French installers Response to Heat Pump Subsidies

María Aragay, Martin Lambotte

November 22, 2025

- **Introduction**

- Background Policy

- Data

- Empirical strategy

- Results and Discussion

- Conclusion and Policy Implication

- Future Research Directions

Why its relevant?

- Heating accounts for a large share of residential energy consumption and CO_2 emissions.

- Electrification through heat pumps is key for carbon neutrality.

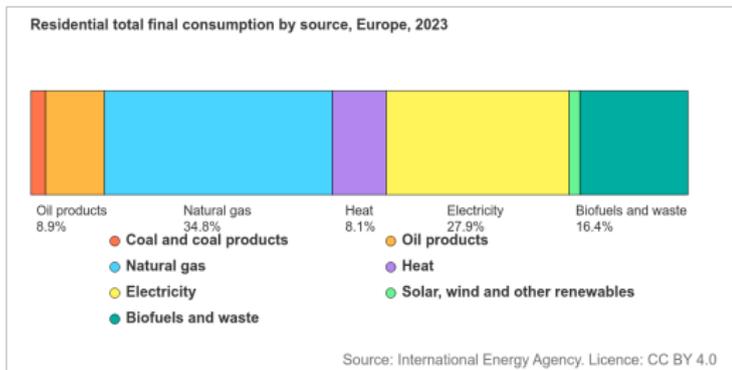- Understanding heating firms responses to subsidies helps to design effective policies.

Figure: Residential total final consumption by source, Europe, 2023 (IEA)

Context

- France has implemented several subsidy schemes for heat pumps (CITE, MaPrimeRénov').
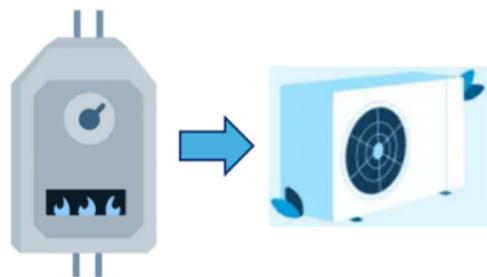- Since 2014, heating firms must be RGE-certified to access public incentives.

Figure: Transition from fossil fuel to heat pump

Figure: RGE certification

Introduction

- **Research question:**

  How did heating firms react to the increased need for certified installers generated by the heat pump subsidy reform?

- **Methodology:**

  Difference-in-differences and event study

- **Main contributions:**
  - Provide causal evidence on firms certification response to subsidies.
  - Highlight heterogeneity by fuel exposure and sector.
  - Provide information than can help to policy design for energy transition.

- Introduction

- **Background Policy**

- Data

- Empirical strategy

- Results and Discussion

- Conclusion and Policy Implication

- Future Research Directions

Background Policy

France's Energy Efficiency Policy

- France aims for strong emission reductions and a massive decarbonisation of the residential sector.
- Buildings account for 44% of national energy use and one quarter of CO_2 emissions.
- Energy efficiency policy combines public subsidies (CITE, MaPrimeRénov') and private subsidies (Energy Efficiency Obligations, EEOs).

2014 (RGE requirement) $\rightarrow$ 2018 (CITE subsidies) $\rightarrow$ 2019 (MaPrimeRénov')
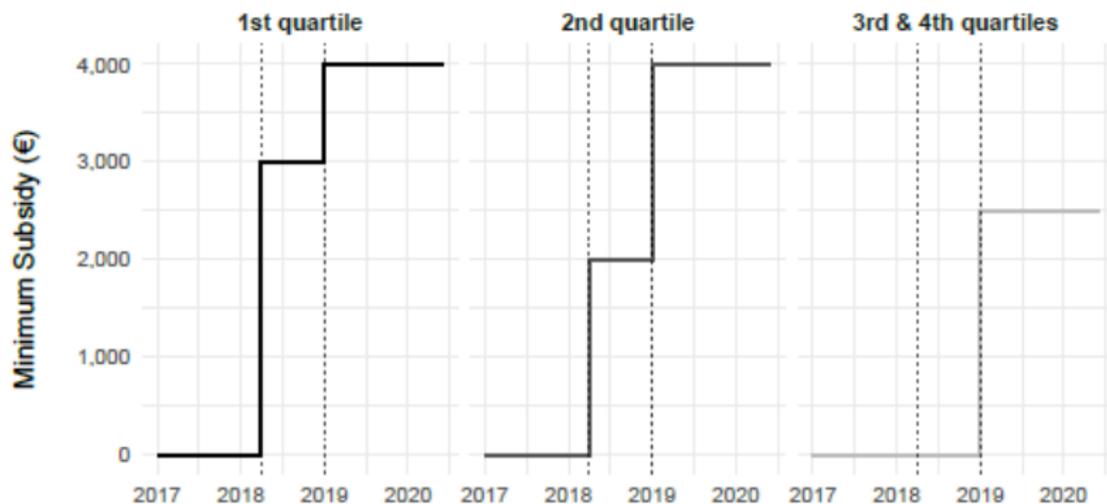
Background Policy

Figure: Minimum Subsidy Levels for Heat Pumps

- Introduction
- Background Policy
- **Data**
- Empirical strategy
- Results and Discussion
- Conclusion and Policy Implication
- Future Research Directions

Data : Data sources

- Data on French establishments (SIRENE database)
  - ∗ History of French establishments over time since their creation (status and main activity)
  - ∗ Comprehensive directory of all French establishments (even those closed for a long time) with their coordinates
- Data on French residential heating
  - ∗ Main heating source by households in 2017 (French population census)
  - ∗ Register of contractors certified for heat-pump installation for each month from 2017 to 2020
- General data on French municipalities
  - ∗ French administrative municipalities Jan. 2019
  - ∗ Median income per municipality in 2021

When considering establishments inactive less than 6 months and likely to become RGE-certified :

⇒ 119,914 estab. with 7,524 certified ones (Jan. 2017 to Mar. 2020)
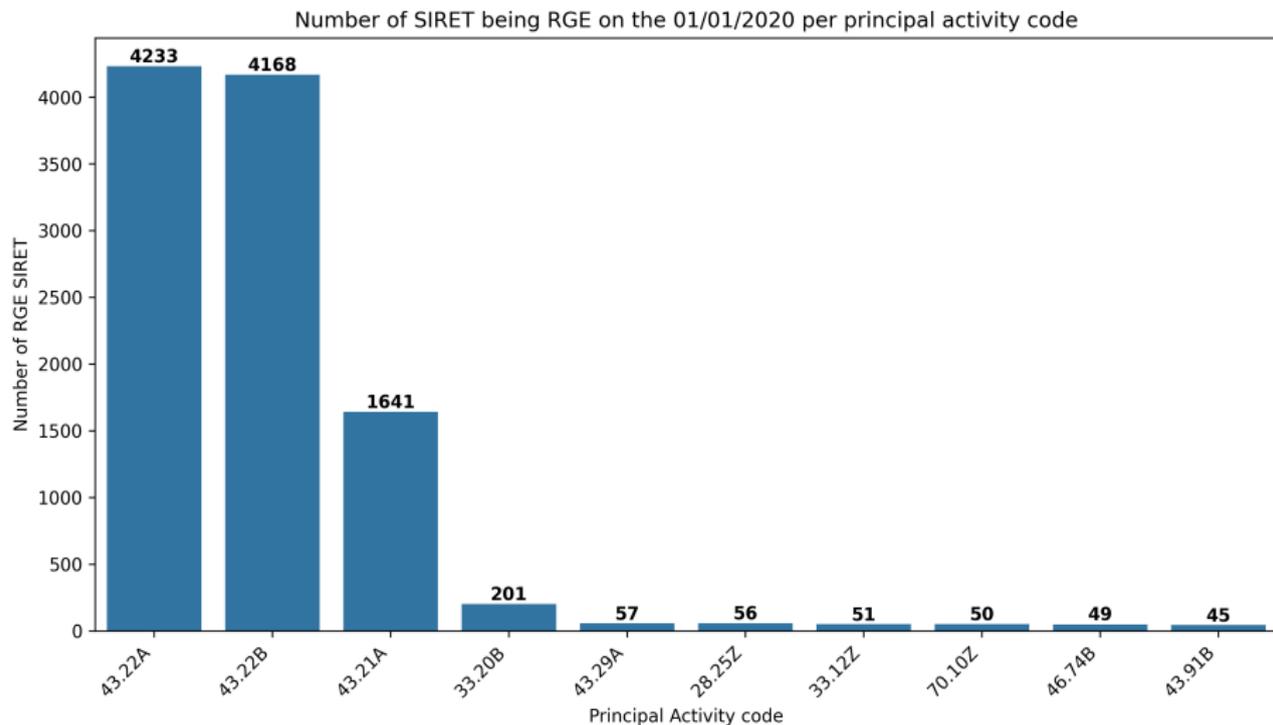
Data : descriptive graph

Figure: Number of RGE establishments per main activity code (01/01/2020)

Data 3 : control and treated groups

We define the control and the treated groups for the models as follows:

- Control group : all establishments inactive less than 6 months between January 2017 and March 2020 with one of the three main activity code (43.22A, 43.22B, 43.21A)

- Treated group : all establishments in the control group that were certified at least one month between January 2017 and March 2020.

Data : descriptive tables

To get more information about the establishments and their local context, we consider all municipalities in a 20km radius around the establishments and we print a few characteristics.

Table: Descriptive statistics for establishments groups

	Control group (excl trtd)		Treated group	
	Number	%	Number	%
Total	109 390	93.6	7524	6.4
Population in a 20km radius				
Mean	1.68×10^6	/	0.420×10^6	/
Mean of the 2021 median income level in a 20km radius (euro)				
Min	17.2×10^3	/	18.8×10^3	/
Mean	25.1×10^3	/	24.0×10^3	/
Median	25.2×10^3	/	23.6×10^3	/

Data : more descriptive tables

Table: Descriptive statistics for establishments groups

	Control group (excl trtd)		Treated group	
	Number	%	Number	%
Housing type (TYPL)				
1 : house	75 307	68.8	6419	85.3
2 : flat	33 178	30.3	1064	14.1
3-6 : other	905	0.9	41	0.6
Main fuel type of the housing (CMBL)				
1 : urban heating network	4923	4.5	81	1.1
2 : mains gas	32 051	29.3	1279	17.0
3 : fuel oil	14 877	13.6	1457	19.4
4 : electricity	36 864	33.7	2383	31.7
5 : bottled gas	2625	2.4	248	3.3
6 : other	18 050	16.6	2076	27.6

- Introduction
- Background Policy
- Data
- **Empirical strategy**
- Results and Discussion
- Conclusion and Policy Implication
- Future Research Directions

Empirical strategy

We want to study the effect of fuel composition on RGE certification for heat pumps. We need to define properly what is the market of each establishment, where fuel composition will matter.

Figure: Search of a contractor

Figure: 20km buffer zone around establishments

Empirical strategy : establishment-level exposure

Definition : rank-weighted average fuel oil (or gas, or fossil fuel) penetration rate across all municipalities within a 20 km radius of establishment i based on the government website ranking system.

Mathematical formulation :

$$E_i = \frac{\sum_{c \in C_i} FU_c \times W_{i,c}}{\sum_{c \in C_i} TH_c \times W_{i,c}}$$

- C_i : set of communes with 20km of installer i
- FU_c : fuel oil (or gas, or fossil fuel) housing units in commune c
- TH_c : total housing units in commune c
- W_{ic} : rank-based weight for installer i in commune c

Rank-Based Weighting : $W_{i,c} = \frac{1}{R_{i,c}}$ where $R_{i,c}$ is the rank of installer i among all installers serving commune c.

Empirical strategy : DiD and Event Study

1. Simple Difference-in-Difference analysis :

$$Y_{it} = \alpha_i + \lambda_t + \beta \times \mathbb{1}_{t \geq Jan.2019} \times S_{FF,i} + \epsilon_{it}$$

where Y_{it} is a binary variable for RGE certification of establishment i in month t (0 if not certified, 1 otherwise), α_i is the establishment fixed effect, λ_t is the month fixed effect, $S_{FF,i} = \log(E_{FF,i})$ is the exposure for establishment i, ϵ_{it} is the error term.

2. Separate fuel type Difference-in-Difference analysis :

$$Y_{it} = \alpha_i + \lambda_t + \beta_1 \times \mathbb{1}_{t \geq Jan.2019} \times S_{Oil,i} + \beta_2 \times \mathbb{1}_{t \geq Jan.2019} \times S_{Gas,i} + \epsilon_{it}$$

3. Separate fuel type Event Study :

$$Y_{it} = \alpha_i + \lambda_t + \sum_{\tau=-14}^{20} \beta_\tau \times \mathbb{1}_{t=April\ 2018+\tau} \times S_{Oil,i} + \sum_{\tau=-14}^{20} \gamma_\tau \times \mathbb{1}_{t=April\ 2018+\tau} \times S_{Gas,i} + \epsilon_{it}$$

- Introduction

- Background Policy

- Data

- Empirical strategy

- **Results and Discussion**

- Conclusion and Policy Implication

- Future Research Directions

Simple DiD : linear probability model

$$Y_{it} = \alpha_i + \lambda_t + \beta \times \mathbb{1}_{t \geq \text{Ref. date}} \times S_{FF,i} + \epsilon_{it}$$

Table: Estimation of β for two thresholds dates (Jan. 2019 and June 2019)

Ref. date	Cov. estim.	Estabs	R-squared	β param.	Std. Err.	T-stat
Jan. 2019	Clustered	$116,914$	2.0×10^{-5}	0.0025	0.0011	2.3
June 2019	Clustered	$116,914$	1.7×10^{-5}	0.0026	0.0011	2.3

- Significant results : positive β parameter
- Robustness tests in appendix

Results : Separate fuel type DiD

Table: Results for January 2019 and June 2019

Estimation 1 (clustered, 01/01/2019)

PanelOLS Estimation Summary	
Covariance Estimator	Clustered
Time Periods	39
R-squared	0.0006
Parameter Estimates	
Parameter	Statistics
β_1 (oil)	0.0071
	std. err. : 0.0006
	T-stat : 11.5
β_2 (gas)	0.0020
	std. err. : 0.0006
	T-stat = 3.56

Estimation 2 (clustered, 01/06/2019)

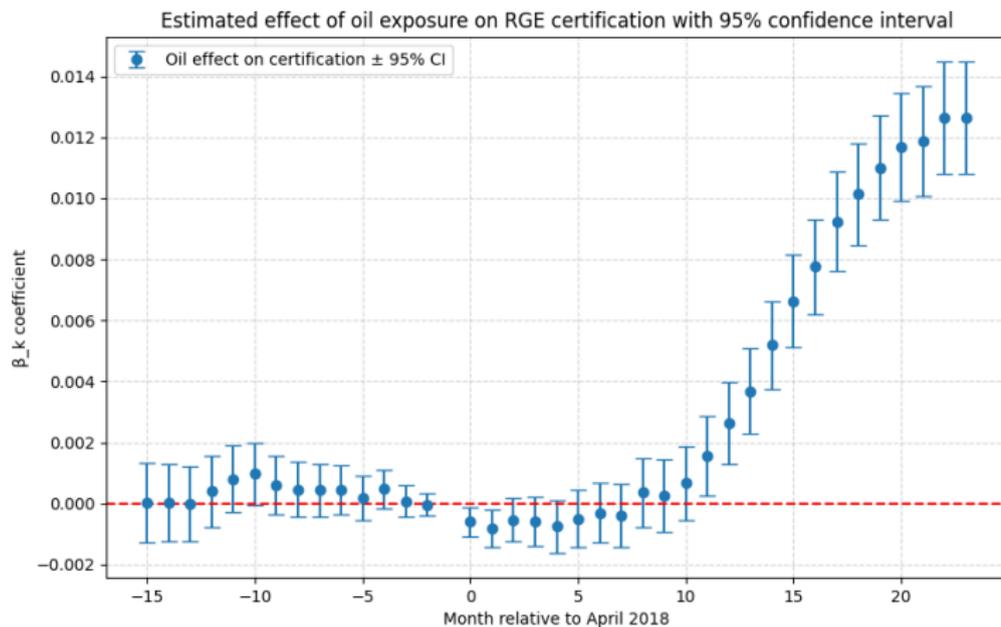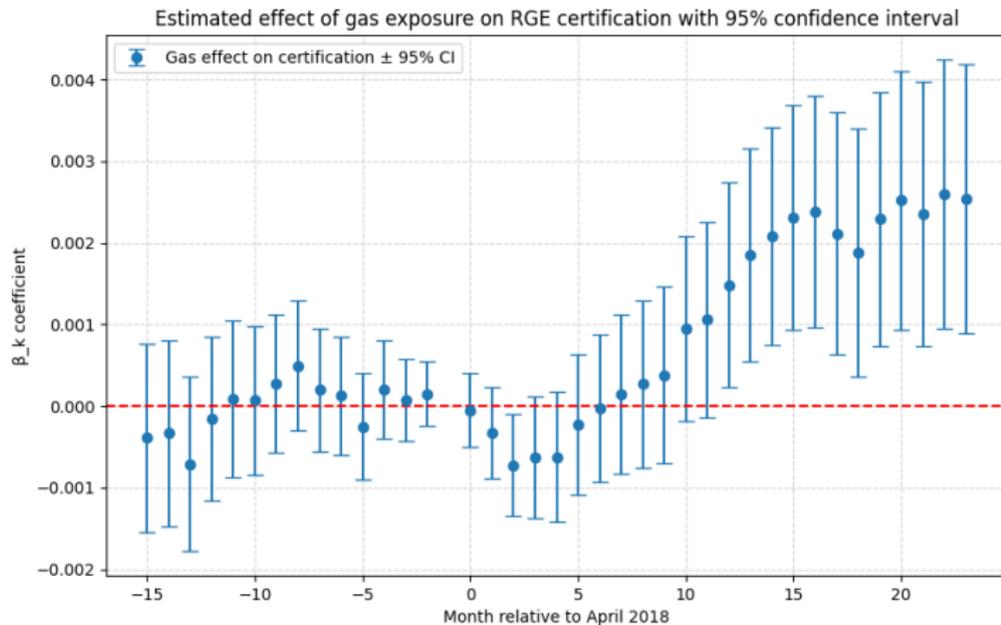| PanelOLS Estimation Summary	
Covariance Estimator	Clustered
Time Periods	39
R-squared	0.0009
Parameter Estimates	
Parameter	Statistics
β_1 (oil)	0.0096
	std. err. : 0.0007
	T-stat : 14.3
β_2 (gas)	0.0022
	std. err. : 0.0006
	T-stat = 3.63

Figure: Event Study oil

Figure: Event Study gas

- Introduction

- Background Policy

- Data

- Empirical strategy

- Results and Discussion

- **Conclusion and Policy Implication**

- Future Research Directions

Conclusion and Policy Implication

- Critical size
  - The 2018 policies affecting low-income households do not seem to have produced a reaction by heat pump installers
  - On the contrary, subsidizing all households from Jan. 2019 onward produced a surge in demand for heat-pumps and pushed installers in rural, isolated and oil-heated areas to adopt the RGE certification

- Efficiency - Equity tradeoff
  - Pass-through effect
  - Increasing inequalities by subsidizing high income households

$\Rightarrow$ Need for a comprehensive assessment of the effects of the policies on low-income households, that may not necessarily benefit from it.

- Introduction
- Background Policy
- Data
- Empirical strategy
- Results and Discussion
- Conclusion and Policy Implication
- **Future Research Directions**

Future Research Directions

- Rebound effect : take into account resales of oil/gas boilers (e.g. web scraping)
- Take into account spatial correlation (Conley Standard Errors)
- Gather data on households benefiting from heat-pump installation to see if the 2019 policy benefited to low-income households
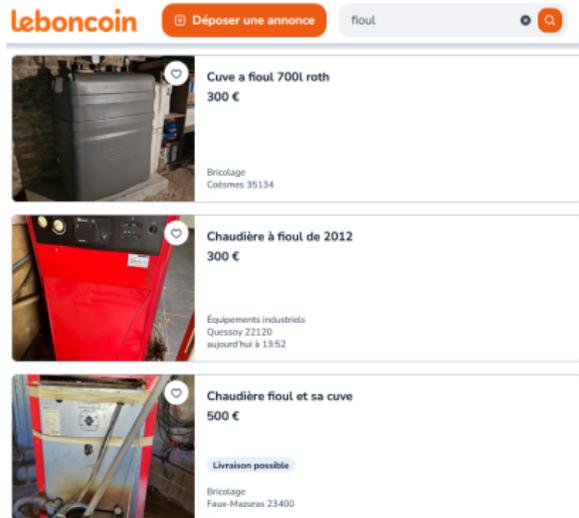

Figure: Advertising for oil boilers on leboncoin.fr

Appendix 1 : Robustness tests

Table: Estimation with different covariance estimator and threshold (3 codes)

Ref. date	Cov. estim.	Estabs	R-squared	β param.	Std. Err.	T-stat
Jan. 2019	Heteroske.	$116,914$	2.0×10^{-5}	0.0025	0.0003	9.0
Jan. 2019	Clustered	$116,914$	2.0×10^{-5}	0.0025	0.0011	2.3
June 2019	Heteroske.	$116,914$	1.7×10^{-5}	0.0026	0.0003	7.7
June 2019	Clustered	$116,914$	1.7×10^{-5}	0.0026	0.0011	2.3

Mean Durbin-Watson statistic in both January and June : 0.038

- Very significant positive autocorrelation between residuals
- **Choice of the cluster-robust standard errors**

- Giraudet, L.-G., Missemer, A., 2023. The history of energy efficiency in economics: Breakpoints and regularities. Energy Research Social Science 97, 102973. https://doi.org/10.1016/j.erss.2023.102973
- Rapport 4195 Assemblée Nationale : Annexe 18 - Écologie, développement et mobilité durables: Énergie, climat et après-mines; Services publics de l'énergie: Financement des aides aux collectivités pour l'électrification rurale, n.d. URL https://www.assemblee-nationale.fr/dyn/15/rapports/cion_fin/l15b4195-a18_rapport-fond (accessed 11.14.25).
- Darmais, A., Glachant, M., Kahn, V., 2024. Social equity provisions in energy efficiency obligations: An ex-post analysis of the French program. Energy Policy 195, 114348. https://doi.org/10.1016/j.enpol.2024.114348
- Bertrand, M., Duflo, E., Mullainathan, S., 2004. How Much Should We Trust Differences-In-Differences Estimates?*. Q J Econ 119, 249–275. https://doi.org/10.1162/003355304772839588