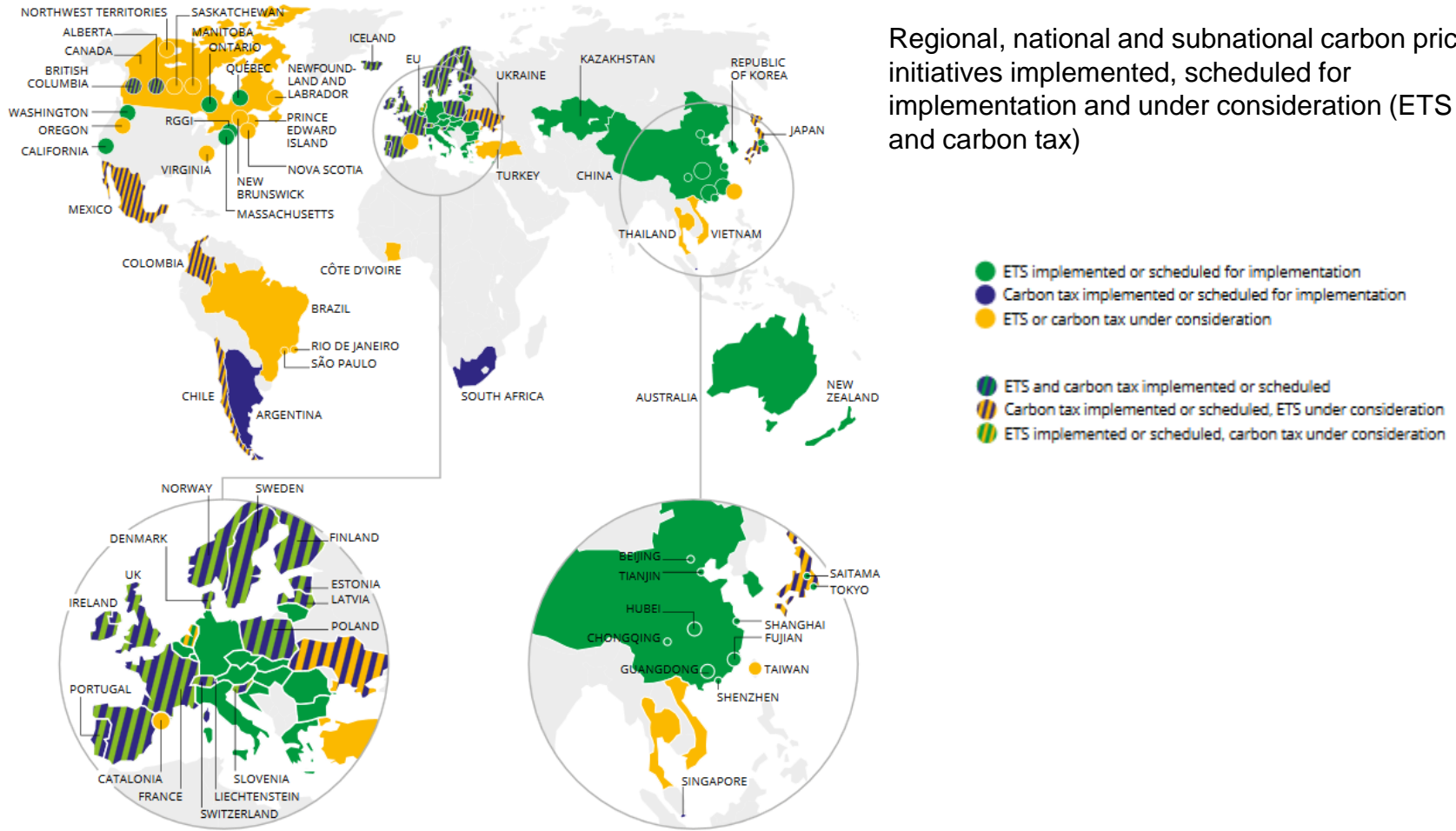# Using emissions trading schemes to reduce heterogeneous distortionary taxes:
# the case of recycling carbon auction revenues to support renewable energy
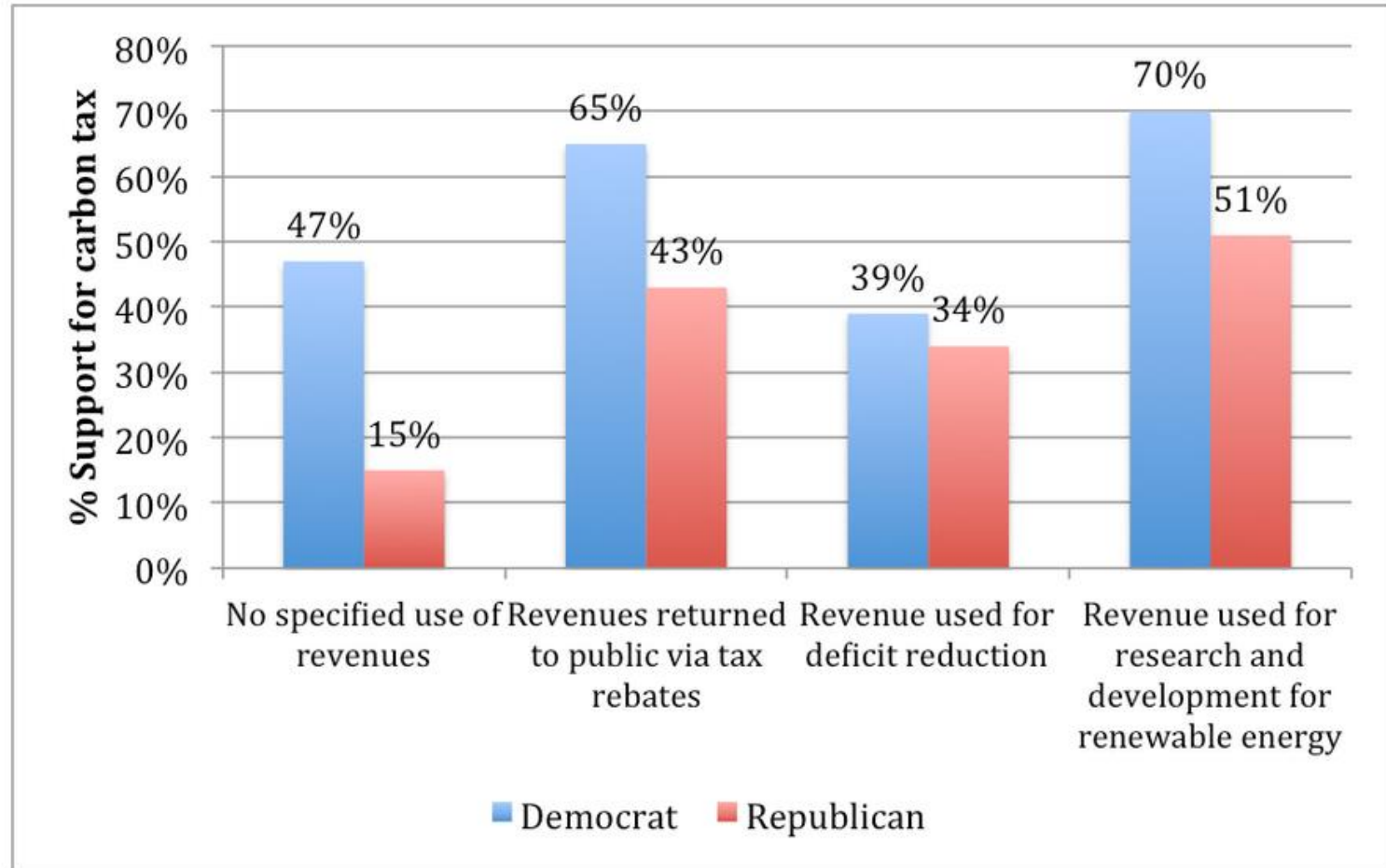
## C. Gavard, S. Voigt and A. Genty

# Motivation and Research Question



Regional, national and subnational carbon pricing initiatives implemented, scheduled for implementation and under consideration (ETS and carbon tax)

**Legend:**
- ETS implemented or scheduled for implementation
- Carbon tax implemented or scheduled for implementation
- ETS or carbon tax under consideration
- ETS and carbon tax implemented or scheduled
- Carbon tax implemented or scheduled, ETS under consideration
- ETS implemented or scheduled, carbon tax under consideration

# Motivation and Research Question



Source: Energy Institute Blog, based on survey analysis by David Amdur, Barry G. Rabe, and Christopher Borick

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- Economic impacts of using carbon revenues to support RE?

- Economic impacts depend on how the pre-existing RE support policies are financed: general public budget or electricity levy (distortionary tax)

- Existing literature:
  - Negative impact of a distortionary tax
  - Benefit of using the revenues from a Pigouvian tax to reduce distortionary taxes (Ballard and Medema, JPE, 1993)
  - The optimal carbon tax is higher if tax revenues are used to reduce distortionary taxes, compared to if they are transferred to households as a lump sum(Nordhaus, AER, 1993)

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# Motivation and Research Question

- Research question: Economic impacts of recycling carbon auction revenues to support RE if heterogeneous electricity levy among sectors?

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## Main results and Contribution

- We extend the economic literature on environmental taxation in the presence of other taxes to :
    - carbon pricing in the form of an emissions trading scheme (ETS),
    - in the presence of a distortionary commodity tax that heterogeneously applies to the various sectors of the economy

- Contribution to the literature on interactions between climate policy instruments

# Main results and Contribution

- Using carbon auctions revenues to reduce the electricity levy used to finance RE results in:

  - Increase in electricity demand

  - Increase of the ETS price but reduction of the carbon constraint in the non-ETS sectors

  - Slight GDP improvement (reduction of the levy distortionary effect)

  - Minor impact on the non-ETS sectors (rather positive if relatively more electricity intensive)

  - ETS sectors:

    - Positive impact if the electriticy levy applies to them

    - Reduced benefits due to general equilibrium effects if these sectors are exempted (exception for the sectors for which the positive demand effect from the non-ETS sectors dominates)

# EU as a Case Study

- EU Emissions Trading Scheme (ETS) since 2005

  – 43% $CO_2$ emissions reduction in the ETS sectors by 2030 compared to 2005 levels

  – Auctioning according to EU ETS regulation since 2013

- RE policy

  – EU objective: 32% RE in total energy consumption by 2030

  – Support policy at the Member State level, diversity of schemes

    - Paid by the general public budget (UK, PL, FI) or an electricity levy

- Effort Sharing Regulation for the non-ETS sectors: 30% $CO_2$ emissions reduction in the non-ETS sectors by 2030 compared to 2005 levels

# Quantitative Framework

- Data
    - Global Trade Analysis Project 9.1
    - EU Reference Scenario 2016
    - International Energy Outlook

| Model region | RE target |
|---|---|
| France | 37.2 |
| Germany | 45.6 |
| Italy | 51.9 |
| Poland | 26.5 |
| Spain | 68.8 |
| United Kingdom | 49.9 |
| Rest of Western MS | 62.1 |
| Rest of Eastern MS | 36.3 |

- PACE model

**Assumed renewable energy targets in electricity sector based on EUCO30 scenario\***

\* These assumptions are based on the 27% renewable energy objective for the whole EU, agreed in 2014.

# Quantitative Framework

- RE support
  - Default: paid by tax payers
  - Developments: paid by electricity consumers (electricity levy)
    - With possible exemptions for energy intensive sectors

- Carbon auctions revenues
  - Default : lump-sum transfer to households
  - Development : recycled as a subsidy to power generation from RE

# Policy Simulations

| | RE support funding | | |
|---|---|---|---|
| | Public budget | Electricity levy paid by all consumers | Electricity levy paid by all consumers except ETS sectors |
| Auctions revenues are transferred to households | PUBLIC | LEVY | LEVY_ETS_EXEMPT |
| Auctions revenues are used to subsidize power production from RE | PUBLIC_REN | LEVY_REN | LEVY_ETS_EXEMPT_REN |

# Results

| Indicators | PUBLIC_REN | LEVY | LEVY_REN | LEVY_ETS_EXEMPT | LEVY_ETS_EXEMPT_REN |
|---|---|---|---|---|---|
| CO2 price ETS (2010 €) | 77.2 | 74.0 | 75.2 | 74.1 | 75.4 |
| Carbon constraint in the non-ETS sectors (2010 €) | 163.9 | 182.8 | 174.3 | 187.9 | 176.8 |
| GDP (% change vs. baseline) | 0.0 | -0.2 | -0.1 | -0.2 | -0.1 |
| Fossil fuel demand (% change vs. baseline) | 0.0 | -0.4 | -0.2 | -0.4 | -0.2 |
| Electricity demand (% change vs. baseline) | 0.0 | -4.5 | -2.4 | -4.1 | -2.2 |
| Primary energy consumption (% change vs. baseline) | 0.0 | -2.5 | -1.5 | -2.4 | -1.4 |

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Electricity prices rise in some Member States when auctions revenues used to support RE (e.g. 3% in France).

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# Results

For the non-ETS sectors, two effects:
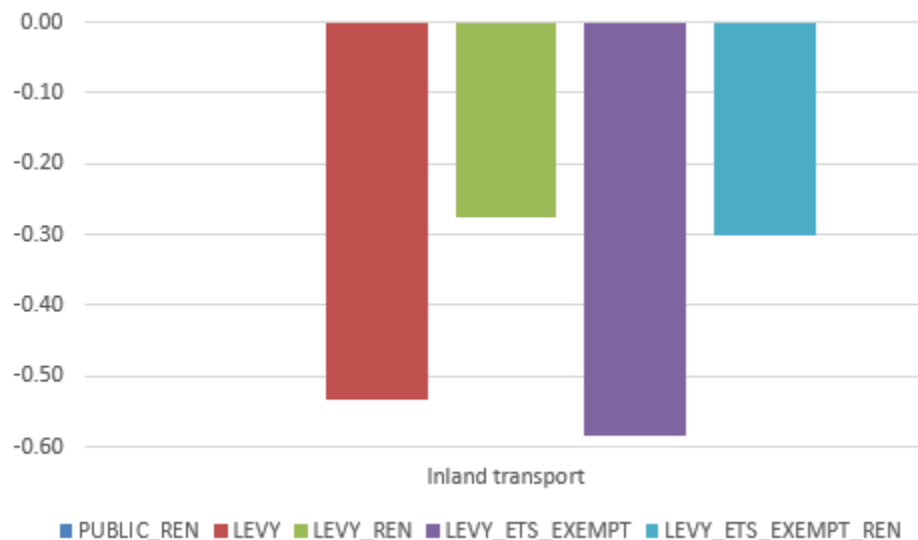- Electricity levy reduction
- Slight increase in energy prices
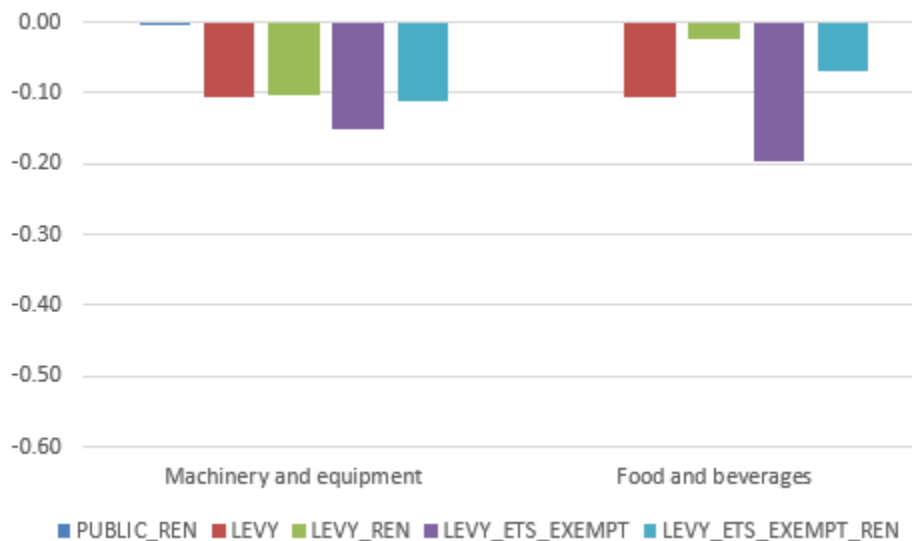


**Changes in output of selected non-ETS sectors in 2030 (% change vs PUBLIC scenario)**
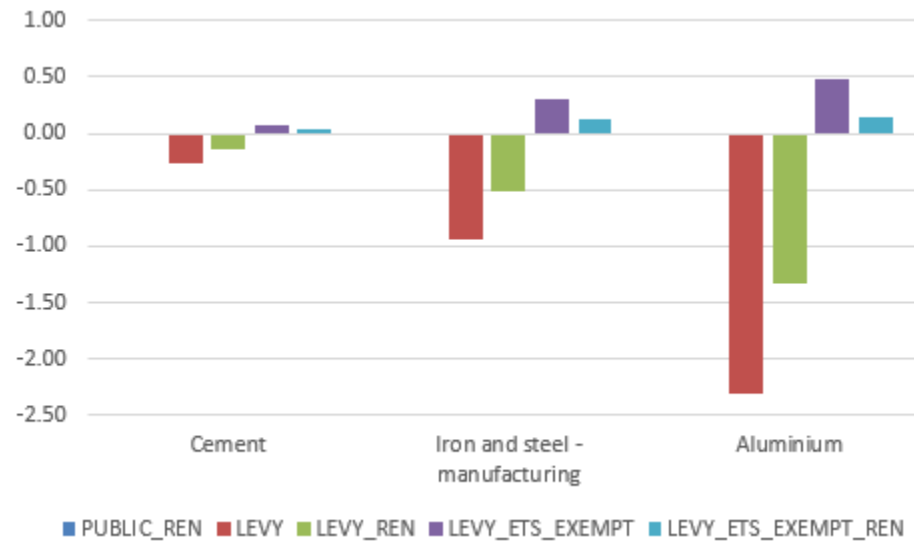
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## Results

For the Inland Transport sector: demand effect from the non-ETS sectors that benefit from the revenue recycling option



**Changes in output of the Inland transport sector in 2030 (% change vs PUBLIC scenario)**

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## Results

The impact on ETS sectors depends on the electricity levy exemption rules.



**Changes in output of selected ETS sectors in 2030 (% change vs PUBLIC scenario)**

# Conclusion

- Using carbon auctions revenues to reduce the electricity levy used to finance RE results in:
    - Increase in electricity demand (+2%)
    - Increase of the ETS price (+2%) but reduction of the carbon constraint in the non-ETS sectors (-5.9%)
    - Slightly higher GDP (+0.1%)
    - Minor impact on the non-ETS sectors (rather positive if relatively more electricity intensive)
    - ETS sectors:
        - Positive impact if the electriticy levy applies to them
        - Reduced benefits due to general equilibrium effects if these sectors are exempted (exception for the sectors for which the positive demand effect from the non-ETS sectors dominates)

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*Thank you for your attention!*

Claire.gavard@zew.de