




Consumer Perspectives: Unveiling the Potential of Flexibility

Insights from a Dutch Field Study

GO 



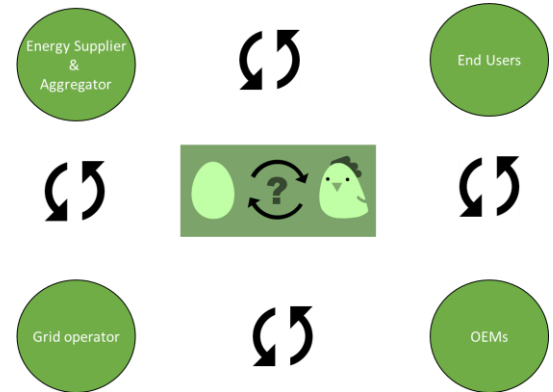
Bob Ran



Joke Kort

The Project

- The aim of GO-e
 - Understand the role of flexibility in the build environment
 - Research how flexibility services will look like for end users
 - Solve chicken and egg problems





Research Questions

- What are the characteristics of congestion in the built environment?
- To what extent is flexibility a solution, how do we harness it properly?
- How do we create flexibility services that represent the interests of all parties, such as market participants, grid operators, and consumers?
- Technical solutions to enable flexibility in a scalable manner



Consortium

Klankbord



Living Labs:
Zakelijk:
Albert Heijn
Distributie
Centrum

Living Labs:
Consumenten:
Houten



PHASE TO PHASE





Project results

Website

www.projectgo-e.nl

LinkedIn 





Flexibility quantification

- To what extent is flexibility a solution, how do we harness it properly?



Quantification of technically available flex



To realistic estimation of available flexibility



The main question

- **How much flex are consumers willing to provide, according to which values (needs, desires) and through what assets?**
 - Assets: Heat pump, PV, EV, (home or neighborhood) battery.
- This presentation only addresses the highlights and results of part of this research, the field study. A full report of this research will be made available for download in October 2023 at the GO-e project website: [Projectsite \(projectgo-e.nl\)](https://projectgo-e.nl)



The field study

- The insights in the values (drivers and barriers) identified in earlier interviews are used to formulate concrete incentives for providing flex in the field study (done with experience sampling).
- Before we go into the results of the field study...
 - What are these values?
 - What is experience sampling?
 - How did we test the willingness to provide flex in practice given specific incentives and assets?



The interviews: conclusions about incentives

Steg et al find/use these values in their research:



- **Bio-spheric value:** Climate and sustainability are important motivators but not at the expense of comfort



- **Altruistic value:** People with strong social values are more prepared to provide flex even at the expense of themselves (e.g. less comfort within limits), especially when it helps those vulnerable.

- **Egoistic value:** People with strong egoistic values find being in control important, they need their needs fulfilled, financially as well as in terms of comfort and ease of use.

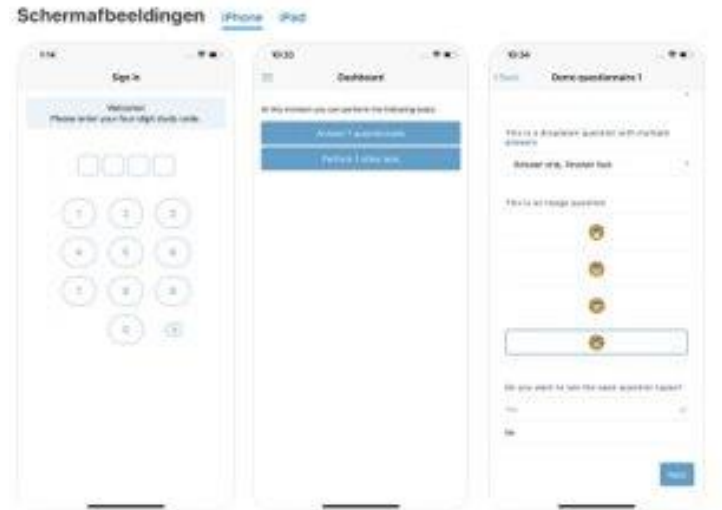


- **Hedonic value:** These people find personal well-being and comfort important.



Experience sampling

- What is experience sampling?
 - Brief questionnaires (3 questions)
 - Provided to participants in context (4 specific timeslots we were interested in)
 - To measure opinions, experiences, etc. in context





The field study

- Scenarios to test the willingness to provide flex in practice



- **Times:** 7.30, 11.45, 16.00 and 20.00
- **Assets** relevant in providing flex
- **Based on the values, different incentives:**



- Bio-spheric -> CO2 reduction



- Altruistic -> make sure that electricity stays available for my neighborhood



- Egoistic -> financial incentive



- Hedonic -> comfort, ease of use

- The financial incentives varied (3 levels), the other incentives did not



6 different scenarios

- Heat pump not heating, temperature decreases with 0,5 degrees:
 - At 7.30 (scenario 1)
 - At 20.00 (scenario 2)
- Heat pump pre-heating water buffer: at 16.00 (scenario 3)
- EV charging during overproduction PV: at 11.45 (scenario 4)
- EV slower charging: at 20.00 (scenario 5)
- PV overproduction and where it should go, to EV, heat pump, battery storage with several options for use: at 11.45 (scenario 6)





The field study

- How willing are consumer to provide flex?
 - 1) At 25% of the relevant moments?
 - 2) At 50% of the relevant moments?
 - 3) At 75% of the relevant moments?
 - 4) At 100%?

Let's see who's got it right, drum roll...





Heat pump - willingness to change behavior

Scenario 1 and 2: Heat pump not consuming electricity, temperature decreases with 0,5 degrees: At 7.30 and 20.00

Incentives: 5, 10 and 15% savings (financial) on daily basis

Results scenario 1 and 2: consumers are willing to provide flex in **80 to 92%** of the cases. In the morning less flex willingness compared to evening

Reasons for providing flex in scenario 1 and 2:



Egoistic (financial) 53 to 61% of the cases



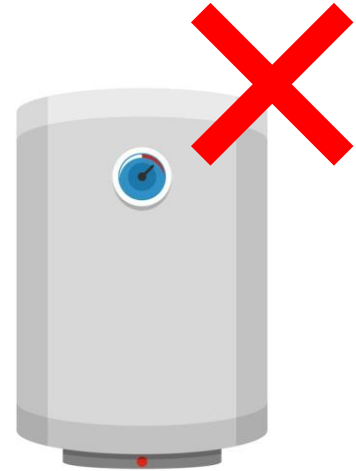
Bio-spheric (CO2) 18 to 28% of the cases



Hedonic (no flex) 8 to 20% of the cases



Altruistic (social) 3 to 7% of the cases





Heat pump - willingness to change behavior

Scenario 3: Heat pump pre-heating water buffer: at 16.00

Incentive: 2, 5 and 7% savings (financial) on daily basis

Results scenario 3: consumers are willing to provide flex in **86 to 87%** of the cases

Reasons for providing flex in scenario 3:



Egoistic (financial) 48 to 58% of the cases

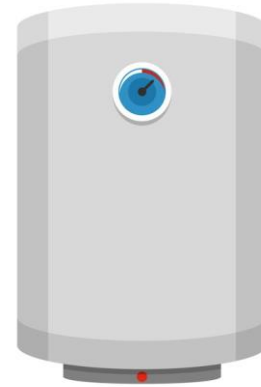


Bio-spheric (CO₂) 20 to 25% of the cases



Hedonic (no flex) 13 to 14% of the cases

Altruistic (social) 9 to 13% of the cases





EV - willingness to change behavior

Scenario 4: EV charging during overproduction PV: at 11.45

Incentives: 22, 45 and 90 euro's savings a month

Results scenario 4: consumers are willing to provide flex in **66 to 72%** of the cases.

Reasons for providing flex in scenario 4:



Egoistic (financial) 43 to 49% of the cases

Car not at home (no flex): 19 to 20% of the cases



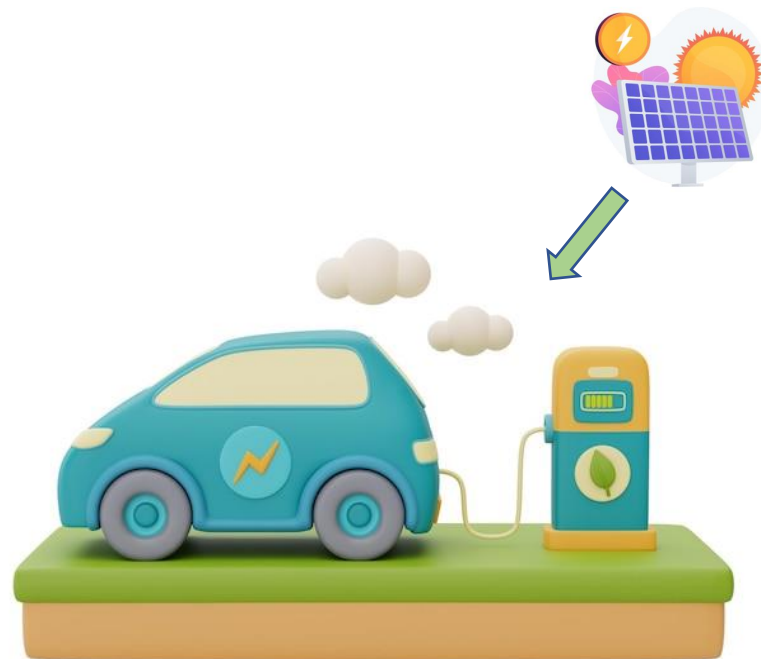
Bio-spheric (CO₂) 13 to 15% of the cases



No (no flex) 12 to 13% of the cases



Altruistic (social) 5 to 9% of the cases





EV - willingness to change behavior

Scenario 5: EV charging slower: at 20.00

Incentives: 10, 22 and 45 euro's savings a month

Results scenario 5: consumers are willing to provide flex in **71 to 72%** of the cases

Reasons for providing flex in scenario 5:



A: Egoistic (financial) 42 to 48% of the cases



C: Bio-spheric 16 to 19% of the cases

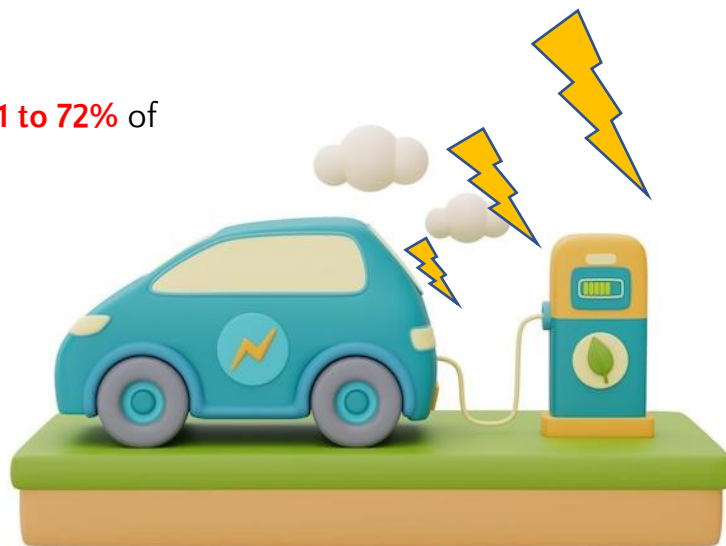


E: Nee (no flex) 17 to 18% of the cases

D: Car not at home (no flex): 11 to 12% of the cases



B: Altruistic 7 to 10% of the cases










PV overproduction should go to...

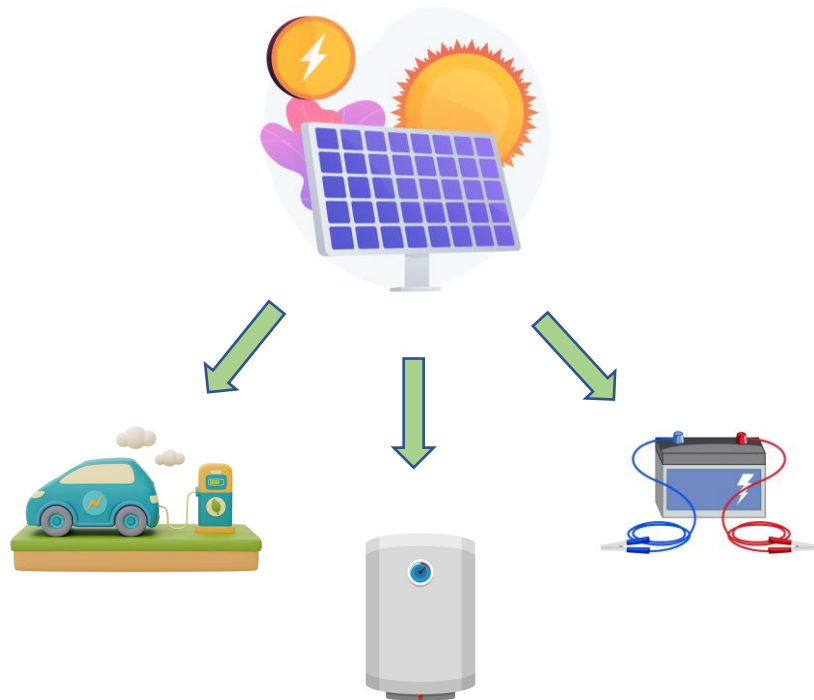
Scenario 6: Where should PV overproduction go: at 11.45

Choices:

- Charge car (90 euro's savings a month)
- Preheat heat pump (5% savings daily)
- Storage for later own consumption
- Storage for selling during peak tariff
- Storage for sharing with neighbors or community

Results scenario 6 (very small differences):

-    Self-consumption (pre-heating water buffer heat pump, charging car, storage for later self-consumption)
-  - Storage and sharing with others
-  - Third preference storage and trading during peak tariff





Main conclusions

- Consumers are very willing to provide flex! (in **66 to 92%** of the cases)
- Egoistic value (financial incentives) is the most chosen reason to provide flex but how high the financial incentive is doesn't matter much. Other reasons:



- Bio-spheric
 - Hedonic (no flex)
 - Altruistic
- These results align with the results from the interviews



Main take-aways

- **Energy literacy is not a given** when considering ‘congestion’, ‘flex’ and the ‘new role consumers get in the energy market’. If energy literacy is not addressed, flex mechanisms, HEMSs, batteries, etc. might not be thought relevant (to adopt).
- Flex is now often explained from a **DSO or energy provider perspective (tariff structures, flex services, market mechanisms)** which is **completely different from how consumers perceive and think about flex** or how they see it fit their daily lives and their values. These two perspectives **need to be aligned** to:
 - Increase understanding and awareness at the consumer end (how flex addresses their values) and
 - Consider the consumer perspective better in design of flex mechanisms, services and products

Thank you for you attention

- Bob Ran
- Email: bob.ran@tno.nl



- Joke Kort
- Email: joke.kort@tno.nl



Het GO-e project is mede tot stand gekomen door financiering van het ministerie van Economische Zaken en Klimaat en het ministerie van Binnenlandse Zaken en wordt uitgevoerd in de MOOI regeling van RVO.

Meer informatie: [Link naar website GO-e](#)

[Toekomstbestendige energienetten | TNO](#)

Project coördinatie: bob.ran@tno.nl (TNO)