Oliver Ruhnau

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Short bio

I am an Assistant Professor of Energy Market Design at the University of Cologne, a Senior Scientist at the affiliated Institute of Energy Economics (EWI), and the Founder and Director of the consultancy tournesol energy. As an energy economist, I study current trends in energy markets—including renewable energy, battery storage, electrification, and demand flexibility—and how market design can shape these trends for society's benefit. I use analytical and numerical models for energy systems and markets, and empirical methods for causal inference. Previously, I was a doctoral and postdoctoral researcher at the Hertie School in Berlin.

Positions

2023 – present **Assistant professor of energy market design at the University of Cologne**
Faculty of Management, Economics and Social Sciences

2023 – present **Senior scientist at the Institute of Energy Economics (EWI) at the University of Cologne**
Acquisition and implementation of research projects

2023 – present **Founder and director of tournesol energy**
Consultancy and software on energy systems and markets

2019 – 2023 **Research associate and postdoctoral researcher at the Hertie School**
Centre for Sustainability

2017 – 2019 **Data scientist at Digital Energy Solutions by BMW and Viessmann**
Tasks: modeling and analysis of integrated energy systems and markets

Initiatives & memberships

2026 – present **Affiliate member of CESifo Research Network**
Area of Energy and Climate Economics

2022 – present **Co-director of Strommarkttreffen**
Network for energy professionals in academia, policy, industry, and nonprofits

2020 – 2021 **Founding member of the d\carb – Future Economy Forum**
Organizing public events on the transition toward a sustainable economy

Education

2019 – 2022 **Doctoral program in governance at the Hertie School**

- "Economics of flexible electricity demand" (summa cum laude)
- Supervisor: Lion Hirth; reviewers: Christoph Weber, Ottmar Edenhofer

2011 – 2017 **Bachelor and master of science at RWTH Aachen**
Engineering and economics (*Wirtschaftsingenieurwesen*)

Teaching

2023 – present **At the University of Cologne**

- Energy Markets and Regulation
- Energy Market Design
- Energy Market Modeling
- Energy and Environmental Economics

2024 **At the Florence School of Regulation**
Loyola Autumn Research School (LARS)

2022 – 2023 **At the Hertie School**
Net-Zero Energy Systems

2022 **At the German Academic Scholarship Foundation (Studienstiftung)**
Net-Zero Energy Systems (w/ Maren Preuß)

2020 **At TU Berlin**
Electricity Economics and Modeling (w/ Anselm Eicke)

Supervision

2023 – present **At the University of Cologne**

- Dissertations: 7x first advisor, 16x second advisor, 9x referee, 2x committee chair
- Master's theses: 10x first examiner, 1x second examiner

2020 – 2023 **At the Hertie School**
Master's theses: 8x second advisor

Funding

2025 **Research collaboration with the German transmission system operator TenneT**
Title "SPACES – spatial coordination in electricity systems"

2025 **Research initiative with the Society for the Promotion of EWI e.V.**
Title "Integrated Electricity Market Design" (w/ Philipp Kienscherf and Philip Schnaars)

2024 **Consulting project for the German Environment Agency (UBA)**
Evaluation of energy savings in 2022–2023 (w/ Fabian Arnold and Merit Dressler)

2022 **Research project for the Federal Ministry of Education and Research (BMBF)**
Title "Machine Learning for Electricity Market Research" (w/ Lion Hirth and Lynn Kaack)

2020 – 2021 **Stipend from the German Economy Foundation (Stiftung der Wirtschaft)**

2013 – 2017 **Stipend from the German Academic Scholarship Foundation (Studienstiftung)**

Honors

2025 **Junior Teaching Award of the WiSo Faculty at the University of Cologne**

2021 **2nd-Best Student Paper Award of the International Association for Energy Economics**

2017 & 2019 **Finalist at awards from the German Association for Energy Economics**

Research interests

Energy economics: energy policy, electricity markets (wholesale, capacity, retail, balancing), market design, tariff design, emissions pricing

Integrated energy systems: wind and solar energy, energy storage, energy demand, electric vehicles, electric heat pumps, hydrogen, net-zero energy systems

Numerical and empirical methods: energy system and market modeling, linear optimization, partial equilibrium models, causal inference, instrumental variables

Journal articles

1. Emelianova, P., Hoffmann-Willers, P., **Ruhnau, O.**, 2026. **Redistribution through cross-border electricity trade: How to achieve Pareto improvement for consumers?** *Energy Policy*.
2. Farag, M., **Ruhnau, O.**, 2026. **Decomposing Return and Volatility Connectedness in Northwest European Gas Markets: Evidence from the R2 connectedness approach**. *Energy Economics*.
3. Moritz, M., Czock, B. H., **Ruhnau, O.**, 2025. **A heated debate – The future cost-efficiency of climate-neutral heating options under consideration of heterogeneity and uncertainty**. *Energy Policy*.
4. Hirth, L., Khanna, T., **Ruhnau, O.**, 2024. **How aggregate electricity demand responds to hourly wholesale price fluctuations**. *Energy Economics*. (presented at INREC 2021, ESEE Pisa 2022, EMEE 2022, IAEE 2023)
5. Casas Ferrús, M. N., **Ruhnau, O.**, Madlener, R., 2024. **Portfolio effects in green hydrogen production under temporal matching requirements**. *Energy Strategy Reviews*.
6. **Ruhnau, O.**, Eicke, A., Sgarlato, R., Tröndle, T., Hirth, L., 2024. **Cost-potential curves of onshore wind energy: the role of disamenity costs**. *Environmental and Resource Economics*. (presented at IAEE Webinar 2023, EGU 2023)
7. **Ruhnau, O.**, Schiele, J., 2023. **Flexible green hydrogen: The effect of relaxing simultaneity requirements on project design, economics, and power sector emissions**. *Energy Policy*. (presented at the FSR Annual Sustainability Conference 2022)
8. Muessel, J., **Ruhnau, O.**, Madlener, R., 2023. **Accurate and scalable representation of electric vehicles in energy system models: A virtual storage-based aggregation approach**. *iScience*. (presented at the Smart Energy Systems Conference 2023)
9. **Ruhnau, O.**, Stiewe, C., Muessel, J., Hirth, L., 2023. **Natural gas savings in Germany during the 2022 energy crisis**. *Nature Energy*. (presented at FSR Insights 2023, ENERDAY 2023)
10. **Ruhnau, O.**, 2022. **How flexible electricity demand stabilizes wind and solar market values: The case of hydrogen electrolyzers**. *Applied Energy*. (2nd-Best Student Paper at the IAEE 2021, presented at INREC 2020, IEW 2021, EAERE 2021, EMP-E 2021, BTU 2022)
11. **Ruhnau, O.**, Qvist, S., 2022. **Storage requirements in a 100% renewable electricity system: Extreme events and inter-annual variability**. *Environmental Research Letters*. (presented at IEW 2022)
12. **Ruhnau, O.**, Bucksteeg, M., Ritter, D., et al., 2022. **Why electricity market models yield different results: Carbon pricing in a model-comparison experiment**. *Renewable and Sustainable Energy Reviews*. (presented at ENERDAY 2021, OR 2021, IAEE Webinar 2022)
13. Cloete, S., **Ruhnau, O.**, Cloete, J. H., Hirth, L., 2022. **Blue hydrogen and industrial base products: The future of fossil fuel exporters in a net-zero world**. *Journal of Cleaner Production*.
14. Pöstges, A., Bucksteeg, M., **Ruhnau, O.**, et al., 2022. **Phasing out coal: An impact analysis comparing five large-scale electricity market models**. *Applied Energy*.
15. Bucksteeg, M., Wiedmann, M., Pöstges, A., Haller, M., Böttger, D., **Ruhnau, O.**, Schmitz, R., 2022. **The transformation of integrated electricity and heat systems – Assessing mid-term policies using a model comparison approach**. *Renewable and Sustainable Energy Reviews*.

16. Eicke, A., **Ruhnau, O.**, Hirth, L., 2021. **Electricity balancing as a market equilibrium: An instrument-based estimation of supply and demand for imbalance energy**. *Energy Economics*.
17. Cloete, S., **Ruhnau, O.**, Hirth, L., 2021. **On capital utilization in the hydrogen economy: The quest to minimize idle capacity in renewables-rich energy systems**. *International Journal of Hydrogen Energy*.
18. **Ruhnau, O.**, Hirth, L., Praktiknjo, A., 2020. **Heating with wind: Economics of heat pumps and variable renewables**. *Energy Economics*. (presented at YEEES 2019, INREC 2019)
19. **Ruhnau, O.**, Hennig, P., Madlener, R., 2020. **Economic implications of forecasting electricity generation from variable renewable energy sources**. *Renewable Energy*. (presented at OR 2015)
20. **Ruhnau, O.**, Hirth, L., Praktiknjo, A., 2019. **Time series of heat demand and heat pump efficiency for energy system modeling**. *Scientific Data*.
21. **Ruhnau, O.**, Bannik, S., Otten, S., Praktiknjo, A., Robinius, M., 2019. **Direct or Indirect Electrification? A review of heat generation and road transport decarbonisation scenarios for Germany 2050**. *Energy*.

Working papers

22. Heuer, J., Johanndeiter, S., **Ruhnau, O.**, 2026. **Striking a Better Deal? Risk Allocation and Renewable Buildout under Contracts for Difference with Endogenous Cost of Capital**. *EWI Working Paper*.
23. Bröcker, M., Krainer, D., Strömer, S., **Ruhnau, O.**, 2026. **The design and implications of demand charges in electricity capacity markets**. *EWI Working Paper*.
24. Herrmann, H., Michelet, F., **Ruhnau, O.**, 2026. **When Wind Blows Through the Backdoor: Revisiting IV Estimates of Household Elasticities under Real-Time Electricity Pricing During the Energy Crisis**. *CESifo Working Paper*.
25. **Ruhnau, O.**, Lehmann, P., 2025. **Green hydrogen support with overlapping climate policies**. *Resubmitted to Energy Economics*. (presented at NRSE 2024, IAEE 2025)
26. Lilienkamp, A., Namockel, N., **Ruhnau, O.**, 2025. **Flexibility in electricity wholesale markets and distribution grids: An integrated model and its application to electric vehicles in Germany**. *EWI Working Paper*.
27. Vey, M., Namockel, N., **Ruhnau, O.**, 2025. **Green charged decision-making: How two-part remuneration, contract flexibility, and environmental nudging drive vehicle-to-grid participation**. *EWI Working Paper*.
28. Tiedemann, S., Sanchez Canales, J., Schur, F., Sgarlato, R., Hirth, L., **Ruhnau, O.**, Peters, J., 2024. **Identifying elasticities in autocorrelated time series using causal graphs**. *Resubmitted to Econometrica*.
29. Stiewe, C., **Ruhnau, O.**, Hirth, L., 2022. **European industry responds to high energy prices: The case of German ammonia production**. *Working Paper*.
30. **Ruhnau, O.**, Muessel, J., 2022. **Update and extension of the When2Heat dataset**. *Working Paper*.

Conference proceedings & book chapters

31. **Ruhnau, O.**, Lundström, L., Dürr, L., Hunecke, F., 2023. **Empirical weather dependency of heat pump load: Disentangling the effects of heat demand and efficiency**. *19th International Conference on the European Electricity Market*.
32. Muessel, J., **Ruhnau, O.**, Madlener, R., 2023. **Simulating charging behavior of electric vehicles: Review and comparison with empirical data**. *19th International Conference on the European Electricity Market*.

33. Madlener, R., **Ruhnau, O.**, 2021. **Variable renewables and demand flexibility: Day-ahead versus intraday valuation**. In: Sioshansi, F., Variable Generation, Flexible Demand. *Academic Press*.

Software & data

34. Hirth, L., **Ruhnau, O.**, Sgarlato, R., 2021. **The European Electricity Market Model EMMA**. *Open-source electricity market model, including input data*.
35. **Ruhnau, O.**, 2019. **When2Heat Heating Profiles**. *Dataset at the Open Power System Data platform*.

Commissioned studies

36. Hoffmann-Willers, P., Klar, H., Meler, C., Lilienkamp, A., **Ruhnau, O.**, 2026. **Locational Steering of Investments in Electricity Generation**. *EWI Research Report*.
37. Dressler, M., Lilienkamp, A., Keutz, J., Just, L., **Ruhnau, O.**, 2025. **Assessment of energy-constrained flexibilities in capacity mechanisms**. *EWI Research Report*.
38. Czock, B., Dressler, M., Keutz, J., Restel, L., **Ruhnau, O.**, Schnaars, P., 2025. **Optimized grid connections for wind and PV: How overplanting can save grid expansion costs**. *EWI Research Report*.
39. Braungardt, S., Hünecke, K., Loschke, C., Arnold, F., Dressler, M., **Ruhnau, O.**, et al., 2025. **Ex-post evaluation of energy consumption reduction in 2022–2023**. *Report for the German Environment Agency (UBA)*.

Commentaries

40. **Ruhnau, O.**, Emelianova, P., Hoffmann-Willers, P., 2026. **Turning the European electricity market integration into a win-win**. *pv magazine Deutschland*.
41. **Ruhnau, O.**, 2026. **Integrating renewables into power grids efficiently and with investment certainty**. *Tagesspiegel Background Energie & Klima*.
42. Hirth, L., Maurer, C., **Ruhnau, O.**, et al., 2022. **Energy policy and energy industry options for Germany and Europe in view of Russia's attack on Ukraine**. *Open letter at Tagesspiegel Background Energie & Klima*.
43. Osorio, S., Pahle, M., **Ruhnau, O.**, 2022. **If buildings renovation fails, the EU ETS pricing mechanism must change**. *energypost.eu*.

Community service

Reviews of journal articles: *Applied Energy, Data in Brief, Economica, Energy Economics, Energy Efficiency, The Energy Journal, Energy Policy, Energy Strategy Reviews, IEEE PES Transactions on Energy Markets, Policy and Regulation, IET Renewable Power Generation, iScience, Joule, Journal of Environmental Economics and Management, Nature Communications, Nature Communications Earth and Environment, Nature Energy, Next Energy, Resource and Energy Economics, Utilities Policy*

Reviews of grant proposals: *German Research Foundation (DFG), German Academic Exchange Service (DAAD), Swiss National Science Foundation (SNSF)*

Reviews of policy briefs: Hydrogen Analysis by the Copernicus Research Project Ariadne, Hydrogen Statement by German Advisory Council on the Environment

Reviews of conference submissions: International Association of Energy Economics (IAEE)

Conference organization and hosting: Young Energy Economists & Engineers Seminar (YEEES), Fall 2025

Training participation

2026 **Designing lectures to be motivating and conducive to learning**
University of Cologne

2021 **Introduction to Teaching in Higher Education**
Hertie School

Written media coverage

2026 **EWI rät zu zeitvariablen Umlagen am Kapazitätsmarkt**
Energie & Management

2025 **Eine Idee, die Milliarden sparen könnte**
Frankfurter Allgemeine Zeitung

2023 **Gasverbrauch ist in Deutschland 2022 stark zurückgegangen**
Tagesspiegel

2022 **Germany dims the light to cope with Russia gas supply crunch**
Financial Times

2022 **Wer in Deutschland Gas spart – und wer nicht**
Spiegel

Audio & video media coverage

2026 **Kraftwerksstrategie: Welches Back-up soll künftig Solar- und Windenergie ergänzen?**
Science Media Center (press briefing)

2023 **Tagesschau am 5. Mai um 20:00**
ARD (television)

2022 **World Business Report on July 8**
BBC Radio

Invited talks & panels

2026 **Integrated Markets: How European Reforms Shape Nordic Power Markets**
Nordic Energy Research

2026 **Konferenz für Kommunales Infrastruktur-Management**
Uni Weimar, Uni Bochum, HTW Berlin

2025 **8. Tagung zum Recht und Management der Energiewirtschaft**
University of Lucerne

2025 **Internationale Energiewirtschaftstagung (Closing Plenary Session)**
TU Wien

2023 **FSR Insights on Experience with Emergency Gas Measures**
Florence School of Regulation

Conference presentations

European Economic Association (EEA), 2026

World Conference of Environmental and Resource Economists (WCERE), 2026

Mannheim Conference on Energy and the Environment (MCEE), 2026

International Association of Energy Economics (IAEE), Annual Conference 2021, 2023, 2025, 2026

Smart Energy Systems (SES) Conference, Copenhagen 2021, 2023

European Energy Markets (EEM) Conference, Lappeenranta 2023

European Association of Environmental and Resource Economists (EAERE), Online 2021