Compensating households from carbon tax regressivity and fuel poverty

A micro-simulation study

Audrey Berry
CIRED, France
berry@centre-cired.fr
IAEE - 04 September 2017

Carbon tax trajectory in France

Introduced with “Budget Law 2014”

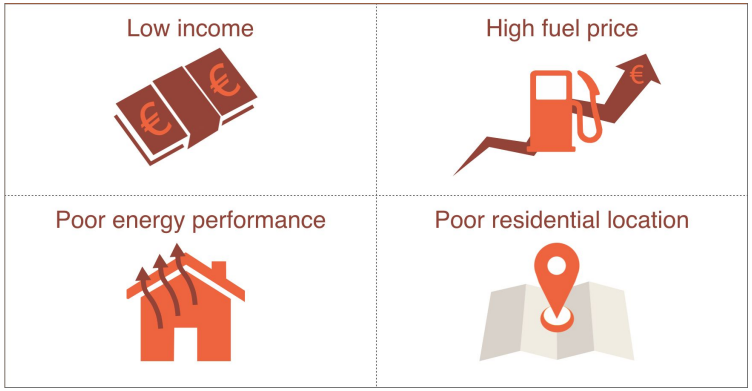
- in line with the propositions made by the European Commission on the review of the European Directive on Energy
- rises over time to achieve the 2030 and 2050 GHG emission reduction targets
- all fossil fuels except electricity (already covered by the EU ETS)
- as a carbon base integrated within existing taxes on energy (TICPE / TICGN)

Year	<2013	2014	2015	2016	2017	2018	2019	2020	2030
		(LF 2014)	(LF 2014)	(LF 2014)	(LFR 2015)	(LFR 2015)	(LFR 2015)	(LTECV 2015)	(LTECV 2015)
Carbon tax level	0€/tCO2	7€/tCO2	14,5€/tCO2	22€/tCO2	30,5€/tCO2	39€/tCO2	47,5€/tCO2	56€/tCO2	100€/tCO2

Source: Budget laws and Law on energy transition

Fuel poverty in France

- **Fuel poverty** according to the Grenelle II Law (2010):
  A person who face difficulties to meet its energy needs because of inadequate financial resources or poor housing conditions.
- In 2012, 1 household in 5 in fuel poverty (5,8 million households)
- Recent increase of the phenomenon (+17% between 2006-2013)
- Results from a **combination of factors**:



A threat to human well-being...

→ **Poor living conditions**

Material deprivation
30% energy inefficient housing
1,4M households feeling cold

- domestic energy services: cook, light, heat, wash, communication, etc.
- transport services: work, study, hospital, shop, administrative, etc.
- other impacts: risk of poverty and social exclusion

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→ **A public health issue**

Excess Winter Mortality
+23 000 deaths/year in France
⅓ due to indoor cold

- exposure to cold: cardiovascular and respiratory diseases
- poor indoor air quality: moisture and mold, air pollution, etc.
- indirect impacts: risky behaviour, depression, reallocation of spending

...now recognised as a political priority !

In France:

LA TRANSITION ÉNERGÉTIQUE pour la CROISSANCE VERTE

PLAN CLIMAT

1 planète, 1 plan

In Europe:

2020 Energy Strategy for Europe

14.8.2009 EN Official Journal of the European Union L 211/55

DIRECTIVE 2009/72/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

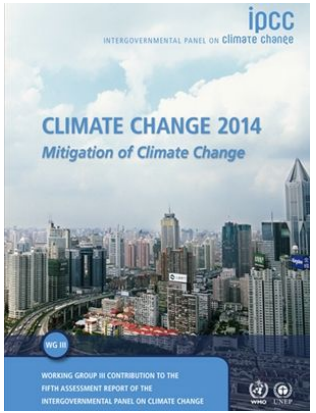
of 13 July 2009

concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC

7. Member States shall take appropriate measures to protect final customers, and shall, in particular, ensure that there are adequate safeguards to protect vulnerable customers. In this context, each Member State shall define the concept of vulnerable customers which may refer to energy poverty and, inter alia, to the prohibition of disconnection of electricity to such customers in critical times. Member States shall ensure that rights and obligations linked to vulnerable customers are applied. In particular, they shall take measures to protect final customers in remote areas. They shall ensure high levels of consumer protection, particularly with respect to transparency regarding contractual terms and conditions, general information and dispute settlement mechanisms. Member States shall ensure that the eligible customer is in fact able easily to switch to a new supplier. As regards at least household customers, those measures shall include those set out in Annex I.

8. Member States shall take appropriate measures, such as formulating national energy action plans, providing benefits in social security systems to ensure the necessary electricity supply to vulnerable customers, or providing for support for energy efficiency improvements, to address energy poverty where identified, including in the broader context of poverty. Such measures shall not impede the effective opening of the market set out in Article 33 or market functioning and shall be notified to the Commission, where relevant, in accordance with the provisions of paragraph 15 of this Article. Such notification may also include measures taken within the general social security system.

Worldwide:



SUSTAINABLE DEVELOPMENT GOAL 7

Ensure access to affordable, reliable, sustainable and modern energy for all

Research questions

1/ What are the distributional impacts of the carbon tax?

→ quantify tax regressivity and fuel poverty

2/ How to compensate households for the negative impacts?

→ discuss the design of compensation measures

→ how much recycling is needed

Outline

1/ Model description

2/ The impacts on households of taxing carbon

Tax regressivity / Fuel poverty

3/ The design of compensation measures

Offsetting regressivity / Fighting against fuel poverty

4/ Conclusion

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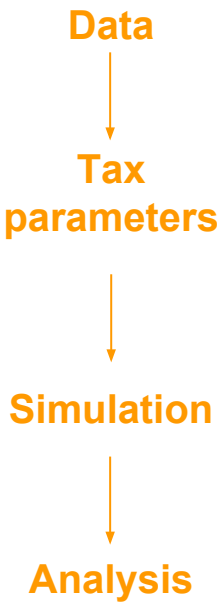
The microsimulation model



Microsimulation model that simulates for a representative sample of the French population the taxes levied on energy consumption, as well as the benefits they receive.

This model allows analysing the distributional effects of rising energy prices and the vulnerability of households to carbon taxation.

This model simulates the French energy tax system for the years 2012 to 2017, and allows exploration of counterfactual scenarios.

Modeling households' energy spending

Electricity / Gas

Spending (including all taxes) = Subscription cost [type of contract] x (1+ reduced VAT)

+ Volume consumed x (cost per kWh + TIC* + **carbon tax**) x (1 + normal VAT)

Gasoline / Diesel / LPG / Heating fuel

Spending (including all taxes) = Volume consumed x (cost per liter + TIC* + **carbon tax**) x (1 + normal VAT)

*TIC = TICGN/TICPE/TCFE - carbon tax

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Phebus survey

Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE

Ministère de l'Environnement, de l'Énergie et de la Mer

Where? metropolitan France
When? on 2012 consumption
Who? with **5405 representative households**
- energy consumption and spending
- **transport** and **domestic** sectors

Modeling households' energy spending

Budget law
+
Energy tariffs

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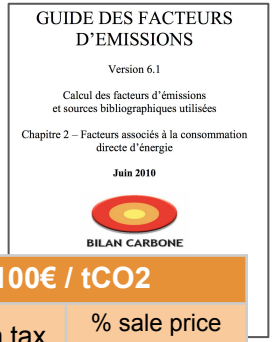
GUIDE DES FACTEURS D'EMISSIONS

Version 6.1

Calcul des facteurs d'émissions et sources bibliographiques utilisées

Chapitre 2 – Facteurs associés à la consommation directe d'énergie

Juin 2010

BILAN CARBONE

Phebus survey

Where? metropolitan France
When? on 2012 consumption
Who? with **5405 representative households**
- energy consumption and spending
- **transport** and **domestic** sectors

	30,5€ / tCO2		100€ / tCO2	
	Carbon tax	% sale price (2012)	Carbon tax	% sale price (2012)
Heating fuel (1 ton)	106 €	9,3 %	348 €	36 %
Network gas (1 MWh)	7,3 €	12,4 %	24 €	26 %
Diesel (1 liter)	9,1 c€	6,5 %	30 c€	21 %
Gasoline (1 liter)	8,6 c€	5,3 %	28 c€	18 %
LPG (1 liter)	5,7 c€	6,5 %	19 c€	21 %

Accounting for behavioural responses

Decile of equivalised income	Mean price elasticity of energy demand in the home	Mean price elasticity of energy demand for travelling
1	-0.461	-0.016
2	-0.470	-0.149
3	-0.426	-0.236
4	-0.411	-0.146
5	-0.390	-0.217
6	-0.373	-0.261
7	-0.302	-0.277
8	-0.256	-0.288
9	-0.258	-0.238
10	-0.190	-0.039
Total	**-0.354**	**-0.183**

$$price\ elasticity\ of\ demand = \frac{\Delta volume/volume}{\Delta price/price}$$

Price elasticity of demand for energy per income decile

Interpretation: Following a 1% increase in energy prices, households will decrease their energy consumption by 0.35% in the home and by 0.18% for travelling on average.

Perimeter: metropolitan France

Source: Budget des Familles 2011

Measuring fuel poverty

Three **indicators of fuel poverty** to reveal different situations of fuel poverty:

1. Spending more than 10% of income on energy (among the 3 lowest income deciles)
2. Cumulating a high energy spending (per UC or per m2) and a low income
3. Feeling cold (subjective)

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Indicator 1:

$$\frac{Energy\ spending}{Income} > 10\%$$

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Indicator 1:

$$\frac{Energy\ spending}{Income} > 10\%$$

Indicator 2:

$$\frac{Energy\ spending}{Number\ of\ UC\ or\ m^2} > Median$$

$$\frac{Income - Energy\ spending}{Number\ of\ UC} < Poverty\ line$$

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→ Update the indicators before/after implementing the carbon tax

→ It relates to the domestic sector only

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The impact of the carbon tax on energy bills.

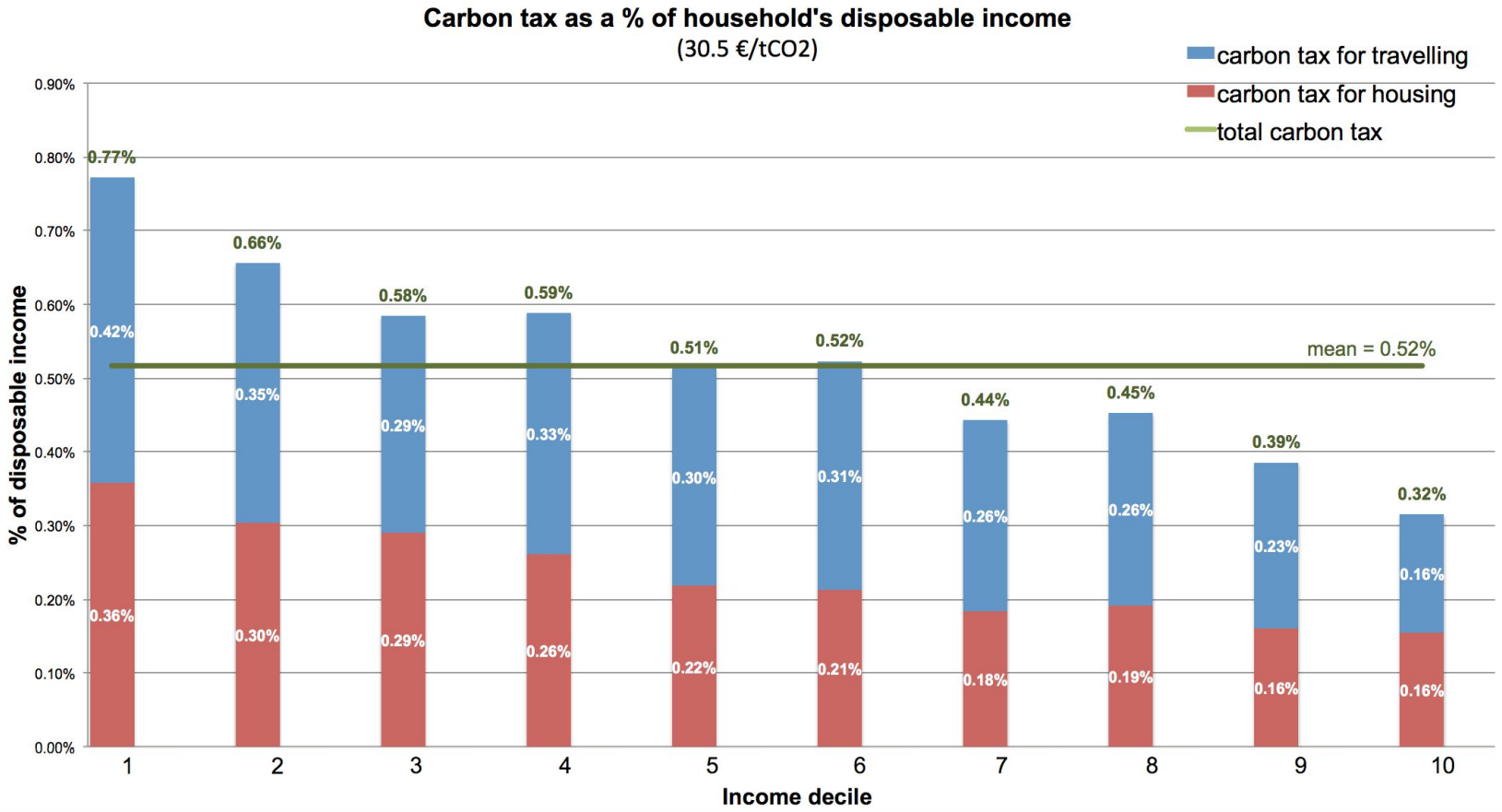
A carbon tax at 30.50€/tCO2:

- increases energy spending by 196€ per household on average
- represents 5% of energy bills in 2012

Yet, this average impact hides large disparities across households:

- for housing, 1 in 2 does not pay any carbon tax
- for transport, 1 in 5 does not pay any carbon tax
- on the contrary, 1 in 10 spends more than 400€/year in total

The carbon tax is regressive.



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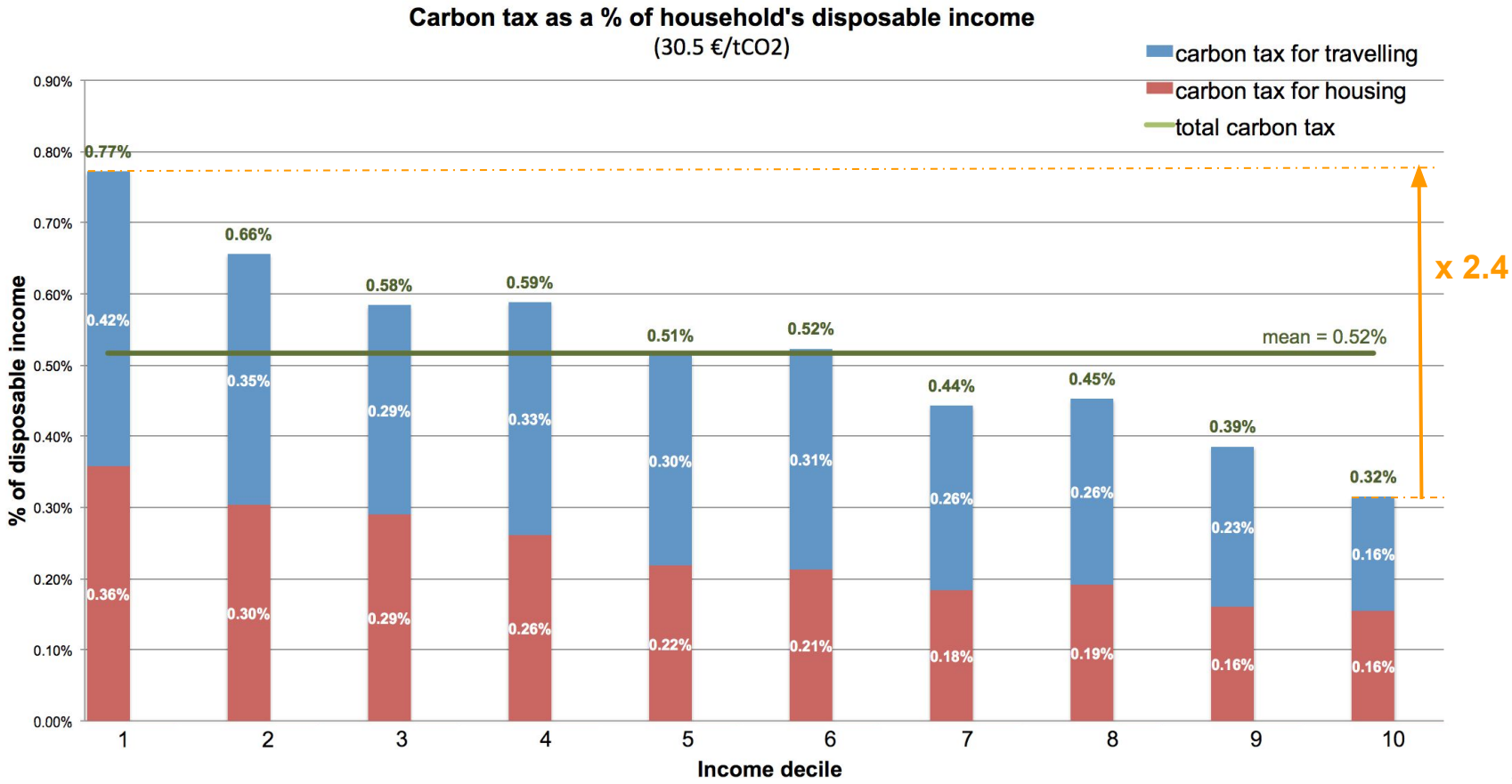

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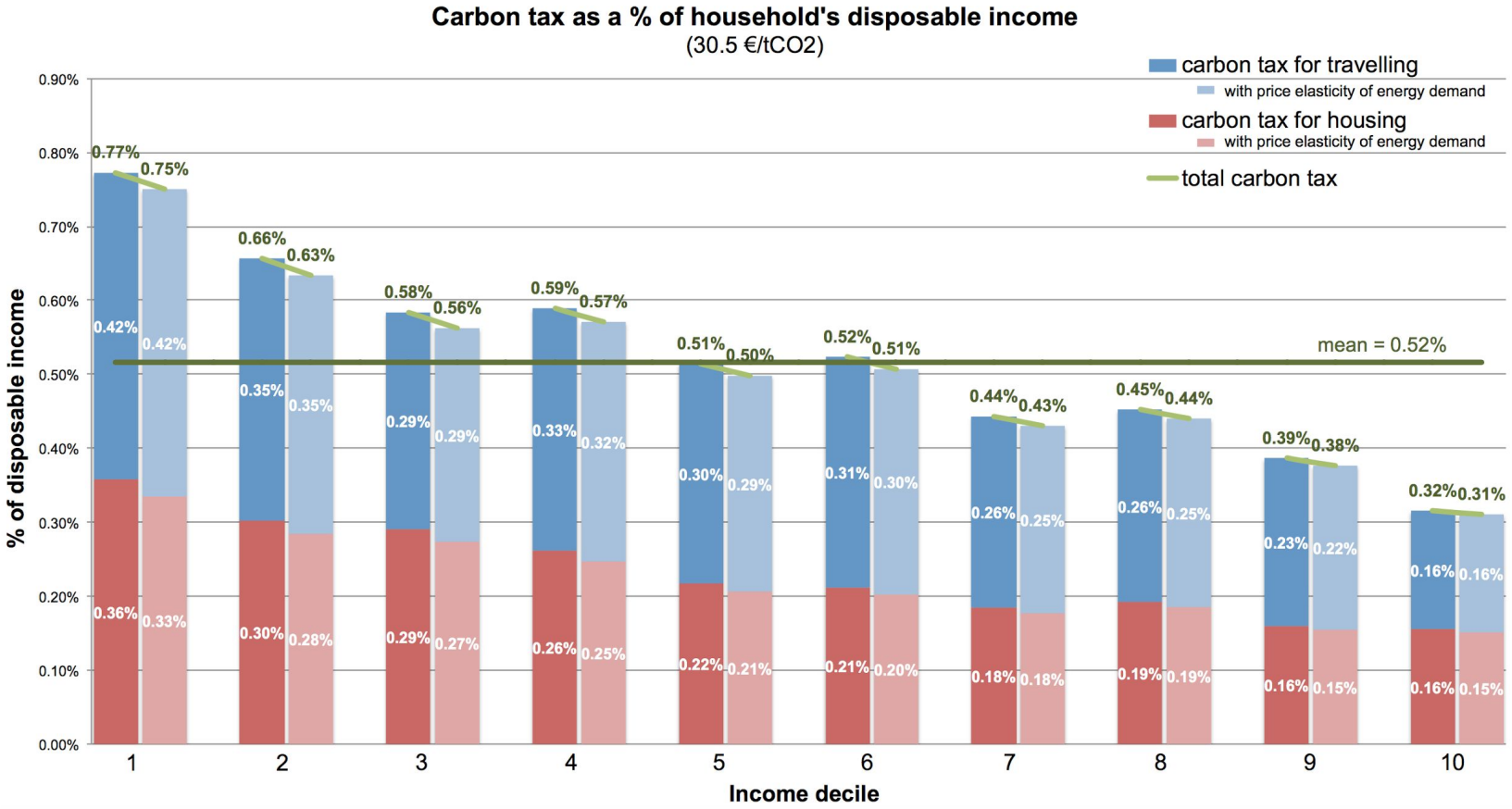

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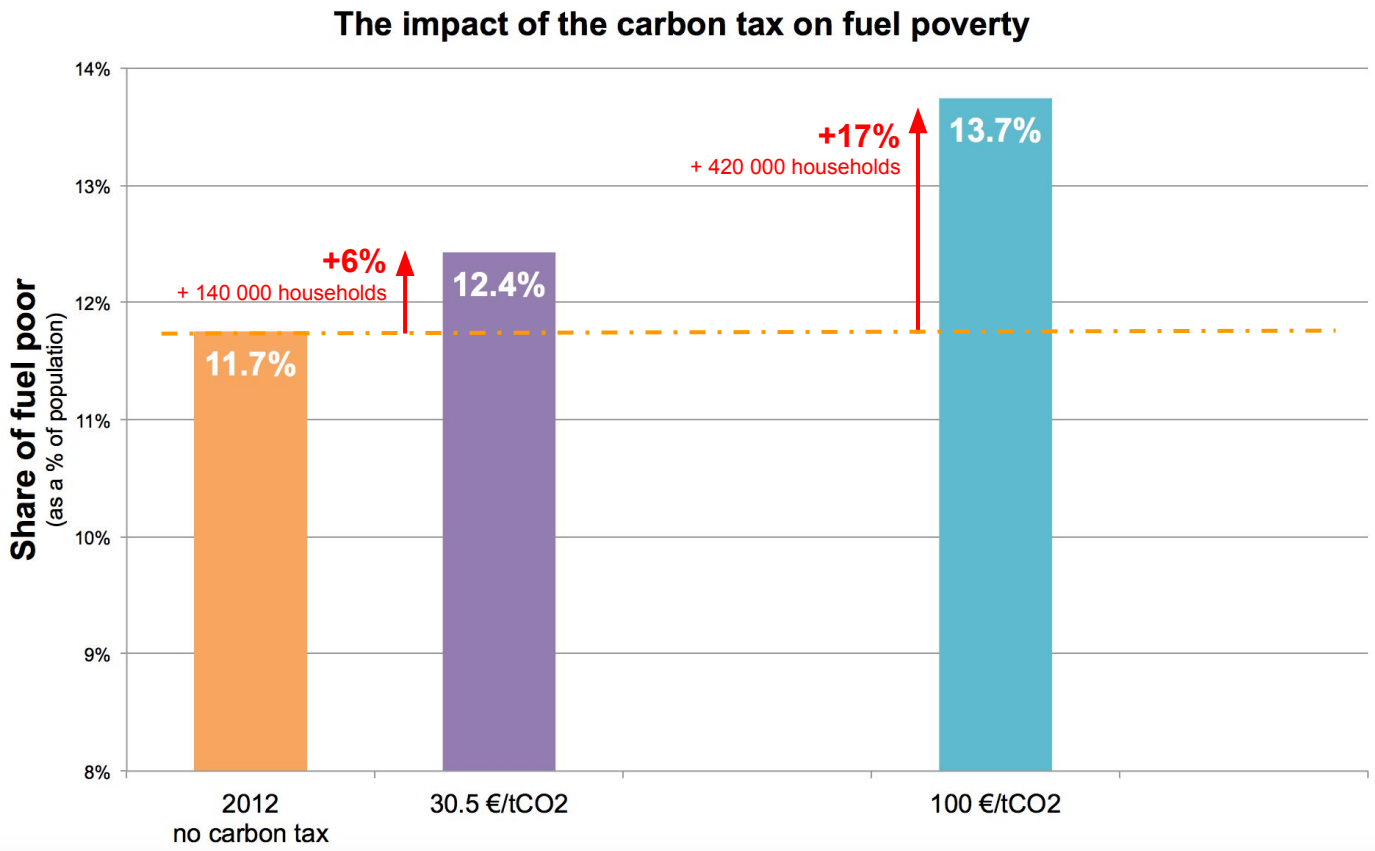

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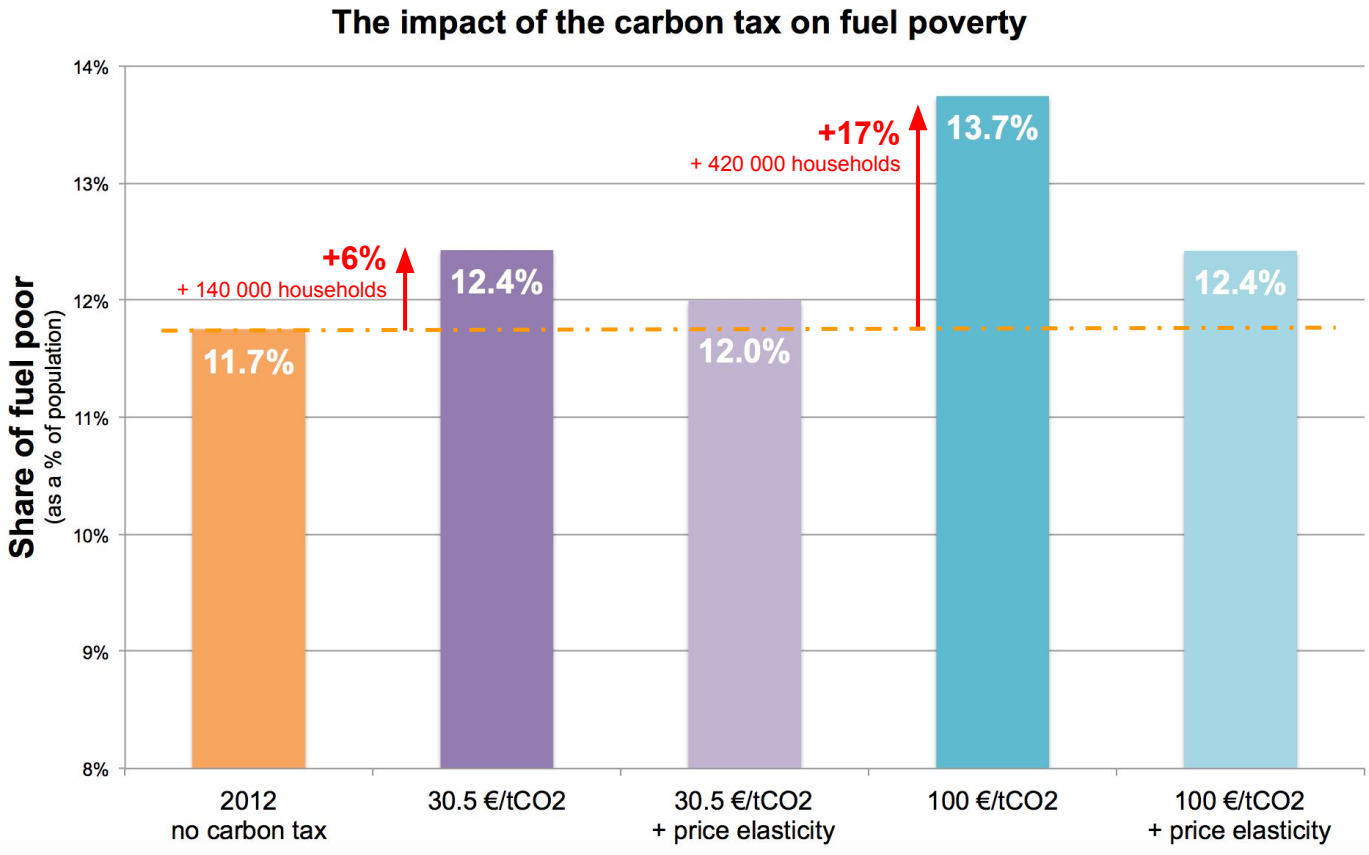

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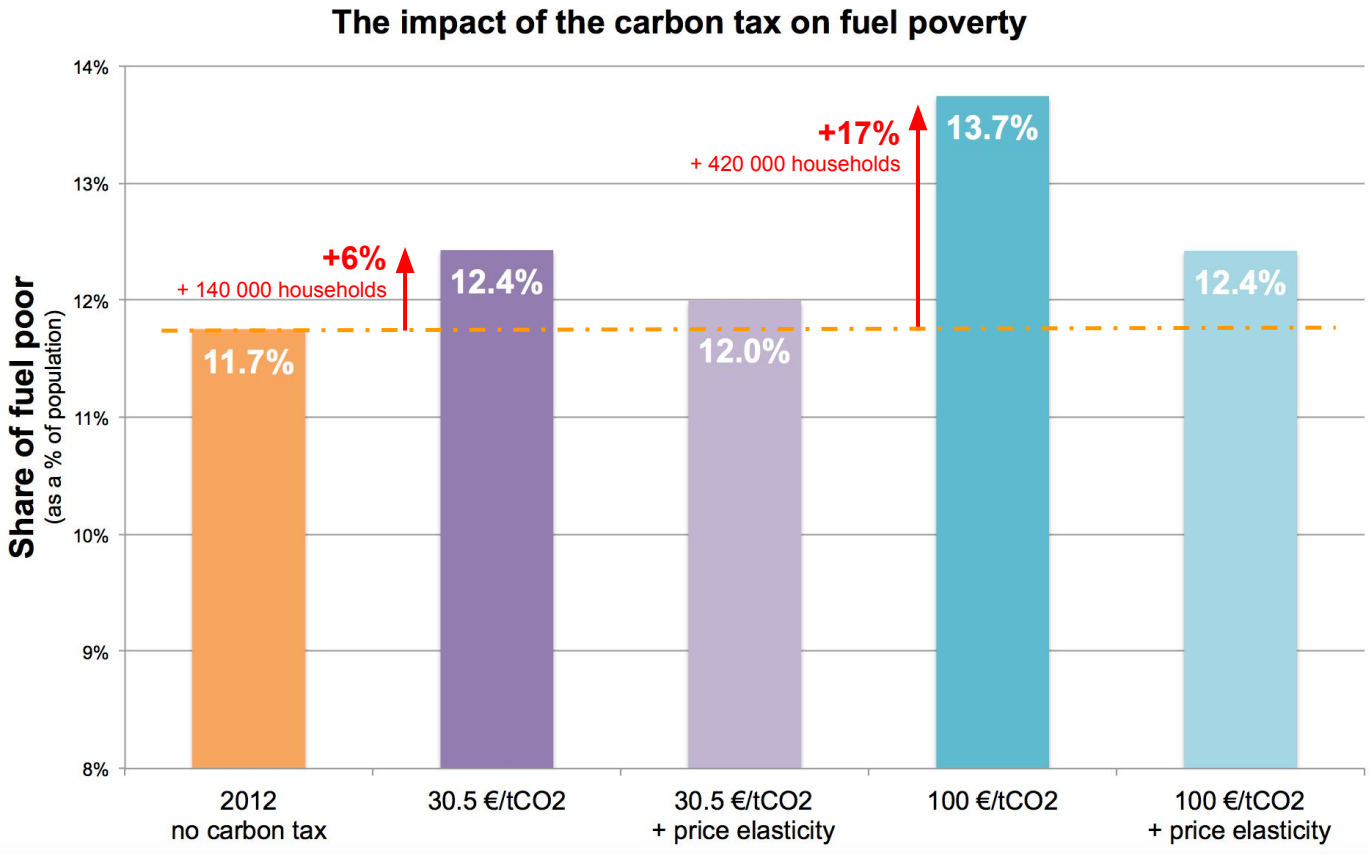

Risk of restriction?

18% of households declared feeling cold in 2012

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Recycling revenues from the tax

- A carbon tax at 30,50€/tCO2 **generate large revenues** for the State
  - about 6.7b€, including 4b€ from households
- **Compensation measures** should
  - not alter price signal of the carbon tax → incite to reduce fossil fuel consumption
  - not be too complex → rely on available data and limit management cost
- Revenues are recycled as **cash transfers**

Different scenarios of cash transfers

- **flat**: same amount to every household,
- **adjusted:**
  - **size-based**: adjusted to the household composition,
  - **income-based:** adjusted to household level of income,
  - **geographic-based:** adjusted to household residential location,
- **targeted at low-income**: only households belonging to the first three deciles of income are eligible.

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→ Two objectives: offset regressivity + fight against fuel poverty

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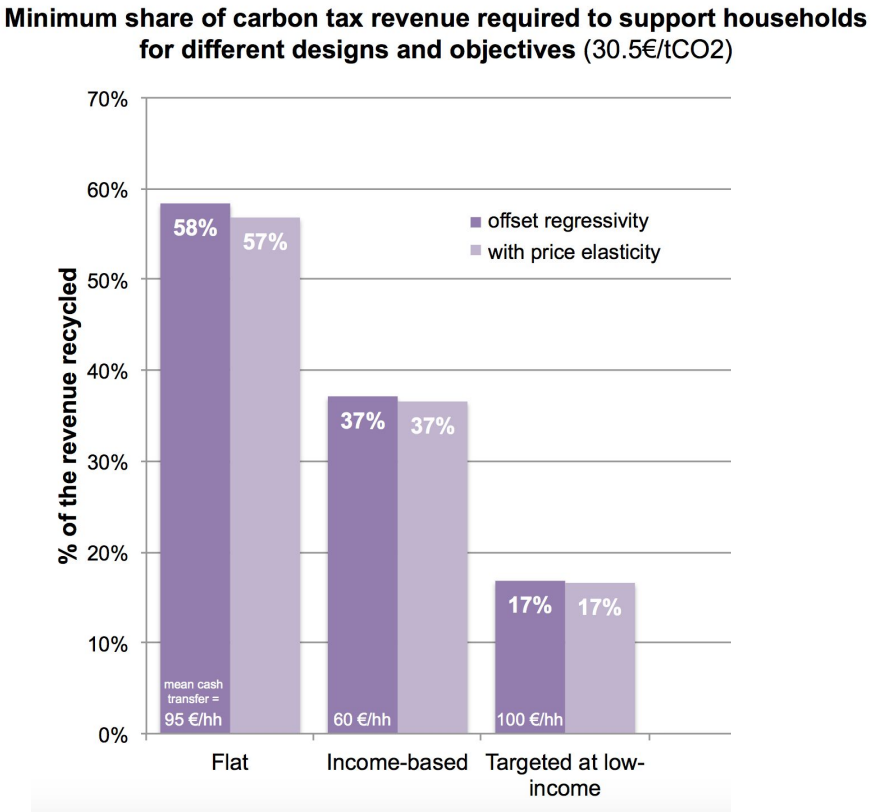
→ How much recycling is needed to compensate?

Compensating for the regressivity could be achieved by recycling only part of the carbon tax revenue.



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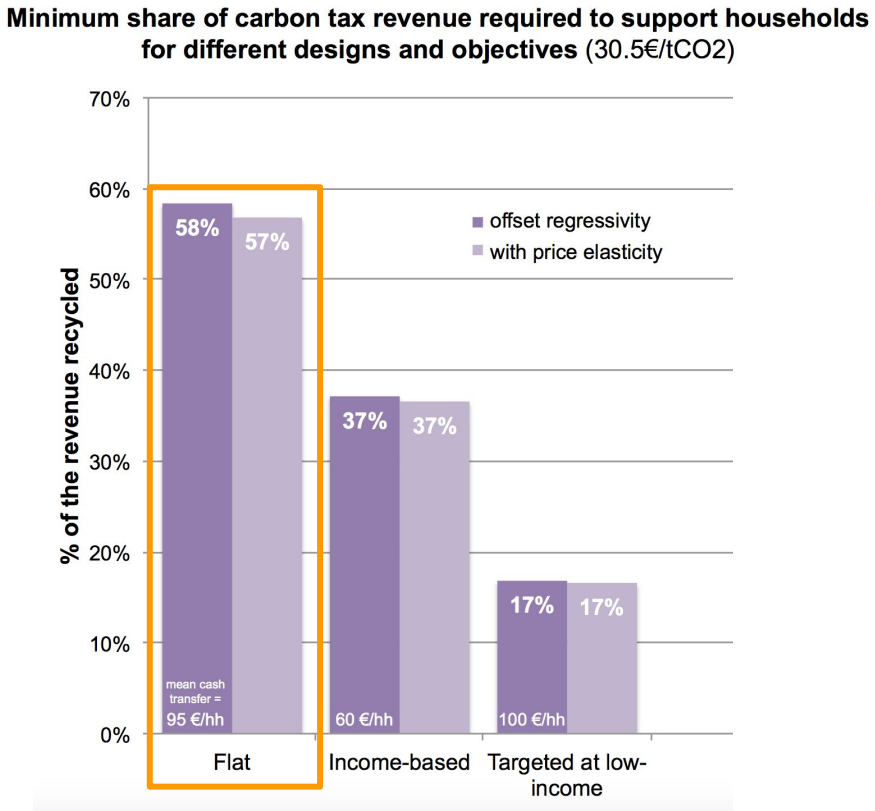
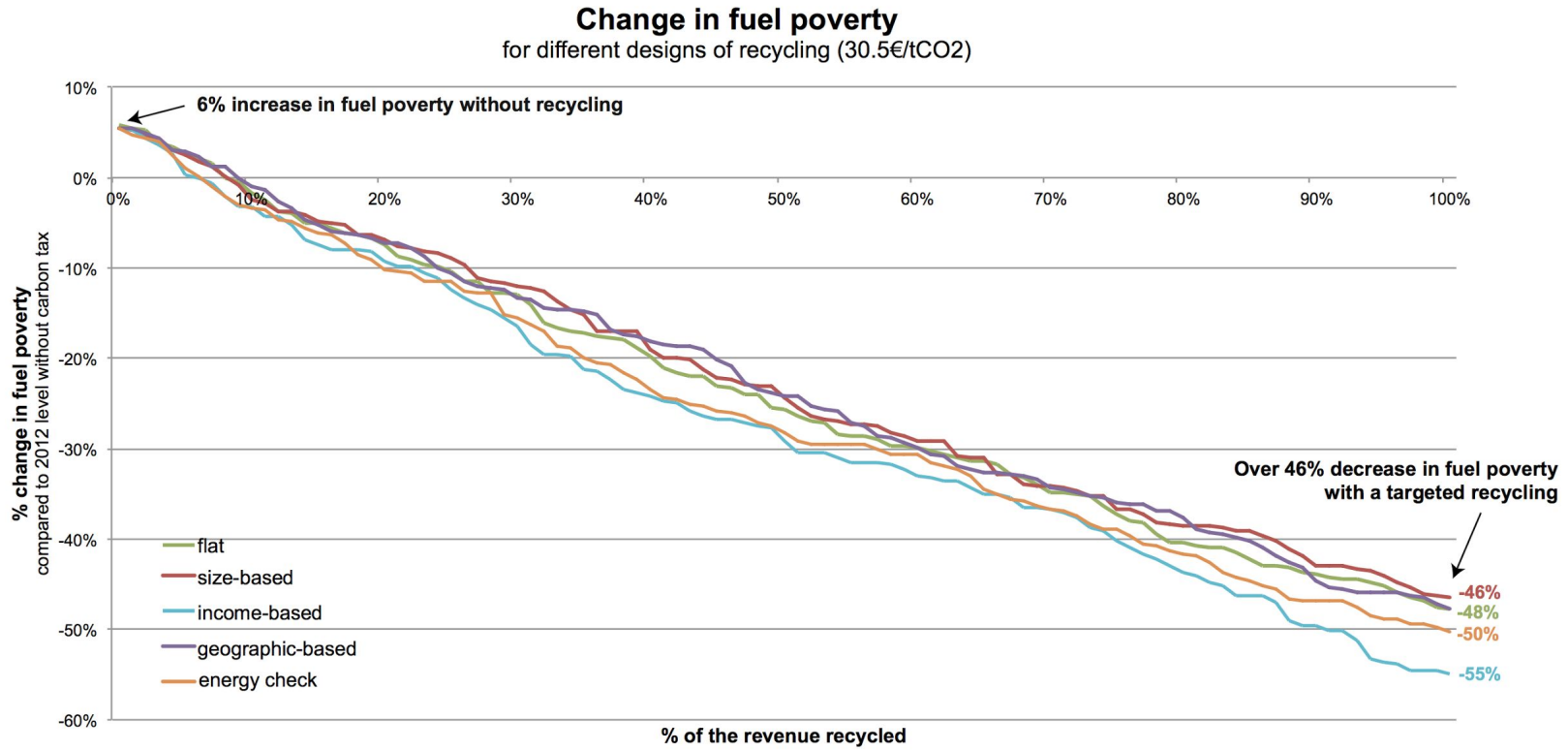


Objective : offset regressivity

- Households get back 60% of their contribution
- Recycle 40% or less of total carbon tax revenue
  (households bear ⅔ of the carbon tax)
- The remaining revenue can be used for other purposes

Targeting the recycling at low-income households could even reduce fuel poverty below the pre-tax level.



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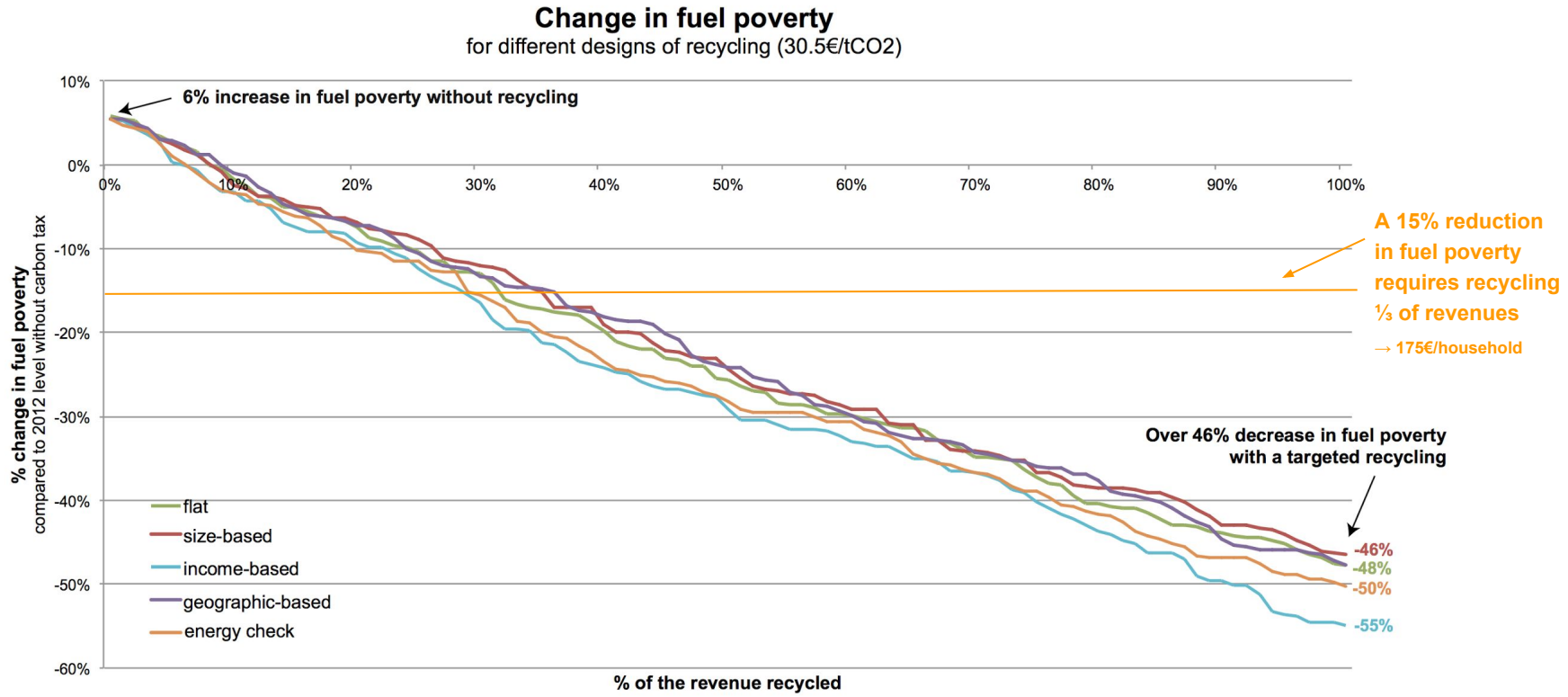

Conclusion

- Objectives
  - quantify the distributional impacts of the carbon tax
  - discuss the design of compensation measures
- Main contributions
  - **develop a micro-simulation model** using the most recent data available in France with detailed information both on the domestic and transport sectors
  - **analyse the link between the carbon tax and fuel poverty** and the opportunity to finance measures to protect low-income households during the transition

Conclusion

- **Compensating households** could offset the short-term impacts of the carbon tax
  - Offsetting regressivity could be achieved by **recycling <40% of total revenue**
  - Targeting the recycling could **reduce fuel poverty far below pre-tax level**
- It **is achievable at reasonable cost** relative to total carbon tax revenues
- It **allows for a smooth transition**, before households access better housing and mobility conditions
- Further research:
  - evaluate the impact of investing in increased energy efficiency
  - couple the microsimulation model with a CGE model

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Thanks !

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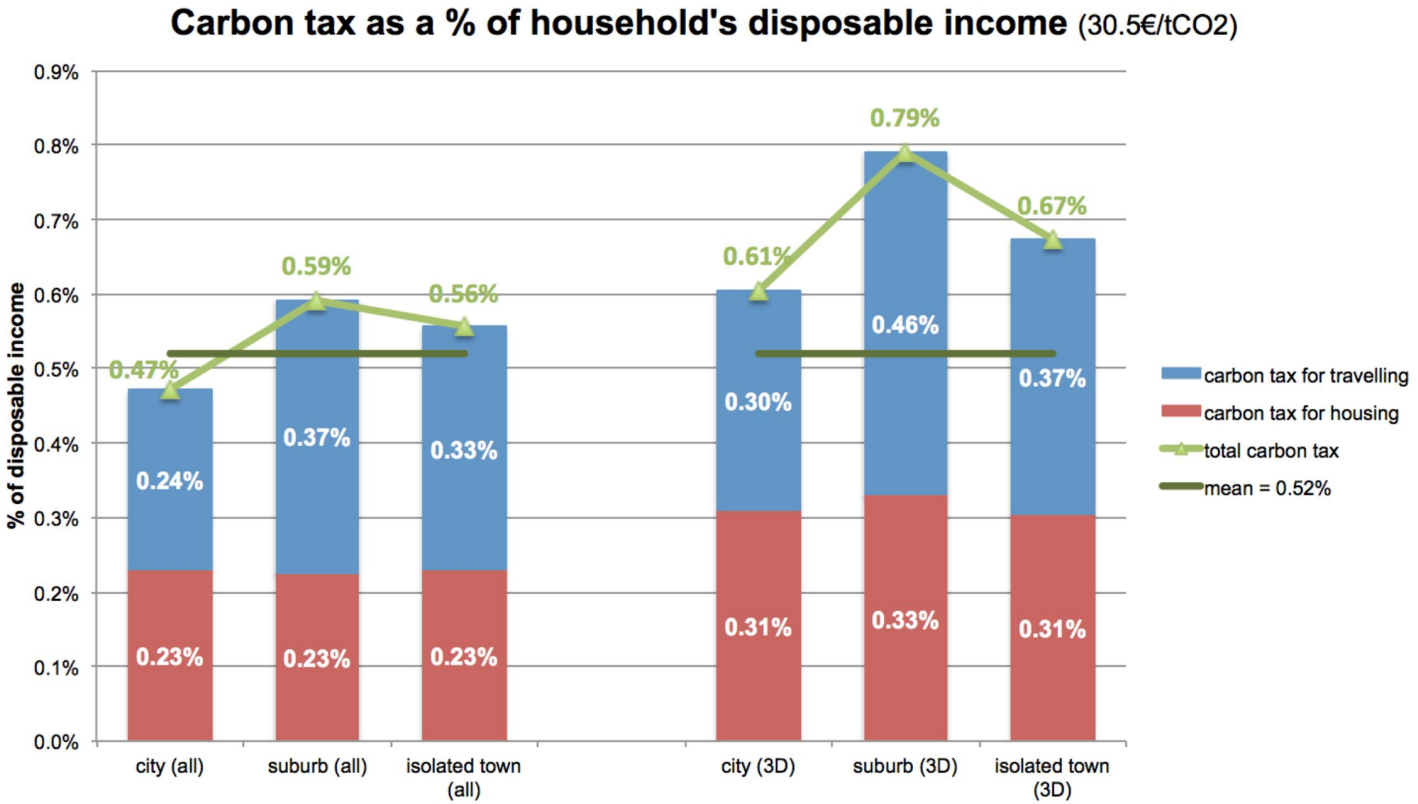
Low-density areas are more affected by the carbon tax for travelling.



Results for different designs of recycling

Recycling of the carbon tax Tax revenue = 3.56 b€	% of population eligible	**Objective: offset regressivity** Cost of measure (million €)	% of tax revenue recycled	Mean cash transfer (€)	% of winners* (among eligible)	**Objective: offset additional fuel poverty** Cost of measure (million €)	% of tax revenue recycled	Mean cash transfer (€)	% of winners* (among eligible)
Flat	100%	2 080 €	58%	95 €	38%	1 029 €	29%	47 €	19%
Size-based	100%	2 066 €	58%	94 €	36%	1 104 €	31%	50 €	19%
Geographic-based	100%	2 030 €	57%	93 €	36%	1 192 €	33%	54 €	22%
Income-based	100%	1 323 €	37%	60 €	24%	524 €	15%	24 €	13%
Targeted at low-income	30%	600 €	17%	100 €	51%	282 €	8%	47 €	30%

* Winners correspond to households receiving more cash transfer than they spend on carbon tax.

Measuring tax regressivity

A tax is said **regressive,** if its burden falls with income.

Suits Index of Tax Progressivity (Suits, 1977)

- Measures the deviation of a tax system from proportionality
- Summarizes the overall effect of a tax in a single number [-1,+1]

$$Suits\ Index = \sum_{households} \frac{1}{2} * \left(T(y_h) + T(y_{h-1})\right) * (y_h - y_{h-1})$$