

How to boost changes in household electricity consumption? Experimental evidence from Finland

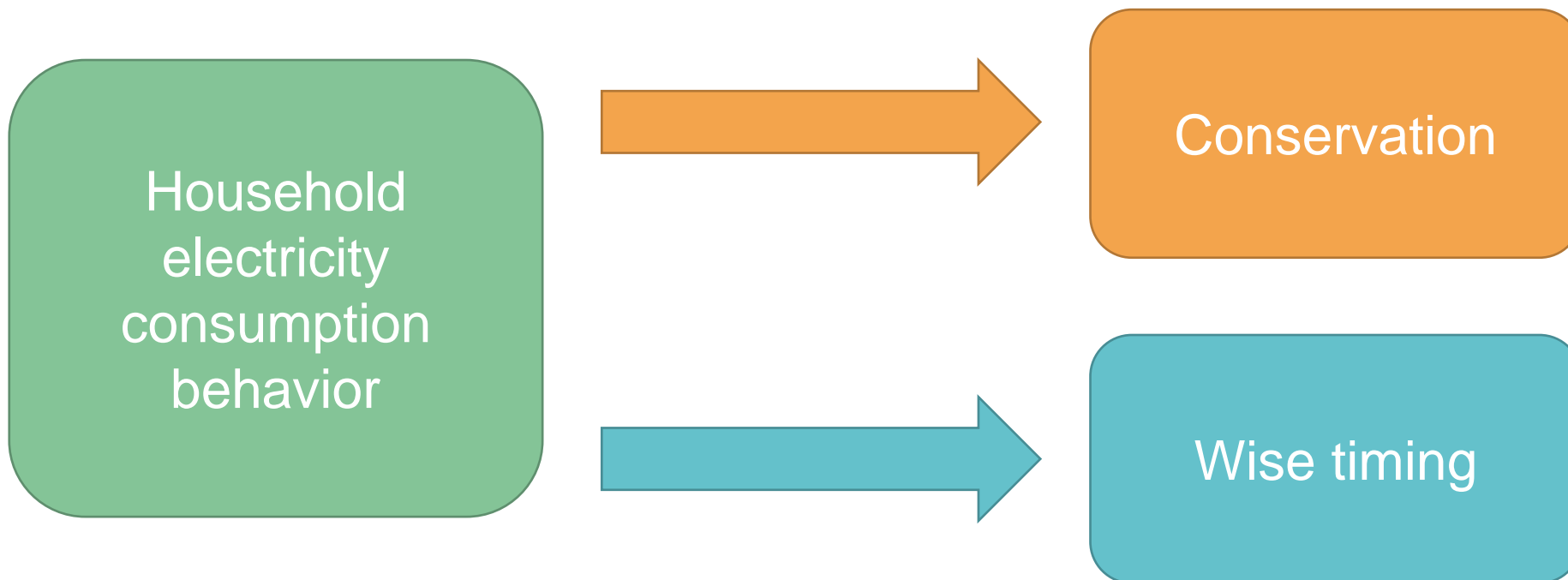
Enni Ruokamo

GLocalFlex hybrid seminar 28.9.2023

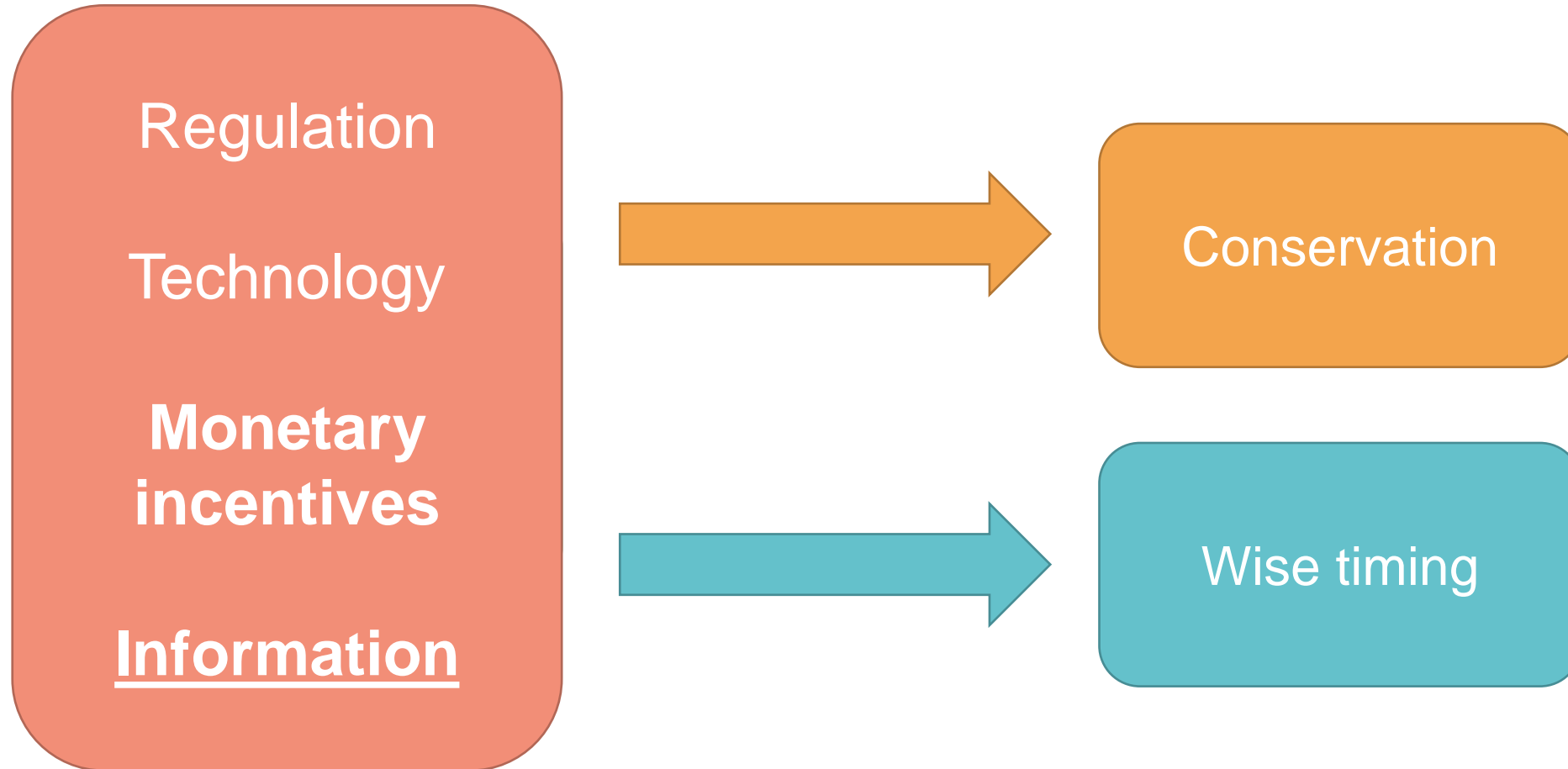


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What kind of changes we are looking for?

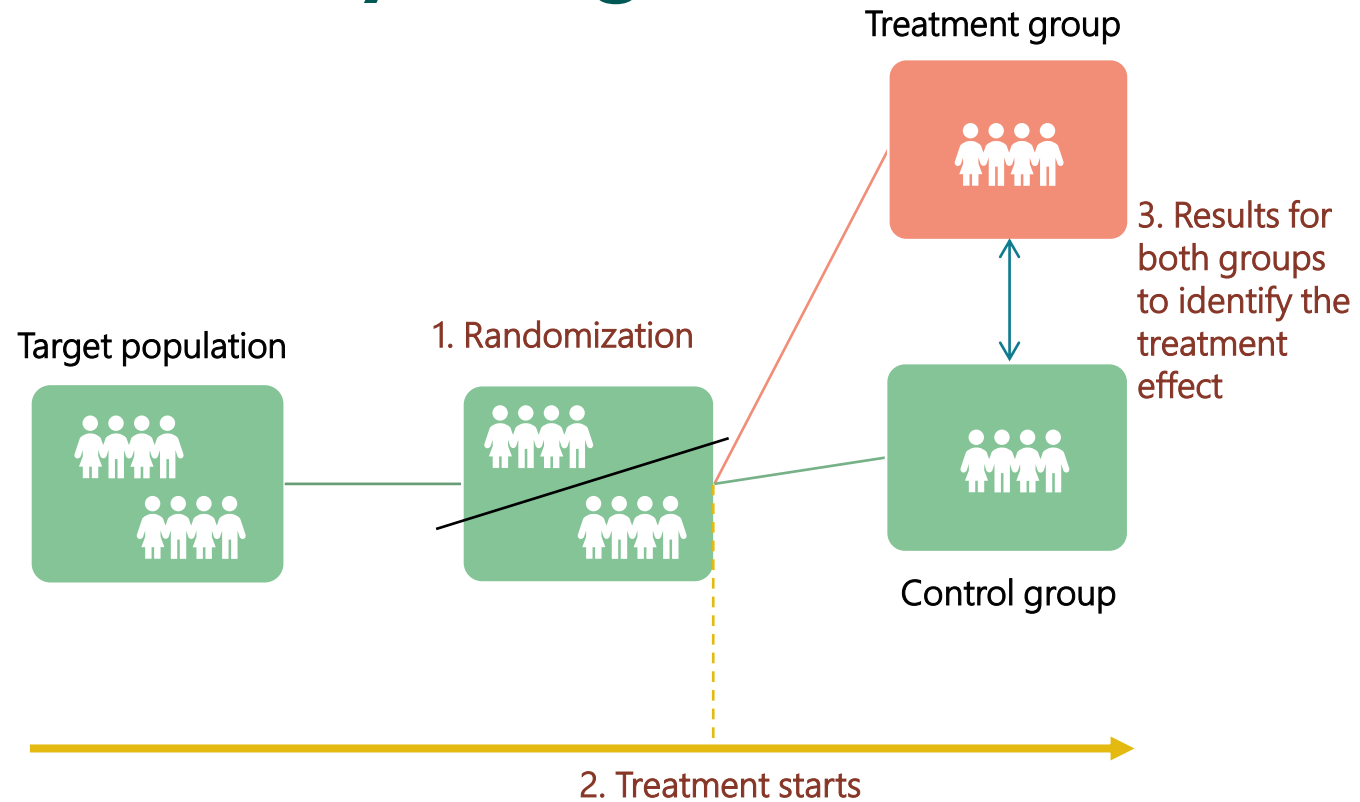


How to boost these changes?



How to identify the causal effect of information (or some other policy) on electricity usage?

- **Randomized field experiment** enables accurate impact analyses of the examined treatment(s)
 - The target population is randomly divided into treatment and control groups
- The randomization ensures that the observed differences in behavior between groups are caused by the treatment



Do information nudges work in practice?

- Several field experiments have shown the potential of information steering to induce **electricity saving**
 - Home energy reports, energy saving tips, social norm and in-home displays can promote energy conservation (see e.g., Allcott 2011, Kažukauskas et al. 2020)
 - Effect size is typically quite modest with more robust results showing average savings from 1% to 4% and not all households are responsive to information (Andor et al. 2020, Buckley 2020, Schleich et al. 2013)
 - The effect size also varies between countries/areas (Andor et al. 2020)
 - If we combine information with monetary incentives/rewards, the effect size increases and households who typically are less responsive to information can be motivated (Jesoe and Rapson 2014, List et al. 2017)

Do information nudges work in practice?

- Experimental evidence on the effectiveness of information nudges to promote **flexible electricity consumption behavior** is more limited
 - Ito et al. (2018) show that information nudges (peak time reminders) create reduction in electricity consumption during peak hours, but financial incentives create a larger and more persistent reduction
 - Bailey et al. (2023) find that financial rewards are effective at shifting EV charging behavior to off peak hours, but information nudges are not

→ Research gap: How effective information nudges are in changing electricity consumption behavior in the Nordic climate conditions? Can we promote a) electricity savings and b) flexible timing of electricity usage?

Porvoo experiment

This research was funded by the Strategic Research Council projects BCDC Energy (2015-2021) and Decarbon-Home (2021-2027)



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Randomized field experiment to promote electricity savings in Finland

Porvoo experiment (conducted in 2019):

- The study explores whether
 - Energy saving tips,
 - Online energy service platform providing electricity consumption information and peer comparisonsinduce electricity savings among households
- Collaborative work with Porvoon energia, Motiva, Energy Authority, University of Oulu and Syke



Tip-NR and Tip-R Informational newsletters – Example (1/2019)

PORVOON ENERGIA BORGÅ ENERGI

Minun energiani

Polkaise vuosi käyntiin energiatehokkaasti

Vuodenvaihteella on erinomaisen hyvä aika esitellä omasta energiatehokkuudesta, tuulettaa muuttaneita keinoja säästämiseen, mutta joulukuussa on vielä aikaa tehdä muutoksia.

Tässä energiatehokkuuden vinkkejä, mitä hyödyntää joulukuussa on. Katso vinkkejä, miten käyttää Energian palveluita.

Näin voit pienentää joulukuun lämmitystasua kasvattavaa vaikutusta:

- Tarkista huonelämpötila ja kiikää termokauhat asetusarvoon noin 20 °C, makuuhuoneisiin 18°C.
- Varmista, rappurakenteissa, koulissa ja kuntosaleissa on toimiva lämpötilan hallinta 17-18°C asti.
- Aiempi lämpötila nautuu huoneesta, jolloin ei ole ollenkaan. Pöytä ovat suljettuna.
- Lämpötila säätelee lämpöä. Käytä pehkeitä ja kavia pöytä.
- Käytä lämpöä huoneesta. Käytä lämpöä lämpöä huoneesta huoneeseen.
- Käytä lämpöä huoneesta huoneeseen ja huoneesta huoneeseen.
- Käytä lämpöä huoneesta huoneeseen ja huoneesta huoneeseen.

KUUKAUDEN VINKKI



TOIMI NÄIN:

- Pöytä ovat suljettuna.
- Käytä vain joulukuun ja kavia pöytä.
- Aiempi lämpötila nautuu huoneesta, jolloin ei ole ollenkaan.
- Käytä lämpöä huoneesta huoneeseen ja huoneesta huoneeseen.
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Miksi kulutustietoja kannattaa seurata?

Osallistajat voivat säästää rahaa ja vähentää hiilijalanjälkeä seuramalla kulutustietoja. Kulutustietojen avulla voit seurata energian käyttöä ja säästää rahaa ja vähentää hiilijalanjälkeä.

Sähkön vuosikulutus erilaisissa kotitalouksissa



ONNISTUIMMEKO?

Omaa kulutustietojen seuranta-asetusta on asetettu joulukuuseksi.

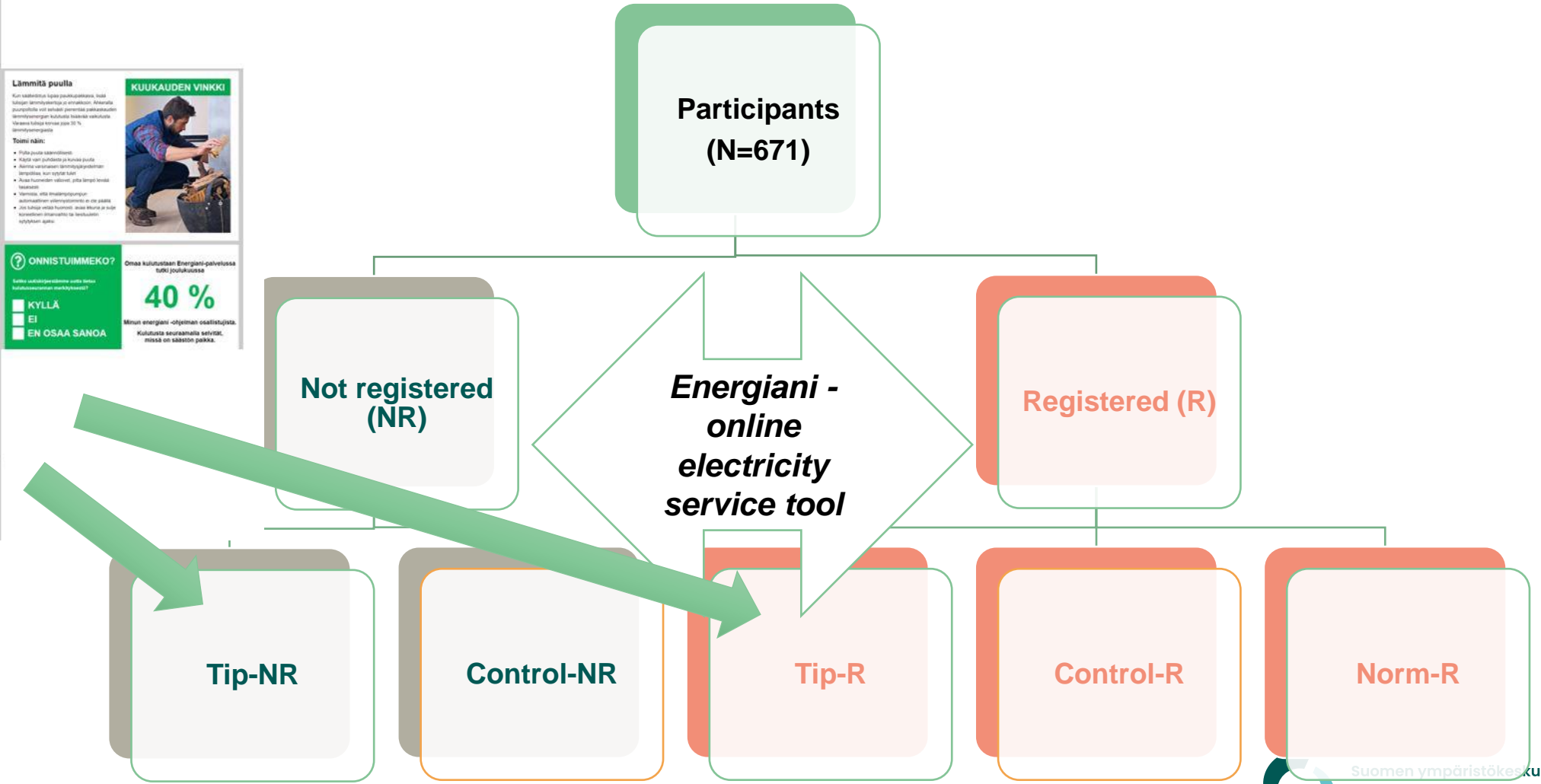
40 %

Minun energian -ohjelman osallistujista. Kulutusta seuraamalla selvitet, missä on säästöjä.

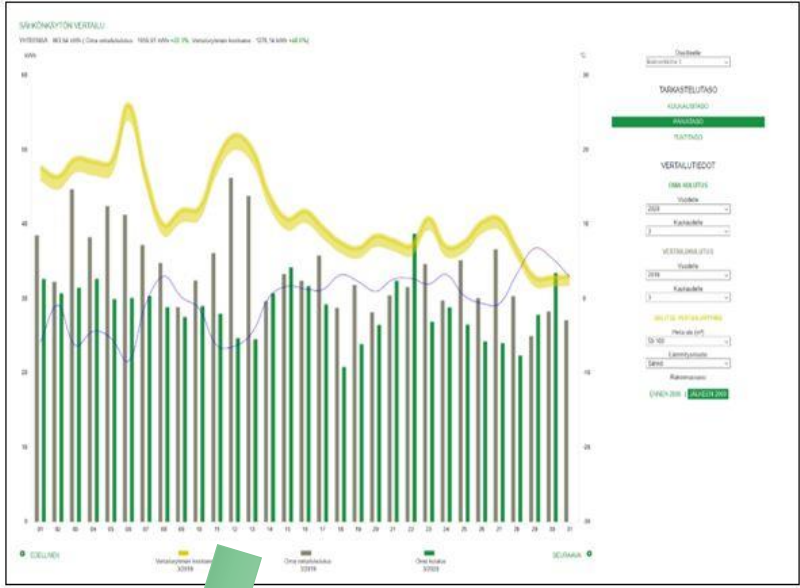
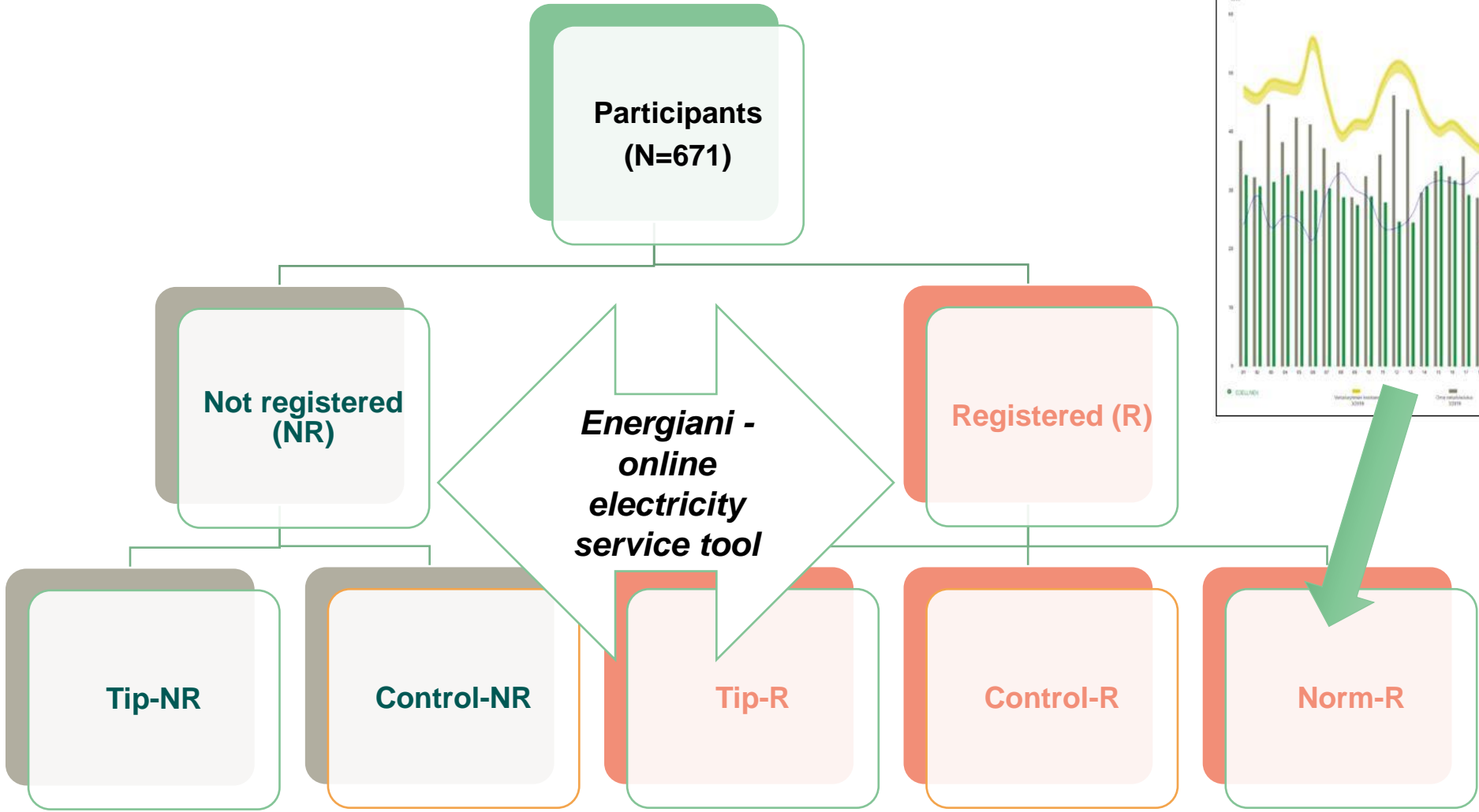
KYLLÄ
EI
EN OSAA SANOA

Näin tutkit kulutustietojasi

Vuosi- ja kuukausittaiset kulutustiedot näkyvät Energian palveluissa. Käytännössä voit seurata kulutustietoja ja säästää rahaa.



Norm-R: Comparison tool in the online energy service platform



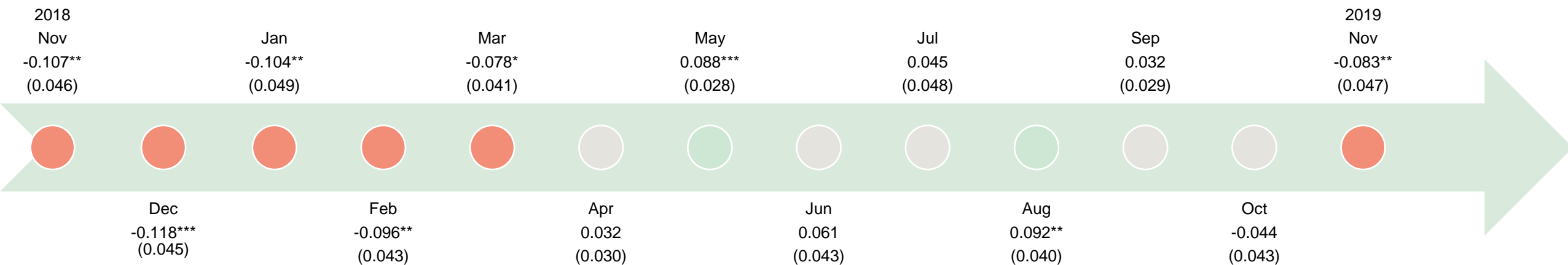
+ reduced informational newsletter

Results (whole year)

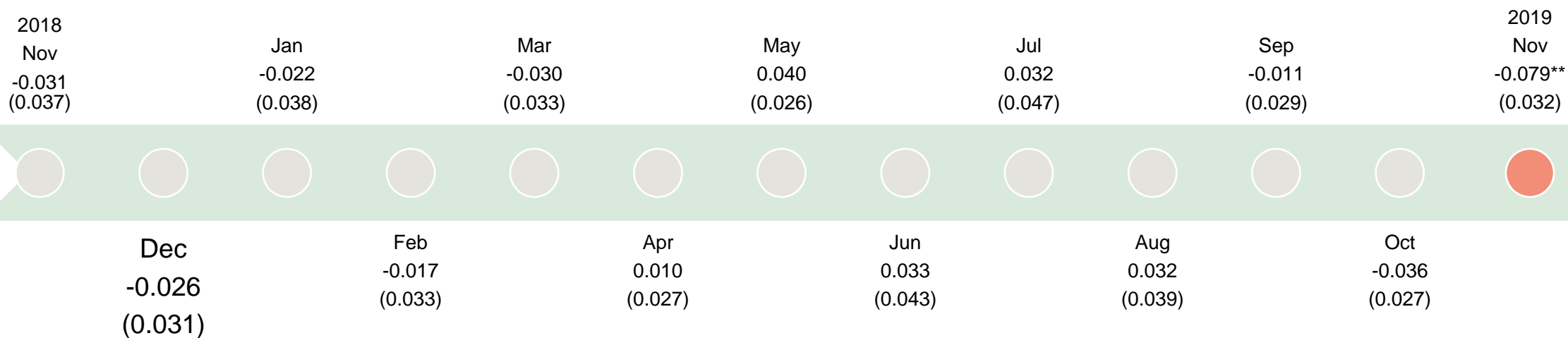
Dependent variable: ln(daily electricity consumption)

Nudge/treatment	Tip-NR	Tip-R	Norm-R
Average treatment effect (s.e.)	0.013 (0.021)	-0.015 (0.019)	-0.005 (0.016)
Controls			
<i>Household characteristics (hh size, income, education, language, work)</i>	✓	✓	✓
<i>Home characteristics (house type, owner-occupied, floor area, energy use level, house age, location, heating system)</i>	✓	✓	✓
<i>Weather (temperature, rainfall)</i>	✓	✓	✓
Adjusted R²	0.72	0.75	0.79

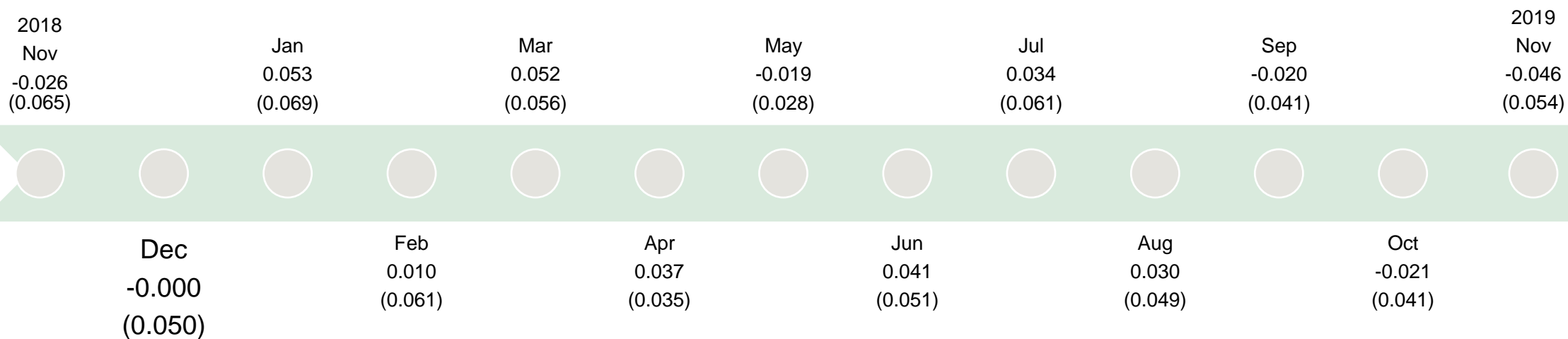
Monthly results: Tip-R



Monthly results: Norm-R



Monthly results: Tip-NR



Main findings and recommendations

- Detailed energy saving tips decreased household electricity consumption between 8% and 12% among registered households in wintertime
 - Some weak evidence that social norm combined with detailed energy saving tips decreased consumption
 - Unregistered group did not respond to the nudges → Activity to read the newsletter was lower among the unregistered group during the whole experiment period
- Targeting, timing and content matter
 - High consumption season and detailed/tailored energy saving tips increase the effectiveness of monthly energy advice
 - E-mail can be a cost-efficient and well perceived way to deliver energy advice
- You can read more about the experiment from: Ruokamo, E., Meriläinen, T., Karhinen S., Räihä, J., Suur-Uski, P., Timonen, L. & Svento, R. (2022). The effect of information nudges on energy saving: Observations from a randomized field experiment in Finland. Energy Policy. <https://doi.org/10.1016/j.enpol.2021.112731>

Demand response experiment

This research is funded by Academy of Finland
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and ALLTIME (2023-27)

VÄRE



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Randomized field experiment to promote demand response in Finland

Demand response experiment
(starts this fall):

- The study focuses on activating demand response among households by providing information on hourly prices and wise timing of electricity consumption
- Collaborative work with energy service company Väre and Syke

VÄRE

Aims and conduction

- Research questions:
 - Are peak-hour reminders effective in cutting household electricity consumption?
 - How do real price incentives (here fixed price vs. dynamic pricing contracts) work together with delivered information?
 - Can accessible and simple price and timing information affect household electricity consumption behavior?
- Conduction:
 - We randomize participants to treatment and control groups
 - Participant acquisition is ongoing → Experiment will start in October



Photo source: Väre Oy
<https://vare.fi/sahkonkulutus/vappi/>

Information is delivered either via e-mail or notifications from the Väppi-application

VÄRE



Information is delivered either via e-mail or notifications from the Väppi-application

Electricity is on average more expensive tomorrow, but there exists clear price variation. By timing your consumption wisely, you can save money. The most expensive hours to consume electricity start at 10:00, 11:00, 12:00 and 16:00. The cheapest hours start at 01:00, 02:00, 03:00 and 04:00. Note also the cheaper hours starting at 21:00, 22:00 and 23:00. All tomorrow's hourly prices are...

Next steps

- The experiment starts soon and lasts approximately 6 months
- Results should be available by the end of next year 2024
- More information about the experiment available at (in Finnish):
 - [https://www.syke.fi/fi-FI/Tutkimus_kehittaminen/Tutkimus_ja_kehittamishankkeet/Hankkeet/Kulutusjoustokokeilu/Kulutusjoustokokeilu\(65832\)](https://www.syke.fi/fi-FI/Tutkimus_kehittaminen/Tutkimus_ja_kehittamishankkeet/Hankkeet/Kulutusjoustokokeilu/Kulutusjoustokokeilu(65832))
 - <https://vare.fi/lisatietoa-kokeilututkimuksesta/>

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Thank you!

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