User-Centred Energy Systems

TOWARDS A SOCIAL LICENSE TO AUTOMATE IN DEMAND SIDE MANAGEMENT

Challenges, Perspectives and Regional Aspects

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MOTIVATION

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- End-user acceptance is central to successfully automate demand side management
  - but poses a significant challenge due to consumer concerns

H2020 project Sim4Blocks

- A clear understanding of acceptance conditions and their variation across contexts and user segments is needed

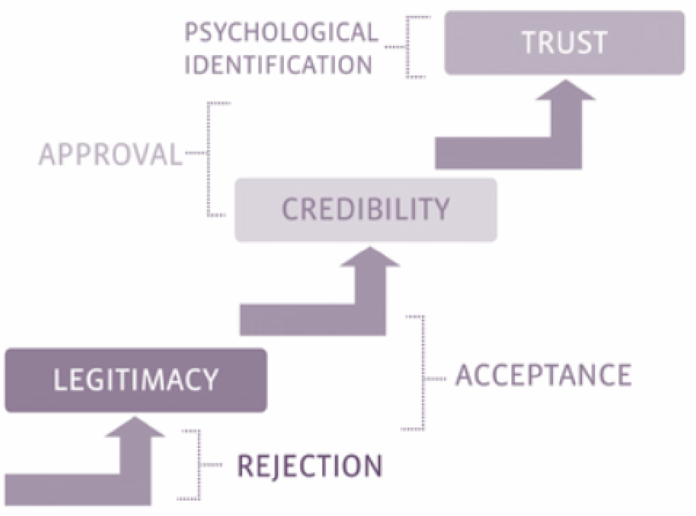
- Final goal is the development of a framework providing insight into the relevant social, regulatory, economic and organisational factors

- Understand international and cultural varieties, by forming an international expert group

A SOCIAL LICENSE TO AUTOMATE

User-Centred Energy Systems

- **Social License** refers to approval from an affected community and stakeholders towards an organisation‘s or industry‘s operation (aspect)
- Has evolved from concepts of „social corporate responsibility“ and „social acceptability
- Does not refer to a formal agreement but to **perceived credibility and trust** within the community towards the responsible organisation / industry
- A **Social License to Automate** represents an approval by participants to apply (different levels of) automation within their homes and businesses in order to optimize demand side management



FACTORS FOR DSM AUTOMATION

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User interaction features
(consent, customization, monitoring)

Energy practices
(Attitudes, expectations, experiences)

Socio-technical making
(expectations, framings, cultures)

Acceptance and trust
Social License for DSM

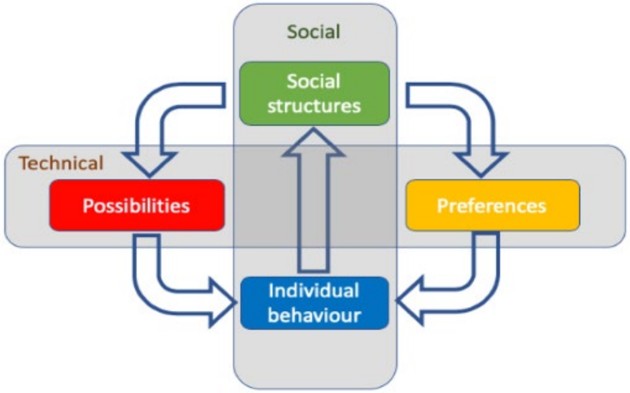
Institutional alignment
(Roles of stakeholders, pricing regimes)

Governing automation
(Policy and regulatory aspects)

THE IEA USER-CENTERED ENERGY TCP

User-Centred Energy Systems

- Follow-on from IEA's DSM TCP
- Adopts systems perspective
- People as important players as the technology itself
  - technology designers, policy makers, intermediaries and end users
- Activities ("Annexes"):
  - Energy service business models
  - Hard-to-reach energy users
  - Peer-to-peer energy trading
  - Community self-consumption models
  - **Social licence to automate**
- Further information:
  - https://userstcp.org/



THE ANNEX
„SOCIAL LICENSE TO AUTOMATE“

Benefits and expected results

- Systemic and multidisciplinary perspective
- Collaboration by leading researchers in the areas of
  - Sociology, Science and Technology Studies, User experience, Human Computer Interaction, Energy Economics, Systems Engineering, Policy Analysis
- International comparison and country profiles

WORK STEPS AND CURRENT STATUS

User-Centred Energy Systems

1. Create a common template for social and technical research approach
   (Until March 2020)
2. Desktop and case study data collection and analyses
   (Until Oct 2020)
3. Understanding trust to automate: social, economic, institutional and technical dimensions
   (Until Oct 2021)
4. Country profiles and policy relevant body of knowledge (Until Oct 2021)
   (Until Oct 2021)

WORK STREAMS

User-Centred Energy Systems

1. User interaction features (consent, customization, monitoring)

2. Energy practices (attitudes, expectations, experiences)

3. Socio-technical making (expectations, framings, cultures)

Acceptance and trust

Social License for DSM

4. Institutional alignment (roles of stakeholders, pricing regimes)

5. Governing automation (policy and regulatory aspects)

CURRENT KNOWLEDGE AND PLANNED ACTIVITIES

1. USER INTERACTIONS
CURRENT KNOWLEDGE

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- Aspects known as central to acceptance in automation
  - Level of control, Transparency, Performance (Usefulness), Simplicity (Ease of Use), and Ensurance of Privacy & Security

    e.g. Hoff & Bashir, 2015; Schaefer, Chen, Szalma, Hancock, 2016; Balta-Ozkan, Davison, Bicket, Withmarsh, 2013

- General factors critical with regards to interaction preferences for smart grid applications are
  - Platform accessibility, speed of feedback, required cognitive effort, required interaction frequency, interruption quality (including need to react / make a decision), and novelty of presented information

    Buchanan, 2015; Hartzog, 2018; Hartmann & LeBlanc, 2014

SCDA Smart Cities Demo Aspern

Sim4Blocks

SMARTGRIDS Modellregion Salzburg HiT Begleitforschung

RASSA Reference Architecture for Secure Smart Grids in Austria

1. USER INTERACTIONS
RESEARCH QUESTIONS & AIMS

Research questions

1. Under which conditions are end-users willing to accept DSM automation?
2. How do end-users prefer to interact with DSM automation?
3. How can trust in DSM automation be increased?

Next analysis steps within the TCP

- Finalize the template for further data collection, using own projects as an operationalization
- Data of specific importance:
  - Automation level and perceivable impact
  - End-user interaction, engagement aspects
  - Trust and acceptance measurement

2. ENERGY PRACTICES
CURRENT KNOWLEDGE & RESEARCH QUESTIONS

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Current knowledge

- Some practices are more amenable to load shifting than others
  Powells et al 2014; Goulden et al 2014; Smale et al 2017
- Changes to household practices associated with load shifting have been perceived by some trial participants as inconvenient and disruptive
  Christensen and Friis 2016, Pallesen and Jenle 2018)
- The acceptability of automation in DSM may therefore depend on the expectation that it will not cause disruption or other detrimental effects in households.
  Strengers 2010; Cass and Shove 2018

Research questions

1. What factors enable and constrain load shifting and shaving, particularly in residential settings?
2. Which energy practices are or are not amenable to load shifting and why?
3. What would have to change to make them amenable to load shifting?

3. SOCIO-TECHNICAL MAKING
CURRENT KNOWLEDGE

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- The extent to which householders understand the rationale for DSM, and consider themselves as having a part to play in it, are other factors that influence user acceptance of and engagement with automation in DSM
  Darby and Pisica 2013; Burchell et al 2016

- A concern about loss of control is one of the main impediments to user acceptance of automated DSM
  Hansen and Hauge 2017; Naus et al 2015

- However, studies show that users may be willing to give up some control of their energy consumption in some conditions – for example, if they feel that they are adequately recognised and compensated for it, or if they have the possibility to manually override remote control of their appliances
  Buchanan et al 2015; Fell et al 2014, Darby and McKenna 2012.

3. SOCIO-TECHNICAL MAKING

RESEARCH QUESTIONS

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Research questions:

1. How do understandings and expectations of load flexibility and automated DSM differ among the various actors involved in DSM, including energy users, electricity retailers, network operators, and regulators? In other words, what is the problem that these actors consider automation to be the solution to?
2. How does the framing of the rationale for automated DSM shape public receptiveness to it?
3. How do various aspects of the socio-technical context, such as national cultures, shape user receptiveness to automated DSM?

4. INSTITUTIONAL ALIGNMENT
CURRENT KNOWLEDGE

User-Centred Energy Systems

Current knowledge

- Automated DSM offers a more reliable (i.e. greater certainty over the amount, timing and location) demand flexibility; therefore is in interest of many institutions (DSOs, TSOs, aggregators).
  Bhattacharyya 2011; Ericson 2009; Newsham & Bowker 2010

- However, limited evidence on the overall electricity system benefits of automated DSM.
  Veldman & Verzijlbergh 2015 and Dallinger & Wietschel 2012

- Conflict may rise within (technically complex operations of TSOs and DSOs) and simple market actors; challenges exist in designing new institutions.
  Boutellier & Thomsen, 2011

4. INSTITUTIONAL ALIGNMENT
RESEARCH QUESTIONS

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Challenges

- Contracts for consumers should be easy and understandable
- Processes for TSO-DSO-AGG interaction still have to be developed

Research questions

1. What role do various actors (DSOs, aggregators) see automated DSM playing in electricity reforms?
2. How have key direct load control and other automation projects (mis)aligned with industry, household, supplier and other interests?
3. How do the current ownership structures influence the forms of engagement of the promoters of automation projects?
4. Analyse how the interaction and contracts between stakeholders influence the trust of the end consumers.

EXPECTED RESULTS

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- An analysis of the obstacles for gaining a social license to automated DSM.
- A condensed collection of guidelines on how to achieve a social license for automated DSM, structured along factors, such as
  - Details on DSM
    - Use case and DSM strategy, technical components, automation aspects, end-user impact
  - Interaction and Engagement
    - End-user interaction, energy practices
  - Institutional and regulatory aspects
- Country profiles
  - Contextualization of the profiles about countries, regions and cultures

CONCLUSIONS AND OUTLOOK

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- The IEA TCP UCES „Social License to Automate“ aims to provide novel insights on
  - The factors leading to acceptance of and engagement with DSM automation
  - International comparisons and profiles
  - Contextually sensitive guidelines for different actors for acceptable DSM automation

Join us to share your experiences and expectations!

Find out more about our next international TCP meeting on 31 March / 01 April in Vienna!

REFERENCES (1)

User-Centred Energy Systems

Balta-Ozkan, Davison, Bicket, Withmarsh, 2013. Balta-Ozkan, N., Davidson, R., Bicket, M. and Whitmarsh, L. 2013 “Social barriers to the adoption of smart homes,” Energy Policy, vol. 63, pp. 363–374, 2013.

Bhattacharyya, Subhes C. 2011. Energy Demand Management: Concepts, Issues, Markets and Governance. Energy Econ, Springer, London.

Boutilier, R. G., & Thomson, I. (2011). Modelling and measuring the social license to operate: fruits of a dialogue between theory and practice. Social Licence, 1-10.

Buchanan, K., Russo, R., and Anderson, B., “The question of energy reduction: The problem(s) with feedback,” Energy Policy, vol. 77, pp. 89–96, Feb. 2015.

Buchanan, K., Banks, N., Preston, I., & Russo, R. (2016). The British public’s perception of the UK smart metering initiative: Threats and opportunities. Energy Policy, 91, 87-97.

Christensen, T.H., Friis, F., n.d. Materiality and automation of household practices: Experiences from a Danish time shifting trial 11.

Dallinger, David, and Martin Wietschel. 2012. “Grid Integration of Intermittent Renewable Energy Sources Using Price-Responsive Plug-in Electric Vehicles.” Renewable and Sustainable Energy Reviews 16(5): 3370–82.

Darby, S.J., Pisica, I. 2013. Focus on electricity tariffs: experience and exploration of different charging schemes. ECEEE Summer Study Proceedings 8-318-13: 2321-2331.

Darby, S. J., & McKenna, E. (2012). Social implications of residential demand response in cool temperate climates. Energy Policy, 49, 759-769.Fell et al 2014.

Goulden, M., Bedwell, B., Rennick-Egglestone, S., Rodden, T., Spence, A., 2014. Smart grids, smart users? The role of the user in demand side management. Energy Research & Social Science 2, 21–29.

Hoff, K. A. and Bashir, M., “Trust in automation: Integrating empirical evidence on factors that influence trust,” Human factors, vol. 57, no. 3, pp. 407–434, 2015.

REFERENCES (2)

User-Centred Energy Systems

Hansen, M., & Hauge, B. (2017). Prosumers and smart grid technologies in Denmark: developing user competences in smart grid households. Energy Efficiency, 10(5), 1215-1234.

Hartzog, W., Privacy's blueprint: The battle to control the design of new technologies. Harvard University Press, 2018.

Hartman, B. and LeBlanc, W. , "Smart meters, big data, and customer engagement: in pursuit of the perfect portal," in Proc. of, 2014, pp. 172–182.

Naus, J., Spaargaren, G., van Vliet, B.J.M., van der Horst, H.M., 2014. Smart grids, information flows and emerging domestic energy practices. Energy Policy 68, 436–446.

Pallesen, T., Jenle, R.P., 2018. Organizing consumers for a decarbonized electricity system: Calculative agencies and user scripts in a Danish demonstration project. Energy Research & Social Science 38, 102–109.

Powells, G., Bulkeley, H., Bell, S., Judson, E., 2014. Peak electricity demand and the flexibility of everyday life. Geoforum 55, 43–52.

Schaefer, K. E., Chen, J. Y. , Szalma, J. L., and Hancock, P. A. 2016., "A meta-analysis of factors influencing the development of trust in automation: Implications for understanding autonomy in future systems," Human factors, vol. 58, no. 3, pp. 377–400, 2016.

Cass, N. F., & Shove, E. A. (2018). Time, Practices and Energy Demand: Implications for flexibility.

Smale, R., van Vliet, B., Spaargaren, G., 2017. When social practices meet smart grids: Flexibility, grid management, and domestic consumption in The Netherlands. Energy Research & Social Science 34, 132–140.

Strengers, Y., 2010. Air-conditioning Australian households: The impact of dynamic peak pricing. Energy Policy 38, 7312–7322.

Veldman, E. Verzijlbergh, R.A. (2015). Distribution grid impacts of smart electric vehicle charging from different perspectives. IEEE Transactions on Smart Grid. Vol:6(1), pp:333-342.

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