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.

**Biomass Supply Planning for Combined Heat and Power Plants using Stochastic Programming**

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.

**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.
Projects:

Efficient Operation of Energy Grids
Department of Applied Mathematics and Computer Science
Period: 01/12/2016 → 30/11/2019
Number of participants: 4
Phd Student:
Banis, Frederik (Intern)
Supervisor:
Guericke, Daniela (Intern)
Madsen, Henrik (Intern)
Main Supervisor:
Poulsen, Niels Kjølstad (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Activities:

ECSO 2017
Period: 20 Sep 2017 → 22 Sep 2017
Ignacio Blanco (Guest lecturer)
Daniela Guericke (Other)
Department of Applied Mathematics and Computer Science
Dynamical Systems

Description
European Conference on Stochastic Optimization
Links:
http://ecso2017.inf.uniroma3.it/

Related external organisation
Universita Roma Tre
Italy
Activity: Talks and presentations › Conference presentations

IFORS 2017
Period: 17 Jul 2017 → 21 Jul 2017
Ignacio Blanco (Speaker)
Daniela Guericke (Other)
Department of Applied Mathematics and Computer Science
Dynamical Systems
Degree of recognition: International

Related event
IFORS 2017: 21st Conference of the International Federation of Operations and Research
17/07/2017 → 21/07/2017
Québec City, Canada
**Decision-making for integrated energy systems**

*Period:* 1 Jul 2017  
Daniela Guericke (Invited speaker)  
Department of Applied Mathematics and Computer Science  
Dynamical Systems  
Centre for IT-Intelligent Energy Systems in Cities  

**Description**  
Presentation at 10th DS&OR Forum

**Related external organisation**

University of Paderborn  
Germany

**Decision-making under uncertainty for energy companies in smart cities**

*Period:* 30 May 2017  
Daniela Guericke (Speaker)  
Ignacio Blanco (Other)  
Department of Applied Mathematics and Computer Science  
Dynamical Systems  
Centre for IT-Intelligent Energy Systems in Cities  

**Links:**  

**Related event**

CITIES consortium meeting 2017: Centre for IT–Intelligent Energy System in Cities  
30/05/2017 → 31/05/2017  
Aarhus, Denmark