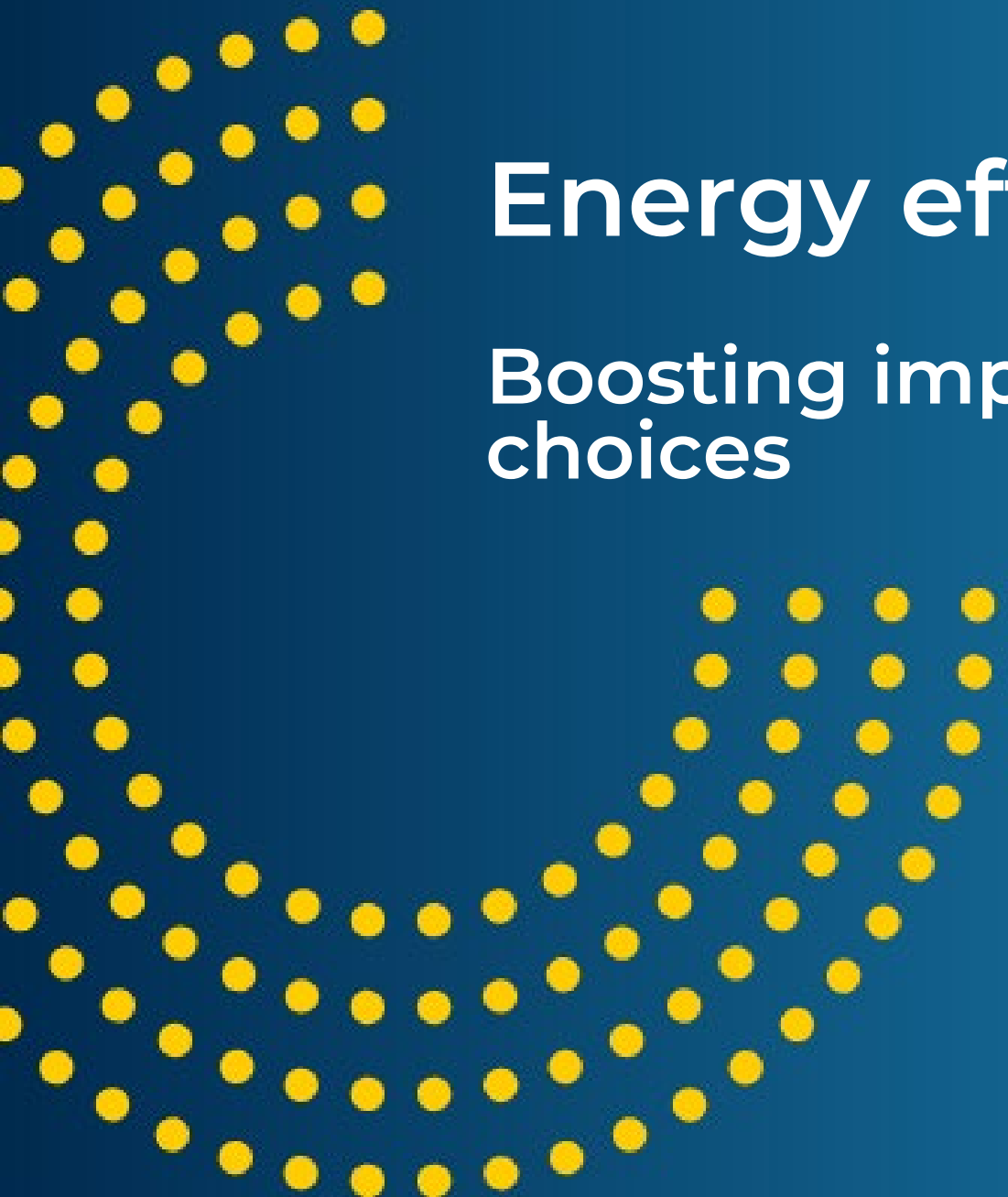
Energy efficiency investments

Boosting impacts through smart design choices



European Commission

WORLD BANK GROUP

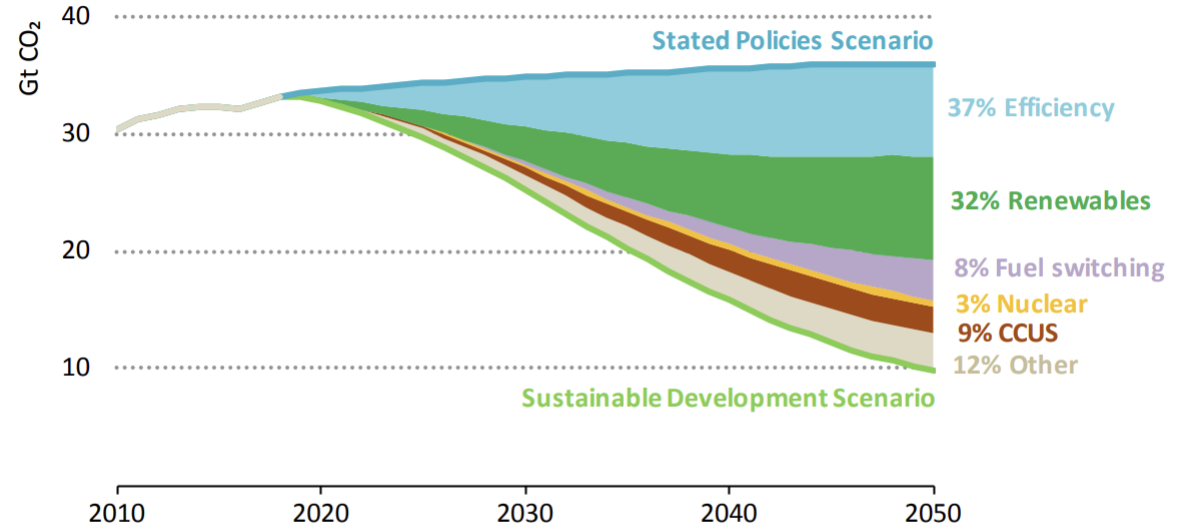
Climatic benefits

"A sharp pick-up in efficiency improvements is the single most important element that brings the world towards the Sustainable Development Scenario"

"No decarbonisation pathway is achievable without rapid and significant deployment of energy efficiency measures."

(International Energy Agency, 2019)

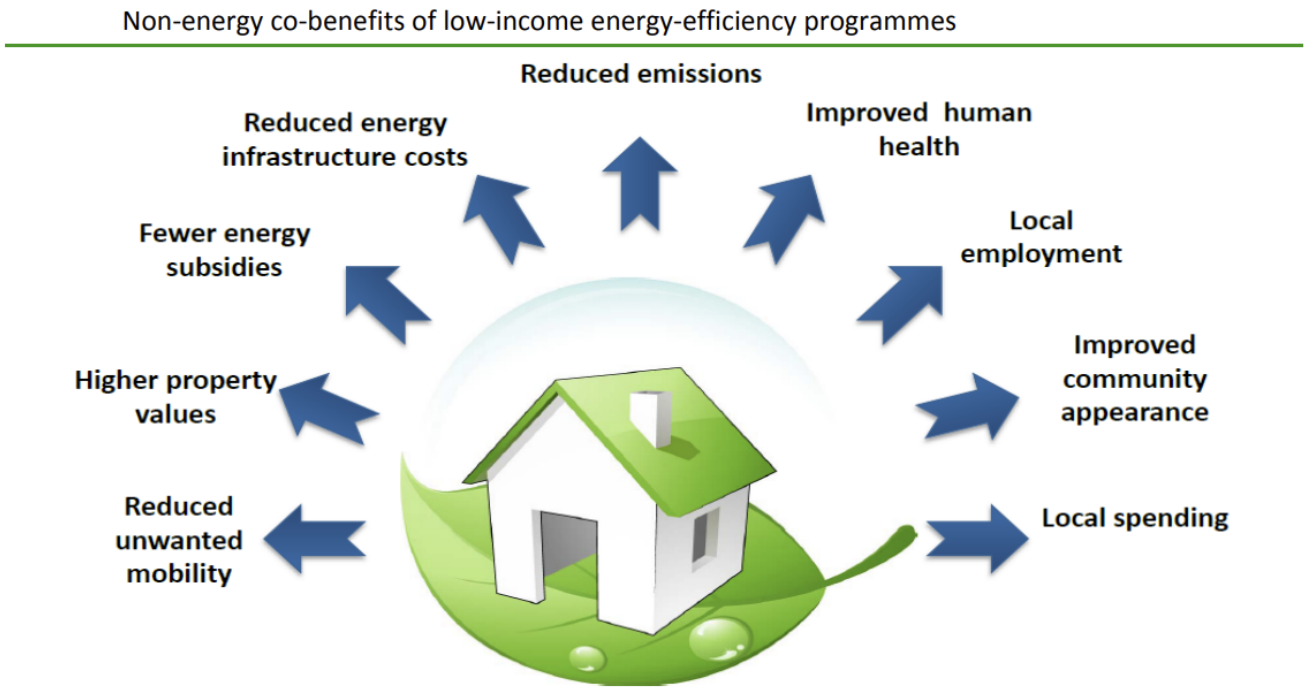
CO_2 emissions reductions by measure in the Sustainable Development Scenario relative to the Stated Policies Scenario



All clean energy technologies are needed in the Sustainable Development Scenario; energy efficiency is the main contributor to emissions savings to 2050

Notes: CCUS = carbon capture, utilisation and storage. Reduced thermal losses in power generation account for 15% of efficiency improvements.
The stated policies scenario outlines the energy system's future based on current policies and announced policy intentions—but only if they are backed by concrete measures for implementation.
The sustainable development scenario outlines an alternative policy pathway that is consistent with all three energy-related sustainable development goals (global warming, universal energy access, and clean air)

Further benefits (example)

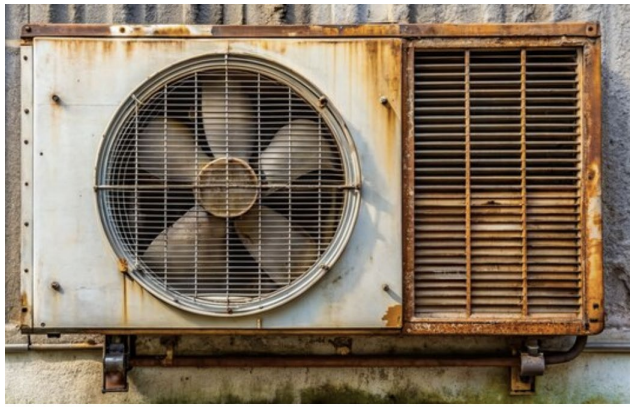


Non-energy co-benefits can be categorised according to the nature of the benefit and the beneficiary. The co-benefits literature is quite diverse, but most studies describe the following categories

International Energy Agency (2011)

Behind the Curtains: Behavioral and Social Dynamics of Impact

- Behavioral responses (e.g., rebound)



Cash for cooler program
(Davis et al., 2014)

Behind the Curtains: Behavioral and Social Dynamics of Impact

- Principal-agent relationship (e.g., renter vs. owner)

1) landlords underestimate renters‘ discomfort
→ underinvest in improved insulation

(Philips, 2012)

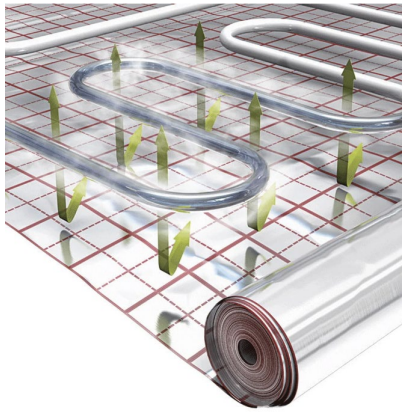
Behind the Curtains: Behavioral and Social Dynamics of Impact

- Principal-agent relationship (e.g., renter vs. owner)

1) landlords underestimate renters‘ discomfort
→ underinvest in improved insulation

cheap for landlord

vs.



cheap for renter

2) differential investment preferences

(Philips, 2012)

Behind the Curtains: Behavioral and Social Dynamics of Impact

- Herding behavior (e.g., peak-demand, spillovers)

energy cut-offs during peak-months
aggravate discomfort of renters

Behind the Curtains: Behavioral and Social Dynamics of Impact

- Herding behavior (e.g., peak-demand, spillovers)

energy cut-offs during peak-months
aggravate discomfort of renters

neighbors mimic neighbors

Irwin (2021)

Approaches for Boosting Impacts

- Cognition-based tools
- Norms-based tools
- Incentive-based tools

Approaches for Boosting Impacts

- Cognition-based tools

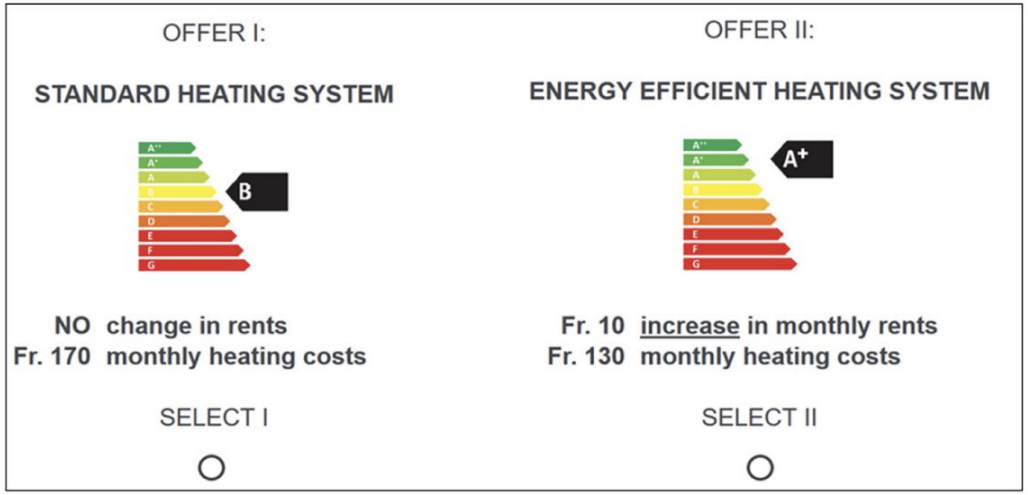


Fig. 2. E ice list choice task with heating costs.

How much do tenants value reduced…

expenditures

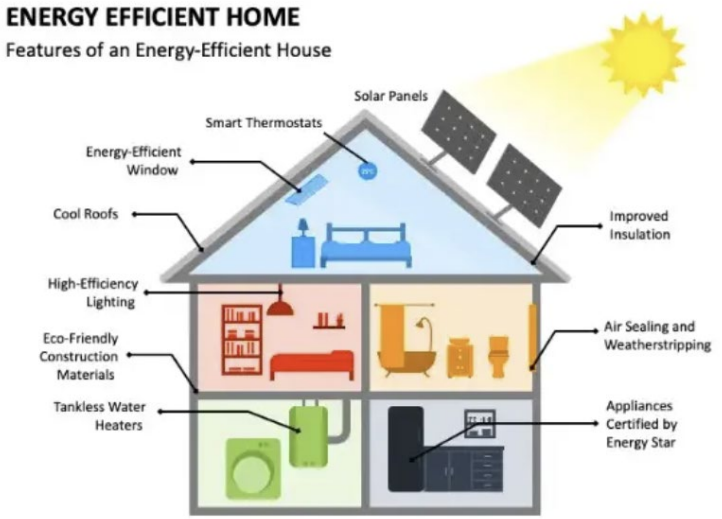
AND

emissions?

Example: informing tenants of decrease in energy bills increases acceptability of rent increase in Switzerland, especially when energy bill savings stem from energy efficiency investments (Lang & Lanz, 2021)

Approaches for Boosting Impacts

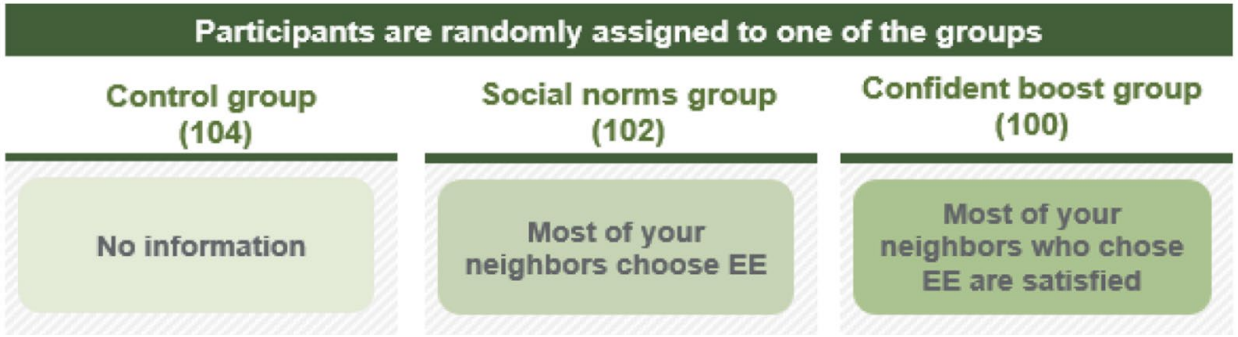
- Norms-based tools



(Belaïd & Flambard, 2023)

Approaches for Boosting Impacts

- Norms-based tools



social norms and motivational boosts increase preferences for sustainable building practices among French students (Belaïd & Flambard, 2023)

Approaches for Boosting Impacts

- Incentive-based tools

time-of-use electricity pricing….

…. reduced peak-demand residential consumption in Spain (Enrich et al., 2024)

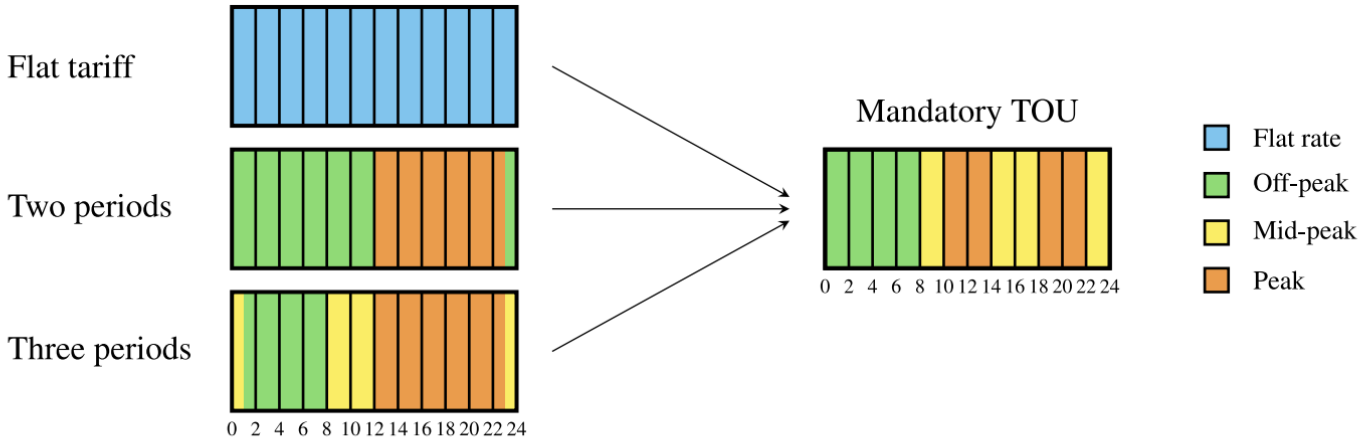
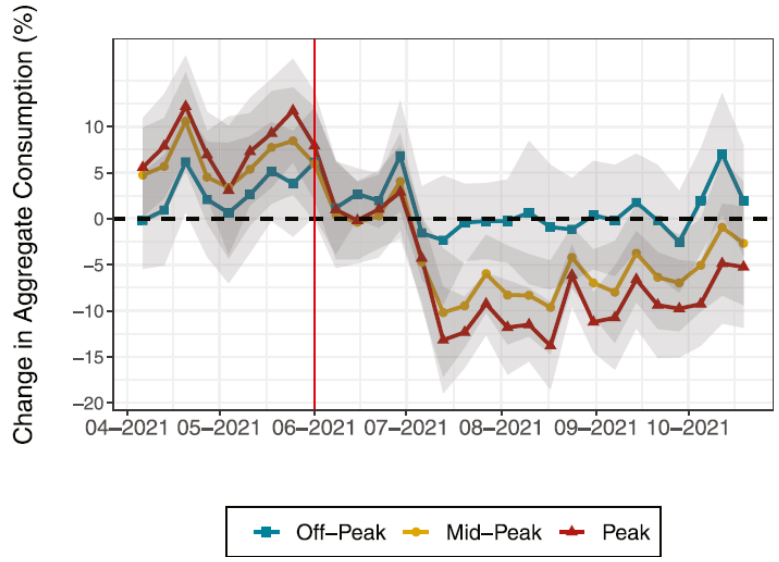


Fig. 1. Tariffs before and after the policy.
Notes: Available tariffs for the charges component of the electricity bill before and after the policy was implemented. Before June 2021, consumers were assigned a flat rate tariff by default, but could opt-in to different TOU programs, while the policy made compulsory a three-tier TOU pricing.



…. reduces the need for costly power plants specifically built for few days of the year in the US (Blonz, 2022)

Approaches for Boosting Impacts

- Incentive-based tools

energy tax credit…

… induces households who are already determined to renovate to perform more substantial energy-saving renovations, but does not attract new investments in France (Risch, 2020)

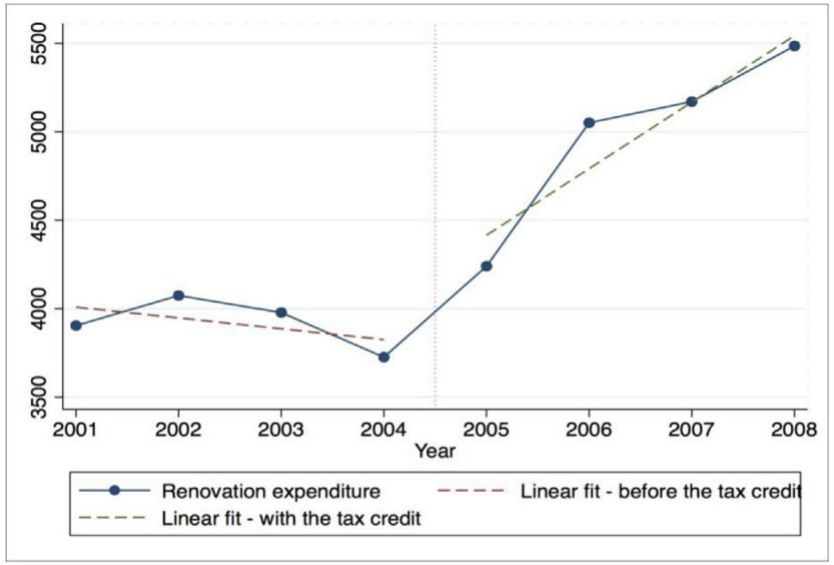
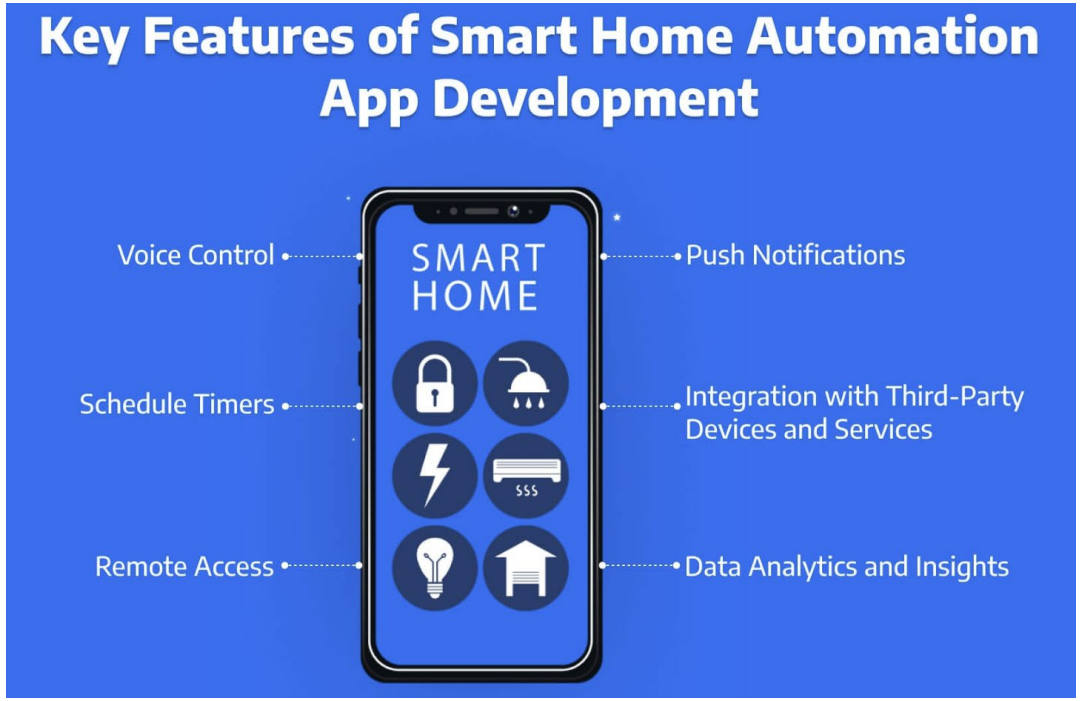


Fig. 3. Renovation expenditures and linear fit before and after the introduction of the tax credit. Note: This figure is based on 2277 observations, including 1320 households eligible for the tax credit (i.e. observed in 2005 and after).

Combine Approaches in Digital Platforms

- Cognition-based + norms-based + incentive-based tools

lack of empirical evidence on a combination of various of these tools



Thank you

Literature

Belaïd, F., & Flambard, V. (2023). Boosting buildings energy efficiency: the impact of social norms and motivational feedback. *Journal of Economic Behavior & Organization*, 215, 26-39.

Blonz, J. A. (2022). Making the best of the second-best: Welfare consequences of time-varying electricity prices. *Journal of the Association of Environmental and Resource Economists*, 9(6), 1087-1126.

Davis, L. W., Fuchs, A., & Gertler, P. (2014). Cash for coolers: evaluating a large-scale appliance replacement program in Mexico. *American Economic Journal: Economic Policy*, 6(4), 207-238.

Enrich, J., Li, R., Mizrahi, A., & Reguant, M. (2024). Measuring the impact of time-of-use pricing on electricity consumption: Evidence from Spain. *Journal of Environmental Economics and Management*, 123, 102901.

International Energy Agency, 2019. World energy outlook 2019. https://www.iea.org/ reports/world-energy-outlook-2019.

International Energy Agency, 2011. Evaluating the co-benefits of low-income energy-efficiency programmes. https://iea.blob.core.windows.net/assets/10128d72-2171-4be4-9634-5cb4fcb21feb/low_income_energy_efficiency.pdf

Literature

Irwin, N. B. (2021). Sunny days: Spatial spillovers in photovoltaic system adoptions. *Energy Policy*, 151, 112192.

Lang, G., & Lanz, B. (2021). Energy efficiency, information, and the acceptability of rent increases: A survey experiment with tenants. *Energy Economics*, 95, 105007.

Phillips, Y. (2012). Landlords versus tenants: Information asymmetry and mismatched preferences for home energy efficiency. *Energy Policy*, 45, 112-121.

Risch, A. (2020). Are environmental fiscal incentives effective in inducing energy-saving renovations? An econometric evaluation of the French energy tax credit. *Energy Economics*, 90, 104831.