



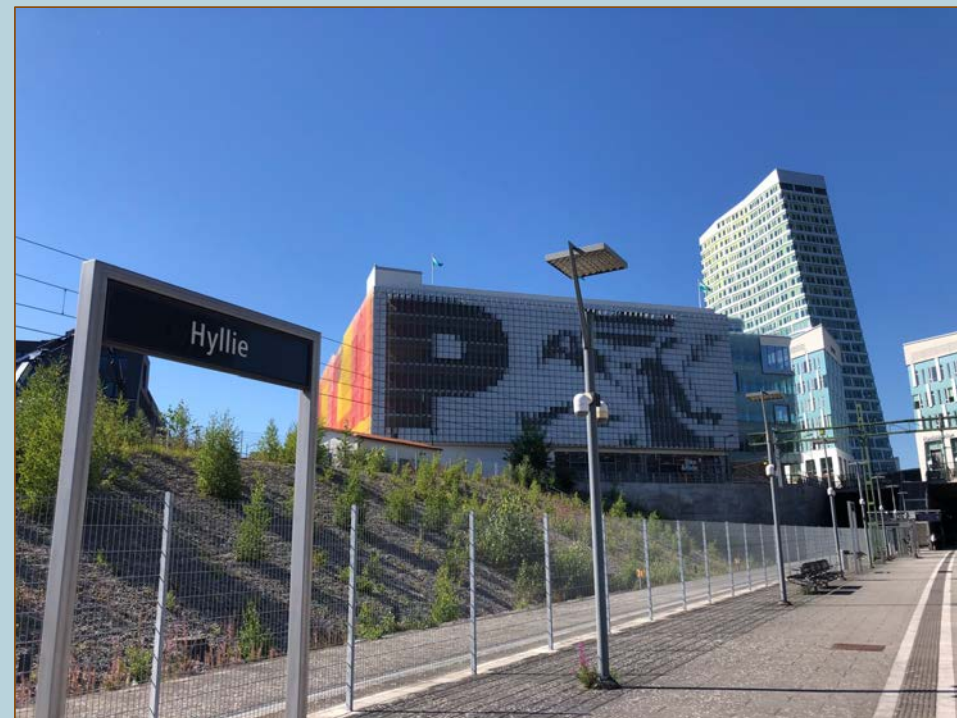
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THE INTERNATIONAL INSTITUTE FOR  
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# Requesting control and flexibility: A mixed methods case study on user perspectives on smart charging

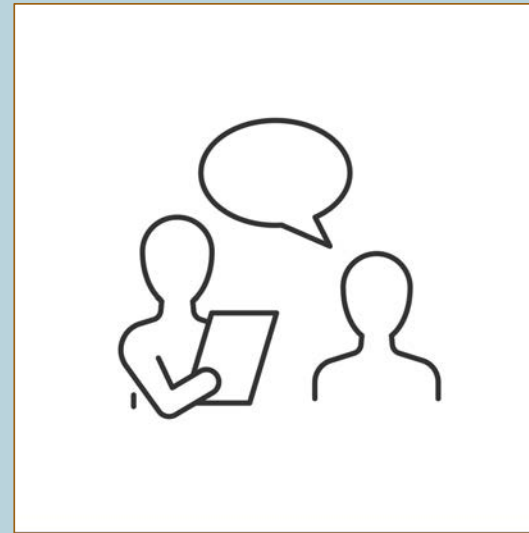
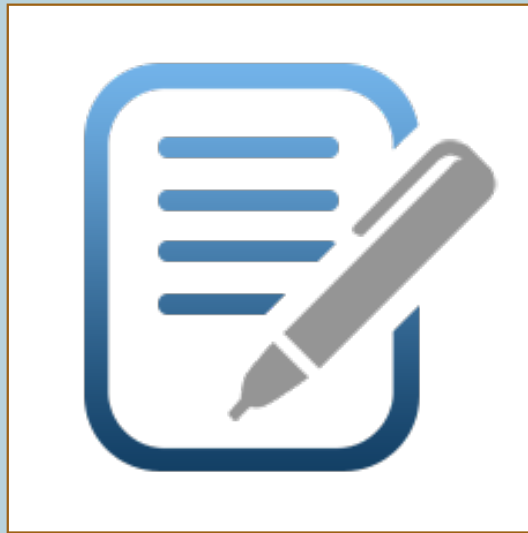
FRANS LIBERTSON | ECEEE | 10 JUNE 2022







# Mixed method case study



# Research aim

Demographics, charging habits, attitudes, perceptions

Knowledge and perception (Axsen et al., 2017)

- Knowledge, functional attributes, symbolic attributes, societal attributes

Flexibility capital (Powells & Fell, 2019)

- Time (constraints)
- Household composition
- Material dependencies
- Knowledge

# Results (QUAL)



# Results (QUAL)

*Control*

*Socio/technical*

# Results (QUAL)

## *Control*

- Timing
- Duration
- Power

## *Socio/technical*



# Results (QUAL)

## *Control*

- Timing
- Duration
- Power

## *Socio/technical*

- Working patterns
- Home conditions
- Knowledge
- EV type
- Access to charging

# Results (QUAL)

- *Time (constraints)*
  - Elaborate planning, stress & anxiety

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  - Type of EV, personal charging station, existing infrastructure

# Results (QUAL)

- *Time (constraints)*
  - Elaborate planning, stress & anxiety
- *Household composition*
  - Influenced charging
- *Material dependencies*
  - Type of EV, personal charging station, existing infrastructure
- **Knowledge**
  - **Motivational factors**

# Results (QUAN)



# Results (QUAN)

## Time (constraints)

Respondents who deemed *fast* and *full* charging important were less willing to accept smart charging.

$(rs(1326) = -0.286, p < 0.001)$

$(rs(1326) = -0.207, p < 0.001)$

# Results (QUAN)

## Time (constraints)

Respondents who charged fewer kWh had a higher acceptance of smart charging.

$(H(6) = 45.428, p < 0.001)$



# Results (QUAN)

## Time (constraints)

Respondents with low battery/range anxiety had a higher acceptance of smart charging.

$(H(4) = 14.36, p = 0.006)$

$(H(5) = 24.64, p < 0.001)$

# Results (QUAN)

## Household composition

Number of household members was not reflected in the acceptance of smart charging.

*No correlation found.*

# Results (QUAN)

## Material & technological dependencies

Higher acceptance of smart charging among PHEV drivers than BEV drivers.

*( $U = 167563$ ,  $p < 0.001$ ,  $r = 0.16$ )*

# Results (QUAN)

## Material & technological dependencies

The higher the dependency on public charging stations the lower the acceptance of smart charging.

$(rs(1328) = -0.155, p < 0.001)$

# Results (QUAN)

## Knowledge

Main reason for accepting smart charging:

- *Environmental concerns*

*No correlation*

- *Grid stability*

*More than 120 min*

- *Economic reasons*

*Up to 60 min*

# Results (QUAL and QUAN comparison)

• Time (constraints)	<i>Convergence</i>
• Household composition	<i>Divergence</i>
• Material dependencies	<i>Convergence</i>
• Knowledge	<i>Convergence</i>

# Conclusion

The success and optimization of smart charging is more complex than a matter of individual choice.

- Policy-makers
- Industry
- Public

# Thank you

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# References

Axsen, J., Langman, B., & Goldberg, S. (2017). Confusion of innovations: mainstream consumer perceptions and misperceptions of electric-drive vehicles and charging programs in Canada. *Energy research & social science*, 27, 163-173. <https://doi.org/10.1016/j.erss.2017.03.008>

Powells, G., & Fell, M. J. (2019). Flexibility capital and flexibility justice in smart energy systems. *Energy Research & Social Science*, 54, 56–59. <https://doi.org/10.1016/j.erss.2019.03.015>