



University of Cologne

Department of Economics – Chair in Economics and Energy Economics
 Prof. Dr. Marc Oliver Bettzüge

Seminar in Energy, Resource and Environmental Economics

Summer Term 2018

Decentralized Flexibility Markets

Schedule	<ul style="list-style-type: none"> ▪ Introductory Meeting: <u>April 18th 2018, 15-16:30</u> at the Institute of Energy Economics (ewi), Vogelsanger Str. 321a, 50827 Cologne <ul style="list-style-type: none"> ▪ Introduction ▪ Organizational Issues ▪ Allocation of Seminar Topics ▪ Skills Session: <u>April 26th 2018, 15-16:30 (@ewi)</u> <ul style="list-style-type: none"> ▪ Guidelines on how to write a paper and give a presentation ▪ Seminar: <u>June 19th and June 20th 2018 (@ewi, time tba depending on number of participants)</u> <ul style="list-style-type: none"> ▪ Presentation by each seminar participant ▪ Discussion ▪ Submission of final seminar papers until July 16th 2018. ▪ Field Trips: tba
Allocated Modules	<ul style="list-style-type: none"> ▪ Specialisation in Energy Economics – Seminar in Energy, Resource and Environmental Economics ▪ The seminar can also be selected by IMES students (restrictions might apply)
Credits	6
Language	English
Examiner	Prof. Dr. Bettzüge

1. Topic: Decentralized Flexibility Markets

The proportion of renewable generation in Germany, as well as worldwide, is growing steadily and is expected to continue to do so in the future. Renewable generation (solar, wind) can be characterized by high volatility, weather dependency, a high degree of decentralization, and, effectively, zero marginal costs. These characteristics increase the value of flexible assets such as storage or demand side management. In addition, there is a growing number of active system subscribers, both on the demand side (e.g. heat pumps, battery-electric vehicles) and on the generation side. In combination, these factors will likely induce increased pressure on the grid, both transmission and distribution, as bottlenecks will multiply and intensify. Grid expansion is a potential solution, however, it will face strong limits because of acceptance and cost, especially with respect to local and regional de-bottlenecking.

Thus, the future electricity system will most likely require adapted and novel coordination and allocation mechanisms. This holds not only for the 'static' dispatch problem which will have to efficiently coordinate a multitude of players (almost) in real-time, while still guaranteeing system stability at every point in time. Also, the 'dynamic' problem of investment coordination between generation, demand, storage, and the grid needs to be efficiently solved.

Current institutions are not adequately organized to efficiently support such a fragmented, decentralized, and volatile environment. While existing market design still largely reflects the old 'top-down'-organization of energy markets, a new 'bottom-up'-market design needs to be found. In particular, standard notions of 'unbundling' between grid and market participants have to be critically reviewed and potentially be adapted. Also, new digital technologies must play a decisive role in this context. Ideally, most (if not all) of the novel coordination tasks can be solved via market mechanisms. The corresponding buzz-word is "decentralized flexibility markets", and the overarching theme of this seminar.

IN particular, we aim to analyse the potential and challenges of decentralized flexibility markets in Europe, with a special focus on Germany. Doing so, seminar papers will cover a broad variety of topics including the role of regional pricing mechanisms in order to avoid congestion in the grid, the potential and challenges of aggregators and virtual power plants (such as our cooperation partner Next Kraftwerke), the economics of smart grids, the blockchain technology, the economic potential of energy storage (including mobile storage in the form of electric vehicles), and the increasing need for demand side management, as well as the implications for market design and grid regulation (also to be discussed with our cooperation partner Bundesnetzagentur).

2. Cooperation Partners

- Next Kraftwerke
- Bundesnetzagentur

3. Meetings

- Introductory meeting
- Skill Session
- 2-3 day(s) seminar meeting, depending on number of seminar participants
- Field Trip to Bundesnetzagentur

4. Mode of Examination

- Seminar Paper (max 5000 words)
- Presentation of work progress at seminar meeting (15 minutes)
- Oral feedback to a fellow student's topic, written feedback optional (in order to receive bonus points)

5. General Requirements

The seminar participants are expected to gain an in-depth insight into their topic independently. They should determine the main focus of their seminar paper. The emphasis within the own topic as well as the draft structure of the paper shall be discussed with a supervisor at an early stage. Furthermore, students should deal critically with the contributions of other participants. Active participation in the seminar discussion is expected. We provide a guideline for the preparation of seminar papers. This includes all design requirements.

6. Application

The registration for examination should be done using KLIPS. The registration is binding and students who do not hand in a seminar paper or who do not present their paper will receive a failing grade.

7. Organisation

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Please do not hesitate to contact me in case of further questions.