Planning the production and energy supply minimizing the costs of a factory.

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Abstract: Industrial processes can be highly energy consuming. Industrial actors are increasingly trying to integrate renewable energies to their energy supply for economic and environmental reasons. Recent reviews on related research can be found in [2] and [3].

In this work, we present a mixed-integer multistage stochastic problem optimizing both the production planning and the energy supply management of an industrial complexity. The goal is to minimize the expected energy supply costs of the factory. The mathematical problem is difficult to address first due to the stochasticity of renewable energy, coupled with a large number of time-step and the presence of (a few) binary variables.

We consider two classic methods to resolve our problem: dynamic programming and model predictive control. Those methods are computationally time-consuming, leading us to explore two heuristics based on stochastic dual dynamic programming (SDDP, [4, 5]), an algorithm solving the continuous relaxation of the problem fast. The heuristic uses the cost-to-go approximation of the continuous relaxation (obtained through SDDP) and computes a policy (satisfying integer constraints) with dynamic programming. The second heuristic adapt this idea by computing a policy over two time-step instead of one.

Exactly solving the mixed integer multistage stochastic linear programm would be to use an extension of SDDP known as SDDiP ([1]). Unfortunately this algorithm approximate all continuous variables with binary ones, which in our problem with few binary variables doesn't seem reasonable. Instead we develop an alternative approach based on branch & cut methodology.

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