Financing home energy retrofits in France

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Motivation

• Energy efficiency key to meeting Paris goals
  – France scores second in EE (ACEEE 2018 Scorecard)
  – Has set multiple targets in residential buildings

• Adequacy between targets and instruments? A comprehensive assessment
  – Broad: multiple subsidies, taxes, building codes
  – Deep: economic, environmental, distributional performance

• Methodological approach
  – Res-IRF model: highly detailed depiction of barriers to EE
  – This exercise: careful treatment of policy interactions
Stratégie nationale bas-carbone mandates:

1. Reduction of energy use by 20% in 2030 and 50% in 2050 compared to 2012
2. Yearly renovation of 500,000 dwellings
3. Elimination of EPC labels F et G by 2025
4. Performance label B or higher widespread by 2050
5. Fuel poverty alleviation by 15% in 2020

Supporting policies:

1. Income tax credit
2. Zero-interest loans
3. Reduced VAT
4. Carbon tax
5. White certificates
6. Building codes
   + others

Effectiveness to targets?
Policy efficiency and distributional impacts?
Inputs:
- Population: +0.3% p.a.
- Household income: +1.2% p.a.
- Fuel prices: ~ +1.5% p.a.

Outputs:
- Renovation and construction costs (ext./int. margins)
- Demolition rates
- Resulting consumption for elec, gas, oil, wood
- Heating comfort

Main extension in version 3.0 (based on Phébus survey)

Technical Parameters:
- Renovation and construction costs
- Demolition rates

Behavioral Parameters:
- Landlord-tenant dilemma
- Barriers to decision-making in collective housing
- Non-energy costs
- Credit constraints
## Policy parameterization

<table>
<thead>
<tr>
<th></th>
<th>Reference variant</th>
<th>Tighter variant</th>
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<tbody>
<tr>
<td>CITE</td>
<td>17% ad valorem <strong>subsidy</strong>, uniform rate</td>
<td>Restricted to high performance</td>
</tr>
<tr>
<td>EPTZ</td>
<td>~9% ad valorem <strong>subsidy</strong>, restricted to HP</td>
<td>Higher rate ~23%</td>
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<tr>
<td>CEE</td>
<td>Non-uniform <strong>subsidy</strong>, equivalent to an average ad valorem rate 5% + energy <strong>tax</strong></td>
<td>Subsidy and tax components x3</td>
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<tr>
<td>Taxe C</td>
<td>Carbon <strong>tax</strong>, myopically expected</td>
<td>Perfect expectation</td>
</tr>
<tr>
<td>TVA r</td>
<td><strong>Subsidy</strong>, VAT rate of 5.5% instead of 10%</td>
<td></td>
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<tr>
<td>RT 2020</td>
<td><strong>Building code</strong> mandating BEPOS level in 2020</td>
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### 4 scenarios
- **All policies (TP)**
- **No policy (ZP)**
- **All policies in their tighter variant (TP+)**
- **All policies, no land./ten. dilemma (TP sans DPL)**

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~ reference

counterfactuals
Target 1: Energy use

- Feasible...with tight policies maintained until 2050!
- 2/3 are autonomous improvements (energy prices, building codes, etc.)
Target 2: Yearly renovations

- Easily reached – at odds with Hulot’s resignation statement ?!?!?
- Note the definition: renovation = upgrade by at least one EPC label
- Estimate in line with Ademe’s latest TREMI survey (2018)
Targets 3 & 4: Dwelling stock

-75% in 2025.
Target met in 2040 if landlord-tenant dilemma is overcome.

50% to 70% in 2050
Objectif 5: Fuel poverty

- Energy-to-income ratio: heating conventional expend. >10% income
- Natural decline, despite structural increase ~0.6% p.a. (=0.3%+1.5%-1.2%)
- Carbon tax has a retarding effect, subsidies accelerating
<table>
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<th>Target</th>
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<th>Comment</th>
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| 1      | ?     | • Non-specific to the residential sector  
|        |       | • Requires tight policies maintained until 2050  
|        |       | • Progress largely autonomous |
| 2      | ✔️❌  | • Largely fulfilled in private housing  
|        |       | • Largely missed in social housing  
|        |       | • The definition matters! |
| 3      | ❌    | • Important progress, -75% en 2025  
|        |       | • Target fulfilled in 2040 if landlord-tenant dilemma overcome |
| 4      | ❌    | • 50% to 70% at best with tight policies |
| 5      | ☐    | • Fulfilled only with tightest policies |
- EPTZ over-estimated by one order of magnitude!
- Unaccounted for barriers on the demand and supply sides?
Long-term costs
Considering all possible interactions among policies:

- Carbon tax plays on investment + utilization
- CITE is the most effective of all subsidies
Subsidies have leverage $\geq 1$, declining over time.

Interactions are mostly over-additive, due to model non-linearities.
Leverage increases when...

- Ad valorem rate is reduced
- Eligibility is restricted to the most significant upgrades
- Eligibility is restricted to the first two income quintiles
Conclusion

• Key insights
  – Target fulfillment requires **tight policies, extended to rented dwellings** and maintained until 2050
  – If budget constraints were to bind, **restricting eligibility to low-income households** would be a nice opportunity to reconcile efficiency and equity
  – The 500,000 target needs to be properly defined!

• Contribution
  – Unique integrated assessment framework
  – Simulation/observation gap reveals barriers to EPTZ
  – Original approach to addressing policy interactions