NEW ECONOMIC SCHOOL
Masters in Energy Economics

Quantitative Methods for Decision Support in Energy Industry

5th module, 2019-2020

Sergey Syntulsky
ssyntulsky@gmail.com

Course information

Course Website:

Instructor's Office Hours:

Class Time:

Room Number:

TAs: [Names and contact information]

Course description

Energy industry is undergoing transition, driven by several trends. One of these trends is digitalization: every event in power system will have digital representation and will be managed digitally. Important part of making profit from digitalization is building efficient quantitative models to support better decision making. However some models can be built even in current heterogeneous technology landscape.

This course will be focused on quantitative decision support for oil & gas companies, power suppliers, grids, consumers and regulators. It is not purely technical course – qualitative reasoning behind quantitative models as well as some prerequisite topics will be discussed (related to quantitative methods, economics and energy technologies).

Course requirements, grading, and attendance policies

Final grade will be based on homework, which will be done in teams of 2 or 3 people. Homework will includes 3 quantitative cases each based on one or more considered topics. Working on cases will include independent work with open data sources. Homework will contribute 100% of final grade. Homework should be discussed during and after lectures.

Attendance is not evaluated separately from presentations.

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Prerequisites

Data analysis in Python.

Course contents

Some decision support models will be covered, including:

1. Portfolio optimization for long-term investments planning;
2. Power market modeling in different scales;
3. Demand response and optimal bidding problems;
4. Demand and price analysis and forecasting approaches and their use cases;
5. Real options project valuation in generation and smart grids;
6. Game theory applications in energy decision support;
7. Anomalies detection for streaming data from oil & gas operations;
8. Applications of machine learning and data analysis tools in geological exploration and extraction.

Additional supplementary topics will include:

1. Overview of current trends in electricity industry technologies and economics;
2. Overview of current Russian regulatory and institutional landscape;
3. Mathematical topics like dynamic programming, optimization tools, machine learning;
4. Algorithms for anomalies detection.

Description of course methodology

This course consists of several topics related to a single industry, but not a single theory. These topics are highly decoupled. They do not pretend to cover fully such loosely defined field as decision support systems in electricity, but should be considered as a set of cases dedicated to teach student basic patterns in designing such systems. Each case should take around 2 academic hours on average including prerequisites and in-class discussions.

Course materials

Recommended software (for homework and in-class examples):
https://opensolver.org/
https://www.scipy.org/
http://pandas.pydata.org/

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Academic integrity policy

Cheating, plagiarism, and any other violations of academic ethics at NES are not tolerated.