



Key Takeaways for Focus Group 3 at EMP-E 2020 : Consumer and Citizen Engagement

Focus Group 3 was a session jointly hosted by the openENTRANCE, SENTINEL and SMARTEES H2020 projects that featured some of the leading European researchers in the field of energy social science. Citizens, consumers, and collectives are at the center of the energy system but their representation both within the code and within the community of energy system models is sparse. This session considered how citizens can be engaged in the energy modelling process, how citizen behavioral energy choices are built into energy system models and how agent-based models may be applied to current modelling frameworks. The session is co-hosted by the [SMARTEES H2020 project](#), which works on the cutting edge of consumer science and **agent-based modelling in energy**.

Main takeaways

1. The majority of pre and post session survey respondents believe that agent-based models (ABM) can and should be linked to energy system models
2. Prof. Christian Klöckner outlined the “HUMAT” concept for representing people’s energy decisions in a modelling framework
3. Hannes Gaschnig told us what stakeholders want to be considered in energy system models
 - a. Long term impacts on the environment and natural resource use, and behaviour, lifestyles, and heterogeneity of consumers are the top two interests
 - b. The majority prefers existing, fit-for-purpose, realistic, open source models, and comprehensive, progressive, and 1.5 °C scenarios
4. Prof. Bertha Guijarro-Berdinas clarified that ABM is most useful for exploring possible alternate realities within a well-defined context, less well suited for prediction
5. Dr. Gary Polhill discussed the challenges in linking ABM to energy system models. His takeaway is that this linkage should only be done for specific questions or to tackle specific problems, not just for the sake of linking models

Questions to EMP-E 2020 speakers during FG 3 “Citizen and Consumer Engagement”

1. Has there been much validation of agent models of consumer behaviour?

Gary: Validation is an ongoing research topic in ABMs. In my own work, I have written a book chapter explaining some of the problems

(https://www.researchgate.net/publication/321290649_The_Importance_of_Ontological_Structure_Why_Validation_by_%27Fit-to-Data%27_Is_Insufficient) -- mainly, that traditional methods for validation are not the whole story of establishing confidence in what ABMs do, neither for the kinds of problem to which they are typically applied, nor for doing justice to the fact that ABMs grow the macroscopic dynamics through rich ontological specifications of micro behaviours. Validating the ontological side (the



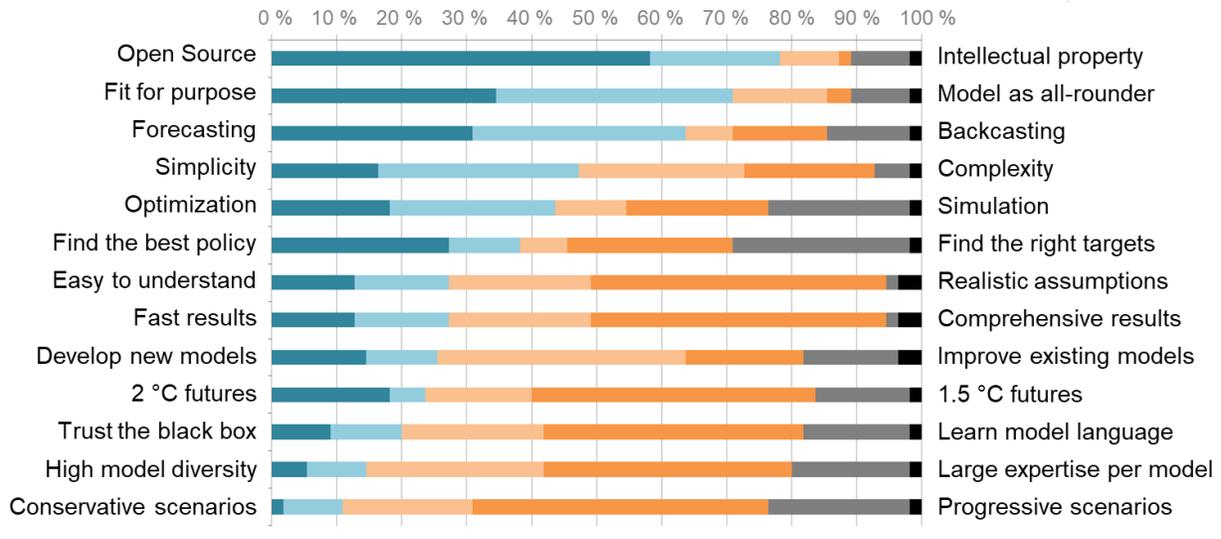
specification of classes, relationships, attributes, individuals and processes) has not received the same attention as the quantitative fit-to-data side. (The book chapter also points to numbers of articles by other authors on validation with ABMs.) For a concrete example of efforts with quantitative validation of an ABM in the energy sphere (again from my own work), see <http://jasss.soc.surrey.ac.uk/20/3/11.html>.

2. There are a lot of open-source models out there already. Would it be time to focus on collaborative work now?

Gary: This question gave me pause for thought. I get that people might be a bit concerned that we are just building model after model with no consolidation or conclusion reached about which is *_the_* model we should all use now. My response won't be popular with people with such concerns, but I preface it with the statement that it is *_always_* time to focus on collaborative work when tackling difficult (complex/wicked) socio-techno-environmental systemic challenges. To return to the question, I am skeptical that there will be *_the_* model of any such system, even in the long term. This is for several reasons, but here are two. First, social science research is ongoing, and, without meaning to be rude, is far from being in a mature state -- nothing like the situation for ecology, biology, chemistry or physics (not that there aren't interesting research questions needing investigation in these areas). Part of the problem is chronic underfunding. I find it odd that we are (metaphorically-speaking) spending a lot of money trying to find out to six significant figures instead of five exactly how much harm we're doing to the environment, and then to narrow down our uncertainty about that to 99.999% instead of 99.99%. Comparatively, we spend very little money researching the political, social, institutional, and psychological factors leading to that situation. Second, what we do know from social science research is that objectivity is questionable, and the questions asked and conclusions reached a function of the cultural, gender, ethnic and class backgrounds of the researchers. (That this is seen as a weakness by some may be one reason for the comparative lack of research funding... An alternative (better IMHO) view is that the observation of such subjectivity is itself a reflection of the rigour and integrity of the social researchers who acknowledge it.) If ontology is important (see my answer to Q1), then we should expect to observe differences in the ways models are specified by different research groups in different places at different times. To return to the collaboration point: in the social sciences we may need to emphasize understanding modelling as a collaborative *process* of knowledge cocreation and discovery rather than the production of a technical artefact.

Hannes: We conducted a literature review, interviews, an online survey and a stakeholder workshop to find the needs of potential SENTINEL platform users. In this multi-method approach, we did not focus on the question about the importance of collaboration directly, but several closely related results support the idea that we should probably strive for collaboration more (in comparison to the current situation). We asked stakeholders (model developers and model users from policy, energy industry, NGOs, and the scientific community; N: 55) from across Europe about basic decisions in modelling, which we had designed as trade-offs (real goal conflicts and resource trade-offs for model development and application). The majority of survey participants preferred (A) "Improve existing models" over "Develop new models", (B) "Only few models, but large expertise per model" over "High model diversity, but small expertise per model", and (C) "Fit for purpose" over "Models as all-rounders" (see figure below).





For the model development and improvement, we also found (in all methods) a strong support of inter- and transdisciplinary collaboration. So, as stakeholders want few, specific and existing models with large inter- and transdisciplinary expertise networks, the modelling community should definitely seek opportunities to consolidate for which collaboration and the change of tendering practices is needed. If there is a need for new models because the existing models don't fit the research questions/purposes, then new models should be developed, of course. However, I doubt that many such niches (from a model design perspective with model input, throughput and output parameters) still exist that cannot be closed by the adjustment of existing models. Here, from my perspective, the bigger problems are (1) the high information costs to receive a comprehensive overview of the existing (open) models and their performance levels and (2) the missing empirical data for the investigation of the socio-technical energy transition that could feed these models to arrive at useful and realistic results.

Therefore, future tenders should try to react to these needs and challenges. I would suggest: (1) Allow scientists to dedicate enough resources to arrive at an comprehensive overview in the corresponding (open) modelling field, (2) Support the use of existing models and focus more on improvement than on "new" development, (3) Allow the modellers to dedicate more resources to the empirical data collection, and (4) Set "open-source/-data", "upload on open platforms", and "inter- and transdisciplinary collaboration" as default in tenders.

3. ABMs are able to better tackle behaviour and heterogeneity (as asked by the stakeholders @Hannes). But how should we link ABMs and system models concretely?

Gary: the pragmatics of linking any two models are simple: take the variables of one and have them influence the variables of another; for a feedback loop allow variables from the latter model to influence the former in return. When both models are implemented in software, this means having two pieces of software exchange data -- most commonly, by reading files in a shared directory, though more advanced options are available (e.g. remote procedure call protocol, or releasing the software as a web service and writing a RESTful API allowing access). My talk, however, emphasized that the semantics of so doing are critical to ensuring that the output from the coupled model makes any sense at all.

4. What datasets are published that can be used for modelling?



5. Per Gary's point that just making sure that data (points) match between models isn't enough - is there relevant work on ensuring consistency and completeness?

Gary: Some of the work on ontological matching (interoperability) is referred to in the book chapter on validation linked in my answer to Q1. In a modelling context, there has been a considerable degree of effort on the topic, especially in the International Environmental Modelling and Software Society, where, as can be imagined, issues with interoperability have consistently recurred due to the multidisciplinary nature of the domain. Authors such as Alexey Voinov, Andrea Rizzoli, Ioannis Athanasiadis, and Ferdinando Villa are particularly worth following. The problem, however, is still open as far as I am concerned, especially where the social sciences are involved, because, as noted in my answer to Q2, standardized social ontologies may embed assumptions that are not universal.

6. Could you touch on the pros and cons of modelling specific behavioral models such as "What predicts eating behaviors?", versus general as the HUMAT

Gary: ABM arose (in part) from the reaction of heterodox economists to a standardized (general) model of human decision-making that dominated the field. Personally, I am skeptical that models of human decision-making can be taken 'off the shelf' and used in any context. HUMAT was generated as part of the SMARTEES project, and specifically concerned the case studies in that project to which it was applied. Confidence in its ability to be applied elsewhere can only be built through experience.

Comments to Session:

1. Please use suitable open licenses for your presentations (like CC-BY-4.0) btw. the CC-BY-NC-ND is not considered open!

Session organization

October 7th 13:30 – 15:00

13:30 – 13:40 Introduction to the topic and the results of the pre-survey

Jed Cohen, openENTRANCE Project

13:40 – 13:50 Citizen behavior in the energy system: Current topics in the social sciences

Christian Klöckner, SMARTEES Project

13:50 – 14:00 User needs of energy models: Findings from the SENTINEL stakeholder participation

Hannes Gaschnig, SENTINEL Project

14:00 – 14:15 Agent-based modelling background and theory: An example from the SMARTEES H2020 project

Bertha Guijarro-Berdiñas, SMARTEES Project

14:15 – 14:30 Linking ABM with energy system models: Feasibility, scale and scope

Gary Polhill, SMARTEES Project



14:30 – 15:00 Questions from the audience, post-presentation survey and structured discussion Diana Süsser, SENTINEL Project

The image shows a Zoom meeting interface with six participants in a grid at the top. Below them is a presentation slide. The slide features the following content:

- Logos:** open ENTRANCE, SENTINEL SUSTAINABLE ENERGY TRANSITIONS, and SMARTTEES local social innovation.
- Text:** "Welcome To Focus Group 3 at EMP-E 2020!" and "Consumer and Citizen engagement".
- Call to Action:** "Join the discussion on Slido.com Code: citizen".
- Graphic:** A stylized map of Europe composed of black dots.
- Footer:** A small European Union flag and text: "This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 823698".