

## ■ MC-11

Monday, 12:20-13:40

8.2.38

### Energy Market Modeling

Stream: Emerging Applications of OR

*Invited session*

Chair: *Steven Gabriel*, Civil & Env. Engin./ Applied Math and Scientific Computation Program, University of Maryland, 1143 Martin Hall, 20742, College Park, MD, United States, [sgabriel@umd.edu](mailto:sgabriel@umd.edu)

#### 1 - Analysis of a Possible Natural Gas Cartel

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In this presentation we present an analysis of the global gas market under several possible cartels involving the Gas Exporting Countries Forum (GECF). We make use of the World Gas Model, a large-scale complementarity model for determining Nash-Cournot based market equilibria.

#### 2 - Using Real Options to Evaluate Optimal Funding Strategies for Carbon Capture and Storage (CCS) Projects in the European Union

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A barrier to large scale implementation of CCS is the lack of demonstration projects that validate the technology. A few projects in the EU are under development to use CCS on a large scale. Taking a funding agency's perspective, we employ a real options framework to select an optimal project portfolio. We solve stochastic dynamic programs to obtain funding strategies in order to maximize success by a target year. The model demonstrates the reduction of risk in the multi-stage competition, while considering knowledge spillover. State space, computational complexity and runtimes are analyzed.

#### 3 - A Model for Oligopolistic Natural Gas Markets

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In our model, the interaction between certain market players is posed as a generalized Nash-Cournot competition. We take into consideration the long-term contracts aspects. The producers sell their gas to a set of independent traders who sell it then to end-users. Storage and transportation aspects are taken care of by global operators. We use a system dynamics approach to model possible fuels substitution between the consumption of coal, oil and natural gas. We describe some of the theoretical aspects as well as preliminary numerical results for the European natural gas market.

#### 4 - Cartelisation in the Natural Gas Market: the Stability Issue

*Olivier Massol*, Center for Economics and Management, IFP - IFP School, 228-232 Avenue Napoléon Bonaparte, 92852, Rueil-Malmaison, France, [olivier.massol@ifp.fr](mailto:olivier.massol@ifp.fr), *Stéphane Chung-Ming*

The creation of the Gas Exporting Countries Forum (GECF) has motivated numerous discussions. In that context, Egging et al. (2009) have recently proposed a numerical model to measure the market power that could potentially be exerted by a coalition of gas exporters. As the GECF is often described as "an informal association" with an unstable membership, an investigation focussed on the cartel stability might be needed. This is precisely the goal of our contribution that illustrates how a numerical model (a simple mixed complementarity problem) can provide some policy-relevant conclusions.

## ■ MC-12

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8.2.39

### AHP 03

Stream: Analytic Hierarchy Processes, Analytic Network Processes

*Invited session*

Chair: *Anabela Pereira Tereso*, Production and Systems Department, University of Minho, Campus de Azurém, 4800-058, Guimarães, Portugal, [anabelat@dps.uminho.pt](mailto:anabelat@dps.uminho.pt)

#### 1 - Multicriteria Decision Aid: Evaluation and Comparison of the Main Tools

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Good decision making is increasingly more important to organizations. This work presents a review of the literature in multicriteria decision aid with a reference to the main techniques available in the area. We also present a research on the software tools available in this field. These software tools were then characterized and classified and their main characteristics summarized in the present work. This work is part of a project that has as final goal to implement a software tool using AHP to help on the selection of the right multicriteria decision aid software.

#### 2 - Environmental Risk Assessment for Roadway Transportation of LNG

*Emel Topuz*, Environmental Engineering, ITU, ITU Ayazaga Yerleskesi Insaat Fakultesi, Cevre Muhendisligi Bolumu Maslak, 34469, ISTANBUL, Turkey, [topuze@itu.edu.tr](mailto:topuze@itu.edu.tr), *Ilhan Talinli*, *Atakan Oztekin*

The objective of this study is to apply an environmental risk assessment approach for roadway transportation of Liquid Natural Gas (LNG) by using fuzzy AHP. Environmental and transportation factors are scored and compared with fuzzy numbers by experts and fuzzy inference methodology is applied. The outputs of this study helped to understand the source of risk and its magnitude which can be used to develop risk management for transportation of LNG. Moreover, quantified environmental risk magnitude is significant to use for further decision analyses in which environmental factors included.

#### 3 - Designing a Prioritization Model for Investment Plans under Uncertainty Using Interval Comparison Matrices

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In hierarchical MCDM methods, one of the main steps is to weigh criteria and compute each alternative weight according to the defined criteria. One of the most common weighting criteria methods is to apply the pairwise comparison matrices. In this paper we model uncertainty in investment plans prioritization by using interval comparison matrices as inputs for Lexicographic Goal Programming (LGP) and Two-stage Logarithmic Goal Programming (TLGP) methods. Finally a numerical example for real location problem is solved for each method and compared with Analytic Hierarchy Process (AHP) approach.

#### 4 - A Two Phased Multi Criteria Approach for Aviation Accident Analysis

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This study proposes a two phased approach based on the 5M (Man, Machine, Medium, Mission and Management) model and the Analytic Hierarchy Process (AHP) method for quantitatively analyzing the aviation accidents. While the 5M model is used to identify all the causal factors in an accident, the AHP method is applied to quantify these factors using the subjective judgments of experts. This approach provides both an analytical framework to assess which factor influences the accident most and valuable insights for the preventive actions to reduce the accident risk in the safety management process.