An Efficient Robust Solution to the Two-Stage Stochastic Unit Commitment Problem

This paper proposes a reformulation of the scenario-based two-stage unit commitment problem under uncertainty that allows finding unit-commitment plans that perform reasonably well both in expectation and for the worst case realization of the uncertainties. The proposed reformulation is based on partitioning the sample space of the uncertain factors by clustering the scenarios that approximate their probability distributions. It is, furthermore, very amenable to decomposition and parallelization using a column-and-constraint generation procedure.
During the last years, the consumption of biomass to produce power and heat has increased due to the new carbon neutral policies. Nowadays, many district heating systems operate their combined heat and power (CHP) plants using different types of biomass instead of fossil fuel, especially to produce heat. Since biomass is transported from the supplier to the consumption sites and the contracts with the suppliers are negotiated months in advance, the negotiation process involves many uncertainties from the energy producer’s side. The demand for biomass is uncertain at the time of negotiation, and heat demand and electricity prices vary drastically during the planning period. Furthermore, the optimal operation of combined heat and power plants has to consider the existing synergies between the power and heating systems while always fulfilling the heat demand of the system. We propose a solution method using stochastic optimization to support the biomass supply planning for combined heat and power plants. Our two-phase approach combines mid-term decisions about biomass supply contracts with the short-term decisions regarding the optimal market participation of the producer to ensure profitability and feasibility. The risk of major deficits in biomass supply is reduced by including appropriate risk measures to the models. We present numerical results and an economic analysis based on a realistic test case.
Stochastic Programming for Fuel Supply Planning of Combined Heat and Power Plants
The consumption of biomass to produce power and heat has increased due to the carbon neutral policies. Combined heat and power (CHP) plants often combine biomass with other fuels, e.g., natural gas. The negotiation process for supply contracts involves many uncertainties due to the long planning horizon. The demand for biomass is uncertain, and heat demand and electricity prices vary during the planning period. We propose a method using stochastic optimization to support the biomass and natural gas supply planning for CHP plants including short-term decisions for optimal market participation.

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**Related external organisation**

**Universita Roma Tre**
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Period: 17 Jul 2017 → 21 Jul 2017
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**Related event**

**IFORS 2017: 21st Conference of the International Federation of Operations and Research**
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Dynamical Systems
Centre for IT-Intelligent Energy Systems in Cities

Links:

**Related event**

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**SMATAD 2017**
Period: 8 May 2017 → 11 May 2100
Ignacio Blanco (Participant)
Juan Miguel Morales González (Organizer)

Department of Applied Mathematics and Computer Science
Dynamical Systems

**Related event**

**SMATAD 2017: Symposia on Mathematical Techniques Applied to Data Analysis and Processing**
INFORMS Annual Meeting
Period: 13 Nov 2016 → 17 Nov 2016
Ignacio Blanco (Speaker)
Juan Miguel Morales González (Other)
Department of Applied Mathematics and Computer Science
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Description

Related event
INFORMS Nashville 2016 Annual Meeting: Fine Tuning Decisions in Music City
13/11/2016 → 17/11/2016
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Activity: Talks and presentations › Conference presentations

Optimization challenges in the evolution of energy networks to smart cities.
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