User-Centred Energy Systems

Making a ‘social license to automate’ demand side flexibility

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The Users TCP and the International Energy Agency (IEA)

- The **International Energy Agency (IEA)** developed in 1970s following oil crisis as intergovernmental organisation shaping a secure and sustainable energy future, through analysis and policy advice to governments and industry around the world.
- To facilitate global cooperation on energy technology, the IEA created the **Technology Collaboration Programme (TCP)**. Today, the **Users TCP** is the first and only social science-focused TCP of the 38 running. Together, the TCPs connect thousands of experts across government, academia and industry in 55 countries dedicated to advancing energy technology research and application.
- **Disclaimer:** the Users TCP is functionally and legally autonomous from the IEA. Views and findings of the Users TCP do not necessarily reflect those of the IEA.

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1. Background and Research Focus

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Background

- This Task was born out of concern that automated demand side management could meet the same resistance as other renewable energy developments such as wind farms.
- We are investigating the conditions for user acceptance, engagement and trust.
- The Task was launched in October 2019 and will conclude in October 2021.
- The participating countries are Australia, Austria, the Netherlands, Norway, Sweden, Switzerland and the USA.

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Multidisciplinary research collaboration

The collaboration brings together diverse perspectives:

- Human-Computer Interaction (how interfaces matter to technological success)
- Social practice theory (how technology use is socially structured)
- Science and Technology Studies (how society and technology shape each other)
- Economic and business studies (how prices matter)
- Policy and regulatory studies (how technology and markets are made by laws)

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2. Case Studies

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Virtual Power Plant study, AU

UNSW SYDNEY

solar analytics

https://reneweconomy.com.au/south-australia-offers-up-to-6000-grants-for-home-battery-installations-49440/

Virtual Power Plant study, AU

Factors influencing battery purchase:

- the main motivations are maximising self-consumption (for financial and/or environmental reasons), energy independence and security of power supply.

- the main barriers are financial: the cost, the capital required, and the payback period.

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Reasons for VPP participation:

Financial

- bill savings or income
- assurance ‘that I'm getting what I believe is an adequate return’

Social

- grid management, e.g. voltage control
- preventing blackouts
- reducing electricity costs for everyone

Environmental

- enabling more renewable energy: ‘I think that this would be a way […] of having more clean energy generated for all’

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Barriers to VPP participation:

- that they would lose control, typically related to loss of access to solar energy if their battery is participating in a VPP event
- that they would not benefit – or may even be disadvantaged – financially: ‘if I don’t use my battery […and] what I’m paying for my power is more than what I’m getting back, it might not even be worth it’
- that a VPP would serve others’ interests and that they would be exploited: ‘I need to understand who is benefiting from this’, ‘Is there any way it can be used […] against me?’

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	Option A No VPP Battery Only	Option B Occasional VPP	Option C Shared Use	Option D Full time VPP
How often does the VPP control your battery?	Never	10 occasions per year	30 occasions per year	Constant control to maximise income
Proportion of Battery capacity retained for household	100%	0% VPP has control of entire battery	50%	0% VPP has control of entire battery
Information and Choices		Advance notice - able to opt out	Advance notice - no opt out	No advance notice
Annual Financial Benefit (Battery + VPP)	$800-$1200	$1200-$1600	$1200-$1600	$1600-$1900
Payback	10 years	7 years	7 years	5 ½ years

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Conditions of VPP participation:

- the possibility to retain at least a portion of the battery's capacity to meet the household's needs: 'I want to make sure we have enough left over'
- the option to opt out of participation – whether specific VPP events, or out of their contract – at any time
- information and transparency – both before entering a VPP program and, for some, to be able to monitor exactly when and how their battery is participating in a VPP

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Conclusions:

- VPP participation does not align with the main motivations for investing in solar or batteries. For people who have solar and who see themselves as being on a pathway towards greater self-consumption and independence of the grid, VPP participation would require a significant shift in thinking.
- On the other hand, people without solar and batteries are more open to VPPs as a purely financial proposition, and it may be possible to engage them to invest in solar and a battery for the purpose of VPP participation.

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EV smart charging pilots, NO

https://www.solaredge.com/us/smart-ev-charger/setup

This projects has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727470 and No 731148

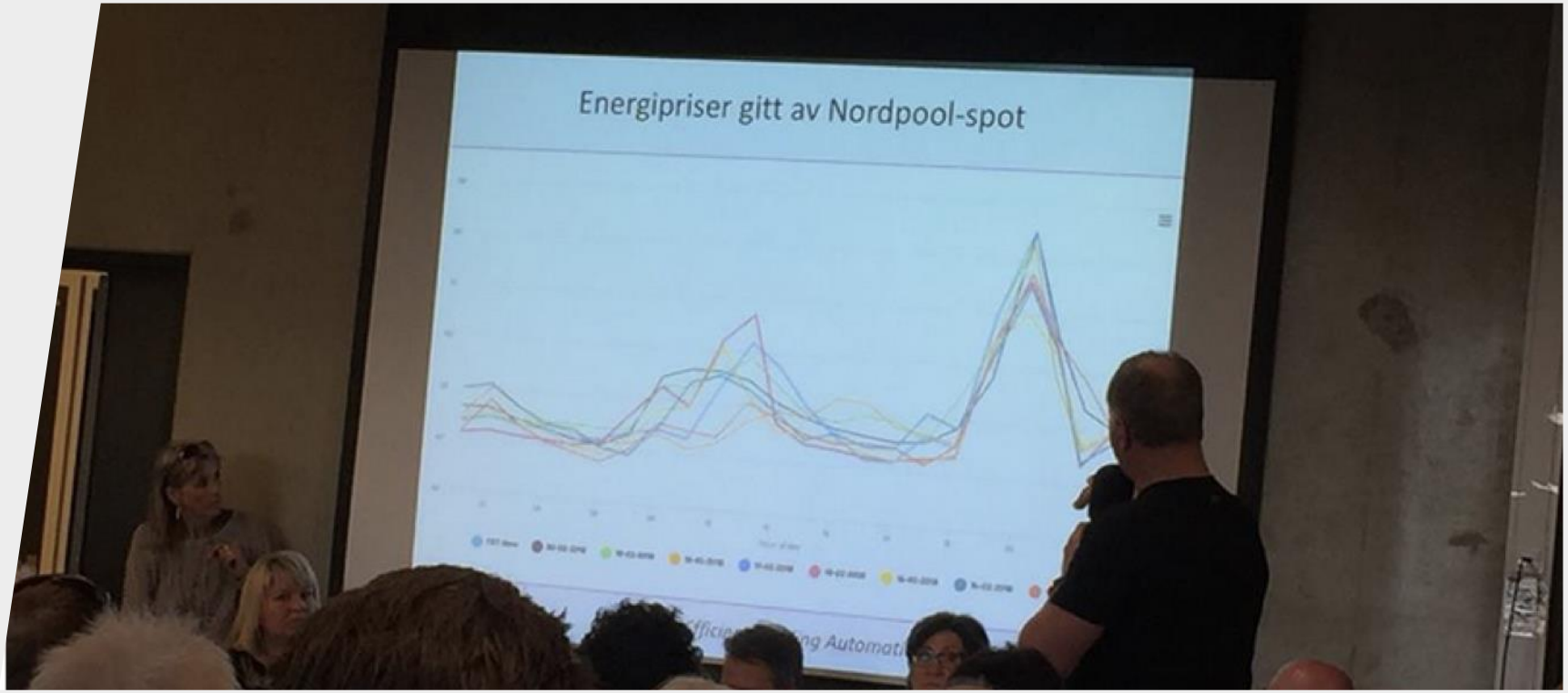
EV smart charging pilots, NO

In the INVADE pilot, detached home owners have a variety of motivations for participation:

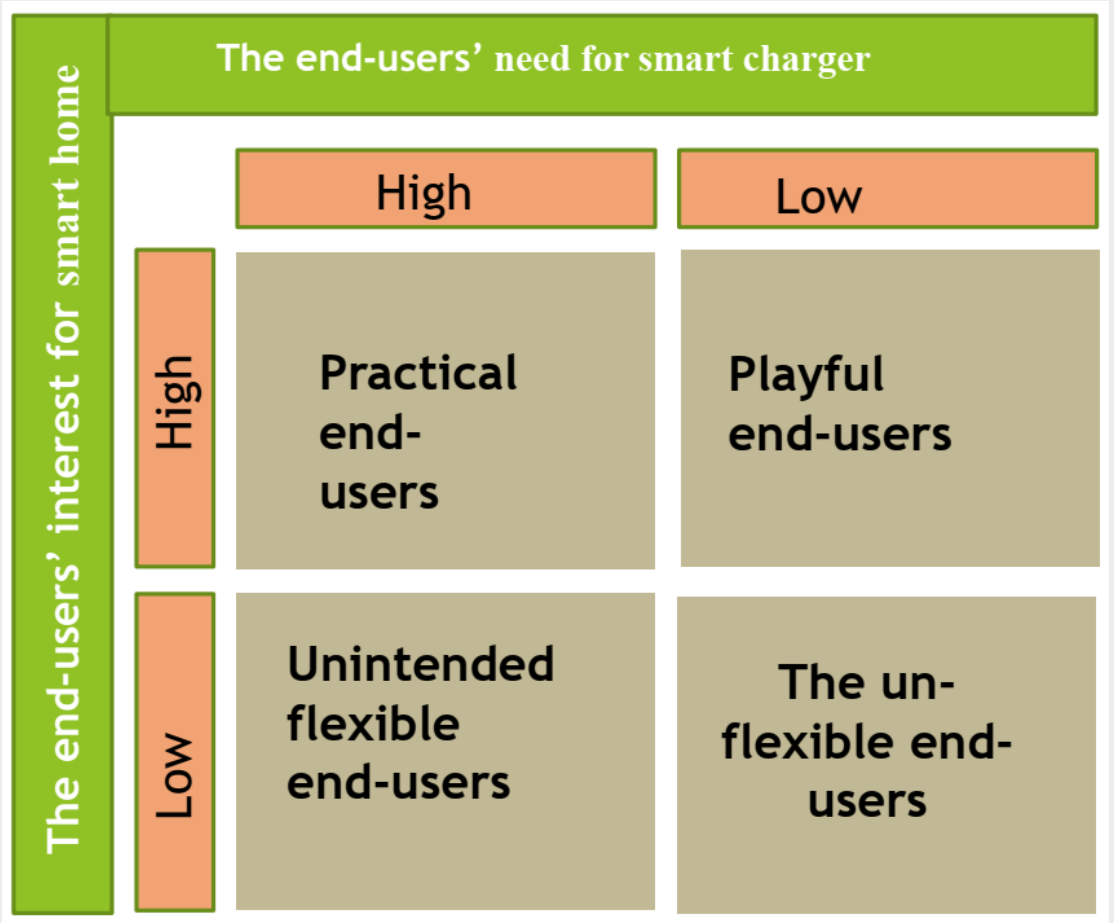
- Smart charging is faster and more fire-safe: ‘I’ve come to realize it is much safer to use it, we can control it much, much more than you can with a regular outlet, when considering the fire hazard’
- Interest in technology and fun: ‘I like to control the thing myself…. I think is fun to optimize things’
- Practicality
- Comfort and battery maintenance: ‘that’s important in the winter, that the battery is pre-heated’

EV smart charging pilots, NO

In the ECHOES pilot, the decision to install smart EV chargers in apartment building garages is a collective one.



EV smart charging pilots, NO



Note: This description are not mean to summarize the empirical variation, but are constructed as ideal types by selectively emphasising some similarities over others for analytic purposes (Weber 2012).

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EV smart charging pilots, NO

The practical end-user:

- high need
- high interest

‘We have 60 EV owners on a waiting list...The electric cars have come to stay and the charging situation at the time consists in many different solutions. So it was time for a comprehensive solution (smart charging with load control) that we can live with for many years to come’ (Board member B)

EV smart charging pilots, NO

The playful end-user:

- low need
- high interest

‘It is when you get loose and try things and do things that you find interesting solutions’ (Smart charger user 3)

The EV charging became very chaotic so we said, “listen here, we’ll do this together”. Then we tried to come up with a common solution for the garage – […] a Salto smart charging with load control that takes up to 15 EV cars. By using this you do not blow up [the] grid. All the electricians are happy. (Board leader C)

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EV smart charging pilots, NO

The unintended flexible end-user:

- high need
- low interest

‘…It was the other option that the electrician suggested then [… that we should install] some system that monitors power distribution. Exactly the details about that I simply do not know… If it is not regulated then it becomes pure spaghetti, it becomes completely hopeless’ (Board leader D)

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EV smart charging pilots, NO

The inflexible end-user:

- low need
- low interest

‘Why is it urgent to expand it [charging infrastructure] now, who knows if we need so much capacity. Because you do not know how to utilize or distribute the power smarter in the future when it has not been invented yet.’ (Inhabitant 16)

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4. Emerging Insights and Next Steps

Emerging insights

1. Automation technologies carry particular meanings and can acquire new meanings in the contexts in which they are placed.
2. These technologies depend on new forms of individual and collective engagement by the people using them.
3. People may be engaged to provide demand flexibility when they perceive its necessity to support energy systems as shared infrastructures.
4. A social license can be made by aligning demand flexibility with people's needs, aspirations and expectations.

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Next steps

- Reporting in October 2021: Thematic analysis and country reports, including institutional context

- Clear need for further research:
  - Digitalisation and decentralisation of energy
  - Emerging issue of low demand periods (security justification)
  - EV integration challenges
  - Natural disasters and supply interruptions

- We welcome opportunities to partner!

Thank you

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