

What carbon prices and other policies and measures are needed to achieve the new EU 2030 climate targets?

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How to achieve the EU Green Deal?

Very ambitious targets:

- 🌀 -55% vs 1990 → ~40% emission reductions vs. today in 9 years!
- 🌀 GHG neutrality in <30 years ⇔ lifetime of many technologies >25 years
→ new investment into fossil technologies may risk the 2050-target
„It is going to be bloody hard to do“ - Frans Timmermans

The **very ambitious timeline** raises fundamental questions:

1. How much does it shift the focus from **economic efficiency** to **effectiveness** and **robustness**?
2. When is it better to make a **suboptimal choice** rather than leaving **all options open** and thereby **risk slowing the transformation**?

How to break down the overall target?

Two key pillars of the EU climate policy

- ⦿ EU emissions trading system (EU-ETS): Electricity sector, large industry
- ⦿ Effort Sharing Regulation (ESR): Transport, Buildings, Agriculture, small industry

How to break down the overall target?

Additional reductions in ESR

New 2030-Target EU: -55%
additional reductions: ~700Mt CO₂e

2030-Target EU: -40%

ESR -30%

ETS -43%

Additional Reductions in ETS

How to break down the overall target?

Additional reductions in ESR

Additional reductions
split like current split

2030-Target EU: -40%

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Additional Reductions in ETS

New 2030-Target EU: -55%
additional reductions: ~700Mt CO₂e

ESR -40%:

ETS -61%:

- ➔ What does such a cap in the ETS mean for the power sector?
- ➔ What does such an ESR target mean for the ESR sectors?



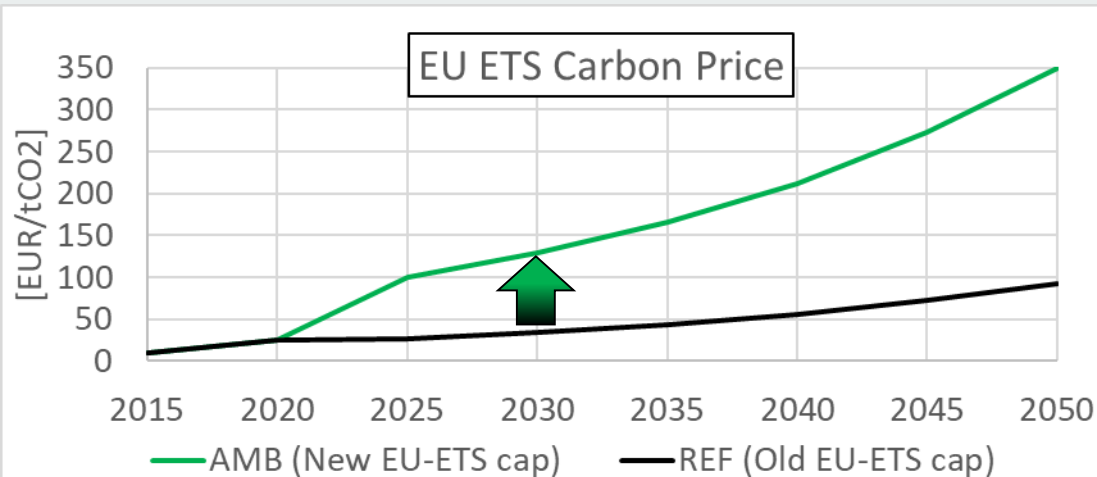
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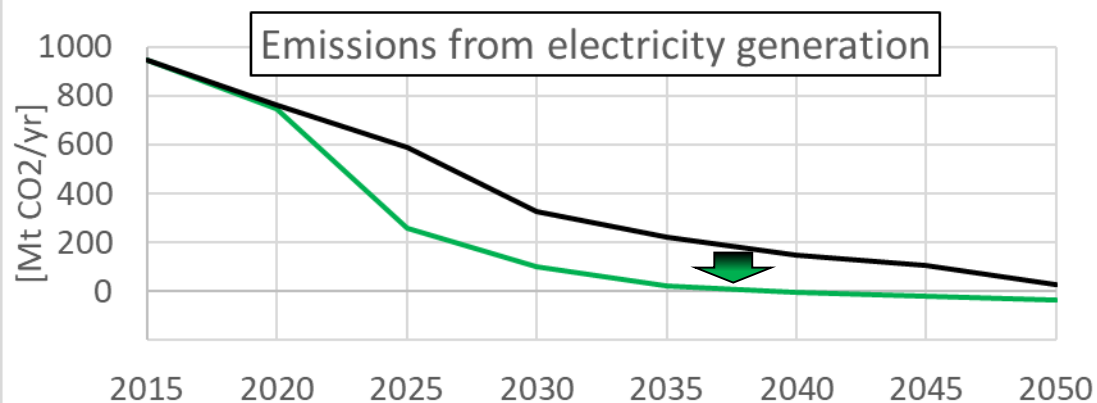
Tightening EU ETS targets in line with the European Green Deal: Impacts on the decarbonization of the EU power sector

Robert C. Pietzcker¹, Sebastian Osorio¹, Renato Rodrigues²

Tighter ETS caps have large impact on carbon prices



- CO₂ prices in the ETS would more than triple, from 35€/tCO₂ in 2030 to 130€/tCO₂

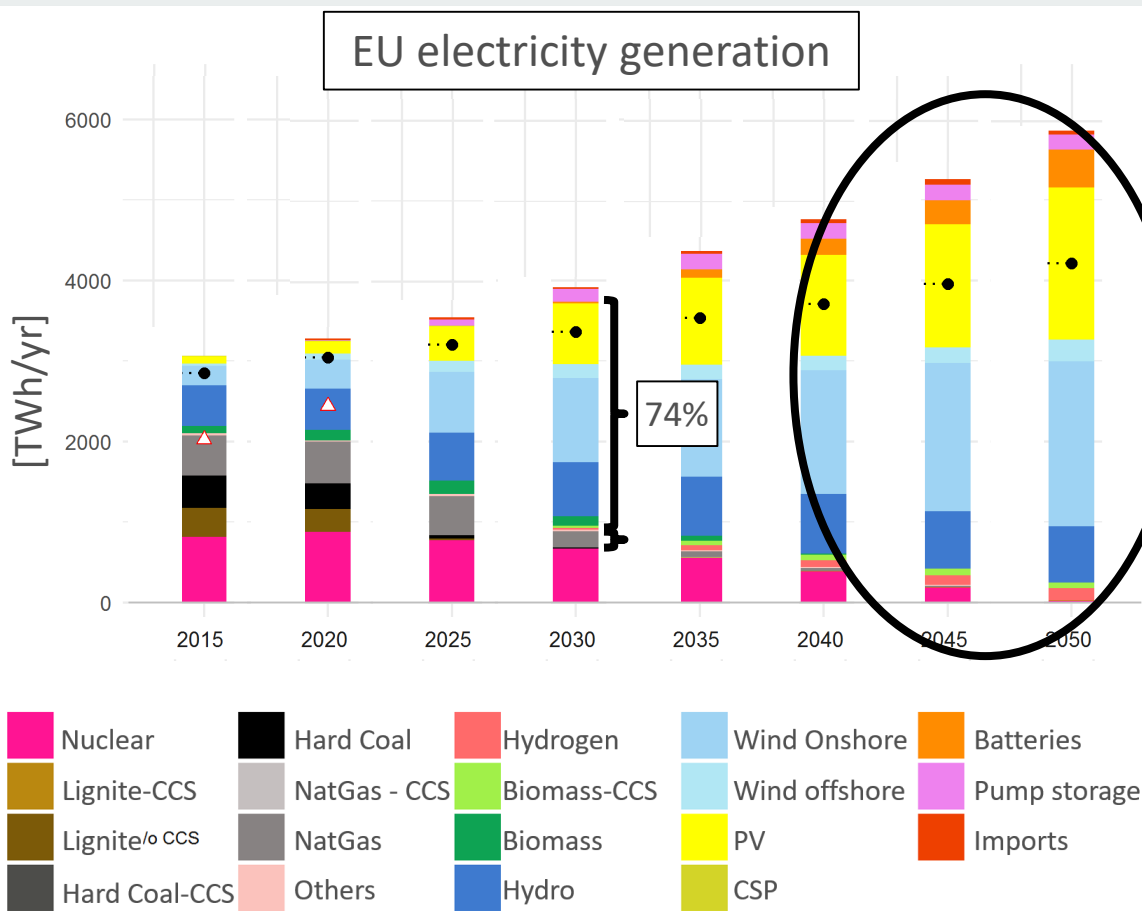


- Power sector would be carbon-neutral before 2040

Pietzcker, R.C., Osorio, S., Rodrigues, R., 2021: "Tightening EU ETS targets in line with the European Green Deal: Impacts on the decarbonization of the EU power sector"

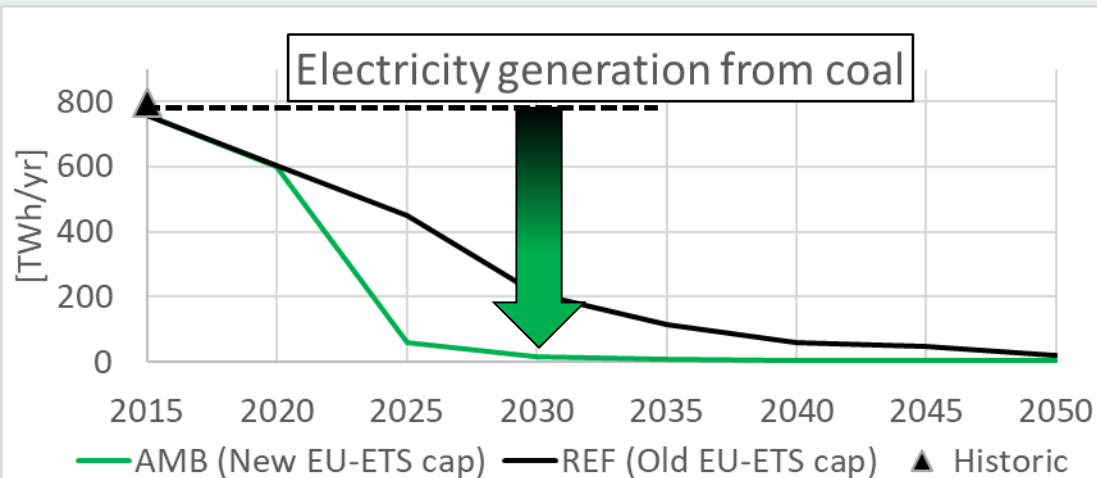
LIMES model: <https://www.pik-potsdam.de/limes>

Carbon prices >100€/tCO₂ transform power sector

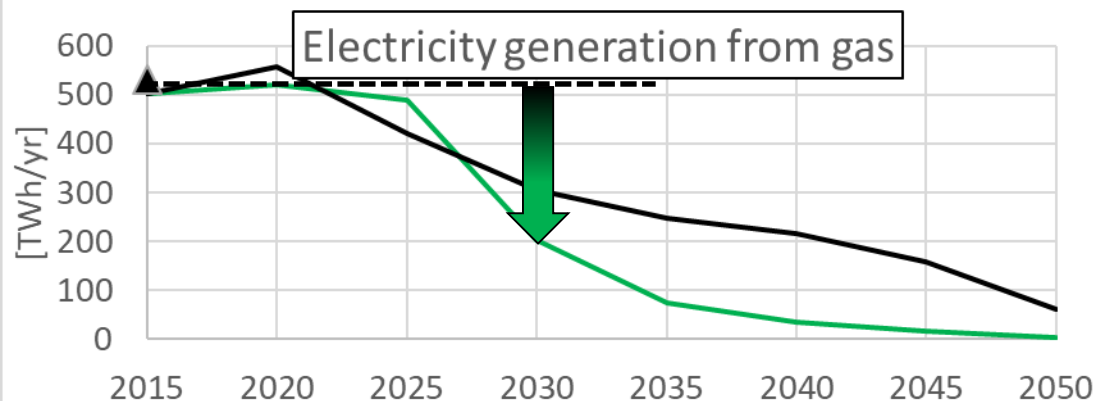


- Long-term EU power sector almost exclusively based on renewable energies
- In 2030, renewables share reaches >70%
- For this, high investments needed 2020-2030:
50 GW/yr PV,
30 GW/yr wind
4GW/yr H₂,
2 GW/yr batteries
- Fossil fuels strongly reduced by 2030

Phaseout of fossil fuel use in power



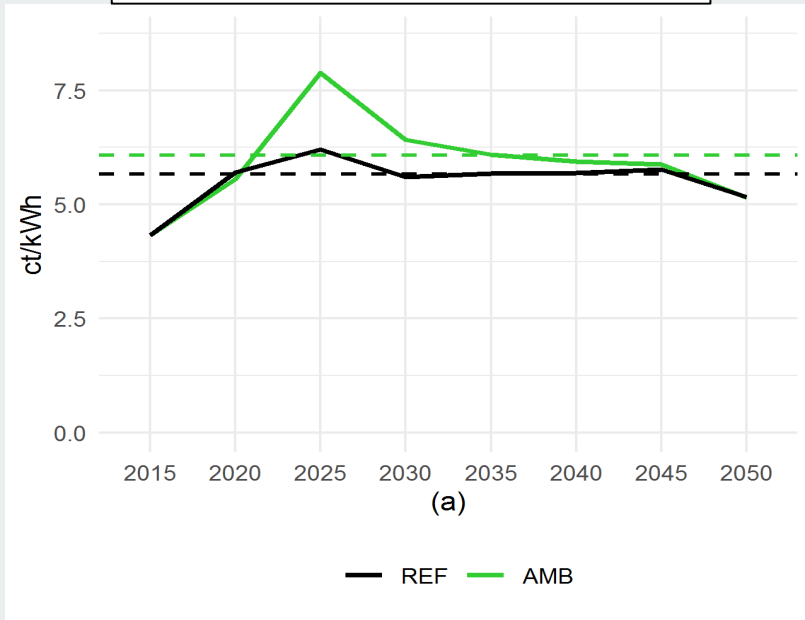
- EU-wide coal phaseout by 2030 (<20TWh) – driven by carbon prices



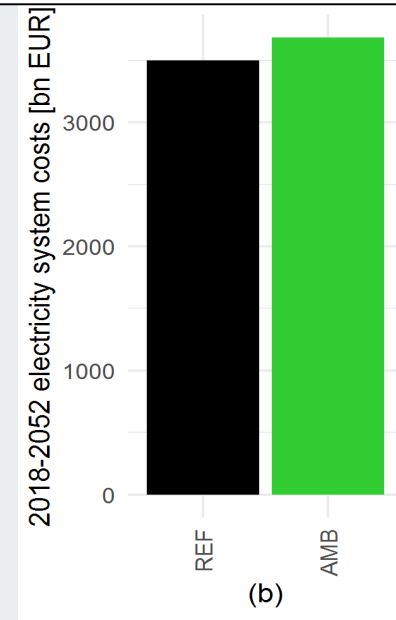
- In 2030, gas-based generation is reduced by 60% vs 2015

Economic impacts

Wholesale electricity prices



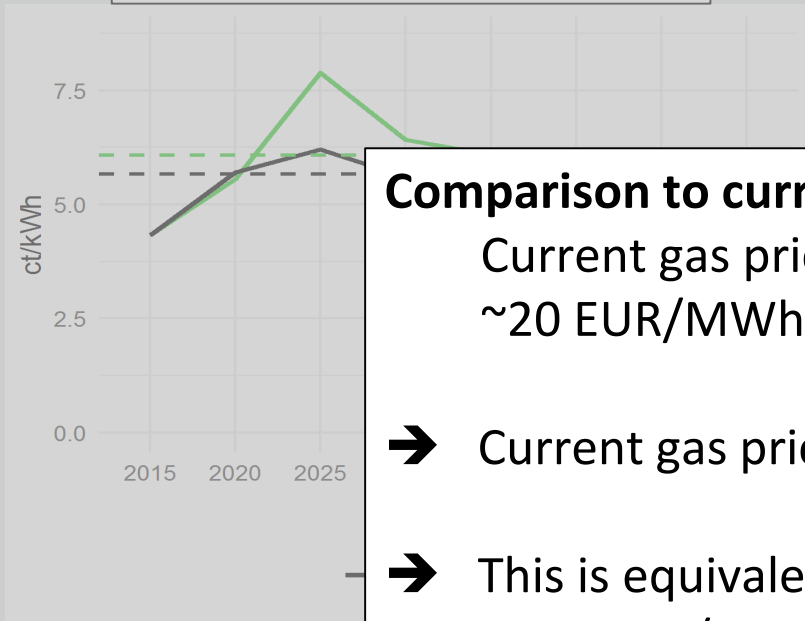
Total power system costs



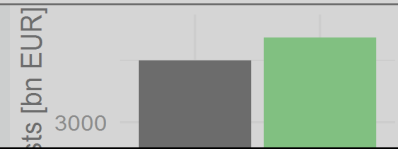
- Electricity prices increase on average by 0.4 ct/kWh (~2 ct/kWh max in 2025)
- Total power sector costs increase by roughly 5%

Economic impacts

Wholesale electricity prices



Total power system costs



Comparison to current gas price shock:

Current gas prices: ~90 EUR/MWh, compared to ~20 EUR/MWh over last years

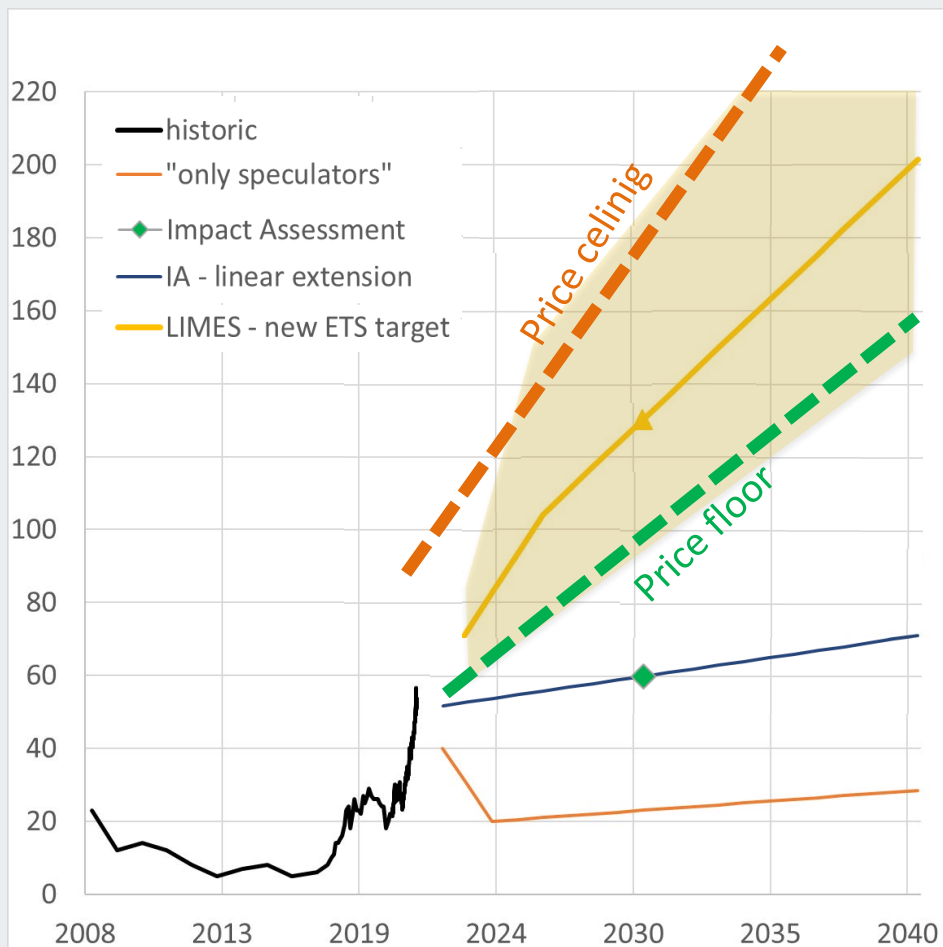
- ➔ Current gas prices are 70€/MWh higher than before
- ➔ This is equivalent to effect of a carbon price of ~350 EUR/tCO₂
- ➔ The 2030 ETS target will have much lower effect on energy prices than the current gas price spike

○ Electricity price

○ Total power system costs

What is needed – beyond tighter ETS caps – to make this scenario reality?

- ☉ **Stabilize the expectation of high carbon prices**
eg by introducing a **price floor** (and potentially a price ceiling)
- ☉ **Remove hindering regulation** for RES investments, grid expansion, storage and demand flexibility
- ☉ Increase the amount of RES tenders or other instruments to **keep financing costs low**



Now to the difficult part: the ESR sectors

Now to the difficult part: the ESR sectors

Scenario calculations based on the full-system model REMIND-EU*
...these prices assume no tightening of additional policies

2030-Target EU: -55%

ESR -40%: **280** (range: 250-410) €/tCO₂

ETS -61%: **130** (range: 95-190) €/tCO₂

Additional
reductions split
like current split

2030-Target EU: -40%

ESR -30%:

ETS -43%:

Additional Reductions in ETS

Pietzcker et al – in preparation

REMIND model: www.pik-potsdam.de/remind

Why do ESR sectors need so high carbon prices?

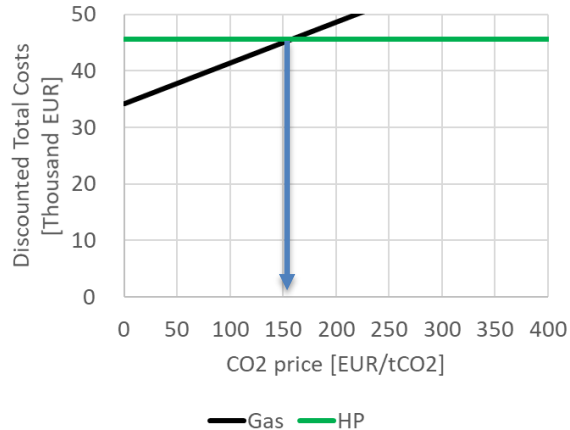
In the transformation phase (2020 - 2035), CO₂ prices have to be **higher** than “mature technology abatement costs” due to **impeding factors**, e.g.

1. Uncertainty about future CO₂ prices – even worse than in the EU-ETS
2. Principal-agent problem, eg carmakers and customers
3. Chicken and egg problem: infrastructure and technology sales
4. Not enough skilled workers & knowledge about low emission techs
5. Status quo bias
6. High discount rate of consumers

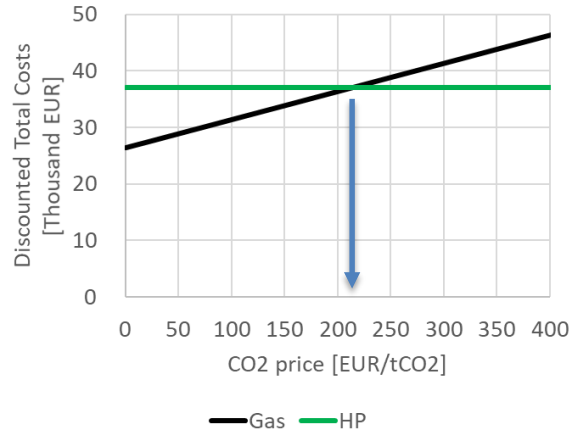
Exemplary calculation – heat pump vs gas

Total system costs for a single family home, partially renovated, JAZ 3, emission-free electricity

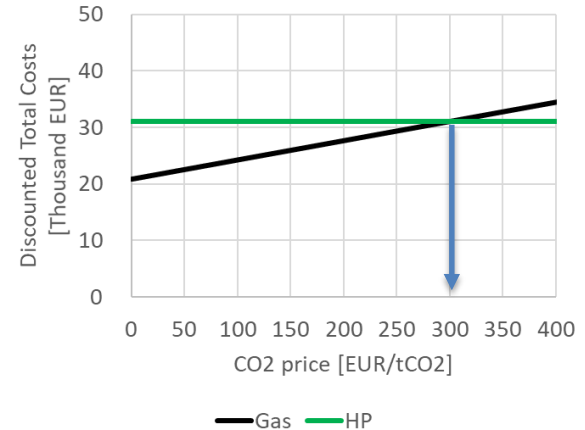
1% discount rate



5% discount rate



10% discount rate



CO2-price required for break-even ranges from 150-300€/tCO2 for discount rates of 1..10%

On average, consumers expect a payback time for cars of 1.5-2.5 years (Greene, 2011)

➔ equivalent to >30% discount rate over 10 years lifetime

➔ Almost impossible to shift technology choices via energy/CO2 prices (future costs) for those consumers that have such high discount rates

Enabling policy instruments can address impeding factors & facilitate the ESR transformation

Impeding factors

- ⊗ Uncertainty about future CO₂ prices
- ⊗ Principal-agent problem
- ⊗ No skilled workers
- ⊗ Chicken and egg: infrastructure
- ⊗ Status quo bias
- ⊗ High discount rates of consumers

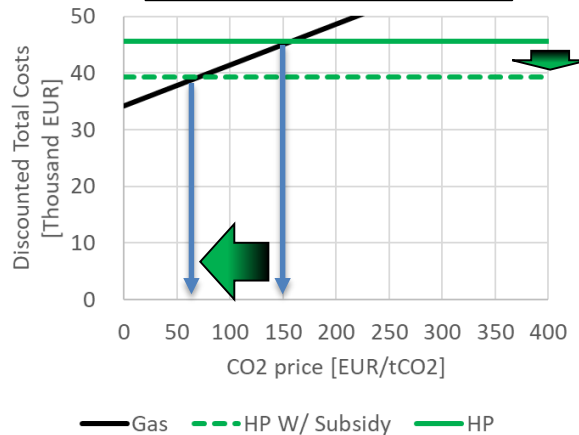
Can be addressed by e.g.

- ⊗ Floor price for ESR sectors of ~200€/tCO₂
- ⊗ Tightening vehicle CO₂ emission standards
- ⊗ Buildings standards, phase-out fossil boilers
- ⊗ Support & requirements for training
- ⊗ State-organized infrastructure buildup
- ⊗ Initial technology support to create market and reduce fears
- ⊗ Efficiency standards,
- ⊗ Subsidies on investment / Feebate systems

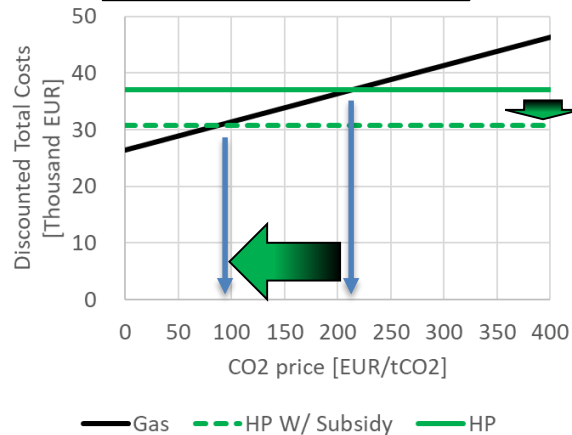
Exemplary calculation – heat pump vs gas

Total system costs for a single family home, partially renovated, JAZ 3, emission-free electricity
Including a 35% investment subsidy for heat pumps

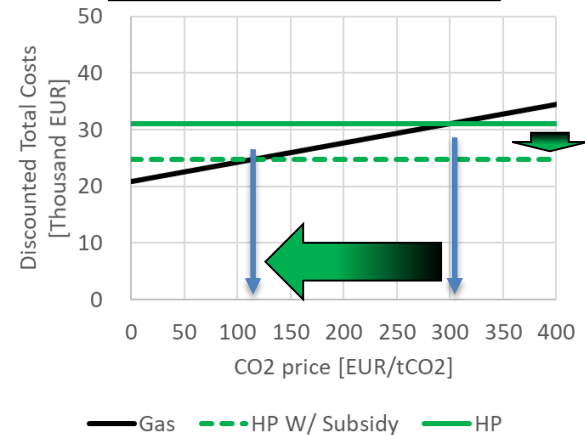
1% discount rate



5% discount rate



10% discount rate



- Investment subsidy/fee-bate system is much more robust against consumer myopia / high discount rates. Investment subsidy reduces range from 150..300 to 60..120€/tCO2
- Remove technology options: Given expected scarcity of hydrogen & biogas, forbid new gas boilers

Two levers to reduce pressure in ESR sectors

1. Shift part of the burden to ETS

Additional reductions in ESR

2030-Target EU: -55%

ESR -40%: **280** (range: 250-410) €/tCO₂

ETS -61%: **130** (range: 95-210) €/tCO₂

Additional
reductions split
like current split

Middle road

ESR -35%: **195** (range: 140-255) €/tCO₂

ETS -67%: **190** (range: 125-255) €/tCO₂

2030-Target EU: -40%

ESR -30%:

ETS -43%:

Additional
reductions all in ETS

ESR -30%: **155** (range: 100-220) €/tCO₂

ETS -73%: **200** (range: 140-320) €/tCO₂

Additional Reductions in ETS

Two levers to reduce pressure in ESR sectors

1. Shift part of the burden to ETS
2. Reduce barriers via additional policies

2030-Target EU: -55%

ESR -40%: **280** (range: 250-410) €/tCO₂

ETS -61%: **130** (range: 95-210) €/tCO₂

Additional
reductions split
like current split

1. Final Energy efficiency target
2. Car performance standards
3. Renewable energy requirements

2030-Target EU: -40%

ESR -30%:

ETS -43%:

Additional Reductions in ETS

Additional FitFor55 policy updates analyzed

Preliminary results – do not cite

Efficiency target (final energy level)

- ⦿ Reduces ESR price from ~280 €/tCO₂ to ~240 €/tCO₂

Car performance standards

- ⦿ No direct effect (cost-efficient to have BEV sales shares > 70% in 2030)
- ⦿ When assuming effect on manufacturers to accelerate investment into BEV production earlier: Reduces ESR price from ~240 €/tCO₂ to 190 €/tCO₂
- ⦿ The 100% target in 2035 can safeguard against stranded investments by manufacturers

Renewable energy targets

- ⦿ No direct effect (climate target requires higher RES use anyway)
- ⦿ Acts as robust safeguard against slower scale-up

The need for social recompensation

- ⊗ Carbon prices ALONE will surely increase energy expenditures for many poor people, as they have the least capacity to shift to emission-free alternatives
- ⊗ Reducing carbon prices – as proposed by some Member States – will do little against energy price crisis due to the much larger gas price spike
- ➔ go to the root of the problem: address poverty, instead of making climate policies weaker and risking the 2030 targets
- ➔ Many studies show that revenues from carbon pricing can make carbon pricing progressive, eg via lump-sum returns

Conclusions

1. To achieve FitFor55 emission targets mainly via CO₂ prices, they need to reach ~**130** €/tCO₂ in the **EU-ETS** in 2030, ~**280** €/tCO₂ in **ESR sectors** in 2030
2. At such ETS prices, the power sector would fundamentally transform by 2030: EU-wide **coal phaseout** & **gas-based power generation** reduced by **>50%**
3. **Impeding factors** can slow the transformation and increase the CO₂ prices necessary to achieve reduction targets – **especially in ESR sectors**
4. **Enabling policy instruments** can address impeding factors, **increase the effect** of **CO₂ prices** and thereby facilitate the transformation
5. FitFor55 **enabling policies** increase **robustness** and potentially **effectiveness**, might **need to be more ambitious** in order **to reduce CO₂ prices**
6. **Shifting** part of the **ESR reduction burden to ETS** can reduce the 2030 challenge
7. It is paramount to stabilize the **expectation of high CO₂ prices** in 2030 and beyond, e.g. by setting a **floor price of 100 (ETS) or 200 (ESR) €/tCO₂** in 2030

Thank you

Results published in:

Pietzcker, R.C., Osorio, S., Rodrigues, R., 2021. Tightening EU ETS targets in line with the European Green Deal: Impacts on the decarbonization of the EU power sector. Applied Energy 293, 116914.
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