

# On Compromises Between Data-Driven Energy Management Optimization and Digital Frugality

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In recent years, Artificial Intelligence (AI) and Operations Research (OR) techniques have relied on the availability of large amounts of data and the power of computing infrastructures to solve more and more complex problems. This strongly contrasts with the practice of these disciplines a few decades ago when developers had to minimize the memory footprint and CPU time of their applications. Nowadays, frugality objectives are returning, to control the energy consumption and environmental impact of AI/OR solutions. Three complementary studies conducted in the Schneider Electric AI Hub illustrate this new trend. Delgado Fernandez et al. [1] have shown how office building energy consumption models can be learned with little data, by reusing already available building models, enabling the generation of a good-enough forecasts with only a few days of local data. Puech et al. [2] have benchmarked various stochastic optimization techniques to control microgrids without relying on external meteorological data, establishing 2-Stage Stochastic Programming as a viable compromise between complexity and results quality on this benchmark. Finally, extending a previous study [3], Weber and Lagarde have compared the carbon savings enabled by 46 typical microgrids ( $\sim 100\text{tCO}_2\text{eq./year}$  on average) to the carbon emissions necessary to manufacture, transport and install the microgrid equipment ( $\sim 10\text{t/year}$ ), and the emissions resulting from day-to-day operations ( $\sim 0.1\text{t/year}$ ). This line of research will be pursued in 2024 to learn how to establish “carbon-wise” the best compromises between data size, computational complexity, and results quality.

[1] C. Delgado Fernandez, A. Abdali, B. Boguslawski, F. Pesando, L. Drumetz, and V. Gripon. [Cold Start Methods for Building's Energy Consumption Forecasting](#). ASHRAE Annual Conference, Tampa, United States, June 2023.

[2] A. Puech, T. Rigaut, A. Le Franc, W. Templier, J.-C. Alais, M. Tournoud, V. Bossard, A. Yousef, and E. Stolyarova. [Controlling Microgrids Without External Data: A Benchmark of Stochastic Programming Methods](#). IEEE PES European Conference on Innovative Smart Grid Technologies, Grenoble, France, October 2023.

[3] P. Béguery, C. Mugnier, H. Obara, T. Lagarde, and V. Minier. [Simulation-Based Framework for “Building of the Future” Studies](#). 18<sup>th</sup> IBPSA International Conference on Building Simulation, Shanghai, China, September 2023.