



Henrik Madsen

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Address: Anemonevej 32, 2970, Horsholm, Denmark (Home)

ABOUT ME

I am an internal expert with 25+ years of experience on data-driven and AI solutions needed for a green transition of the energy system. Furthermore, I am a Senior Project Manager, and I have been the coordinator of several international and national projects, like the Flexible Energy Denmark project.

My focus is on advanced methods for a digitalization of the energy grids and the entire energy system, including sector coupling, carbon capture and PtX. Most of my books on advanced statistics and integration of renewables in electricity markets are used by a number of universities. My recent scientific papers are mostly related to data-driven digital twins, stochastic modeling of physical systems, forecasting of wind and solar power generation, demand-side flexibility, control and optimization. The applications are mostly within smart grids and energy systems.

WORK EXPERIENCE

PROFESSOR – TECHNICAL UNIVERSITY OF DENMARK – 01/02/1999 – Current – LYNGBY, DENMARK

Business or Sector: Professional, scientific and technical activities |

Department: Department for Applied Mathematics and Computer Science |

Address: Richard Petersens Plads, Building 324, Kgs. Lyngby, 2800, Lyngby, Denmark | **Email:** hmad@dtu.dk |

Website: <https://dtu.dk/english/>

Professor in Stochastic and Dynamical Systems at DTU

Head of Center for IT-Intelligent Energy Systems

Head of the University Coordination Group on Smart Energy

Co-chair of the steering board for Center Denmark (EU Innovation Hub for Smart Energy)

Senior project manager - related to AI, Energy Systems, Forecasting, Modeling, Control and Optimization, Digital Twin, Demand-Side Flexibility

PROFESSOR II – NORWEGIAN UNIVERSITY OF SCIENCE AND TECHNOLOGY (NTNU) – 01/06/2017 – 31/12/2023 – TRONDHEIM, NORWAY

Data driven methods for the sustainable cities and districts

Net zero energy districts

HEAD OF CENTER FOR HIGH PERFORMANCE COMPUTING – TECHNICAL UNIVERSITY OF DENMARK – 01/02/2001 – 01/02/2009 – LYNGBY, DENMARK

Responsible for the High Performance Computers used in research and teaching at DTU

ASSOCIATED PROFESSOR – TECHNICAL UNIVERSITY OF DENMARK – 01/02/1989 – 01/02/1999 – LYNGBY, DENMARK

Research related to mathematical modelling of dynamical systems with a special focus on energy systems.

EDUCATION AND TRAINING

01/02/1982 – 01/02/1985 Copenhagen, Denmark

PHD, MATHEMATICAL STATISTICS AND DYNAMICAL SYSTEMS Technical University of Denmark

Formulation of Stochastic Dynamical Models for Climate Process and Energy Systems

Data-driven Digital Twins

Grey-box modelling

Bridging the gap between modeling based on physics and modeling based on data-driven approaches (time series analysis, statistics, AI, ML)

Website <https://dtu.dk/english/> | **Final grade** Letter | **Level in EQF** EQF level 8 | **National classification** NQF level 8 |

Thesis Statistical Climate Models

01/08/1976 – 01/02/1982 Lyngby, Denmark

MASTER IN ENGINEERING (MATH. STATISTICS) Technical University of Denmark

Website <https://www.dtu.dk/english/> | **Level in EQF** EQF level 7

LANGUAGE SKILLS

Mother tongue(s): **DANISH**

Other language(s):

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken production	Spoken interaction	
ENGLISH	C2	C2	C2	C2	C2
NORWEGIAN	C2	C2	C2	C2	A2

Levels: A1 and A2: Basic user; B1 and B2: Independent user; C1 and C2: Proficient user

SKILLS

statistics | Google Drive | Microsoft Powerpoint | Social Media | Zoom | Microsoft Word | Microsoft Office | Other: Physics, Mathematics, Statistics. | machine learning | Energy Systems | smart grids systems | Demand Response | Energy Forecasting | Micro controllers/Soldering/Sensor and actuation

HONOURS AND AWARDS

01/06/2016

Knight of the Order of Dannebrog – Her Majesty the Queen of Denmark

The reward from the Queen of Denmark is argued by Prof. Madsen contributions and influence on the development of technologies for the green transition of energy systems in Denmark.

01/06/2017

Doctor Honoris Causa – Lund University

Argued by the contributions to advanced AI and data-driven methods for an efficient integration of renewable energy into the power system.

PUBLICATIONS

2026

[Physics-informed band structure-integrated Continuous-time inhomogeneous Markov chains for stochastic occupancy modeling](#)

Authors: Zhang, H., Thilker, C. A., Xiao, F., Madsen, H., Li, R., Ma, T., & Xu, K. | **Journal Name:** Advanced Engineering Informatics | **Volume, Issue and Pages:** Vol. 71, Article 104204 | **Publisher:** Elsevier

2025

[Unlocking the potential of AI and generative AI in European smart grids – A strategic position paper and guide for action](#)

Authors: Vale Cunha, L., Veen, A. V. D., Espinosa, B., Diran, D., Ruoff, D., Karangelos, E., Sarmas, E., Madsen, H., Chaves, J. P., Horst, K. A. D., Dauer, M., Georgiev, M., Sanchez-Fornie, M., Souza e Silva, N., Cihangir Martin, N., Novykh, O., Carvalho, P., | **Volume, Issue and Pages:** 125 pages | **Publisher:** European Commission

2024

[Integrating Distributed Flexibility into TSO-DSO Coordinated Electricity Markets](#)

TSO-DSO coordination for optimizing flexibility in power systems

Authors: Tsaousoglou, G., Junker, R., Banaei, M., Tohidi, S. S., & Madsen, H. | **Journal Name:** IEEE Transactions on Energy Markets, Policy and Regulation | **Volume, Issue and Pages:** 2, 214-225 | **Publisher:** IEEE

2024

[Incentivising and Activating Multi-Purpose Flexibility for the Future Power System](#)

Authors: Madsen, H., Tsaousoglou, G., Ritschel, T. K. S., Tohidi, S., Binder, H., Frandsen, H. L., & Junker, R. G | **Journal Name:** Incentives and Digitalization for Flexibility in the Green Transitions | **Volume, Issue and Pages:** 28-42 | **Publisher:** Danish Utility Regulator

2024

[Frigg 2.0: Integrating price-based demand response into large-scale energy system analysis](#)

Energy systems planning toolbox which takes short-term flexibility and demand response solutions into account.

Authors: Schledorn, A., Charousset-Brignol, S., Junker, R. G., Guericke, D., Madsen, H., & Dominkovic, D. F. | **Journal Name:** Applied Energy | **Volume, Issue and Pages:** Vol. 364, Article 122960 | **Publisher:** Elsevier

2025

[Probabilistic ultra-short-term solar photovoltaic power forecasting using natural gradient boosting with attention-enhanced neural networks](#)

Methods for short-term forecasting of PV generation.

Authors: Song, Z., Xiao, F., Chen, Z., & Madsen, H. | **Journal Name:** Energy and AI | **Volume, Issue and Pages:** Vol. 20, Article 100496 | **Publisher:** Elsevier

2025

[nabqr: Python package for correcting probabilistic forecasts](#)

A Python software package for correcting probabilistic forecasts.

Authors: Jørgensen, B. S., Møller, J. K., Nystrup, P., & Madsen, H. | **Journal Name:** SoftwareX | **Volume, Issue and Pages:** Vol. 30, Article 102153 | **Publisher:** Elsevier

2024

[Recent Trends in Demand-Side Flexibility](#)

Authors: Madsen, H., Tohidi, S. S., Ebrahimi, R., Banaei, M., Ritschel, T. K. S., & Mahdavi, N. | **Journal Name:** El.A 2024 | **Volume, Issue and Pages:** pp. 167-184 | **Publisher:** Springer

2024

[Probabilistic Machine Learning for Enhanced Chiller Sequencing: A Risk-Based Control Strategy](#)

Probabilistic ML for risk-based chiller control strategies. Lead to significant savings.

<https://doi.org/10.1016/j.enbenv.2024.03.003>

Authors: Chen, Z., Zhang, J., Xiao, F., Madsen, H., & Xu, K. | **Journal Name:** Energy and Built Environment | **Volume, Issue and Pages:** In press | **Publisher:** Elsevier

2025

[Sequential methods for error correction of probabilistic wind power forecasts](#)

Advanced sequential methods for error correction of probabilistic wind (and solar) power forecasts.

Authors: Jørgensen, B. S., Møller, J. K., Nystrup, P., & Madsen, H. | **Journal Name:** Expert Systems with Applications | **Volume, Issue and Pages:** Vol. 284, Article 127872 | **Publisher:** Elsevier

2025

[Stochastic occupancy modelling for spaces with irregular occupancy patterns using adaptive B-Spline-based inhomogeneous Markov Chains](#)

Authors: Zhang, H., Thilker, C. A., Madsen, H., Li, R., Xiao, F., Ma, T., & Xu, K. | **Journal Name:** Building and Environment | **Volume, Issue and Pages:** Vol. 261, Article 111721 | **Publisher:** Elsevier

2024

[Procuring flexibility in power systems with incentive-based grid access requests](#)

Authors: Banaei, M., D'Ettoire, F., Ebrahimi, R., Almassalkhi, M. R., & Madsen, H. | **Journal Name:** Int. Journal of Electric Power and Energy Systems | **Volume, Issue and Pages:** Vol. 156, Article 109745 | **Publisher:** Elsevier

2025

[Optimal price signal generation for demand-side energy management](#)

Authors: Tohidi, S. S., Madsen, H., Calì, D., & Ritschel, T. K. S. | **Journal Name:** Smart Energy | **Volume, Issue and Pages:** Vol. 17, Article 100173 | **Publisher:** Elsevier

2023

[Data Quality Assessment for ML Decision-Making](#)

Authors: Moloiu, A.-Ș., Albeanu, G., Madsen, H., & Popențiu-Vlădicescu, F. | **Journal Name:** Applications in Reliability and Statistical Computing | **Volume, Issue and Pages:** p. 163-178 | **Publisher:** Springer

2023

[Reconciling temporal hierarchies of wind power production with forecast-dependent variance structures](#)

Authors: Sørensen, M. L., Møller, J. K., & Madsen, H. | **Journal Name:** Ems Magazine, 130, pp 4-1 | **Volume, Issue and Pages:** Vol. 130, pp. 4-13 | **Publisher:** European Mathematical Society

2025

[Improving Software Dependability by AI Agents](#)

Authors: Grigore Albeanu, Florin Popențiu-Vlădicescu, Henrik Madsen | **Journal Name:** Proceedings of the 30th ISSAT International Conference on Reliability and Quality (ISSAT 2025) | **Volume, Issue and Pages:** p. 292-296 | **Publisher:** Curran Associates Inc.

BOOKS AND CITATIONS

CURRENT

Books, and Citations

Number of publications: 813 publications (314 papers in journals)

Most recent books:

- H. Madsen, *Time Series Analysis*, Chapman and Hall, 392 pp., 2008
- H. Madsen and P. Thyregod, *An Introduction to General and Generalized Linear Models*, Chapman and Hall, 320 pp., 2011
- J.M.M. Gonzáles, A.J. Conejo, H. Madsen, P. Pinson, M.Zugno, *Integrating Renewables in Electricity Markets, Operational Problems*, Springer, 429 pp., 2014
- E. Lindström, H. Madsen, J.N. Nielsen, *Statistics for Finance*, Chapman and Hall, 365 pp., 2015
- J.K.Møller, M. Schweiker, R.K. Andersen, B. Gunay, S. Yilmaz, V.M. Barthelmes, H. Madsen, *Statistical Modelling of Occupant Behaviour*, Chapman and Hall, 366 pp., 2024.

Number of Citations: > 39750

h-index: > 89

i10-index: > 515

(google scholar)

● PROJECTS

01/04/2019 – 31/03/2023

FED - Flexible Energy Denmark

Innovation Fund Denmark. Budget 44 mDKK. Coordinator.

FED is a Danish digitization project aiming at making the Danish power consumption flexible in order to enable utilization of excess power from wind turbines and solar cells, and for proving smart grid services. The project brings together Denmark's foremost researchers, organizations, supply companies, software companies and a number of living labs that provide data for the project.

01/01/2026 – CURRENT

Digitalization for Integrated and Smart Energy Systems.

Innovation Fond Denmark. Global Innovation Network Programme. Coordinator

Denmark-Australia Energy Flexibility Network will establish strategic research collaboration between DTU, SDU, and Australian research institutions to advance demand response technologies using data and AI.

01/10/2024 – CURRENT

AI-EFFECT – Artificial Intelligence Experimentation Facility For the Energy seCTOR

European Project, HEUROPE – Grant Agreement 101172952. Budget: 5.6M€. Senior researcher. DTU Coordinator

It will establish a European Testing Experimentation Facility (TEF) for developing, testing, and validating AI applications in the energy sector. It will be distributed across nodes, virtually connecting existing European facilities. The solution includes a digital platform leveraging European building blocks for interoperability, flexibility, and scalability. AI-EFFECT aims to be a central hub for testing energy sector AI algorithms, fostering collaboration across utilities, industry, academia, and regulatory authorities.

01/04/2025 – CURRENT

INSIEME - Integrated Network for Data Space and Interoperable Energy Management in Europe

DIGITAL EUROPE Project (DIGITAL-SIMPLE). Budget: 16M€. Subtask leader. Subtask leader. DTU Coordinator

Call on Cloud, Data and AI. The objective is to deploy a reliable and secure common European data space for energy announced in the European Strategy for Data and the EU Action plan on digitalising the energy system. The outcomes of the INSIEME project are expected to address the challenges to foster clean energy transition, resilience across use cases addressed and advancing energy security goals. The envisioned data space and all its building blocks will broaden access to data needed to develop innovative energy services, integration of advanced technologies (AI, Edge Computing, Digital Twins) and will help balancing and optimisation of the electricity grids.

01/01/2014 – 31/12/2020

Center for IT-Intelligent Energy Systems

Danish Strategic Research (DSF). Budget 72 mDKK. Coordinator.

The objective of CITIES is to establish a realistic and concrete pathway to ultimately achieving independence from fossil fuels by harnessing the latent flexibility of the energy system through data intelligence (AI), integration, and planning, focussing on city environments and working towards both European and Danish 2030/2050 goals.

Link <https://smart-cities-centre.org/>

01/01/2024 – CURRENT

BIPED - Building Intelligent Positive Energy Districts

European Project, HEUROPE – Grant Agreement 101139060. Budget: 10 M€. DTU is Coordinator.

BIPED is aiming at using digital twins and AI for accelerating the green transition of large cities with a focus on Aarhus, Denmark. A key enabler of this virtual prototyping is the Local Digital Twin (LDT) technology. Traditionally, LDTs create digital representations of a functional territory by combining low- and high-velocity data with dynamic models of energy, traffic, buildings and natural environment.

01/02/2024 – CURRENT

DeployAI

DIGITAL EUROPE - GA No. 101146490 - Budget 28 mEUR. DTU task leader.

DeployAI develop and bring to market a Trustworthy AI-on-Demand platform that champions ethics and integrity for a seamless **AI implementation by startups, SMEs, and the public sector**.

Our resource hub and marketplace will host a curated array of responsible AI tools for end-users and developers.

01/01/2024 – CURRENT

BEGONIA

DIGITAL EUROPE CSA Project, Budget: 4 M€ (phase 1), 40 M€ (phase 2 decision pending). DTU is Coordinator.

The BEGONIA Project (phase 1), is an EU-funded Coordination and Support Action rooted in holistic, collaborative, and connecting approaches, aims to expedite this **digital transformation**. It identifies, studies, and prepares the development of ODPs across EU countries, starting from the identification of cross-border use cases in the energy and transport sectors. BEGONIA is aiming at supporting Europeans transformative endeavour to modernise digital information usage, with a focus on enhancing **the efficiency, sustainability, and connectivity of our energy and transportation sectors**.

01/10/2022 – CURRENT

ELEXIA

HORIZON EUROPE, GA No. 101075656, Budget 11 mEUR. DTU is Pilot and Subtask Leader.

Demonstration of a **digitised energy system** integration across sectors enhancing flexibility and resilience towards an efficient, sustainable, cost-optimised, affordable, secure, and stable energy supply. ELEXIA is developing validated tools for planning and managing integrated energy systems in different conditions. In ELEXIA we integrate and combine energy systems across vectors and sectors towards a cost-optimised as well as **flexible and resilient energy system of systems**. ELEXIA will demonstrate the use of planning and operational tools in a one-stop-shop, modular and open, digital platform in three pilot sites.

01/01/2022 – CURRENT

ARV

GREEN DEAL H2020 PROJECT - BUDGET 20 mEUR. DTU WP LEADER

The ARV project aims to demonstrate and validate attractive, resilient, and affordable solutions that significantly speed-up deep energy renovations in four different climatic zones in Europe and deployment of energy and climate measures in the construction and energy industries. Since the project works towards the **implementation of climate-positive circular communities in Europe**, focusing on net zero-emission buildings and neighbourhoods, ARV will provide guidelines and a policy framework for **future energy-efficient, circular, and digital solutions**.

● CO-FOUNDER OF START-UP COMPANIES

01/03/2006 – CURRENT

ENFOR a/s - Energy Forecasting and Optimization for the Energy Sector

Today, the developed **AI and data-driven** tools are used for forecasting and integration of 20 - 25 pct of the wind and solar power in the World.

Link <https://enfor.dk/>

01/01/2021 – CURRENT

CLIMIFY ApS

The all-in-one, **AI-powered** solution for comfortable and sustainable buildings. Human-in-the-Loop and AI-based solutions.

Link <https://climify.com/en/>

01/01/2022 – CURRENT

AI-Energy ApS

AI Assisted Methods for Energy Systems Operation and Design Automation. **Optimizing** energy market **bidding** and **operation** of a portfolio of power and energy plants. Energy Systems Operation, including Dynamic Line Rating and Dynamic Transformer Rating.

Link <https://ai-nergy.net/>