

# Retrofitting obligation

A modelling assessment on French dwellings

L. Vivier and L.-G. Giraudet

Centre International de Recherche sur l'Environnement et le Développement (CIRED)

École des Ponts ParisTech (ENPC)

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# Context

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- Bottom-up studies show a mitigation potential up to 85% in Europe and North America for the residential sector (*robust evidence, high agreement*) (Cabeza et al., 2022) and shared belief that this sector is replete with cost-effective abatement opportunities.

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  2. 500,000 annual global retrofitting and even 700,000 for the new elected government.

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Conclusion: only 40,000 annual global retrofitting (Enertech et al., 2021)

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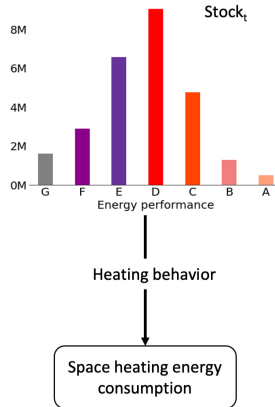
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- **How to practically impose an obligation?**
  - **How can subsidies cover the extra cost?**

# Methodology

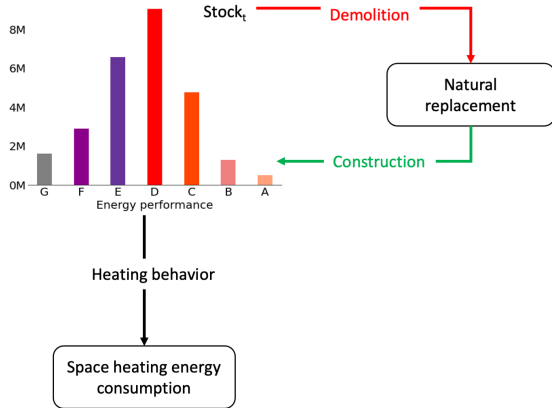
### Res-IRF 3.1

Dynamic microsimulation model of residential energy consumption.



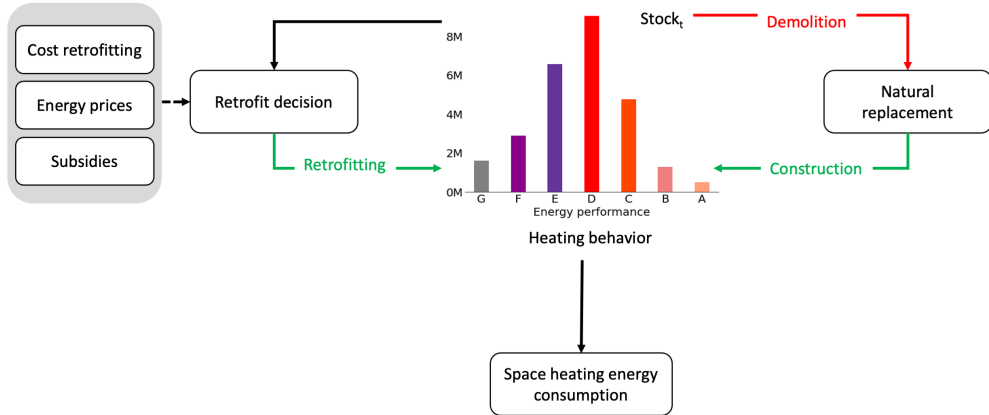
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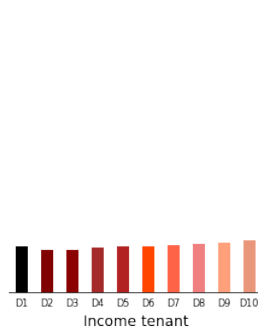
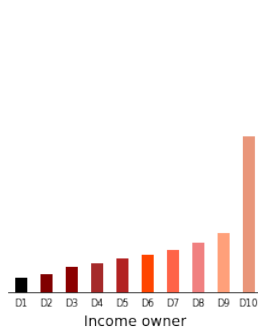
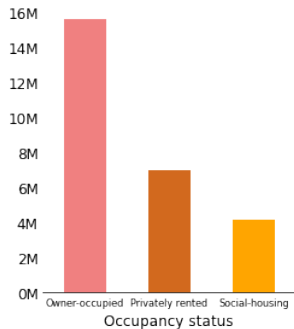
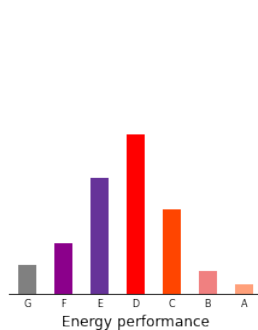
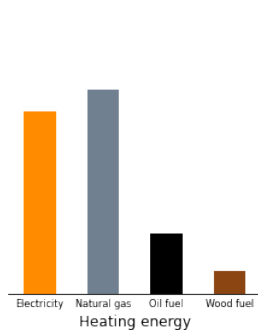
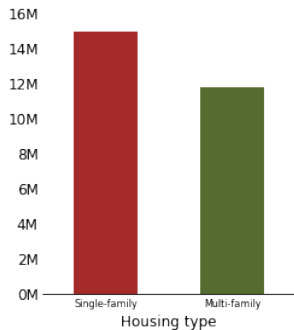


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# Res-IRF key processes

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## Renovation decisions:

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- Model and documentation are open-source (Vivier, 2022).

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# Retrofitting obligation

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<b>Occupation status</b>	<b>rented, private</b>	<b>owner-occupied</b>	<b>rented, social</b>
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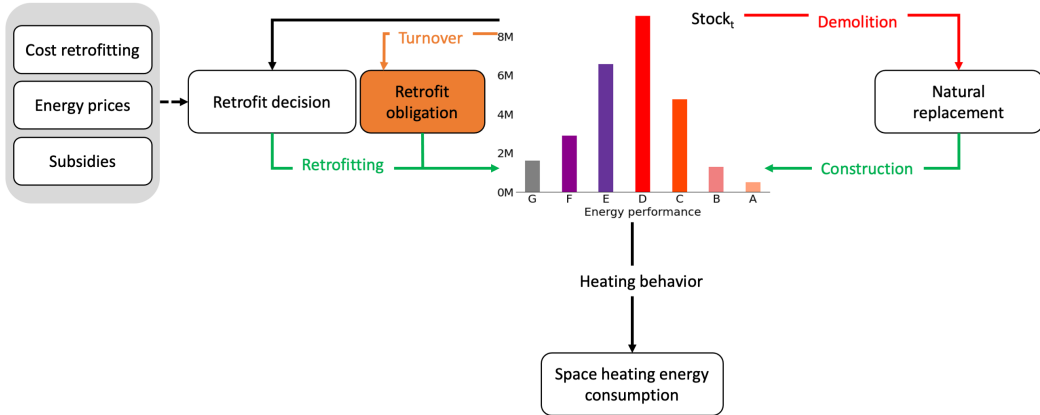
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## Scenarios:

- **REF** = Reference, including pre-existing policies
- **OBLIG** = Additional obligation to renovate to label B.
- **SUBS** = Subsidy program, as defined by the CCC.
- **OBLIG+SUBS**

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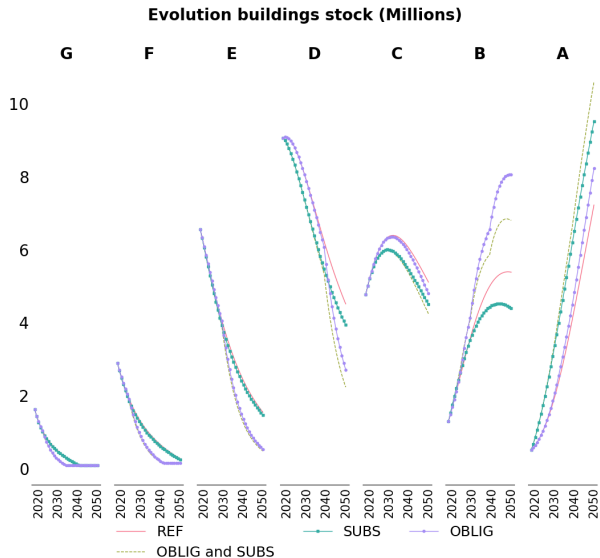
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$$\text{NPV} = \Delta\text{Retrofit cost} - \Delta\text{Energy expenditures} - \Delta\text{Emission} - \Delta\text{Health cost}$$

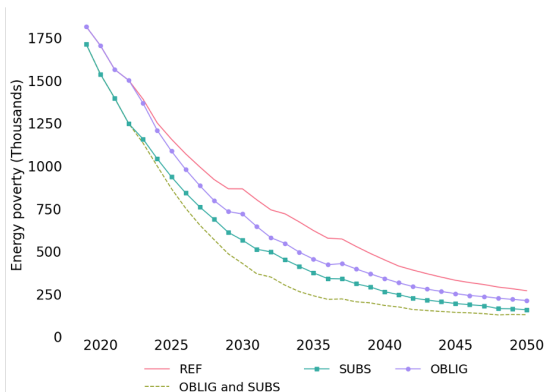
Social discount rate: 4.5%,

Investment horizon: 30 years.

# Results



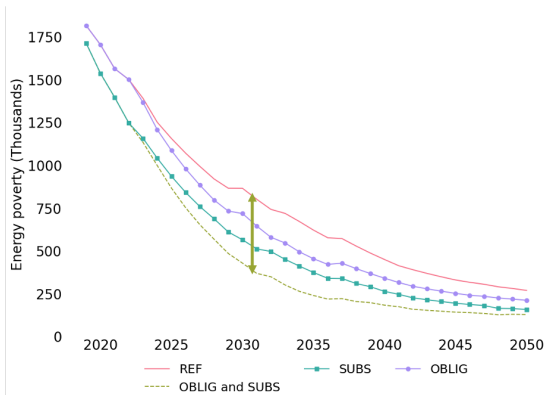
# Energy poverty



Fuel poverty assessed by number of households energy-to-income ratio (EIR) < 10%.

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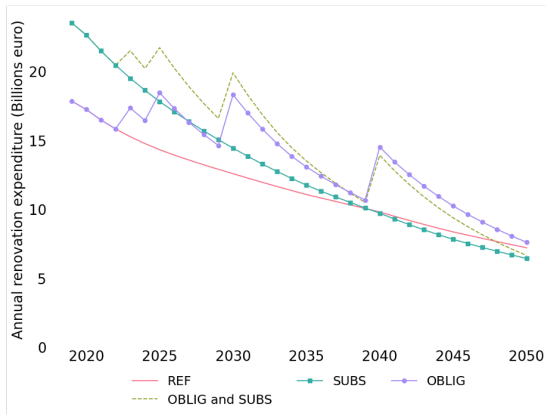


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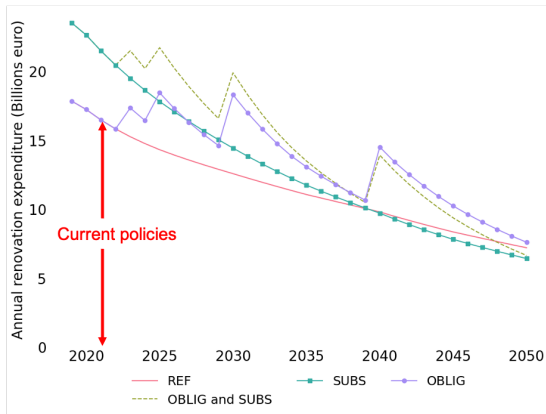
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200,000 households out of fuel poverty

# Renovation expenditures

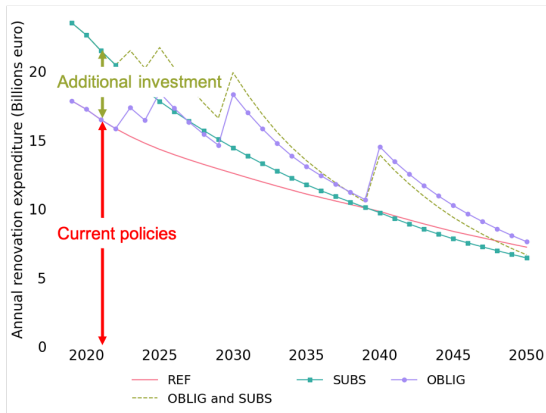


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- Estimate consistent with the size of the French market for home energy retrofits, estimated to amount to 20 billion euros in 2019. (ADEME)

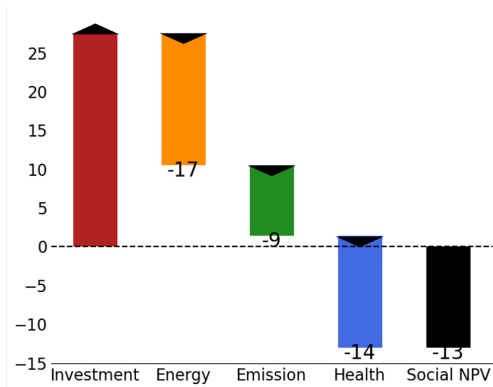
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- Estimate consistent with the size of the French market for home energy retrofits, estimated to amount to 20 billion euros in 2019. (ADEME)
- Annual investment increases by 4 to 6 billion euros.

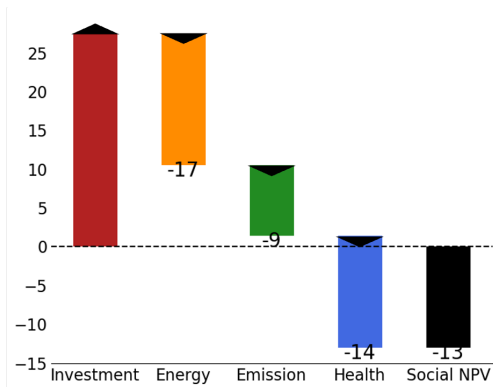


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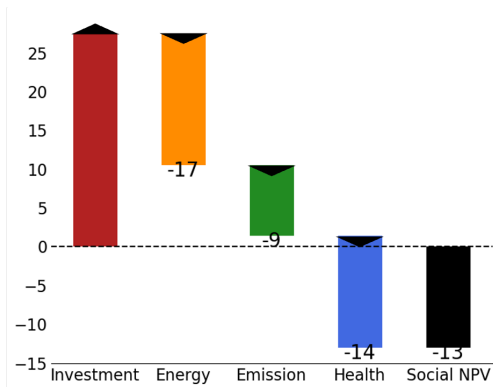
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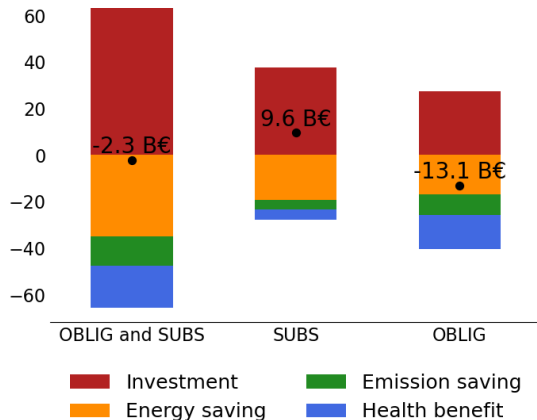
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- Investment - energy - emissions nearly break-even.

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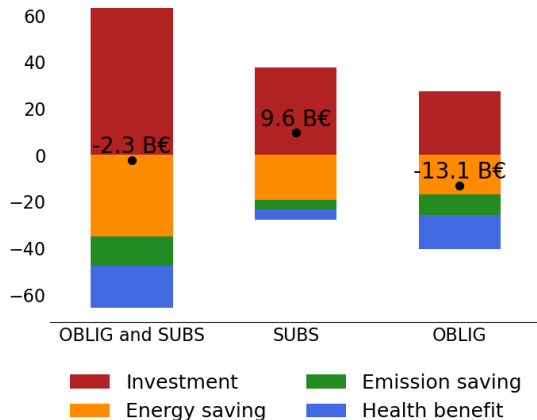
- $NPV < 0$  indicates benefit.
- Investment - energy - emissions nearly break-even.
- Health improvement among tenants provides substantial extra benefits.

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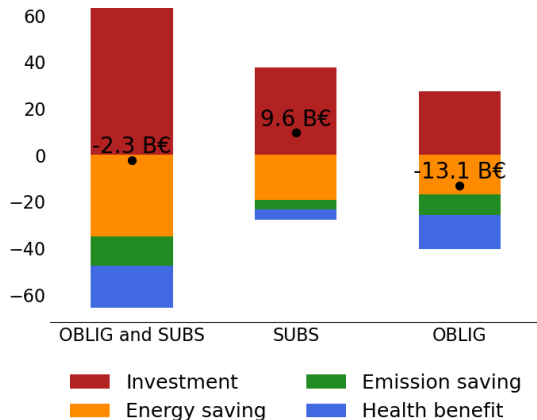
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- The proposed subsidy programmes could be counterproductive without the retrofitting obligation.
- Incentives only programmes miss some low-efficiency dwellings (rental).

# Policies takeaway

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## 1. Specification considered

- Obligation based on stock turn-over (less blunt than true proposal).
- Performance threshold: B (tighter than proposal).
- Tightened over time (as proposed).

## 2. Outcomes

- 200k more retrofits p.a.
- Particularly effective at eliminating least-efficient dwelling in rental housing, thus reducing fuel poverty.
- Extra cost: €6-8 billion p.a., including €3-5 in subsidies.

## 3. The socio-economic balance is net positive

- Energy and environmental benefits nearly outweigh investment costs
- Health benefits are substantial

# Further research

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## **Richer scenarios:**

- Performance threshold: C, B or A.
- Blunt vs. turnover-based implementation.
- Endogenously-determined backup subsidy program.
- More sensitivity analysis.

## **Richer processes and market retroactions:**

- Industrial bottlenecks
- Capitalization in real-estate markets
- Credit supply



# Annex

# Health cost

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1. Health expenditures of the social security
2. The loss of well-being associated with the disease
3. The social cost of mortality
4. Does not take into account indirect costs

Households income		Average health cost per household		
Decile 1 to 3	Bellow poverty line	33,656 €	19,231 €	7,479 €
	Above poverty line	6,731 €		
	Decile 4 to 10		421 €	

Table: Source: (Dervaux and Rochaix, 2022)

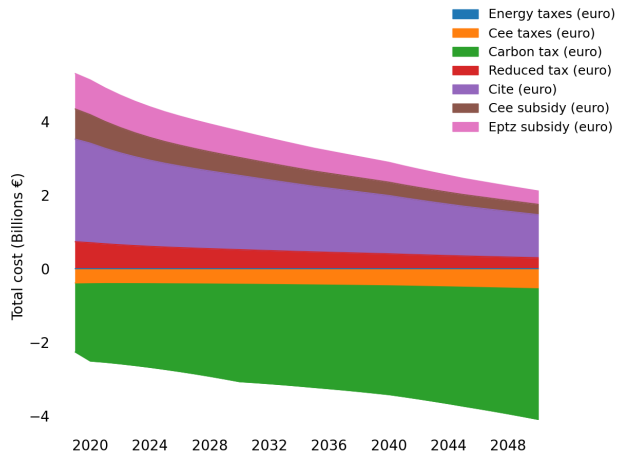


Figure: Policies expenditures (Billion €).

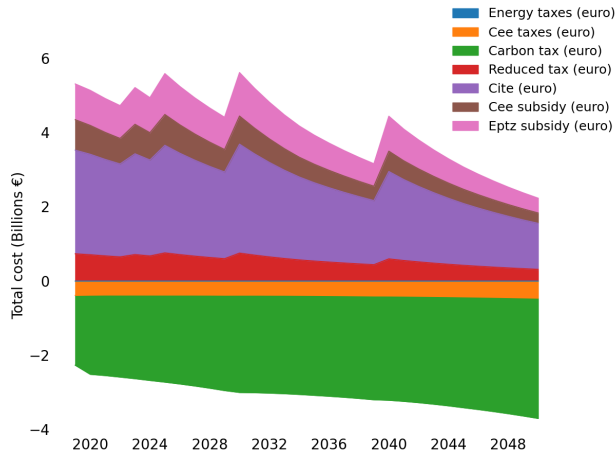


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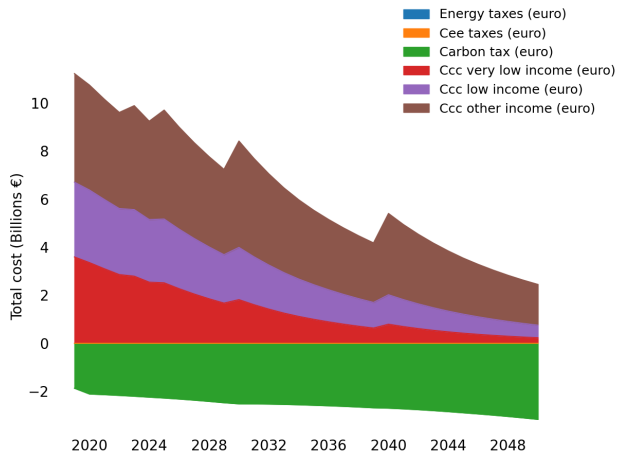


Figure: Policies expenditures (Billion €).

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