

INVITED TALK (MATHEMATICS IN ATMOSPHERIC SCIENCE AND CLIMATE CHANGE))

Stochastic programming models for the energy transition

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Abstract

In this presentation we describe a framework for multiscale stochastic programming and demonstrate how it can be applied to energy transition problems. In the horizon towards 2050 we will see that the share of intermittent renewables in the energy system increases. That implies there are several long-term decisions to be made on how to design the energy system in terms of types of energy generation technologies, import/export capacities for energy (pipelines, cables, lines) and demand side technologies. At the same time, due to the intermittent and stochastic nature, it is important to model the short-term operation of these systems inside the long-term models with sufficient detail. We present examples of the use of multi horizon stochastic programming with both long-term and short-term uncertainty. The structures of multihorizon programming also invite for decomposition and we present examples on tailored Benders decomposition and Lagrangean decompositions. We show that it is possible to solve problems with more than a billion variables and hundreds of millions of constraints, in practical applications.

References

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Asgeir Tomasgard is a professor of operations research at the Department of Industrial Economics and Technology Management. He is the director of [NTNU Energy](#) and the [NTNU Energy Transition Initiative](#). He obtained his PhD in operations research at NTNU in 1998. Tomasgard researches techno-economic modeling and analyses at the interface between technology, economy, and society. He is particularly interested in the connection between zero-emission energy systems and the decarbonization of transport, industry, and buildings. To analyze these issues, often large scale stochastic optimization models are the fundament.

Tomasgard is a member of the Norwegian Academy of Technological Sciences (NTVA) and is in the steering panel for energy in the European Academies Science Advice Council. He was elected chair (2010-2013) for the Committee on Stochastic programming (COSP) a technical committee of the [Mathematical Optimization Society](#). He is also part of the management board of the EURO working group on stochastic optimization.

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