayshaw

Associate Professor in Climate Science and Energy Meteorology, University of Reading

On behalf of the organising committee:

- Hannah Bloomfield (Univ Reading)
- Jethro Browell (Univ Strathclyde)
- Roger Dargaville (Monash)
- Matteo de Felice (JRC)
- Paula Gonzalez (Univ Reading)
- Katharina Gruber (BOKU)
- Adriaan Hilbers (ICL)
- Alex Kies (Univ Frankfurt)
- Julie Lundquist (Univ Colorado)
- Mathaios Panteli (Univ Manchester)
- James Price (UCL)
- Laurens Stoop (Utrecht University, TenneT, KNMI)
- Hazel Thornton (UK Met Office)
- Jan Wohland (ETH Zurich)
- Marianne Zeyringer (Univ Oslo)

Guillermo Areosa Bäuml guillermo.areosa-baeuml@amprion.net

I am currently developing spatial and temporal aggregation methods for capacity expansion problems

Eleanor Armstrong eleanor.armstrong@metoffice.gov.uk

I'm involved with a project looking at weather patterns and their relationship with challenging weather for the energy system.

Keith Bell keith.bell@strath.ac.uk

Keynote Speaker

I am one of the co-Directors of the UK Energy Research Centre and a member of the UK's Committee on Climate Change and an invited expert member of CIGRE Study Committee C1 on System Development and Economics. I am a Chartered Engineer and, at different times, have advised the Scottish Government, the Republic of Ireland government, Ofgem and the UK Department of Business, Energy and Industrial Strategy on power systems issues.

Making energy system models useful: Good practice in the modelling of multiple vectors
https://doi.org/10.1002/wene.363
Quantification and visualisation of extreme wind effects on transmission network outage probability and wind generation output
https://doi.org/10.1049/iet-stg.2019.0145

Philip Bett philip.bett@metoffice.gov.uk

Impacts of climate variability and climate change, seasonal to decadal forecasting.

The climatological relationships between wind and solar energy supply in Britain
http://dx.doi.org/10.1016/j.renene.2015.10.006
Skilful seasonal predictions for the European energy industry
http://dx.doi.org/10.1088/1748-9326/aa57ab
Seasonal Forecasts of the Summer 2016 Yangtze River Basin Rainfall
http://doi.org/10.1007/s00376-018-7210-y

Emilio Bianchi ebianchi@unrn.edu.ar

I am interested in studying the integration of weather-dependent renewable energy sources into any national electricity grid from an atmospheric perspective. I am particularly interested in identifying meteorological events and climatic trends that could significantly impact renewable energy production or its variability.
Optimized Balance Between Electricity Load and Wind-Solar Energy Production
https://doi.org/10.3389/fenrg.2020.00016
Spatiotemporal variability of the wind power resource in Argentina and Uruguay
https://doi.org/10.1002/we.2342
Large scale climate drivers for wind resource in Southern South America
https://doi.org/10.1016/j.renene.2017.07.075

Hannah Bloomfield h.c.bloomfield@reading.ac.uk Organising Committee

My main interests focus around the impacts of climate variability and climate change on present day, and plausible future energy systems across Europe. Previous work has quantified the impacts of inter-annual climate variability on weather-dependent power system components, and investigated the possible impacts of climate change. As well as this I have looked at the impacts of climate variability on market design strategies and highlighted key events that may cause power system strain, such as "Sunny Windy Sundays". Current work investigates weather typing methodologies most appropriate for predicting weather-dependent energy variables at timescales of weeks to months ahead. The key common focus within my work is understanding how the possible risks and responses of energy systems are sensitive to the system structure (e.g. the amount of installed wind generation or the temperature sensitivity of demand).

Quantifying the increasing sensitivity of power systems to climate variability
https://doi.org/10.1088/1748-9326/11/12/124025
The changing sensitivity of power systems to meteorological drivers: a case study of Great Britain
https://doi.org/10.1088/1748-9326/aabff9
Characterizing the winter meteorological drivers of the European electricity system using targeted circulation types.
https://doi.org/10.1002/met.1858

Diana Böttger diana.boettger@iee.fraunhofer.de

Short and long term energy system modelling; sector coupling

David Brayshaw d.j.brayshaw@reading.ac.uk Organising Committee

Dr David Brayshaw leads the University of Reading's Energy-Meteorology research group (https://research.reading.ac.uk/met-energy/). He is involved in wide range of academic and commercial projects concerning weather and climate risk in the energy sector, spanning timescales from days to decades. He is particularly interested in how changes in large-scale atmospheric circulation "translate" into responses in complex human-and-environmental systems (particularly energy networks), and the consequences this has for understanding climate uncertainty and system risk management (e.g., operation/dispatch, energy trading, system design/planning). He is a co-PI on several major energy-sector related climate science projects and services including ECEM (http://ecem.wemcouncil.org); S2S4E (https://s2s4e.eu) and PRIMAVERA (https://uip.primavera-h2020.eu).

The contribution of North Atlantic atmospheric circulation shifts to future wind speed projections for wind power over Europe
https://doi.org/10.1007/s00382-019-04776-3
Quantifying the increasing sensitivity of power systems to climate variability
https://doi.org/10.1088/1748-9326/11/12/124025
Using reanalysis data to quantify extreme wind power generation statistics: a 33 year case study in Great Britain. Renewable Energy,
https://doi.org/10.1016/j.renene.2014.10.024

Jethro Browell jethro.browell@strath.ac.uk Organising Committee

All aspects of energy forecast production and use, with a focus on utilising probabilistic information to improve decision-making processes in the context of power system operation and participation in energy markets. Work to date has included wind, solar and hydropower forecasting, electricity demand and price forecasting, and access forecasting for maintenance applications.

Evaluation of wind power forecasts—An up-to-date view
https://doi.org/10.1002/we.2497
The future of forecasting for renewable energy
https://doi.org/10.1002/wene.365
Improved very short-term spatio-temporal wind forecasting using atmospheric regimes
https://doi.org/10.1002/we.2207

Aditya Choukulkar aditya@vibrantcleanenergy.com

I do energy system modelling using high resolution weather data and taking into account impacts of climate change of energy system planning and resource adequacy.

Michael Craig mtcraig@umich.edu

I work on decarbonizing energy systems. One subfocus is how climate change impacts on energy systems might alter optimal decarbonization pathways. I use a systems-level perspective: I am less interested in how climate change might affect one or several power plants on an average basis, but rather how it affects all components of the power system on a synchronous basis. That allows us to understand feedbacks and compounding interactions between components, but also poses immense climate and weather modeling challenges.

A review of the potential impacts of climate change on bulk power system planning and operations in the United States
https://doi.org/10.1016/j.rser.2018.09.022
Effects on power system operations of potential changes in wind and solar generation potential under climate change
https://doi.org/10.1088/1748-9326/aaf93b
Compounding climate change impacts during high stress periods for a high wind and solar power system in Texas
https://doi.org/10.1088/1748-9326/ab6615

Roger Dargaville roger.dargaville@monash.edu Organising Committee

Design of low carbon electrical energy systems, incorporating time series of wind speeds and solar radiation over large geographic areas (e.g. 5000km East Australian grid), using linear programming optimisation to find the least cost trade off between access to the best renewable resources, and the cost of building transmission lines and energy storage. Also interested in impacts of climate change of hydropower systems.

Power system decarbonisation with Global Energy Interconnection——a case study on the economic viability of international transmission network in Australasia
https://doi.org/10.14171/j.2096-5117.gei.2018.04.011
Hydroelectric production from Brazil's São Francisco River could cease due to climate change and inter-annual variability
https://doi.org/10.1016/j.scitotenv.2018.03.256
Least cost, utility scale abatement from Australia's NEM (National Electricity Market). Part 1: Problem formulation and modelling
https://doi.org/10.1016/j.energy.2016.02.017

Laura Dawkins laura.dawkins@metoffice.gov.uk

I am currently working on a project with the National Infrastructure Commission in which we hope to develop a data set of extreme adverse weather scenarios, representative of future cliamates, for future electricity system resillience testing. This work is going to draw upon a lot of the insights from the University of Reading's research, so attending this workshop will be extremely relevant for understanding the latest thinking and bringing it into my work.

Adverse Weather Scenarios for Renewable Energy System Testing
https://www.nic.org.uk/wp-content/uploads/MetOffice-Adverse-Weather-Scenarios-Discovery-Phase.pdf
Weather and Climate Related Sensitivities and Risks in a Highly Renewable UK Energy System: A Literature Review
https://www.nic.org.uk/wp-content/uploads/MetOffice_NIC_LiteratureReview_2019.pdf

Kumar Debnath k.debnath@hw.ac.uk

My primary research interest is understanding the complex interrelationship among climate (and change), energy (demand and planning), built environment (building physics) and society (users and economy) – as applied to design and operation of the built environment – through the application of simulation and computational intelligence techniques. In my research in the past few years, I have been focusing on long-horizon energy-environment-economic modelling, the quantification of scenarios and pathways, and interdisciplinary issues in energy economics and policy. I am also interested in the performance-based design of low– and zero–carbon buildings, and their constituent energy and environmental systems.

Challenges and gaps for energy planning models in the developing-world context
https://doi.org/10.1038/s41560-018-0095-2
Corruption Significantly Increases the Capital Cost of Power Plants in Developing Contexts
https://doi.org/10.3389/fenrg.2018.00008
Understanding Residential Occupant Cooling Behaviour through Electricity Consumption in Warm-Humid Climate
https://doi.org/10.3390/buildings10040078

Matteo De Felice matteo.de-felice@ec.europa.eu

Organising Committee

Keynote Speaker

The impact of climate variability and climate change on power systems operations (adequacy and costs).
Power system flexibility in a variable climate
https://doi.org/10.2760/75312
Scoping the potential usefulness of seasonal climate forecasts for solar power management
https://doi.org/10.1016/j.renene.2019.03.134
Seasonal climate forecasts for medium-term electricity demand forecasting
https://doi.org/10.1016/j.apenergy.2014.10.030

Matthew Deakin matthew.deakin@newcastle.ac.uk

Two disparate things: (i) system adequacy, with a particular interest in international interconnector modelling, (ii) impacts on electrical & gas distribution systems planning & operations through demand-weather sensitivities

Calculations of System Adequacy Considering Heat Transition Pathways
https://arxiv.org/abs/2002.11570

Laurent Dubus laurent.dubus@rte-france.com

I'm a lead scientist with RTE, the French TSO, currently working on the integration of improved climate change information into energy system models.
Reconstruction of Multidecadal Country-Aggregated Hydro Power Generation in Europe Based on a Random Forest Model
https://doi.org/10.3390/en13071786
A parametric model for wind turbine power curves incorporating environmental conditions
https://doi.org/10.1016/j.renene.2020.04.123
Creating a proof-of-concept climate service to assess future renewable energy mixes in Europe: An overview of the C3S ECEM project
https://doi.org/10.5194/asr-15-191-2018

Ali Ehsan ali.ehsan@manchester.ac.uk

I am a Postdoctoral Research Associate within the Department of Electrical and Electronic Engineering at The University of Manchester. At present I am investigating new techniques needed to adequately model and analyse the impact risk and uncertainty in multi-vector energy networks within the Supergen Energy Networks Hub. This includes quantifying the resulting risks within these interdependent multi-vector energy networks and exploiting new opportunities for mitigation. It will be established how uncertainties propagate through interconnected and interdependent energy networks, which methods are useful to quantify uncertainty on across different timescales and locations, and which are the best methods for communicating uncertainty and risk to different stakeholders.

Scenario-based investment planning of isolated multi-energy microgrids considering electricity, heating and cooling demand
https://doi.org/10.1016/j.apenergy.2018.11.058
Coordinated Investment Planning of Distributed Multi-Type Stochastic Generation and Battery Storage in Active Distribution Networks
https://doi.org/10.1109/TSTE.2018.2873370
Active Distribution System Reinforcement Planning With EV Charging Stations—Part I: Uncertainty Modeling and Problem Formulation
https://doi.org/10.1109/TSTE.2019.2915338

Fred Espen Benth fredb@math.uio.no

Modelling and management of risk in renewable energy markets. Particular attention to power production from wind and solar, the impact on energy market prices, and how weather variables interplay with supply and demand. In this respect, spatial-temporal random fields for both weather variables and price dynamics are in the core of my interest. Spatio-temporal random fields can either be developed based on statistical features and/or from physical/meteorological models. Questions evolving around probabilistic properties, scenario simulations and statistical estimations cover my interests, as well as managing risk.

A structural model for electricity forward prices.
https://ideas.repec.org/p/usg/sfwpfi/201611.html
Modelling and Pricing in Financial Markets for Weather Derivatives.
https://ideas.repec.org/b/wsi/wsbook/8457.html

James Fallon j.fallon@pgr.reading.ac.uk

My research focus is into subseasonal forecast skill and value in decision making. I am investigating and developing novel techniques into decision making that provide the most value from S2S forecasts. I am interested in ways that meteorological derived skill can be better used to guide decision making, and how we view and improve the value of these decisions.

Ekaterina Fedotova ek.v.fedotova@gmail.com

I am a leader of a small research group looking for possible climate change adaptation and mitigation strategies considering modernisation of the Russian power industry. Climate parameters used in our work should be as realistic as possible. That is why we must rely heavily on observation evidence while making any forecast estimations relating to the climate characteristics. In particular, we have applied an observation-based semi-empirical approach to project the future mean seasonal temperatures that were used for quantification of the climate change impacts on the national-scale energy balance. However, assessment of the regional energy systems as well simulating of hydro- and wind power do require a more detailed representation. That is why I'm currently interested in development of computational approaches which would allow using the results of global and regional climate models simulation to represent power-related climate parameters in the way that is most consistent with observations and climate physics.

Long-Term Development Prospects of Russia's Wind Energy in the Conditions of Expected Climate Changes
https://doi.org/10.1134/S0040601520060051
A Deep Learning Approach to Recognition of the Atmospheric Circulation Regimes
https://doi.org/10.1007/978-3-030-19738-4_20
Vulnerability of the Russian power industry to the climate change
https://doi.org/10.1016/j.energy.2017.10.069

Patrícia Fortes p.fs@fct.unl.pt

My research interests are in the area of transition to low carbon energy systems, focusing in technological changes, energy-climate policies analysis, the feedbacks between the energy system and the macroeconomy and the design of socio-economic and emissions scenarios. I have more than 10 years of experience in energy system and computable general equilibrium modelling. Recently I have been working in the vulnerability and adaptation of energy systems to climate change, and the competition for water uses, mostly associated with my participation on Clim2Power project. In the future I would like to consider the impact of extreme weather events on the design of power sector scenarios.

Assessing the impacts of climate change on hydropower generation and the power sector in Portugal: A partial equilibrium approach
https://doi.org/10.1016/j.rser.2017.03.002

Francesco Gardumi gardumi@kth.se

At KTH division of Energy Systems, we are amongst the creators and developers of the CLEWs (climate-land use-energy-water strategies) modelling approach to the NEXUS. We use open source linear models and combinations of them to this end. I am one of the developers and users. I have managed large European modelling projects using large sets of tools to further investigate aspects of the Nexus.

The role of Energy-Water nexus to motivate transboundary cooperation: An indicative analysis of the Drina river basin
https://doi.org/10.5278/ijsepm.2018.18.2
Development of functionalities for improved storage modelling in OSeMOSYS
https://doi.org/10.1016/j.energy.2020.117025

Ugo Gasparino ugo.gasparino@rwe.com

The last 10+ years I have been working in a power company (RWE Generation UK) and therefore I am presently an end-user of research results, rather than a researcher myself. I am a modeler and my work is finalised to support operational assets (mainly a fleet of combined cycle gas turbines) and strategic decision-making. My main activities in the field of energy-and-climate relate to: risk assessment (weather resilience and adaptation to climate change), wind generation [development of a model (based on MERRA)], hydrological modelling (real-time, if at risk of droughts/low river water levels), scenarios for future water uses by the energy sector (to 2050), commercial implications of weather related events [e.g. Balancing Services Use of System (BSUoS) forecast]. I participate to several working groups (Energy UK, Joint Environmental Programme - JEP)

Paula Gonzalez p.gonzalez@reading.ac.uk

Organising Committee

Keynote Speaker

I am interested in the impacts of climate variability, predictability and change on the energy sector (and more generally!). I work mainly with climate model output and forecast information and I've focused on different application sectors for several years (now at U. of Reading, UK; before at IRI, Columbia University, USA). I am interested in the process of creating useful climate information for climate data (e.g., dealing with large ensembles, adjusting biases, combining models, developing scenarios, etc). I also like to keep a focus on exploring the physical processes behind the sectoral impacts. I work for 2 H2020 projects, PRIMAVERA and S2S4E, the first one on the applications of high-res high-freq data for energy, and the second one on subseasonal-to-seasonal prediction for the energy sector. Currently, I am looking at impacts of atmospheric blocking and changes in the North Atlantic jet on European energy-relevant climate.

The contribution of North Atlantic atmospheric circulation shifts to future wind speed projections for wind power over Europe
https://doi.org/10.1007/s00382-019-04776-3

Carmen Gonzalez Romero carmengr@iri.columbia.edu

I am interested in combining seasonal and sub seasonal forecasts (in a seamless approach) for the energy sector in Latin America, specially in the context of the ENANDES project in Chile, Peru and Colombia.

S2S application case studies, White et al, Meteorological applications (in prep).
Towards an Early Warning and Early Action System in Guatemala and Colombia, Carmen Gonzalez and Ángel Muñoz (in prep).
Scaling-up climate services with users in Latin America, Navarro et al., presented at ICCS6 2020, Pune, India.

Martin Grasenack martin.grasenack@haw-hamburg.de

Linking climate and energy models ; Impact of climate on energy markets and systems ; Differences in the conditions of future energy supply ; Energy market concepts that take the climate into account.

Katharina Gruber katharina.gruber@boku.ac.at

Organising Committee

Analysis of different hind-cast reanalysis products (MERRA-2, ERA5, COSMO-REA) on different spatial and temporal scales for wind power generation simulation. The analysis is performed for various regions of the world, testing also the opportunities of bias correction with globally available datasets. My research interest are understanding the needs of future energy systems, to which levels of uncertainty resource availability can be modelled and the implications for highly renewable energy systems. More particularly, how much do we need to know about the weather and climate to plan future energy systems and what are the risks and threats connected to climate change. And connected to this, what maybe not yet used technologies can complement or attenuate the risks posed by the natural intermittency of renewable energy and climate change.

Assessing the Global Wind Atlas and local measurements for bias correction of wind power generation simulated from MERRA-2 in Brazil
https://doi.org/10.1016/j.energy.2019.116212

Dilara Gulcin Caglayan d.caglayan@fz-juelich.de

Latest research topics that I am interested are techno-economic potential of renewables and salt caverns based on GIS tools, cost optimal energy system design with 100% renewables and hydrogen and variations in the system design by spatial and temporal complexity reduction tecniques. Especially use of some representative periods from a single year historical weather data, single or few representative locations for renewable electricity generation time series for a country are the topics I tackled for my PhD.

Impact of different weather years on the design of hydrogen supply pathways for transport needs
https://doi.org/10.1016/j.ijhydene.2019.08.032
The techno-economic potential of offshore wind energy with optimized future turbine designs in Europe
https://doi.org/10.1016/j.apenergy.2019.113794
Technical potential of salt caverns for hydrogen storage in Europe
https://doi.org/10.1016/j.ijhydene.2019.12.161

Gareth Harrison gareth.Harrison@ed.ac.uk

Primary interest integration of renewables in power/energy systems covering renewable resource assessment, power systems operation and planning and multi-vector energy systems. Also long history in climate change impacts in energy.

Graeme Hawker graeme.hawker@strath.ac.uk

I am working on 'the resilience of the future energy system' under Phase 4 of the UK Energy Research Centre, and this work will include better understanding of both the impact of climate on renewable energy resources, as well as the increased need for predicting and preparing for extreme weather events across the energy system. This also includes an understanding of international energy flows during continental-scale stress events.

Making energy system models useful: Good practice in the modelling of multiple vectors
https://doi.org/10.1002/wene.363
Electricity security in the European Union—The conflict between national Capacity Mechanisms and the Single Market
https://doi.org/10.1016/j.erss.2016.12.009
Synthesis of wind time series for network adequacy assessment.
https://ieeexplore.ieee.org/document/7540975

Dan Hdidouan d.hdidouan15@imperial.ac.uk

I look at integrating climate change projections into technoeconomic assesments with the use of virtual wind and solar pv models. I am interested in propagating the uncertainty and information through to decision-making metrics like capacity factor, annual energy production, LCOE, and IRR of particular projects.

The impact of climate change on the levelised cost of wind energy
https://doi.org/10.1016/j.renene.2016.09.003

Heidi. Heinrichs h.heinrichs@fz-juelich.de

I am working in energy systems modelling with a special focus on robust import strategies of renewable energy resources for Europe, which are heavily affected by weather conditions and climate change.

Roberto Heredia Fonseca rdhf@kth.se

Climate change effects/risk on renewable energy mostly hydropower, wind and solar.

Adriaan Hilbers a.hilbers17@imperial.ac.uk Organising Committee

My PhD focuses on using statistics to make the best decisions in the energy transition, particularly in the electricity sector. Such decisions (e.g. whether to build a wind farm, battery or new transmission line) are typically difficult due to the complexity of electricity grids and considerable uncertainty regarding future government policy, grid developments, demand patterns and weather events.

Importance subsampling: improving power system planning under climate-based uncertainty
https://doi.org/10.1016/j.apenergy.2019.04.110
Efficient quantification of the impact of demand and weather uncertainty in power system models
https://arxiv.org/abs/1912.10326

Linh Ho linh.ho@uni-koeln.de

I'm currently interested in the effect of large-scale meteorological circulation on wind and solar power production, especially that of high-pressure system on low production events. In the future climate change, such high-pressure system can change in terms of location and/or intensity. In the past, I worked on modelling hydro power generation using climate reanalysis data set ERA5.

Reconstruction of Multidecadal Country-Aggregated Hydro Power Generation in Europe Based on a Random Forest Model
https://doi.org/10.3390/en13071786

Bri-Mathias Hodge brimathias.hodge@colorado.edu Keynote Speaker

Incorporation of climate-related uncertainty into the design, planning, and operations of future carbon-free power and energy systems.

Compounding climate change impacts during high stress periods for a high wind and solar power system in Texas
https://doi.org/10.1088/1748-9326/ab6615
Consequences of neglecting the interannual variability of the solar resource: A case study of photovoltaic power among the Hawaiian Islands
https://doi.org/10.1016/j.solener.2018.03.085
Effects on power system operations of potential changes in wind and solar generation potential under climate change
https://doi.org/10.1088/1748-9326/aaf93b

David Huckebrink huckebrink@ee.rub.de

Climate data is crucial for renewable energy generation. I was investigating irradiance variability in my masters thesis and now I'm rather interested in handling data and implied uncertainties.
Recently, I started my PhD on the topic of energy system modelling and am particular interested in combining multiple sectors in a model.

Laura Hume-Wright laura.hume-wright@metoffice.gov.uk

Currently scoping UK climate resilience requirements in the energy sector. Long term involvement in wind climate analysis and energy yield prediction for the wind energy sector.

Jakub Jurasz jakubkamiljurasz@gmail.com

My main interest revolves around how to securely and cost-effectively integrate large scale solar and wind power sources to the existing power systems considering their current structure and role in the national economy. I am very interested in how the future climate will affect the power system on the optimal portfolio of renewables on a national and continental level.

A review on the complementarity of renewable energy sources: Concept, metrics, application and future research directions
https://doi.org/10.1016/j.solener.2019.11.087
Large scale complementary solar and wind energy sources coupled with pumped-storage hydroelectricity for Lower Silesia (Poland)
https://doi.org/10.1016/j.energy.2018.07.085
Solar–hydro hybrid power station as a way to smooth power output and increase water retention
https://doi.org/10.1016/j.solener.2018.07.087

Lucas Elias Kuepper kuepper@stanford.edu

I am a researcher & founder in the field of complex energy systems optimization. Specializing on time-series aggregation and capacity expansion.

TimeSeriesClustering: An extensible framework in Julia
https://doi.org/10.21105/joss.01573

Alexander Kies kies@fias.uni-frankfurt.de Organising Committee

Large and Small Scale Energy System Optimisation, Optimisation under Uncertainty

The impact of climate change on a cost-optimal highly renewable European electricity network
https://doi.org/10.1016/j.apenergy.2018.09.084
A review on the complementarity of renewable energy sources: Concept, metrics, application and future research directions
https://doi.org/10.1016/j.solener.2019.11.087
How regional differences in cost of capital influence the optimal design of power systems
https://doi.org/10.1016/j.apenergy.2020.114523

Martin Kittel mkittel@diw.de

I am researching the impact of variability of intermittent renewable energy sources on the (European) power system, notably in terms of short-term, mid-term and long-term storage requirements. More precisely, I am investigating the impact of variability over the course of one year and up to multiple decades. One concrete project I am working on right now, is the impact of different renewable energy availablity time series on the power system. These time series are based on a) different data sets and b) different time periods.

Andrew Kumler andrew.kumler@nrel.gov

While I am currently a researcher at the National Renewable Energy Laboratory (NREL), I am starting my PhD this fall with Professor Julie Lundquist. My focus for my PhD will be on wind energy forecasting, with a primary focus on offshore wind energy. With the US just starting its investment in offshore wind, it will be critical to study not only the resource in this area, but also the climate effects. In addition, the east coast of the US is prone to a variety of severe weather events (hurricanes, tornadoes, etc.), each of which are expected to change with frequency and intensity with a changing climate. Understanding this dynamic climate-energy relationship will be key for the energy security of offshore wind in the US going forward.

Validation of RU-WRF, the Custom Atmospheric Mesoscale Model of the Rutgers Center for Ocean Observing Leadership
https://www.nrel.gov/docs/fy20osti/75209.pdf
Inter-annual variability of wind and solar electricity generation and capacity values in Texas
https://doi.org/10.1088/1748-9326/aaf935
Consequences of neglecting the interannual variability of the solar resource: A case study of photovoltaic power among the Hawaiian Islands
https://doi.org/10.1016/j.solener.2018.03.085

Llorenç Lledó lledo@bsc.es

I'm interested in the predictability of climate variability at sub-seasonal, seasonal and decadal timescales and its impact on the energy system, and specially on wind power generation, with a view of translating scientific advances into climate services.

Seasonal forecasts of wind power generation
https://doi.org/10.1016/j.renene.2019.04.135
Investigating the Effects of Pacific Sea Surface Temperatures on the Wind Drought of 2015 Over the United States
https://doi.org/10.1029/2017jd028019
Seasonal prediction of Euro-Atlantic teleconnections from multiple systems
https://doi.org/10.1088/1748-9326/ab87d2

Julie Lundquist julie.Lundquist@colorado.edu

Organising Committee

Prof. Lundquist leads an interdisciplinary research group in the Dept. of Atmospheric and Oceanic Sciences (ATOC) at the University of Colorado, with a joint appointment at the National Renewable Energy Laboratory. Her research group uses observational and computational approaches to understand the atmospheric boundary layer, with an emphasis on atmosphere-wind energy interactions. She is particularly interested in how atmospheric variability on daily, seasonal, and interannual timescales affects renewable energy power production.

Costs and consequences of wind turbine wake effects arising from uncoordinated wind energy development
https://doi.org/10.1038/s41560-018-0281-2
Grand challenges in the science of wind energy
https://doi.org/10.1126/science.aau2027
Southward shift of the global wind energy resource under high carbon dioxide emissions
https://doi.org/10.1038/s41561-017-0029-9

Jean-Nicolas Louis jean-nicolas.louis@oulu.fi

My research interests lie in sustainability assessment, energy system and smart buildings modelling, especially optimisation problems in the context of smart energy networks under climate change constraints. I have therefore worked on the pan-European transmission network development under climate constraints (using POLES for the projections), but also developed models to understand the impact of climate change on the residential sector and their resilience to provide flexibility (mainly focused on Northern Europe/Arctic conditions, where climate change will strike hard).

A multi-objective approach to the prospective development of the European power system by 2050
https://doi.org/10.1016/j.energy.2019.116539
Environmental impact indicators for the electricity mix and network development planning towards 2050 – A POLES and EUTGRID model
https://doi.org/10.1016/j.energy.2018.08.093
Impact Of Climate Change to the Total and Peak Energy Demands of A Northern Finnish Building By 2050.
http://jultika.oulu.fi/Record/nbnfi-fe2020042019292

Andrea Manrique-Suñén andrea.manrique@bsc.es

I am interested in the use of climate predictions in the energy sector. I have worked on forecast assessment of climate variables to identify windows of opportunity that can benefit energy modelling. I have expertise in different methodologies of bias adjustment to produce unbiased and reliable forecasts. I have worked in the conversion of climate variables to energy indicators, in particular wind capacity factors. I am also interested in the relationship between large scale circulation patterns and the energy demand-supply configurations and how these can change over time.

Sub-seasonal to seasonal climate predictions for wind energy forecasting
https://doi.org/10.1088/1742-6596/1222/1/012009
Choices in the verification of S2S forecasts and their implications for climate services. (in review in Monthly Weather Review)
https://doi.org/10.1175/MWR-D-20-0067.1

Melinda Marquis melinda.marquis@noaa.gov

I am interested in pathways to reduce GHG emissions from the energy sector, optimizing the siting of wind and solar plants to ensure sufficient power production despite variability in turbine-height winds and surface irradiance, improving forecasts of wind and solar resources to support grid integration, increasing wind and solar power generation by addressing atmospheric science challenges, and improving projected impacts of climate change on wind and solar resources in the future.

IPCC, 2007: Climate Change 2007: The Physical Science Basis. Contribution of Working Group 1 to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.
https://www.ipcc.ch/report/ar4/wg1/
A unified high-resolution wind and solar dataset from a rapidly updating numerical weather prediction model
http://doi.org/10.1016/j.renene.2016.10.059
Improving Wind Energy Forecasting through Numerical Weather Prediction Model Development
https://doi.org/10.1175/BAMS-D-18-0040.1

Oscar Martinez-Alvarado o.martinezalvarado@ncas.ac.uk

I'm interested in the use of reanalysis to the assessment of wind and solar resources and in the predictability of these resources using numerical weather prediction models at various lead times, including the effects of climate change.

Frank McDermott frank.mcdermott@ucd.ie

Main interest is in relationship between the spatio-termporal variability in wind and solar resources and how these link to large scale atmospheric pressure and circulation patterns such as the NAO, EA and Scandinavian pattern. Also interested in how interactions between these patterns impact both the resource and energy (heating and cooling) demand, mainly focused on North Atlantic and European regions.

Spatial variability in winter NAO–wind speed relationships in western Europe linked to concomitant states of the East Atlantic and Scandinavian patterns
https://doi.org/10.1002/qj.2943
A weather regime characterisation of Irish wind generation and electricity demand in winters 2009–11
https://doi.org/10.1088/1748-9326/aabd40
An investigation of the regional correlation gradients between Euro-Atlantic atmospheric teleconnections and winter solar short wave radiation in northwest Europe
https://doi.org/10.1002/met.1892

Robbie Morrison robbie.morrison@posteo.de

improving scope and representation in energy models / use of numerical models to improve public engagement / legal aspects of open models and open data / data as a common and living resource

Submission on a European strategy for data with an emphasis on energy sector datasets
https://forum.openmod-initiative.org/uploads/short-url/uXM0OfGs6Z6zPHOeLwpNtJm1qsQ.pdf
Energy system modeling: Public transparency, scientific reproducibility, and open development
https://doi.org/10.1016/j.esr.2017.12.010

Fabian Neumann fabian.neumann@kit.edu

I am a 3rd year PhD student at the computer science department at Karlsruhe Institute of Technology where we are developing the open European power transmission system model PyPSA-Eur. We are continuously striving to improve the representation of weather conditions in our model, both on temporal and spatial scales, which drive investment decisions in renewables and balancing technologies such as power transmission and long- and/or short-term storage. For computational reasons, energy system models like ours usually pick a reference year, which is however insufficient to assess robustness against e.g. 1/10 years weather events. Extreme shortfall events are particularly interesting from an investment planning perspective as they drive investment not for financial merit but feasibility. We are currently pairing up with meteorologists to better understand the frequency and severity of multi-day lulls, how they relate to investment decisions in the model, and their relation to weather regimes.

The Near-Optimal Feasible Space of a Renewable Power System Model
https://arxiv.org/abs/1910.01891

André Ortner andre.ortner@mvv.de

I am a quantitative analyst for a large energy company and are responsible for the development of long-term electricity market scenarios. It becomes increasingly important to understand location-specific weather conditions to model electricity markets.

The future relevance of electricity balancing markets in Europe - A 2030 case study
https://doi.org/10.1016/j.esr.2019.01.003

Mathaios Panteli mathaios.panteli@manchester.ac.uk Organising Committee

My main research stream focuses on assessing the impact of extreme weather events and climate change on the resilience of power grids.
I have worked in this area for about 10 years, developing advanced mathematical planning tools for different countries, including UK, Malaysia, China, Chile, Ghana and East Africa Power Pool.

David Pozo-Vazquez dpozo@ujaen.es

I am interested in the study of the solar and wind resources for the optimal design of low carbon power system. This implies the study of the spatial and temporal variability of the solar and wind energy resources at different temporal and spatial scales but also the development of improved techniques for solar and wind power forecasting at regional scale. I am particularly interested in the balancing of the solar and wind forecasting errors and the influence of weather conditions on these forecasting errors.

Exploring the meteorological potential for planning a high performance European electricity super-grid: optimal power capacity distribution among countries
https://doi.org/10.1088/1748-9326/aa8f18
Exploring the mean-variance portfolio optimization approach for planning wind repowering actions in Spain
https://doi.org/10.1016/j.renene.2017.01.041
Worldwide impact of aerosol's time scale on the predicted long-term concentrating solar power potential
https://doi.org/10.1038/srep30546

James Price james.price@ucl.ac.uk Organising Committee

Weather resilient power and energy systems with high shares of variable renewables.

Eunice Ramos epramos@kth.se

My research focus is on integrated assessments at national and regional scales. In particular, I am focusing on the development of the Climate, Land, Energy and Water systems framework.

Joachim Reinhardt joachim@reinhardthuang.com

I am the co-founder of ReinhardtHuang Data Science, a Berlin-based startup with a focus on the energy sector. We are developing solutions for the analysis of weather-dependent uncertainty in the context of renewable energy and offer probabilistic analyses for renewable energy projects. Our algorithms generate highly realistic synthetic time series, which allows robust energy system design by providing an assessment of long-term weather-dependent risks for specific projects and energy systems.

Techno-economic optimization of a Floating Solar Hydropower Hybrid Plant using the Monte Carlo method.
https://www.hydropower-dams.com/asia-2020/

Maximilian Roithner maximilian.roithner@its.uio.no

PhD at UiO in the Section for Energy Systems (ENSYS) of the Department of Technology Systems

Elmar Rüther elmar.ruether@siemens.com

My research interest is directly related to the impact of weather and climate data on the design of energy systems, e.g. hybrid power plants, decarbonized energy systems,.... Such systems especially which are consisting of renewable power plants require optimization and design based on historic climate and weather data. Climate change globally and locally may have a significant impact on the design of such energy system. My motivation is to understand better the correlations and the impact on weather and climate during the process of energy system design.

Severin Ryberg s.ryberg@fz-juelich.de

Using geospatial analysis to limit renewable energy placements as a result of numerous socio-technical criteria, and then combining that with quasi-physics-based wind turbine and PV module simulation schemes tied to climate model data outputs. Past analyses have been completed for Europe and numerous other countries, with the focus now shifting towards Africa.

Evaluating Land Eligibility Constraints of Renewable Energy Sources in Europe
https://doi.org/10.3390/en11051246
Uniformly constrained land eligibility for onshore European wind power
https://doi.org/10.1016/j.renene.2019.06.127
The future of European onshore wind energy potential: Detailed distribution and simulation of advanced turbine designs
https://doi.org/10.1016/j.energy.2019.06.052

Leonardo Rydin Gorjão l.rydin.gorjao@fz-juelich.de

My PhD focus on power-grid stability, tackled from a stochastics/dynamical systems point-of-view, especially in relation to exogenous effect like climate impact. My focus is centred on the power-grid side, thus I could profit considerably from a Workshop especially tackling this issues in conjunction, that could shed some light on climate systems, dynamics, and related research.

Data-Driven Model of the Power-Grid Frequency Dynamics
https://doi.org/doi:10.1109/ACCESS.2020.2967834
Open data base analysis of scaling and spatio-temporal properties of power grid frequencies
https://arxiv.org/abs/2006.02481
Stochastic properties of the frequency dynamics in real and synthetic power grids
https://doi.org/10.1103/PhysRevResearch.2.013339

Bruno Schyska bruno.schyska@dlr.de

My research interests include:
- Investigating and describing the sensitivity of power system expansion models on different parameters, including the weather time series for capacity factors and the spatial and temporal resolution of the model. I found that the sensitivity of a highly renewable model of the European power system to the underlying climate period is high compared to the regional distribution of capital cost (e.g.) but relatively low compared to the temporal resolution.
- Modelling the sensitivity of a stochastic dispatch model on the quality of the ensemble data used to generate probabilistic power forecasts. By describing this sensitivity, the 'value' of increased forecast skill, achieved from applying different calibration techniques, for power system operation shall be quantified.

Weather dependent estimation of continent-wide wind power generation based on spatio-temporal clustering
https://doi.org/10.5194/asr-14-131-2017
How regional differences in cost of capital influence the optimal design of power systems
https://doi.org/10.1016/j.apenergy.2020.114523

Sofia Simoes sofia.Simoes@lneg.pt Keynote Speaker

I coordinate the CLIM2POWER project where we are developing a climate service to make large energy system models more fit for assessing climate variability (long term and seasonal). I am very interested on: (i) understanding the limitations of climate data for decision support for climate and energy policy making and for the power sector, (ii) communicating uncertainty in a useful way for power companies, (iii) overcoming the bottleneck of dealing with massive climate datasets and (iv) how to address extreme events.

Less Information, Similar Performance: Comparing Machine Learning-Based Time Series of Wind Power Generation to Renewables.ninja
https://doi.org/10.3390/en13092277
Impact of different levels of geographical disaggregation of wind and PV electricity generation in large energy system models: A case study for Austria
https://doi.org/10.1016/j.renene.2016.12.020
Comparing policy routes for low-carbon power technology deployment in EU – an energy system analysis
https://doi.org/10.1016/j.enpol.2016.10.006

Laiz Souto laiz.souto@gmail.com

I am particularly interested in developing algorithms and uses of data for Energy-and-Climate impact assessment and mitigation. I am developing a MSCA IF proposal about this topic to work at the University of Edinburgh School of Mathematics with Dr. Chris Dent and colleagues.

Karen Stengel karen.stengel@nrel.gov

I am interested in using deep learning to spatially enhance various climate scenarios to a resolution usable in energy resource assessments in the future. I am mostly interested in wind and solar resources but the techniques I work on can be applied to other resources.

Adversarial super-resolution of climatological wind and solar data
https://doi.org/10.1073/pnas.1918964117

Sebastian Sterl sebastian.sterl@vub.be

I work on the interface of modelling and policymaking for energy and climate change planning, with a particular focus on developing countries who need to grow renewables along with growing the grid. Most of my research uses high-resolution spatiotemporal modelling of solar, wind and hydropower generation using large meteorological, hydrological and climatological datasets to assess transition pathways towards high renewables' penetration.

Smart renewable electricity portfolios in West Africa
https://doi.org/10.1038/s41893-020-0539-0
Winter is leaving - Reduced occurrence of extremely cold days in Belgium and implications for power system planning
https://cris.vub.be/files/51473222/CREG_Report_FINAL.pdf

Laurens Stoop l.p.stoop@uu.nl **Organising Committee**

Currently I am conducting my PhD research on the topic of data mining in energy systems. The focus of this research lies within critical weather situations that harm the electricity net when a high percentage of renewable energy source is present, both current and future climate are considered.

Meteorological conditions leading to extreme low variable renewable energy production and extreme high energy shortfall
https://doi.org/10.1016/j.rser.2019.04.065
The influence of weather regimes on European renewable energy production and demand
https://doi.org/10.1088/1748-9326/ab38d3

Conor Sweeney conor.sweeney@ucd.ie

Analysing data from weather and climate models to provide guidance for Energy systems. Quantifying uncertainty and extreme behaviour using ensembles. Performing data analysis at different spatial and temporal resolutions and comparing.
An investigation of the regional correlation gradients between Euro-Atlantic atmospheric teleconnections and winter solar short wave radiation in northwest Europe
https://doi.org/10.1002/met.1892
The future of forecasting for renewable energy
https://doi.org/10.1002/wene.365
Bayesian spatial extreme value analysis of maximum temperatures in County Dublin, Ireland
https://doi.org/10.1002/env.2621

Lina Taube lina.taube@tu-berlin.de

I am a research associate in the field of energy systems. I am mainly interested in the changing energy systems due to climate change at it's challenges. Therefore, this workshop is very relevant to me.

Jamie Taylor jamie.taylor@sheffield.ac.uk

Sheffield Solar currently work with National Grid ESO on an NIA funded project to improve modelling of solar PV. They're also in the process of applying for EPSRC funds to extend this work to other DER.

Hazel Thornton hazel.Thornton@metoffice.gov.uk Organising Committee

Exploring the link between climate dynamics and energy impacts, including process understanding, variability and predictability.

Skilful seasonal prediction of winter gas demand
https://doi.org/10.1088/1748-9326/aaf338
The relationship between wind power, electricity demand and winter weather patterns in Great Britain
https://doi.org/10.1088/1748-9326/aa69c6
The role of temperature in the variability and extremes of electricity and gas demand in Great Britain
https://doi.org/10.1088/1748-9326/11/11/114015

Alberto Troccoli alberto.troccoli@wemcouncil.org

Weather and climate services

Weather & Climate Services for the Energy Industry
https://doi.org/10.1007/978-3-319-68418-5
Advancing climate services for the European renewable energy sector through capacity building and user engagement
https://doi.org/10.1016/j.cliser.2019.100139
Creating a proof-of-concept climate service to assess future renewable energy mixes in Europe: An overview of the C3S ECEM project
https://doi.org/10.5194/asr-15-191-2018

Tim Tröndle tim.troendle@iass-potsdam.de

I am analysing impacts and necessary trade-offs of fully renewable electricity systems in Europe, in particular in terms of land use and import dependencies.

Hannah Troppens htroppens@ixto.de

Modelling and forecasting local and global energy mix and respective CO2 footprint in Germany with focus on solar and wind energy

Edgar Ubaldo Pena Sanchez edgarubaldo.ps@gmail.com

I am an energy system researcher looking for state-of-the-art approaches and techniques to model more realistic and accurate energy systems for the future. Parallelly, I am doing a Ph.D.

Techno-economical Analysis of the Production of CO2-free Hydrogen from Variable Renewable Energy Sources in Mexico
https://app.box.com/s/8eaq0i568skooy355iiwedmsm43qt70f

changlong wang changlong.wang@unimelb.edu.au

This workshop is very relevant to my work. I am interested in electricity system capacity expansion with optimal power flow modelling, whole-systems energy modelling, power-to-gas energy sector coupling, least-cost carbon abatement modelling. Those modelling aspects require weather-related data such as. solar irradiance, wind speed etc. From this workshop, I want to get a clear picture of the role of multi-decadal variations in climate and modelling balance between weather pattern coverage and computational manageability.

Power system decarbonisation with Global Energy Interconnection——a case study on the economic viability of international transmission network in Australasia
https://doi.org/10.14171/j.2096-5117.gei.2018.04.011
Modelling Australia's transition to 100% renewable electricity
https://doi: 10.1109/ICPES47639.2019.9105634

Jan Wohland jwohland@ethz.ch

Organising Committee

Keynote Speaker

I am interested in many aspects of the energy-climate intersection, including spatio-temporal generation variability, resource assessments, climate change impacts on renewables and congestion management. My current focus is on quantifying the impact of long-term climate variability on renewable power generation. To this end, I use centennial reanalyses which cover more than a hundred years. I believe that we need to understand long-term climate variability better to adequately inform the energy transition.

Significant multidecadal variability in German wind energy generation
https://doi.org/10.5194/wes-4-515-2019
Natural wind variability triggered drop in German redispatch volume and costs from 2015 to 2016
https://doi.org/10.1371/journal.pone.0190707
More homogeneous wind conditions under strong climate change decrease the potential for inter-state balancing of electricity in Europe
https://doi.org/10.5194/esd-8-1047-2017

Marianne Zeyringer marianne.zeyringer@its.uio.no

Organising Committee

I am developing and using power system models with high spatio-temporal resolution. Such modelling approach allows representing the spatio-temporal variability of the weather which drives generation from variable renewable energy sources (i.e.wind, solar). My research interest is in designing future renewable based electricity systems which are weather and climate (change) resilient.

Designing low-carbon power systems for Great Britain in 2050 that are robust to the spatiotemporal and inter-annual variability of weather
https://doi.org/10.1038/s41560-018-0128-x
Low carbon electricity systems for Great Britain in 2050: An energy-land-water perspective
https://doi.org/10.1016/j.apenergy.2018.06.127