Filippo Pecci

CONTACT INFORMATION

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RESEARCH OBJECTIVE

Develop optimization-based energy systems models with high resolution and computational performance, providing decision support to accelerate transition to net-zero and resilient energy systems.

APPOINTMENTS

2025-present **Centro Euro-Mediterraneo per i Cambiamenti Climatici (CMCC)**
Scientist at the RFF-CMCC European Institute on Economics and the Environment (EIEE).

2022-2024 **Princeton University**
Associate Research Scholar at the Andlinger Center for Energy and the Environment.

2018-2022 **Imperial College London**
Postdoctoral Research Associate at the Department of Civil and Environmental Engineering.

EDUCATION

2018 **Imperial College London**
Ph.D. in Computational Optimization, Department of Civil and Environmental Engineering.
Thesis: Optimal design for control of water supply networks by mixed integer programming [pdf]

2014 **Università degli Studi di Padova**
MSc in Mathematics.
Thesis: Hierarchical stratification of Pareto sets [pdf]

2011 **Università degli Studi di Padova**
BSc in Mathematics.

PREPRINTS

[P3] Cole, D. L., **Pecci, F.**, Guerra, O. J., Gangammanavar, H., Jenkins, J. D., and Zavala, V. M. "Graph-Based Modeling and Decomposition of Hierarchical Optimization Problems". arXiv. URL: http://arxiv.org/abs/2501.02098.

[P2] Dimanchev, E., Gabriel, S. A., Fleten, S.-E., **Pecci, F.**, and Korpas, M. "Choosing climate policies in a second-best world with incomplete markets: insights from a bilevel power system model". MIT CEEPR Working Paper Series. URL: https://ceepr.mit.edu/wp-content/uploads/2024/09/MIT-CEEPR-WP-2024-14.pdf.

[P1] Lau, M., **Pecci, F.**, Bonaldo, L., Jacobson, A., and Jenkins, J. D. "A Parallelized Cutting-Plane Algorithm for Computationally Efficient Modelling to Generate Alternatives". Zenodo. URL: https://doi.org/10.5281/zenodo.13963962.

REFEERED JOURNAL ARTICLES

[J23] **Pecci, F.** and Jenkins, J. D. "Regularized Benders Decomposition for High Performance Capacity Expansion Models". In: *IEEE Transactions on Power Systems* (2025). DOI: 10.1109/TPWRS.2025.3526413.

[J22] Jacobson, A., **Pecci, F.**, Sepulveda, N., Xu, Q., and Jenkins, J. D. "A computationally efficient Benders decomposition for energy systems planning problems with detailed operations and time-coupling constraints". In: *INFORMS Journal on Optimization* 6.1 (2024), pp. 32–45. DOI: 10.1287/ijoo.2023.0005.

[J21] Jenks, B., Ulusoy, A.-J., **Pecci, F.**, and Stoianov, I. "Distributed Nonconvex Optimization for Control of Water Networks with Time-coupling Constraints". In: *Water Resources Management* (2024). DOI: 10.1007/s11269-024-03985-8.

[J20] Shmaya, T., Housh, M., **Pecci, F.**, Baker, K., Kasprzyk, J., and Ostfeld, A. "Conjunctive Optimal Operation of Water and Power Networks". In: *Helyon* 10 (20 2024). DOI: 10.1016/j.heliyon.2024.e39136.

[J19] Jenks, B., **Pecci, F.**, and Stoianov, I. "Optimal design-for-control of self-cleaning water distribution networks using a convex multi-start algorithm". In: *Water Research* (2023), p. 119602. ISSN: 0043-1354. DOI: 10.1016/j.watres.2023.119602.

[J18] Jenks, B., Ulusoy, A.-J., **Pecci, F.**, and Stoianov, I. "Dynamically adaptive networks for integrating optimal pressure management and self-cleaning controls". In: *Annual Reviews in Control* (2023). ISSN: 1367-5788. DOI: https://doi.org/10.1016/j.arcontrol.2023.03.014.

[J17] **Pecci, F.** and Stoianov, I. "Bounds and convex heuristics for bi-objective optimal experiment design in water networks". In: *Computers and Operations Research* (2023). DOI: 10.1016/j.cor.2023.106181.

[J16] **Pecci, F.**, Stoianov, I., and Ostfeld, A. "Convex Heuristics for Optimal Placement and Operation of Valves and Chlorine Boosters in Water Networks". In: *Journal of Water Resources Planning and Management* 148.2 (2022), pp. 1–14. DOI: 10.1061/(ASCE)WR.1943-5452.0001509.

[J15] Ulusoy, A.-J., Mahmoud, H. A., **Pecci, F.**, Keedwell, E. C., and Stoianov, I. "Bi-objective design-for-control for improving the pressure management and resilience of water distribution networks". In: *Water Research* 222 (2022), p. 118914. DOI: 10.1016/j.watres.2022.118914.

[J14] Waldron, A., Ulusoy, A.-J., **Pecci, F.**, and Stoianov, I. "Principal Component Based Sampling for the Continuous Maintenance of Hydraulic Models". In: *Water Research* 222 (2022), p. 118905. DOI: 10.1016/j.watres.2022.118905.

[J13] Blocher, C., **Pecci, F.**, and Stoianov, I. "Prior Assumptions for Leak Localisation in Water Distribution Networks with Uncertainties". In: *Water Resources and Management* (2021). DOI: 10.1007/s11269-021-02988-z.

[J12] **Pecci, F.**, Stoianov, I., and Ostfeld, A. "Relax-tighten-round algorithm for optimal placement and control of valves and chlorine boosters in water networks". In: *European Journal of Operational Research* 295.2 (2021), pp. 690–698. DOI: 10.1016/j.ejor.2021.03.004.

[J11] Ulusoy, A.-J., **Pecci, F.**, and Stoianov, I. "Bi-objective design-for-control of water distribution networks with global bounds". In: *Optimization and Engineering* (2021). Published online. DOI: 10.1007/s11081-021-09598-z.

[J10] Blocher, C., **Pecci, F.**, and Stoianov, I. "Localizing Leakage Hotspots in Water Distribution Networks via the Regularization of an Inverse Problem". In: *Journal of Hydraulic Engineering* 146.4 (2020). DOI: 10.1061/(ASCE)HY.1943-7900.0001721.

[J9] Nerantzis, D., **Pecci, F.**, and Stoianov, I. "Optimal control of water distribution networks without storage". In: *European Journal of Operational Research* 284.1 (2020), pp. 345–354. DOI: 10.1016/j.ejor.2019.12.011.

[J8] **Pecci, F.**, Parpas, P., and Stoianov, I. "Sequential Convex Optimization for Detecting and Locating Blockages in Water Distribution Networks". In: *Journal of Water Resources Planning and Management* 146.8 (2020). DOI: 10.1061/(ASCE)WR.1943-5452.0001233.

[J7] Ulusoy, A.-J., **Pecci, F.**, and Stoianov, I. "An MINLP-Based Approach for the Design-for-Control of Resilient Water Supply Systems". In: *IEEE Systems Journal* 14.3 (2020), pp. 4579–4590. DOI: 10.1109/JSYST.2019.2961104.

[J6] Waldron, A., **Pecci, F.**, and Stoianov, I. "Regularization of an Inverse Problem for Parameter Estimation in Water Distribution Networks". In: *Journal of Water Resources Planning and Management* 146.9 (2020). DOI: 10.1061/(ASCE)WR.1943-5452.0001273.

[J5] **Pecci, F.**, Abraham, E., and Stoianov, I. "Global optimality bounds for the placement of control valves in water supply networks". In: *Optimization and Engineering* 20.2 (2019), pp. 457–495. DOI: 10.1007/s11081-018-9412-7.

[J4] **Pecci, F.**, Abraham, E., and Stoianov, I. "Model Reduction and Outer Approximation for Optimizing the Placement of Control Valves in Complex Water Networks". In: *Journal of Water Resources Planning and Management* 145.5 (2019). DOI: 10.1061/(ASCE)WR.1943-5452.0001055.

[J3] **Pecci, F.**, Abraham, E., and Stoianov, I. "Penalty and relaxation methods for the optimal placement and operation of control valves in water supply networks". In: *Computational Optimization and Applications* 67.1 (2017), pp. 201–223. DOI: 10.1007/s10589-016-9888-z.

[J2] **Pecci, F.**, Abraham, E., and Stoianov, I. "Quadratic head loss approximations for optimisation problems in water supply networks". In: *Journal of Hydroinformatics* 19.4 (2017), pp. 493–506. DOI: 10.2166/hydro.2017.080.

[J1] **Pecci, F.**, Abraham, E., and Stoianov, I. "Scalable Pareto set generation for multiobjective co-design problems in water distribution networks: a continuous relaxation approach". In: *Structural and Multidisciplinary Optimization* 55.3 (2017), pp. 857–869. DOI: 10.1007/s00158-016-1537-8.

Refereed conference proceedings

[C4] **Pecci, F.**, Stoianov, I., and Ostfeld, A. "Optimal Design-for-Control of Chlorine Booster Systems in Water Networks via Convex Optimization". In: *2022 European Control Conference (ECC)*. 2022, pp. 1988–1993. DOI: 10.23919/ECC55457.2022.9838063.

[C3] **Pecci, F.**, Abraham, E., and Stoianov, I. "Outer approximation methods for the solution of co-design optimisation problems in water distribution networks". In: *IFAC-PapersOnLine*. Vol. 50. 1. 2017, pp. 5373–5379. DOI: 10.1016/j.ifacol.2017.08.1069.

[C2] **Pecci, F.** and Stoianov, I. "Optimising valve placement and pressure control for multi-feed sectors in water supply networks using outer approximation". In: Figshare, 2017. DOI: 10.15131/shef.data.5364196.v1. CCWI 2017 - 15th International Conference on Computing and Control for the Water Industry.

[C1] **Pecci, F.**, Abraham, E., and Stoianov, I. "Mathematical programming methods for pressure management in water distribution systems". In: *Procedia Engineering*. Vol. 119. 1. 2015, pp. 937–946. DOI: 10.1016/j.proeng.2015.08.974. Computing and Control for the Water Industry (CCWI2015).

Patents

[B2] Waldron, A., **Pecci, F.**, and Stoianov, I. "Online maintenance of hydraulic models for WSN through continuous monitoring and adaptive control". 2021. Filed. GB application number 2112111.6.

[B1] Stoianov, I., Abraham, E., and **Pecci, F.** "Management of liquid conduit systems". 2015. Granted. PCT/GB2016/054026. GB2545899B (2018), US11078650B2 (2021), EP3394697B1 (2021).

Conference presentations and invited seminars

12. 2024 INFORMS Annual Meeting, Seattle (WA), 20-23 October, 2024.
11. Hexagon Workshop on Power Grids, Bergamo (Italy), 18-20 June, 2024. Regularized Benders Decomposition for High Performance Capacity Expansion Models.
10. 2023 INFORMS Annual Meeting, Phoenix (Arizona), 15-18 October, 2023. Learning to optimize macro-energy systems.
9. International Conference on Optimization and Decision Science 2022, Florence, Italy, 30 August - 2 September, 2022. A global optimization framework for resilient water distribution networks.
8. European Control Conference 2022, London, United Kingdom, 12-15 July, 2022. Optimal Design-for-Control of Chlorine Booster Systems in Water Networks via Convex Optimization.
7. Control & optimization Seminars, Imperial College London, 22 Gennaio 2020. Mathematical optimization for intelligent water distribution networks: model calibration, and event detection and localisation.
6. 17th Computing and Control for the Water Industry (CCWI), Exeter, United Kingdom, 1-4 September, 2019. Tight Convex Relaxations for Optimal Design and Control Problems in Water distribution Networks.
5. 6th International Conference on Continuous Optimization (ICCOPT), Berlin, Germany, 3 - 8 August, 2019. Non-linear inverse problems via sequential convex optimization.
4. 6th International Conference on Engineering Optimization (EngOpt), Lisbon, Portugal, 17 - 19 September, 2018. A branch and bound method for globally optimizing valve locations in water distribution networks.

3. 20th IFAC World Congress, Toulouse, France, 9 - 14 July, 2017. Outer approximation methods for the solution of co-design optimization problems in water distribution networks.
2. 14th Computing and Control for the Water Industry (CCWI), Amsterdam, the Netherlands, 7-9 November, 2016. Multiobjective pressure optimization in water distribution systems (Poster Presentation).
1. 13th Computing and Control for the Water Industry (CCWI), Leicester, United Kingdom, 2-4 September, 2015. Mathematical programming methods for pressure management in water distribution systems.

TEACHING EXPERIENCE

- **Applied Optimization Methods for Energy Systems Engineering**, *Princeton University*.
  Lecture on decomposition methods. Jupyter notebooks are publicly available.
  - Fall 2024
  - Fall 2023
  - Fall 2022
- **Water Supply and Distribution Systems**, *Imperial College London*.
  Lecture series on convex optimization and its applications to water systems.
  - Autumn 2021 (MSc module)
  - Spring 2021 (MEng module)
  - Autumn 2020 (MSc module)
  - Spring 2020 (MEng module)

  Lectures on hydraulic modeling of water supply systems.
  - Spring 2021 (MSc module)
  - Spring 2020 (MSc module)
  - Spring 2019 (MSc module)
  - Spring 2018 (MSc module)
  - Spring 2017 (MSc module)
  - Spring 2016 (MSc module)
- **Mathematics tutorials for MSc students**, *Imperial College London*.
  - Spring 2017
  - Spring 2016
  - Spring 2015

MENTORING

Doctoral Students

- Mike Lau, Mechanical & Aerospace Engineering, Princeton University, 2023-present. Topic: Efficient methods for Modeling to Generate Alternatives to support energy systems' decision-making and policy formation.
- Anna Jacobson, Program on Quantitative & Computational Biology, Princeton University, 2022-2024. Topic: Computationally efficient decomposition methods for energy system planning models.
- Bradley Jenks, Department of Civil and Environmental Engineering, Imperial College London, 2021-present. Topic: Modelling and Control of Wate Quality in Water Distribution Networks.
- Dr Aly-Joy Ulusoy, Department of Civil and Environmental Engineering, Imperial College London, 2018-2021. Thesis title: "Multi-objective design-for-control of resilient water distribution networks".
- Dr Caroline Blocher, Department of Civil and Environmental Engineering, Imperial College London, 2018-2021. Thesis title: "Leak Localisation in Water Distribution Networks: Regularisation of an Ill-Posed Inverse Problem"

- Dr Alexander Waldron, Department of Civil and Environmental Engineering, Imperial College London, 2018-2021. Thesis: title “Recurring Automated Model Calibration for Dynamically Adaptive Water Distribution Networks".

Graduate and Undergraduate Students

- Sullivan Meyer, Mechanical & Aerospace Engineering, MEng, Princeton University, 2024. Final year thesis: “Integrated Strategic and Operational Model of a National Aviation System to Support Sectoral Decarbonization".
- Tomer Shmaya, Faculty of Civil and Environmental Engineering, Technion - Israel Institute of Technology, 2023 - 2024. MSc project thesis: “Conjunctive Optimal Operation of Power and Water Networks"
- Alexander Thebelt, Department of Computing, Imperial College London, 2018. MSc project thesis: “Application of Large-Scale Optimization Methods for Efficient Real-Time Detection of Contaminations in Water Supply Networks".
- Yifei Lou, Department of Civil and Environmental Engineering, Imperial College London, 2018. MSc project thesis: “The analysis of network resilience for firefighting water supply to a high-rise building".
- Marc Girona Mata, Department of Civil and Environmental Engineering, Imperial College London, 2016. MSc project thesis: “Towards a more adaptive water distribution network in Barcelona”.
- Louis Vallette Viallard, Department of Civil and Environmental Engineering, Imperial College London, 2016. MSc project thesis: “Assessing the resilience of water distribution networks using a multi-critera approach”.