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Smart metering. Social risk perception and risk governance

SYLLABUS

in cooperation with
Faculty of Electrical and Control Engineering
Gdańsk University of Technology

1. Name of the Teaching Module

Smart metering. Social risk perception and risk governance

2. Brief description of the subject matter

Smart metering means employing IT & communication technologies to exchange information between electric utilities and their customers, and sensing technologies to constantly measure the quantity and quality of electricity being transferred over the grid, which is thus called Smart Grid. Smart Grids are comprised of numerous controls, computers, automation, digital energy meters and other digital equipment, as well as advanced software and applications – working together and exchanging lots of data.

Similarly the internet has changed our lives and ways we use information, Smart Grids are expected to change the power systems and the way we use energy and its supply services. Smart Grids promise to overcome numerous obstacles of modern society development (measured by secure access to clean and sustainable energy), but at the same time their broad expansion threatens the society with many risks.

The goal of this teaching module is to present the concept of risk governance in the context of development of smart metering technologies. Main components of risk governance are (1) risk perception, (2) risk communication and (3) risk management. Using examples from other controversial technologies, like nuclear energy, genetically modified organisms or shale gas, students are presented with social perception of risk and various strategies of dealing with technical risks. In the end, students are asked to prepare their own risk governance strategies in the realm of smart metering.

3. Description of social aspects of engineering

Stimulation of Smart Grids into energy consumer market increases social awareness not only of modern technological advancements (such as availability of Renewable

Energy Sources / energy prosumption in residential sectors, integration with Internet of Things etc.), but also of significant social, technical and political threats that are expected to emerge. In general, all three groups of threats are understood to relatedly form risks related to privacy issues.

The risks result directly from the basic technical concept and characteristics and of Smart Grids and foremost include the following dangers:

- the "big brother" effect,
- security of big data systems,
- misuse of consumer personal data.

It is important to stress that efficient dealing with the risk concerns is possible not only on social site (by introduction of suitable regulatory systems) but also within the technical design of Smart Grids (by development of adequate/riskless solutions).

Subsequently, rise of Smart Grids "new technology risks" will certainly require solving at least the following problems:

- risks perception, communication and social acceptability,
- risks assessment, management and minimization.

The above dilemmas call for proper governance and maintenance of Smart Grids, under which one should understand not only technical tasks of big data management, but also political process of implementing many sociotechnical innovations. Staring from who should decide on the crucial logistical choices, who and how should govern the consumer data, going to how should the innovation be integrated into the community – all these aspects are just previews of numerous SSH dimensions to be considered. Without proper technical solutions, regulatory institutions and social awareness, the existing and growing image of Smart Grids can be significantly harmed.

4. Learning outcomes

a. Knowledge
   - basic assumptions of risk governance approach
   - different development stages and approaches to social perception of risk, risk communication and management;
   - crucial examples of dealing with controversial technological innovations.

b. Skills
   - application of risk governance scheme to controversial technologies
   - understanding different perceptions of risk in the society
   - explaining differences in risk perception
   - designing appropriate risk communication & management strategies

c. Social competencies
   - team work
   - finding consensus in a group in a context of strongly variating attitudes

- understanding others' positions
- formulating arguments for one's own opinion.

5. Form of classes

- Lecture, seminars with presentations, group work and workshops
- Four sessions (3h each) for up to 20 students.
- At least 70% direct student participation.
- Additional self-study in-between stages 1-2, 2-3, 3-4.

6. Teaching methods

- Concept problem presentation (power point) with brainstorming, discussion.
- Student project with Webquest, case study, analysis
- Workshops

7. General classes plan

Session 1 Lecture on Smart Grids and Smart Meters (3h)

1) An introductory open-form (with student interaction) lecture on Smart Grids with stress on the representative example of Intelligent Energy Meters.
2) Presentation and discussion of energy consumption data for end-users with indications of data gathering methods.
3) Consumer energy data calculations for different scenarios
4) Discussion with students of their understanding of data management.
5) MATERIALS: presentation

Session 2 Risk perception (3h)

1) Introductory presentation on risk perception based on a case study (radioactive waste disposal in Sweden).
2) Identification of technical risks based on case study materials ("Toronto" case): a) Are there risks? b) verification based on real materials
3) Identification of non-technical risks based on case study materials ("Toronto" case): a) Are there risks? b) verification based on real materials
4) Risk map – via discussion, stakeholder risk perception
5) Discussion on the findings with materials on actually perceived risks: a) Privacy risks b) Health risks from wireless smart meters c) Social (non-technical) consequences

Session 3 Risk communication (3h)

1) Presentation on risk communication with illustrations of different communication strategies (deficit model vs. participatory model).
2) Analysis of risk communication in the "Toronto" case.

3) Oxford debate between these two approaches (case study)? 1) deficit model of communication, 2) participatory approach.
4) Background theoretical reading for the teacher

Session 4. Risk management (3h)

1) Introductory summary of risk discourses
2) Example of "GM Nation?" public debate analysis
3) Discussion: which kind of 'risk discourse' is best for smart meters?
4) Conclusion: risk governance framework
5) TM conclusions

8. TM assessment methods & criteria

- *Class by class verbal evaluation*
- *Workshops and group work results evaluation*

9. Additional literature and other materials

a) Specialized literature including social aspects

- Maarten Wolsink, 'The Research Agenda on Social Acceptance of Distributed Generation in Smart Grids: Renewable as Common Pool Resources', *Renewable and Sustainable Energy Reviews*, 16.1 (2012), 822–35 <https://doi.org/10.1016/j.rser.2011.09.006>.
- Patrick McDaniel and Stephen McLaughlin, 'Security and Privacy Challenges in the Smart Grid', *IEEE Security and Privacy*, 7.3 (2009), 75–77 <https://doi.org/10.1109/MSP.2009.76>.
- Himanshu Khurana and others, 'Smart-Grid Security Issues', *IEEE Security and Privacy*, 8.1 (2010), 81–85 <https://doi.org/10.1109/MSP.2010.49>.
- Kianoosh G. Boroojeni, M. Hadi Amini, and S.S. Iyengar, *Smart Grids: Security and Privacy Issues*, 2017 <https://doi.org/10.1007/978-3-319-45050-6>.

b) Reports of (inter)national organizations concerning social aspects

- Policy initiatives at EU level on the Smart Meters and Smart Grids: CEN-CENELEC-ETSI Smart Grid Coordination Group – Sustainable Processes http://ec.europa.eu/energy/sites/ener/files/documents/xpert_group1_sustainable_processes.pdf

c) Case studies

- Robin Smale, Bas van Vliet, and Gert Spaargaren, 'When Social Practices Meet Smart Grids: Flexibility, Grid Management, and Domestic Consumption in The Netherlands', *Energy Research & Social Science*, 34.February (2017), 132–40 <https://doi.org/10.1016/j.erss.2017.06.037>.
- Xu Li and others, 'Securing Smart Grid: Cyber Attacks, Countermeasures, and Challenges', *IEEE Communications Magazine*, 50.8 (2012), 38–45 <https://doi.org/10.1109/MCOM.2012.6257525>.

d) Security issues

- **Smart electricity meters can be dangerously insecure** https://www.theguardian.com/technology/2016/dec/29/smart-electricity-meters-dangerously-insecure-hackers
- **FBI: Smart Meter Hacks Likely to Spread**A series of hacks perpetrated against so-called "smart meter" installations over the past several years may have cost a single U.S. electric utility hundreds of millions of dollars annually, the FBI said in a cyber-intelligence bulletin https://krebsonsecurity.com/2012/04/fbi-smart-meter-hacks-likely-to-spread/

e) Privacy issues

- **Smart meter hacking can disclose which TV shows and movies you watch** https://nakedsecurity.sophos.com/2012/01/08/28c3-smart-meter-hacking-can-disclose-which-tv-shows-and-movies-you-watch/https://www.youtube.com/watch?v=YYe4SwQn2GE&feature=youtu.be

f) Big data

- **Google Partners with Eight Utilities in Smart Meter Projects to Track Energy Use Online** The Google PowerMeter includes a that graph displays energy use hour by hour, and the users can view consumption totals day to day, across a week or more. The information displays in box that sits on a user's personalized iGoogle homepage.https://www.greenbiz.com/news/2009/05/20/google-partners-eight-utilities-smart-meter-projects-track-energy-use-online

g) Risks perception on smart grids

- https://stopsmartmeters.org

h) Background literature on Risk Governance

- Aven, Terje, and Ortwin Renn. 2010. *Risk Management and Governance. Concepts, Guidelines and Applications*. Springer.
- Aven, Terje. 2010. *Misconceptions of Risk*. Chicester: John Wiley & Sons.
- Fischhoff, Baruch. 1995. "Risk Perception and Communication Unplugged: Twenty Years of Process1." *Risk Analysis* 15(2): 137–45.
- Irwin, Alan, and Brian Wynne. 1996. *Misunderstanding Science?: The Public Reconstruction of Science and Technology*. Cambridge University Press.
- Slovic, Paul. 2000. *The Perception of Risk*. Earthscan.