Attachment: Syllabus

1. Name of the Teaching Module

Smart metering. Social risk perception and risk governance.

2. Brief description of the subject matter

The goal of this TM is to broaden the understanding of technology-related risks and present the concept of risk governance in the context of smart metering technologies.

In current phase of technological development – known as the Fourth Industrial Revolution – rapid and profound changes are likely to set up new and particularly destabilizing risks. In more and more complex technological systems that constitute modern life, the risks become difficult to identify and even more difficult to measure and manage. Many of the technologies, such as artificial intelligence (AI) or genetically modified organisms (GMO) are considered from this point of view. A demonstrative example from the energy sector is smart metering (SM) technology.

Smart metering means employing 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 the Smart Grid. Smart Grids are complex systems comprising numerous interconnected components – controls, computers, measuring devices, and other digital equipment, as well as advanced software and applications – working together and exchanging information.

In such complex systems one can point to relatively isolated technological risks, such as for example the risk of a cyberattack interrupting supply of electricity. However, in an increasingly interconnected world the consequences of such risks – technical, social and political ones – can be of much greater importance.

In order to make students aware how our assumptions and perceptions shape our attitude towards technology-related risks, the theory and practice of risk governance approach is presented and explained.

3. Complete SSH problems description

Stimulation of Smart Grids into energy consumer market increases social awareness not only of modern technological advancements (such as availability of RES / energy prosumption in households, integration with IoT, 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 interrelatedly 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.
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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

1) 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.

2) 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.

3) 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 (3x45 min) 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. Smart Grids and Smart Meters (3 x 45 min)

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.

Session 2. Risk perception (2 x 60 min)

1) Before the classes, the students were asked to find on their own materials concerning technical and non-technical risks related to smart metering. They will have to classify the risks as real and unreal based on the information they have gathered in the classroom.
2) Introductory presentation on risk perception based on a case study (radioactive waste disposal in Sweden).
3) Identification of technical and social risks based on case study materials ("Toronto" case) a) Are there risks? b) verification based on real materials.
4) Summary discussion in which students should focus on the differences between stakeholders. The teacher should ask questions about the practical consequences of social risks, about specific decisions and controversies. This activity is an introduction to the next session.

Session 3. Risk communication (3 x 45 min)

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) Court roleplaying game, two approaches (case study): (1) deficit model of communication, (2) participatory approach are presented and defended.
4) Students are asked to study before the next session materials on a case of UK's 'GM Nation?' debate.

Session 4. Risk management (3 x 45 min)

1) Introductory summary of risk discourses, included example of "GM Nation".
2) Final assignment: Risk simulation analysis.
3) Conclusion: risk governance framework discussion.

8. TM assessment methods & criteria

Session 4 includes the final assignment in which the students are asked to apply all gained skills and knowledge in a risk simulation analysis and present the results. Criteria to be taken into account:

- proper identification and classification of risks;
- adequate understanding and application of risk communication methods;
- correlation of risks and risk communication methods in the risk governance framework.

The proper evaluation and marks awarded for the assignment and module are subject to applicable rules of the institution hosting the module.

9. Additional literature and other materials

Literature:

1. Smart Metering

1.1. Wranga, Kasun et al. 2014. Smart metering. Desing and Applications. Singapore: Springer- Verlag.

2. Smart City

2.1. Mahmood, Zaigham (ed.). 2018. Smart Cities: Development and Governance Frameworks. Switzerland: Springer.

2.2. Papa, Rocco, Fistola Romano (eds.). 2016. Smart Energy in the Smart City. Urban Planning for Sustainable Future. Switzerland: Springer.

3. Risk Perception

3.1. Starr, Chauncey. Social Benefits versus Technological Risk. „Science" 1969, Vol. 165, Issue 3899, pp. 1232-1238.

3.2. Slovic, Paul. 2000. The Perception of Risk. In: Slovic (ed.). The Perception of Risk. Earthscan Publications, London-Washington.

3.3. Aven, Terje, Ortwin Renn. 2010. Risk Management and Governance. Concepts, Guidelines and Applications. Springer

4. Risk communication:

4.1. Fischhoff, Baruch, John Kadvany. 2011. Risk. A Very Short Introduction. New York: Oxford University Press.

4.2. Covello, Vincent, Peter M. Sandman. 2001. Risk communication: Evalution and Revolution. In: Anthony Wolbarst (ed.). Solutions to an Environment in Peril. Baltimore: John Hopkins University Press.

5. Risk management

5.1. Aven, Terje, Enrico Zio (eds.). 2018. Knowledge in Risk Assessment and Management. Chichester: John Wiley&Sons.

5.2. Drobinski, Philippe et al. (eds.). 2017. Renewable Energy: Forecasting and Risk Management. Paris: Springer.

5.3. Renn, Ortwin 2008. Risk Governance: Coping with Uncertainty in a Complex World. Earthscan: London.
5.4. IRGC. 2017. “Introduction to the IRGC Risk Governance Framework”, revised version. Lausanne: EPFL International Risk Governance Center.

6. Nuclear Waste

6.1. Micheal R., Greenberg, Bernadette M. West, Karen W. Lowire, Henry J. Mayer. 2009. The Reporter’s Handbook on Nuclear Materials, Energy and Waste Management. Nashville: Vanderbilt University Press.