Hrvoje Keko

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SKILL PROFILE

- well-seasoned power system planning, analysis and decision support expert
  - work experience and network of direct contacts spanning academia, consulting and industry environments
  - intercontinental collaboration in consultant, scientific and industry teams (Europe, North and South America, Africa)
  - expertise in power system modelling and decision support, proficiency in optimization and machine learning, experience in forecasting, uncertainty modelling and risk management
  - up-to-date knowledge of key industrial automation, data modelling and cyber security standards

- strong business analysis and business development expertise in digitalized electric power systems
  - established and lead a successful research and innovation team that navigated the development of digital solutions portfolio for an electric equipment focused manufacturer establishing a digital solutions branch
  - innovative project portfolio levelled the team with European peers; the team singled out in national and EU JRC reports
  - capable of establishing and maintaining longer-term relationships with key clients: including co-development and adaptation of solutions to the client needs, thanks to strong technical foundation

WORK EXPERIENCE

Founder and Lead Consultant

argovolt Ltd.[11/2024 – current]

- *boutique* consulting SME, with a principal focus on digitalization and digital transformation of the energy sector
- providing business analysis and decision support services for power system and power markets participants
- key differentiation factor: a wide and versatile area of expertise; direct connections spanning academia, consulting, and industry
- offering design, development and business process inclusion of decision support tools based on optimization and forecasting
- innovative R&D project support focused on digitalized electric power systems
- coordination of a multifaceted team of associated experts (economic, environmental and legal aspects of energy projects)

Head of R&D and Lead Engineer

Grid ONE Ltd.[10/2023 – 10/2024]

- leading the R&D arm of a startup and establishment and reinforcement of its R&D portfolio
- product development and market launch of a real-time energy community management platform
- custom tools for big data scaled analytics (Python, TimescaleDB, Azure CosmosDB, PostGIS)
- consulting services to grid operator clients, based on advanced power system analytics

Lead R&D Project Manager

KONČAR-DIGITAL Ltd. [03/2023 – 09/2023]

- successful completion of the ongoing R&D projects portfolio; knowledge transfer into product and business development
- key contribution to a new product line of business, based on IEC CIM series of standards
- preparation, coordination and submission of R&D project proposals

Head of R&D (Smart Grid Products and Solutions)

KONČAR-DIGITAL Ltd.[10/2021 – 03/2023]

- R&D project portfolio and team management, 10+ H2020 funded projects aligned with product and business portfolio
- key smart grid modelling expert, key senior engineer and cyber-security in power systems expert
- contribution to standardization activities (IEC 61850, IEC 62746, IEC 62443, IEC 62351)
- consulting services on optimization, smart technologies and storage deployment in the energy sector

Head of Digital R&D

KONČAR – Engineering Ltd. (formerly KONČAR-KET) [02/2019 – 09/2021]

- R&D project portfolio and team management
    - R&D team brought to top European level considering Smart Grid projects established from scratch
    - the company participation in Horizon programme singled out both in national report and JRC report
- key senior engineer, power systems expert including cyber security in power systems
- standardization activities (primarily in IEC 61850, IEC 62746, IEC 62443)
    - worked on the adoption of OpenADR standard within the IEC 62746 standard series umbrella
    - key team member that led to the *world first* IEC 62443-2-4 certificate for the KONČAR PROZA NET IACS solution

Lead Business Analyst and Business Developer

KONČAR Power Plant and Traction Engineering Inc. (KONČAR-KET) [05/2017 – 02/2019]

- extending the existing product portfolio beyond the classic IACS systems scope
- key senior engineer and power systems domain expert
- cyber-security in power systems expert
- business development in areas linking the IT sector to energy
- lead responsible for R&D activities (the establishment of Horizon 2020 project portfolio synced with the product portfolio)
- standardization activities (IEC 61850, IEC 62746, IEC 62443)

Senior Expert

Energy Institute Hrvoje Požar [2012 – 05/2017]

- wind and hydro power forecasting, renewable power resource analyses, including CFD-based models and spatial analyses
- expansion planning for integrated markets (SE Europe, Africa)
- modelling and multi-criteria evaluation of power system projects incl. technical feasibility and due diligence studies
- electricity and heat market simulations (in PLEXOS, assisted with custom mathematical models and tools)
- optimal operation decision support in market conditions
- electric mobility modelling incl. its impact on power systems and markets
- statistical analyses, geocoding and data mining of customer metering data (for district heating and electricity)
- smart metering and smart grid deployment feasibility studies

Researcher in Power System Unit and PhD student in MIT Portugal program

INESC TEC and FEUP: Faculty of Engineering, University of Porto [2009 – 2012]

- development of a novel wind power forecasting technique
- uncertainty modelling in power system operation
- using decomposition techniques in advanced optimization
- solving large-scale operational research problems applied to electric power systems
- optimal sizing and placement of static compensation devices (coupling optimization with dynamic simulation)
- applying information theoretic learning methods in machine learning
- stochastic multi-criteria optimization (using Gurobi and CPLEX solvers, as well as custom optimization algorithms)
- tailored scenario reduction models appropriate for diverse risk management
- storage models capable of handling stochastic limits
- modelling of the impacts of electric mobility on the electric power system operation

Junior Expert

EIHP: Energy Institute Hrvoje Požar [08/2007 – 2009]

- power system planning and analysis
- uncertainty modelling in power systems
- multi-criteria evaluation of power system projects
- electricity and heat market simulation (using PLEXOS for Power Systems, PSS/E and other established modelling tools)

Junior Researcher in Power System Unit

INESC Porto (now INESC TEC - INESC Science and Technology) [05/2006 – 07/2007]

- development of EPSO: an advanced hybrid evolutionary/particle swarm optimization algorithm
- application of evolutionary computation techniques to power systems and smart grids
- wind power modeling in power systems operation

Research and teaching assistant

Faculty of Electrical Engineering and Computing, University of Zagreb [2004 – 04/2006]

- development, implementation and deployment of an advanced distribution network optimal expansion planning algorithm
- geographic information systems in power systems planning
- electricity market simulations (using early versions of PLEXOS for Power Systems)
- multi-criteria evaluation of energy projects (technical and economic feasibility studies)

EDUCATION AND TRAINING

PhD in Sustainable Energy Systems (MIT Portugal PhD program)

FEUP - Faculty of Engineering, University of Porto [started 2009]

Research topic: implementation of generation coordination algorithm for complex systems including stochastic energy storages (e.g. electric vehicle batteries) including optimization of market participation, currently undergoing submission for evaluation

Master in Electrical Engineering

Faculty of Electrical Engineering and Computing, University of Zagreb [1998 – 2003]

five-year master program in EE with specialization to electric power systems, distribution network planning,

graduated summa cum laude

LANGUAGE SKILLS

Mother tongue(s): Croatian

Other language(s):

English
LISTENING C2 **READING** C2 **WRITING** C2

SPOKEN PRODUCTION C2 **SPOKEN INTERACTION** C2

Portuguese
LISTENING C2 **READING** C2 **WRITING** C1

SPOKEN PRODUCTION C1 **SPOKEN INTERACTION** C1

German
LISTENING B1 **READING** B2 **WRITING** A2

SPOKEN PRODUCTION A1 **SPOKEN INTERACTION** A1

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

SELECTED PUBLICATIONS

Selection only. Full publication profile available on Google Scholar (2680+ citations, overall h-index 20)
https://scholar.google.com/citations?hl=en&user=lVeUvtAAAAAJ

Peer-reviewed journals

L. Herenčić, M. Kirac, H. Keko, I. Kuzle, and I. Rajšl, "**Automated energy sharing in MV and LV distribution grids within an energy community: A case for Croatian city of Križevci with a hybrid renewable system,**" Renewable Energy, vol. 191, pp. 176–194, May 2022

L. Luttenberger Marić, H. Keko, and M. Delimar, "**The Role of Local Aggregator in Delivering Energy Savings to Household Consumers,**" Energies, vol. 15, no. 8, Art. no. 8, Jan. 2022

T. Novosel, L. Perković, M. Ban, H. Keko, T. Pukšec, G. Krajačić, and N. Duić, "**Agent based modelling and energy planning – Utilization of MATSim for transport energy demand modelling**," Energy, 2015

Barbeiro P.N.P., Moreira C., Keko H., Teixeira H., Rosado N., Moreira J., Rodrigues R., "**Sizing and Siting STATCOM Devices in the Portuguese Transmission System for Improving System Security**", IET Generation, Transmission and Distribution, 2014

Miranda V., Krstulovic J., Keko H., Moreira C., Pereira J., "**Reconstructing Missing Data in State Estimation With Autoencoders**", IEEE Transactions on Power Systems, September 2012.

Zhou Z., Botterud A., Wang J., Bessa R., Keko H., Sumaili J., Miranda V., "**Application of Probabilistic Wind Power Forecasting in Electricity Markets**", Wind Energy, April 2013.

Botterud A., Zhou Z., Wang J., Bessa R.J., Keko H., Suamili J., Miranda, V., "**Wind Power Trading under Uncertainty in LMP markets**," IEEE Transactions on Power Systems, September 2011.

Botterud A., Zhou Z., Wang J., Sumaili J., Keko H., Mendes J., Bessa R.J., Miranda V., "**Demand Dispatch and Probabilistic Wind Power Forecasting in Unit Commitment and Economic Dispatch: A Case Study of Illinois**,"IE EE Transactions on Sustainable Energy, September 2011

Wang J., Botterud A., Bessa R., Keko H, Carvalho L., Issicaba D., Sumaili J., Miranda V., "**Representing Wind Power Forecasting Uncertainty in Unit Commitment**," Applied Energy, Vol. 88, No. 11, pp. 4014-4023, 2011.

Miranda,V.; Keko,H.;Jaramillo Duque, Á., **Stochastic Star Communication Topology in Evolutionary Particle Swarms (EPSO)**, International Journal of Computational Intelligence Research (IJCIR) – Volume 4, Number 2 (2008) Special Issue on Particle Swarm Optimization

Book chapters

J. Wang, J. Valenzuela, A. Botterud, H. Keko, R. Bessa, and V. Miranda, "**Reliability Assessment Unit Commitment with Uncertain Wind Power,**" in **Handbook of Wind Power Systems**, P. M. Pardalos, S. Rebennack, M. V. F. Pereira, N. A. Iliadis, and V. Pappu, Eds. Springer Berlin Heidelberg, 2013, pp. 3–20.

Miranda, V.; Keko, H.; Jaramillo Duque, A. **EPSO: Evolutionary Particle Swarms // Advances in Evolutionary Computing for System Design Series: Studies in Computational Intelligence**, Vol. 66 / Jain, Lakhmi C. ; Palade, Vasile ; Srinivasan, Dipti (ed.). New York : Springer, 2007. pp. 139-169.

SELECTED PROJECT REFERENCES

2017-2022: FLEXCoop, https://www.flexcoop.net

Horizon 2020 project on democratising the energy market through introduction of innovative demand response tools and novel business models for energy cooperatives. Development of OpenADR-based secure end-to-end architecture for cooperatives to provide flexibility. A novel concept binding OAuth2 and OpenADR to secure the deployed on-prem gateways. A proposal for a secure, standards-based reference architecture for flexibility activation and democratization.

2017-2022: CROSSBOW, https://crossbowproject.eu

Horizon 2020 project. Supranational level tools, to coordinate TSOs facing high shares of renewables. Development of STO-CC – a storage operator coordination tool.

2020-2023: ATTEST, https://attest-project.eu

Horizon 2020 project. Advanced open-source tools to support TSO and DSO up to 2030 and beyond. Piloted a data silo breaking and multiple truth sources integration tool, enabling IEC CIM (IEC 61968/61970) native and Git-like versioning and management of the network data for diverse processes in the grid operator.

2020-2024: SYNERGY, https://synergyh2020.eu

Horizon 2020 project. A novel framework to enable data exchange between electricity sector stakeholders. Key developments in the internal common data model, compatible with IEC CIM and other data modelling standards in the electricity sector. Standardization contributions via classic channels and Horizon standardization booster efforts.

2011-2013: Transient Stability and Voltage Control Study in the Transmission Network of Portugal: 2014 Horizon

Client: REN (Portuguese TSO). Lifetime extension of older wind power plants and upgrades of performance in short circuit conditions. Coupling of advanced optimization techniques with PSS/E dynamic system simulations, for optimal siting and sizing of static compensation devices in the Portuguese transmission network.

2008-2011: Wind Power Forecasting and Electricity Markets, Argonne National Laboratory (Chicago) and INESC Porto (Porto, Portugal)

US Department of Energy (DoE) funded project. Advancing the state-of-the art of wind power forecasting techniques for wind power.

2016-2017: Southern African Power Pool Plan 2017, https://www.sapp.co.zw/sapp-pool-plan-0

World Bank funded Southern African Power Pool project. A long-term 12-country power system expansion plan up to 2040. Identification of projects with supranational importance. The project covered detailed GIS-based resource analyses, network analyses and market simulation. Responsible for PLEXOS-based power system modelling and market simulation.

2017-2019: Modelling of Offshore Platform Reuse in Wave and Wind Energy Production for the North Adriatic Sea

Modelling of offshore wind potential based on mesoscale reanalysis data. Development of an approximate operational model for the wind-wave offshore power plant to be sited at offshore platform sites. Paper presented at SDEWES 2018 conference.

2010-2012: Automated calculation of NTC and GTC in the national transmission networks of South-Eastern Europe

Automated ENTSO-E sanctioned method, implemented in Python and PSS/E, calculating the increase in net transfer capacities and grid transfer capacities of transmission network expansion projects, applied within PCI Projects of Common Interest nominations.