



# 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?***

# Res-IRF

Giraudet et al., En J, 2011  
 Giraudet et al., En Econ, 2012  
 Branger et al., Env Mod Soft, 2015

## TECHNICAL PARAMETERS

Renovation and construction costs  
 Demolition rates



### INPUTS

Population  
+0.3% p.a.

Household income  
+1.2% p.a.

Fuel prices  
~ +1.5% p.a.

	G	F	E	D	C	B	A
G	Yellow						
F	Grey	Yellow					
E	Grey	Grey	Yellow				
D	Grey	Grey	Grey	Yellow			
C	Grey	Grey	Grey	Grey	Yellow		
B	Grey	Grey	Grey	Grey	Grey	Yellow	
A	Grey	Grey	Grey	Grey	Grey	Grey	Yellow

### OUTPUTS

Renovation and constr.  
(ext./int. margins)

Resulting consumption  
for elec, ngas, oil, wood

Heating comfort



Landlord-tenant dilemma  
 Barriers to decision-making in collective housing  
 Non-energy costs  
 Credit constraints

## BEHAVIORAL PARAMETERS

*Main extension  
 in version 3.0  
 (based on  
 Phébus survey)*

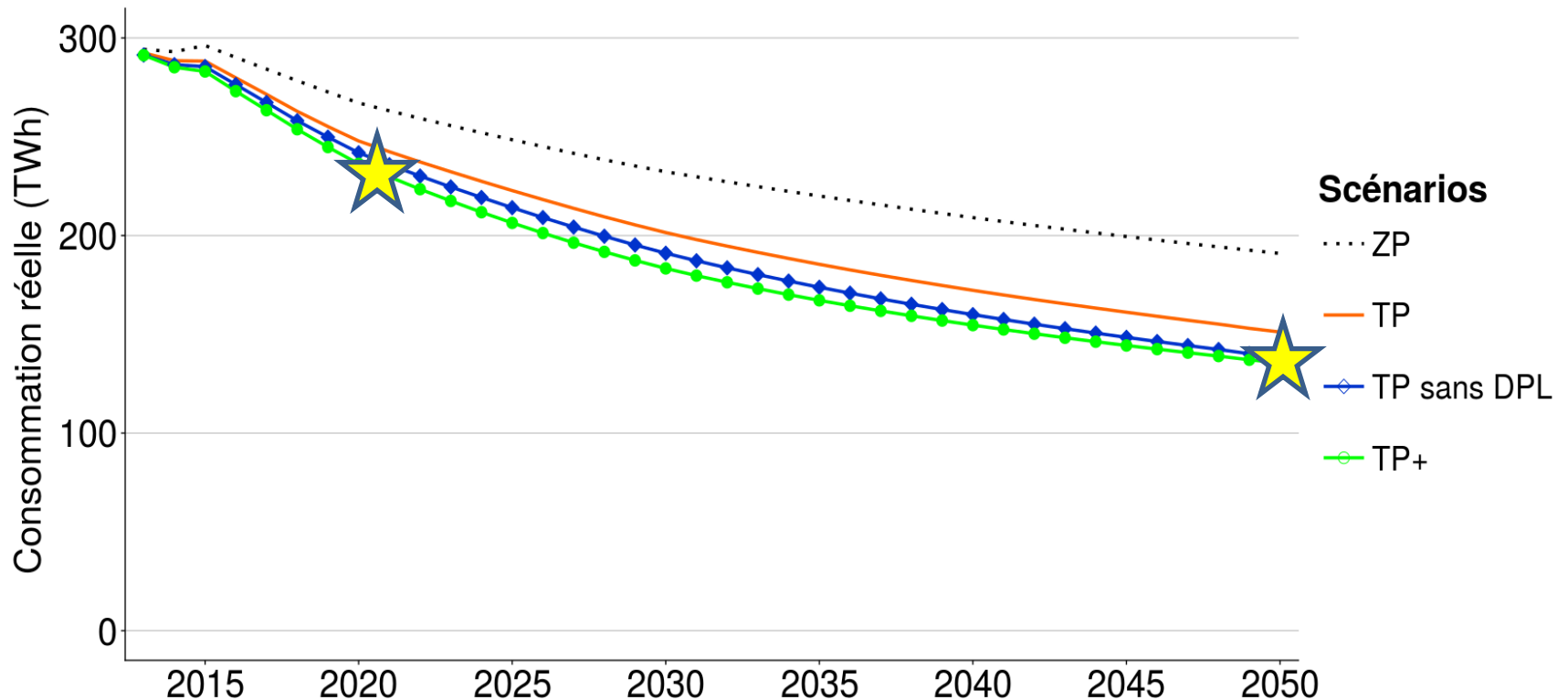
# Policy parameterization

	Reference variant	Tighter variant
<b>CITE</b>	17% ad valorem <b>subsidy</b> , uniform rate	Restricted to high performance
<b>EPTZ</b>	~9% ad valorem <b>subsidy</b> , restricted to HP	Higher rate ~23%
<b>CEE</b>	Non-uniform <b>subsidy</b> , equivalent to an average ad valorem rate 5% + energy <b>tax</b>	Subsidy and tax components x3
<b>Taxe C</b>	Carbon <b>tax</b> , myopically expected	Perfect expectation
<b>TVA r</b>	<b>Subsidy</b> , VAT rate of 5,5% instead of 10%	
<b>RT 2020</b>	<b>Building code</b> mandating BEPOS level in 2020	

## 4 scenarios

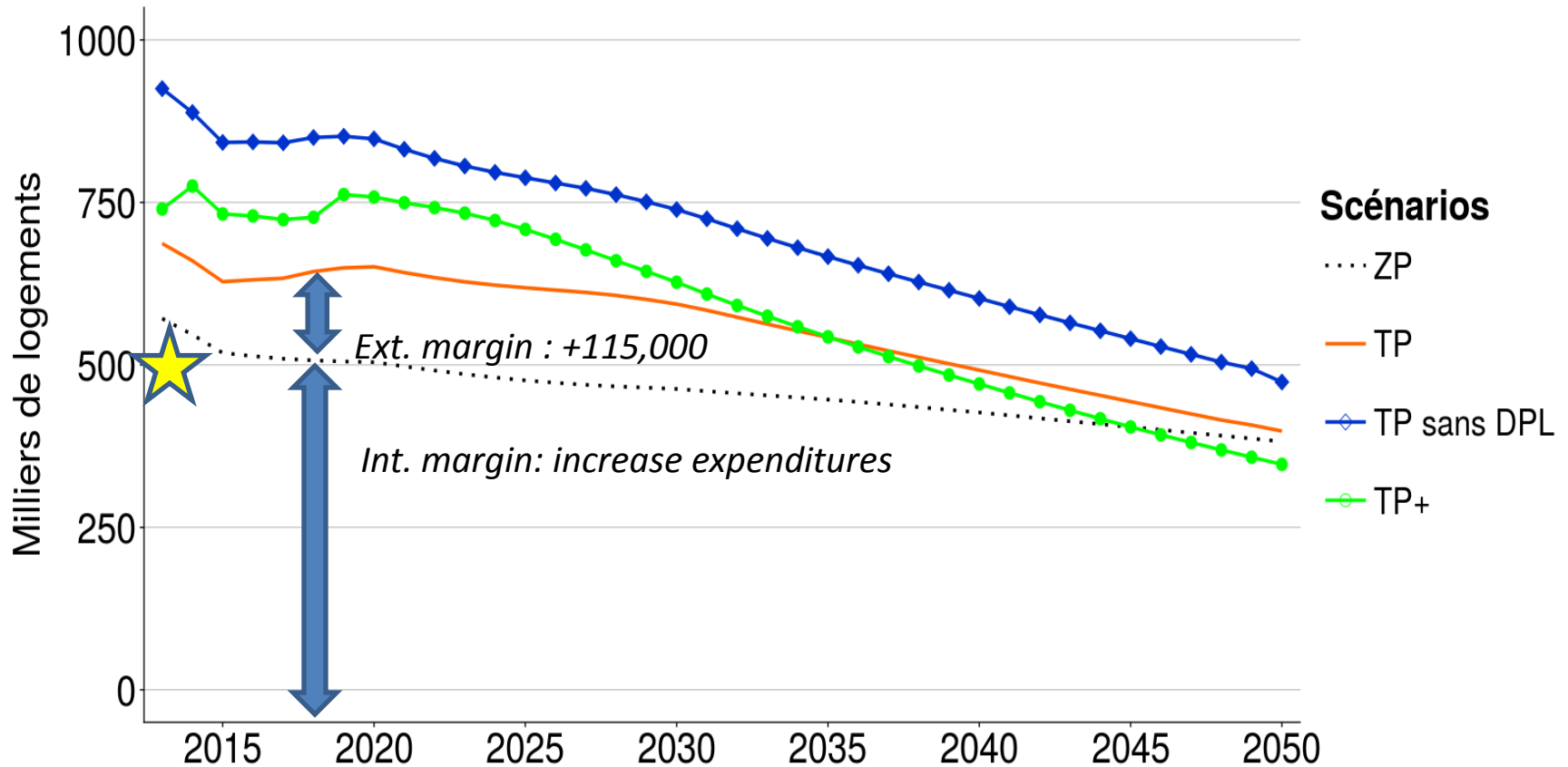
- All policies (TP)
  - No policy (ZP)
  - All policies in their tighter variant (TP+)
  - All policies, no land./ten. dilemma (TP sans DPL)
- ~ reference  
} counterfactuals

# Target 1: Energy use



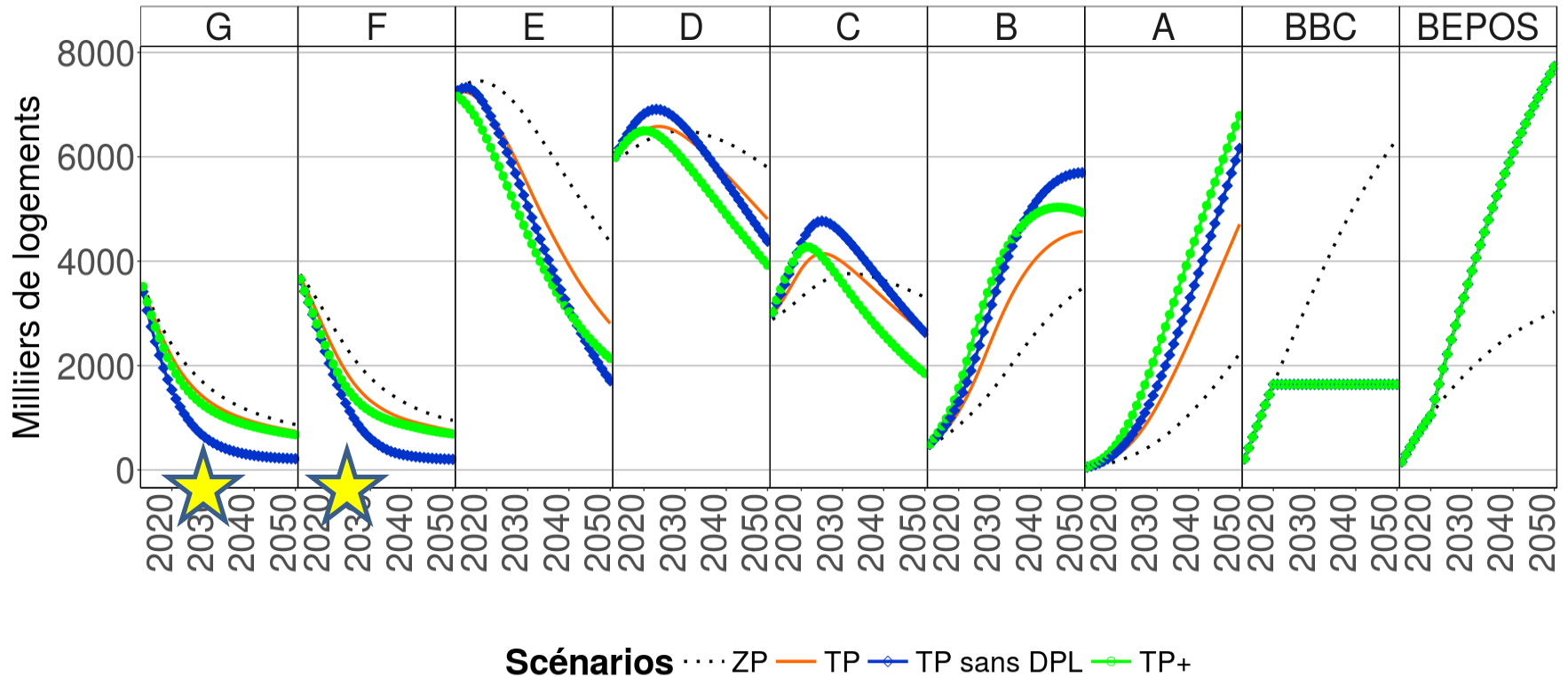
- Feasible...with tight policies maintained until 2050!
- 2/3 are autonomous improvements (energy prices, building codes, etc.)

# 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



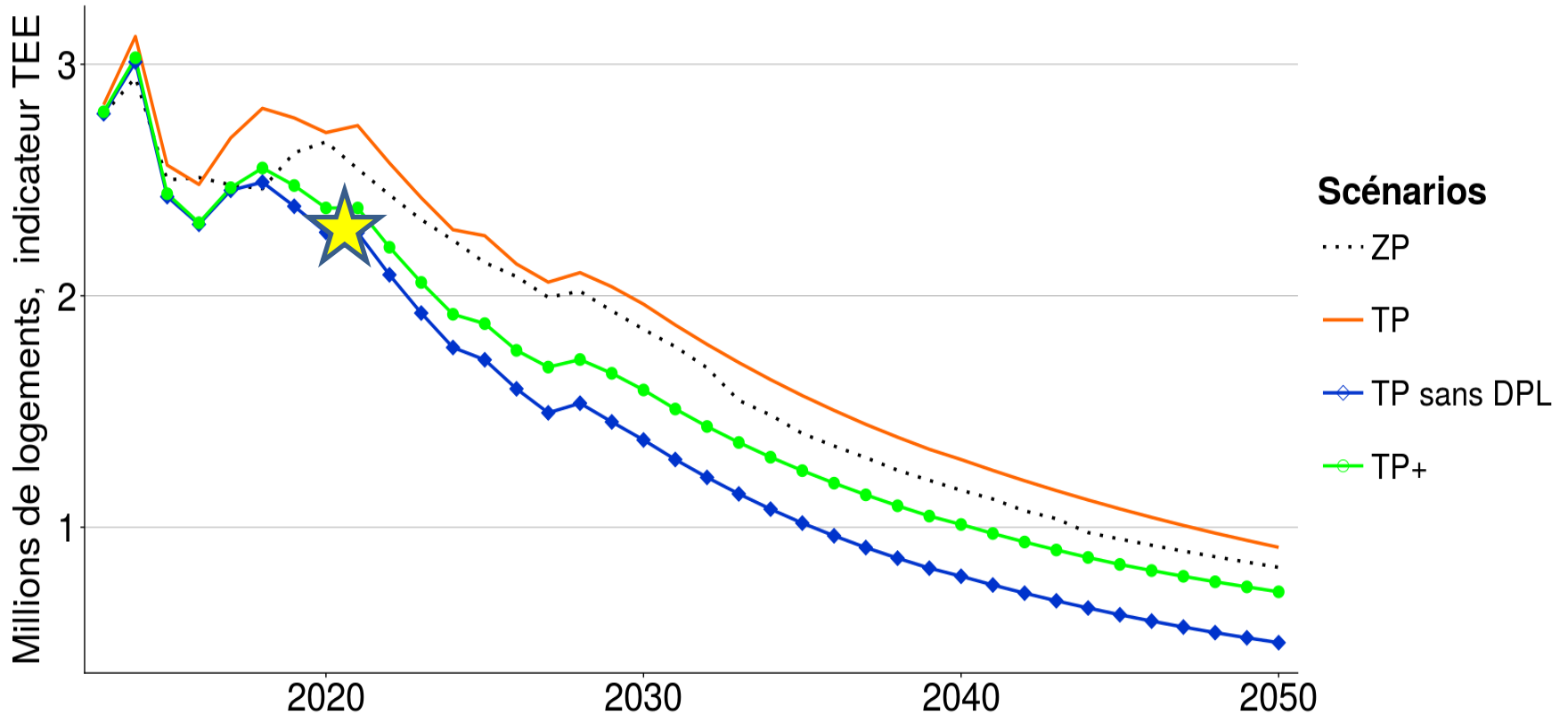
-75% in 2025.

50% to 70% in 2050

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



# Objectif 5: Fuel poverty

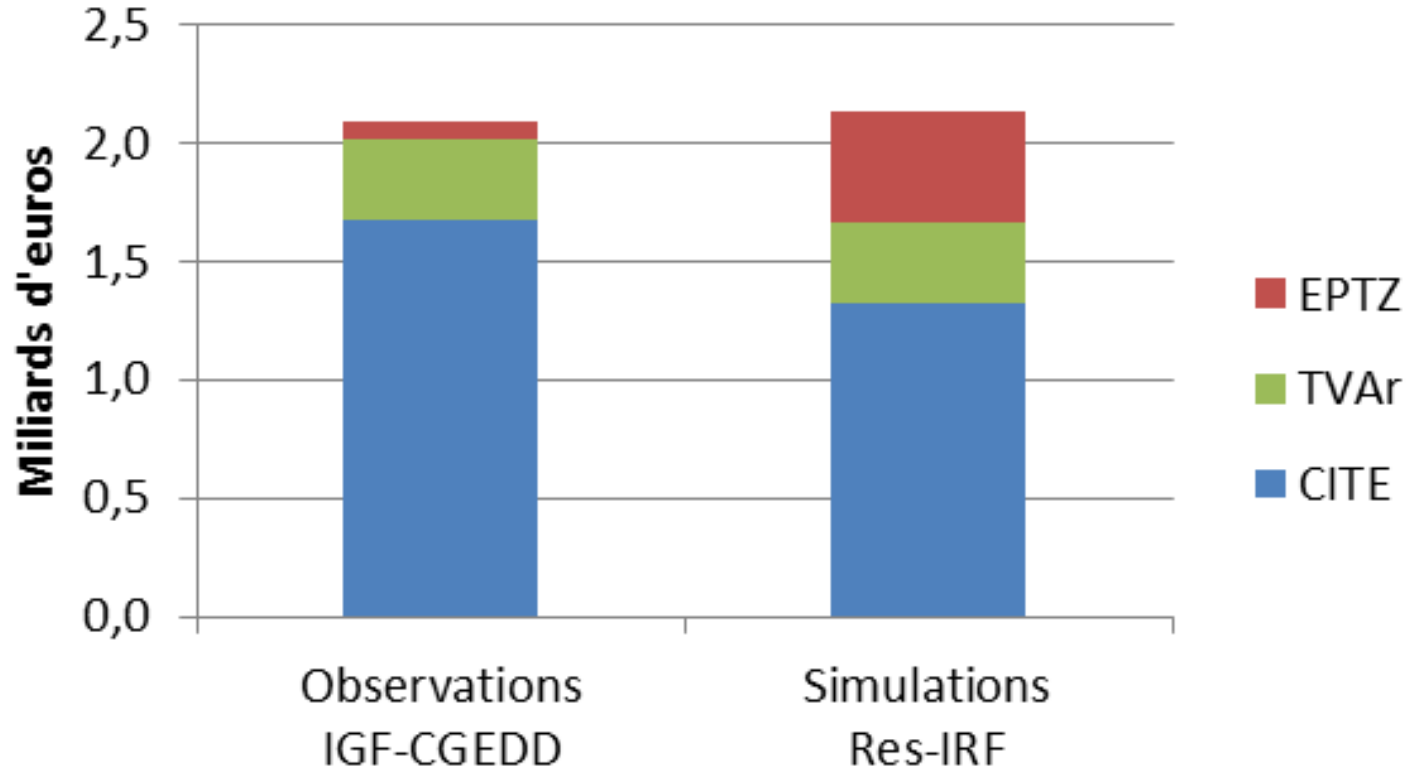


- Energy-to-income ratio: heating conventional expend. >10% income
- Natural decline, despite structural increase  $\sim 0.6\%$  p.a. ( $=0.3\%+1.5\%-1.2\%$ )
- Carbon tax has a retarding effect, subsidies accelerating

# Summary

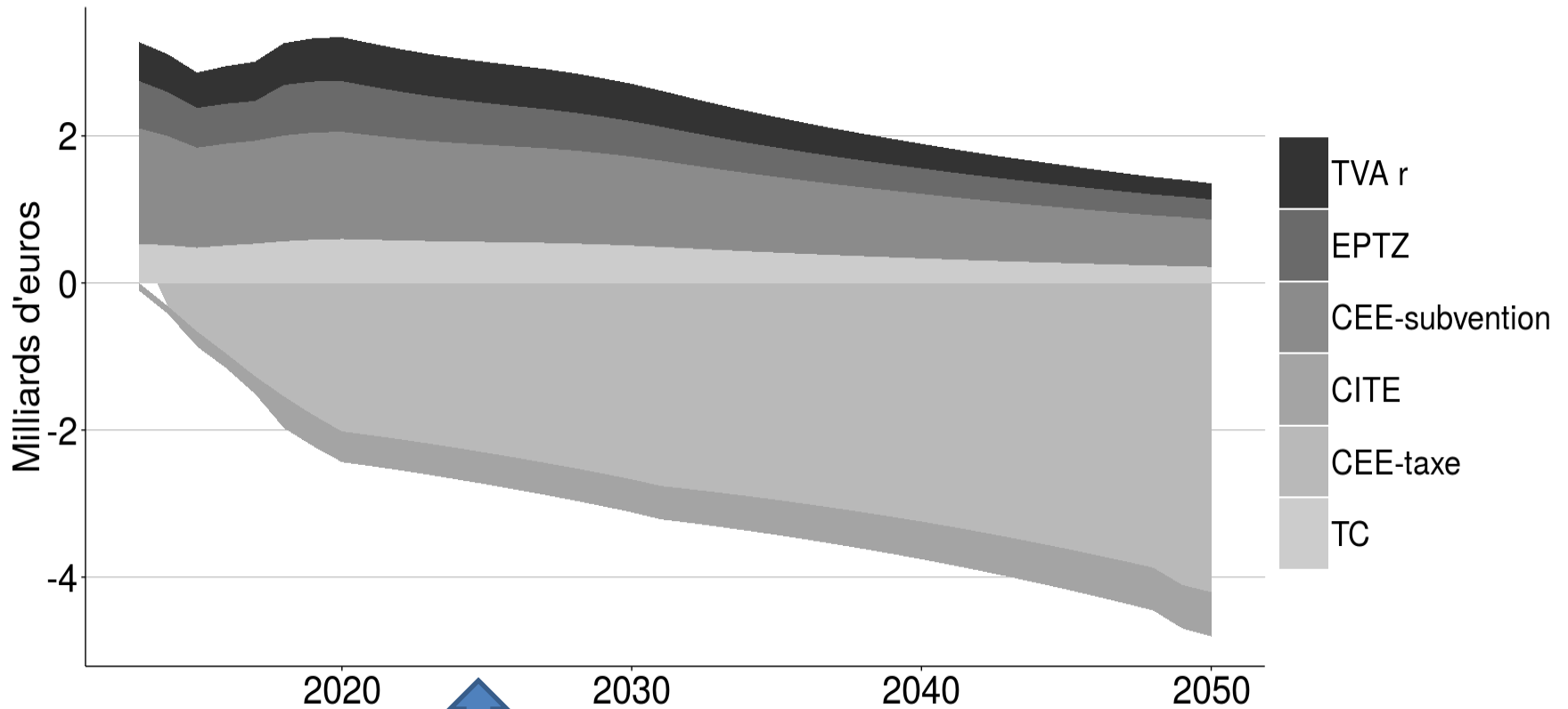
Target		Fulft	Comment
1	Reduction of energy use by 20% in 2030 and 50% in 2050	?	<ul style="list-style-type: none"> <li>• Non-specific to the residential sector</li> <li>• Requires tight policies maintained until 2050</li> <li>• Progress largely autonomous</li> </ul>
2	Yearly renovation of 500,000 dwellings, incl. 120,000 in social housing	✓X	<ul style="list-style-type: none"> <li>• Largely fulfilled in private housing</li> <li>• Largely missed in social housing</li> <li>• The definition matters!</li> </ul>
3	Elimination of labels F and G by 2025	X	<ul style="list-style-type: none"> <li>• Important progress, -75% en 2025</li> <li>• Target fulfilled in 2040 if landlord-tenant dilemma overcome</li> </ul>
4	Label B or higher widespread by 2050	X	<ul style="list-style-type: none"> <li>• 50% to 70% at best with tight policies</li> </ul>
5	Fuel poverty alleviation by 15% in 2020	?	<ul style="list-style-type: none"> <li>• Fulfilled only with tightest policies</li> </ul>

# Simulations vs. Observations, 2016



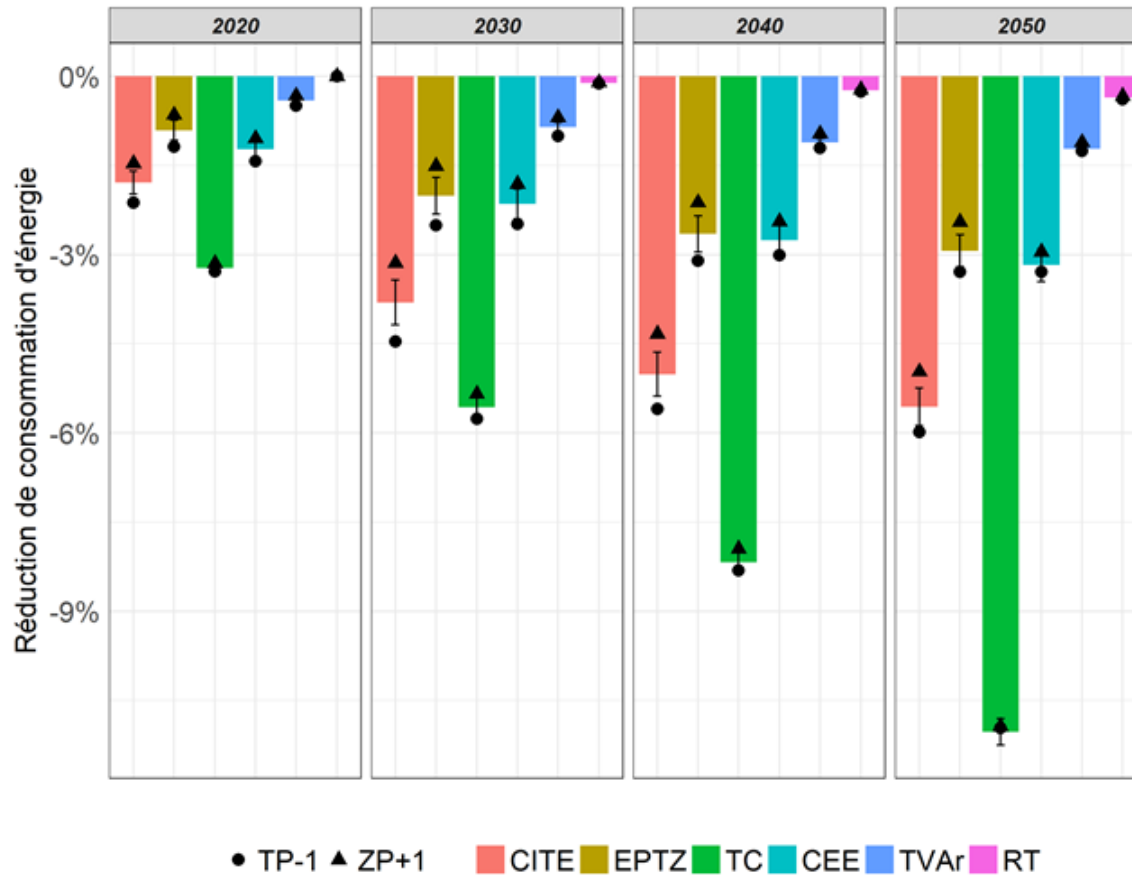
- EPTZ over-estimated by one order of magnitude!
- Unaccounted for barriers on the demand and supply sides?

# Long-term costs



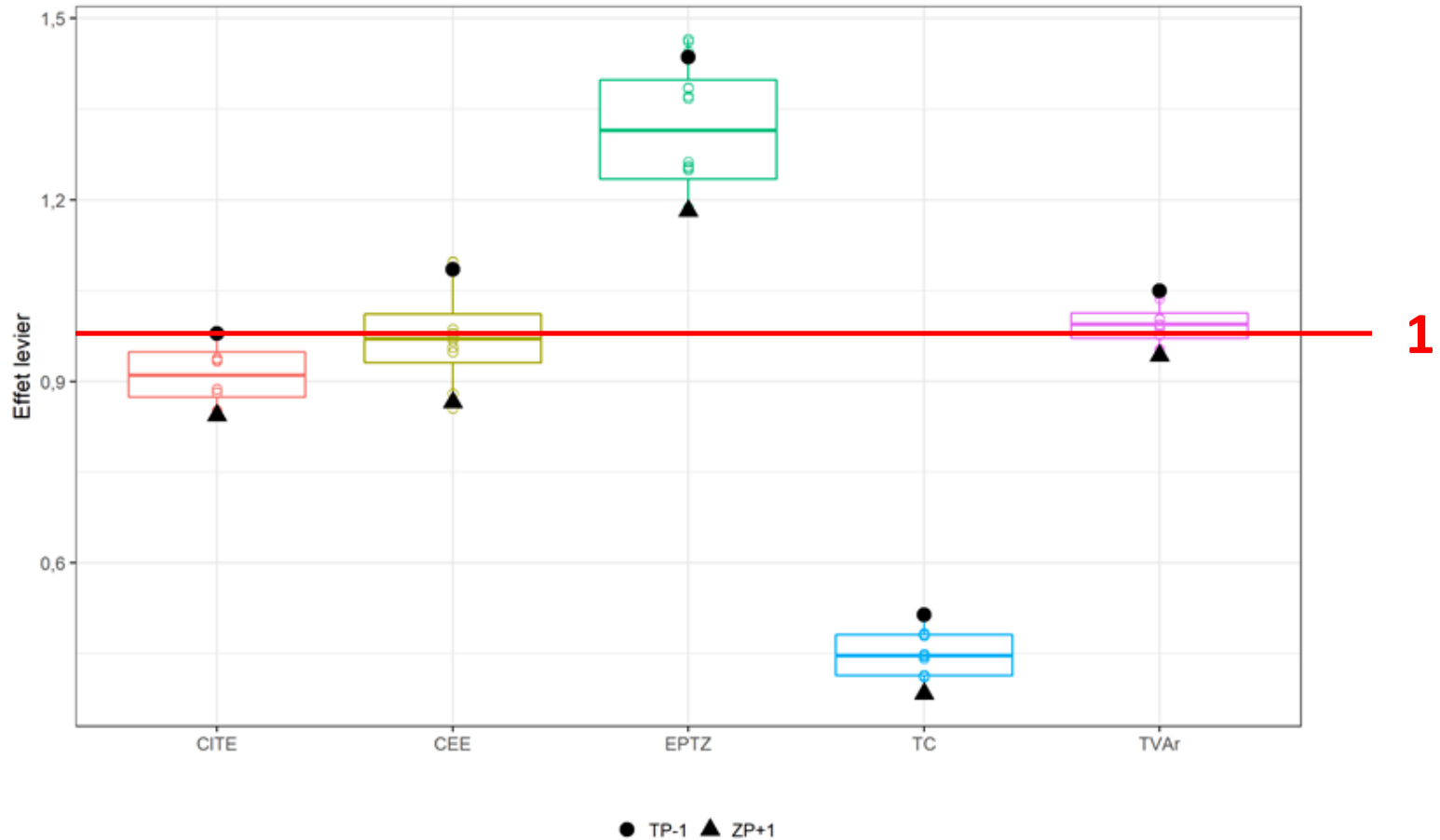
# Policy effectiveness

Considering all possible interactions among policies:



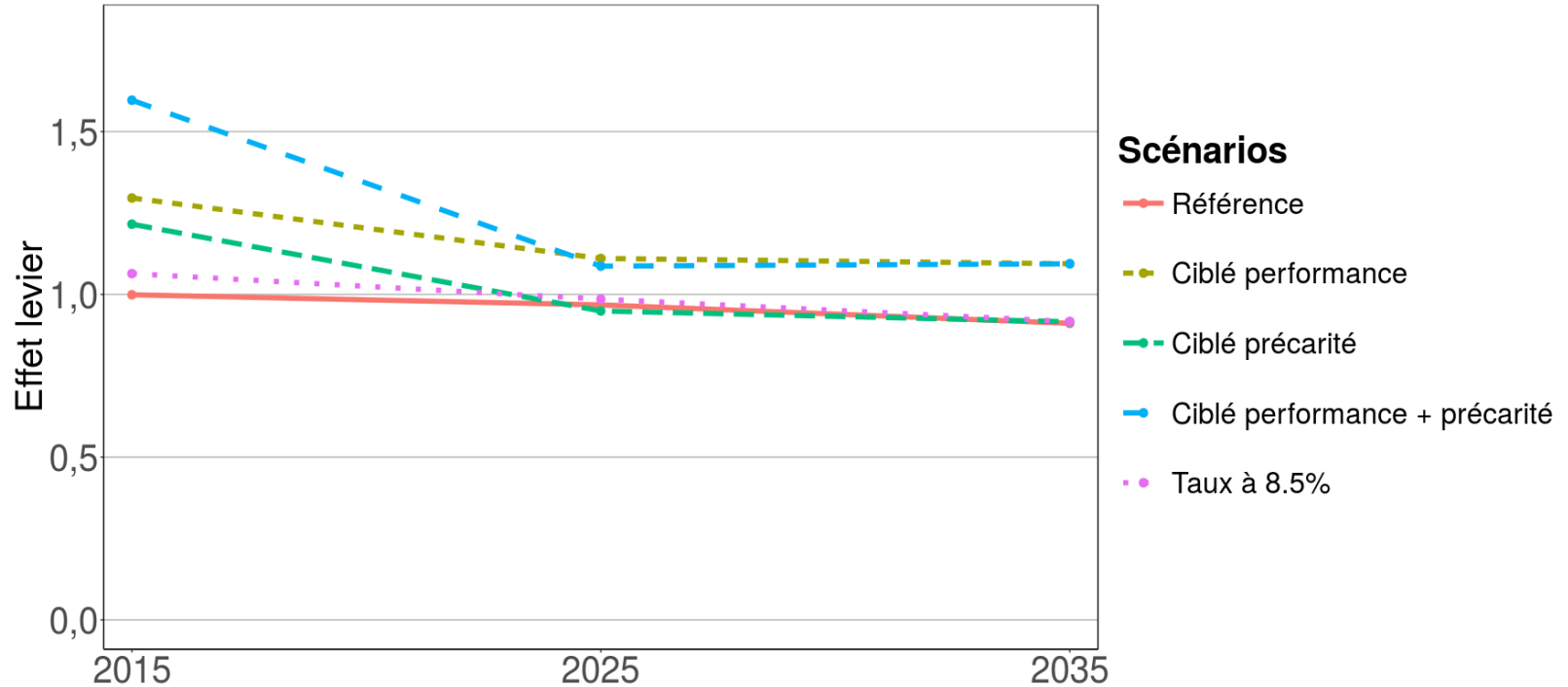
- Carbon tax plays on investment + utilization
- CITE is the most effective of all subsidies

# Leverage, 2015



- Subsidies have leverage  $\geq 1$ , declining over time
- Interactions are mostly over-additive, due to model non-linearities

# CITE variants



*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