Cost assessment of achieving BREF emission limits – an example of poorly designed environmental regulation

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Regulatory context

- July 2017 – new emission limits for large combustion plants (applied from August 2021)
  - Best available techniques (BAT)
  - Coal-burning plants invested to comply with the IED
- Current technologies mostly not efficient to achieve BAT
- Lawsuits against the European Commission

- **Wrong perception about the situation of coal-burning plants**

BAT emission limits

Pollutant	Size (MW)	IED (mg/Nm^3)	BAT – upper bound (mg/Nm^3)
NO_x	50-100	300	270
	100-300	200	200
	>300 (FBC boiler)	200	175
	>300 (PC boiler)	200	150
SO_2	50-100	400	360
	100-300	250	200
	>300 (FBC boiler)	200	180
	>300 (PC boiler)	200	130
PM	50-100	30	18
	100-300	25	14
	300-1,000	20	12
	>1,000	20	8

Derogations (Article 15 of the IED)

- Justified by disproportional costs
- Cost benchmark → the highest level of marginal costs that the plants can be required to spend
- **No unified methodology** → different approach in each EU member state
  - → Development of a methodological Framework in the Czech Republic
- **Unrealistic cost estimates**
  - → Cost analysis based on detalied microeconomic data

Differences among countries

- **2018 state:**
- 14 out of 22 had a methodology in place
- Most countries consider costs of implementation and operation of new technologies
- Labour costs, insurance and other factors considered less frequently
- Lower emissions to air and water considered as benefits
- Odour, noise or waste generation less often

Assessing proportionality

- Only 5 member states had proper guidelines
- Various approaches:
- Benefit/cost ratio (0.7; 0.75)
- Scenarios
- Point system

- Costs mostly compared to benefits (external costs)
- Czech methodology compares costs to previous spending

Cost estimates of pollutant abatement

Table 1
Overview of average and marginal costs of capturing a metric tonne of SO_2 and NO_x, from available relevant studies (in 2019 $).

Study	SO_2	NO_x	Country	Years
Boyd et al. (1996) [a]	60/1,358/21,248	–	USA	1994
Cofala et al. (2004)	1,156	–	Asia	2001
Coggins and Swinton (1996)	534	–	USA	1990–1992
Färe et al. (2005)	2,930–4,028	–	USA	1993, 1997
Fowlie et al. (2008) [b]	–	865/2,020/3,463/6,637	USA	2005, 2008
Jiang and Nolan (2000)	728–817	–	USA	2000
Karvosenoja and Johansson (2003)	1,248–1,694	–	Finland	2002
Keeth et al. (1992)	920–3,563	–	USA	1991
Lee et al. (2002)	5,557	31,721	Korea	1990–1995
Lee and Zhou (2015)	1,564–8,314	7,253–39,193	USA	1990–2010
Mekaroonreung and Johnson (2012)	542–2,152	3,910–39,951	USA	2000–2008
Rezek and Campbell (2007)	210–738	1,657	USA	1998
Singh and Rao (2015)	2,074–2,603	10,747–15,143	India	2014
Sun et al. (2014)	2,349–4,077	6,495–7,662	China	2012
Turner (1995)	260/2,535/34,726	2,149	USA	1985–1987
Vijay et al. (2010)	–	304/745/1,219/2,166	USA	2004

Source: Analysis of the cited papers.

[a] Marginal costs at different levels of captured emissions (first metric tonnes; median; last metric tonnes).

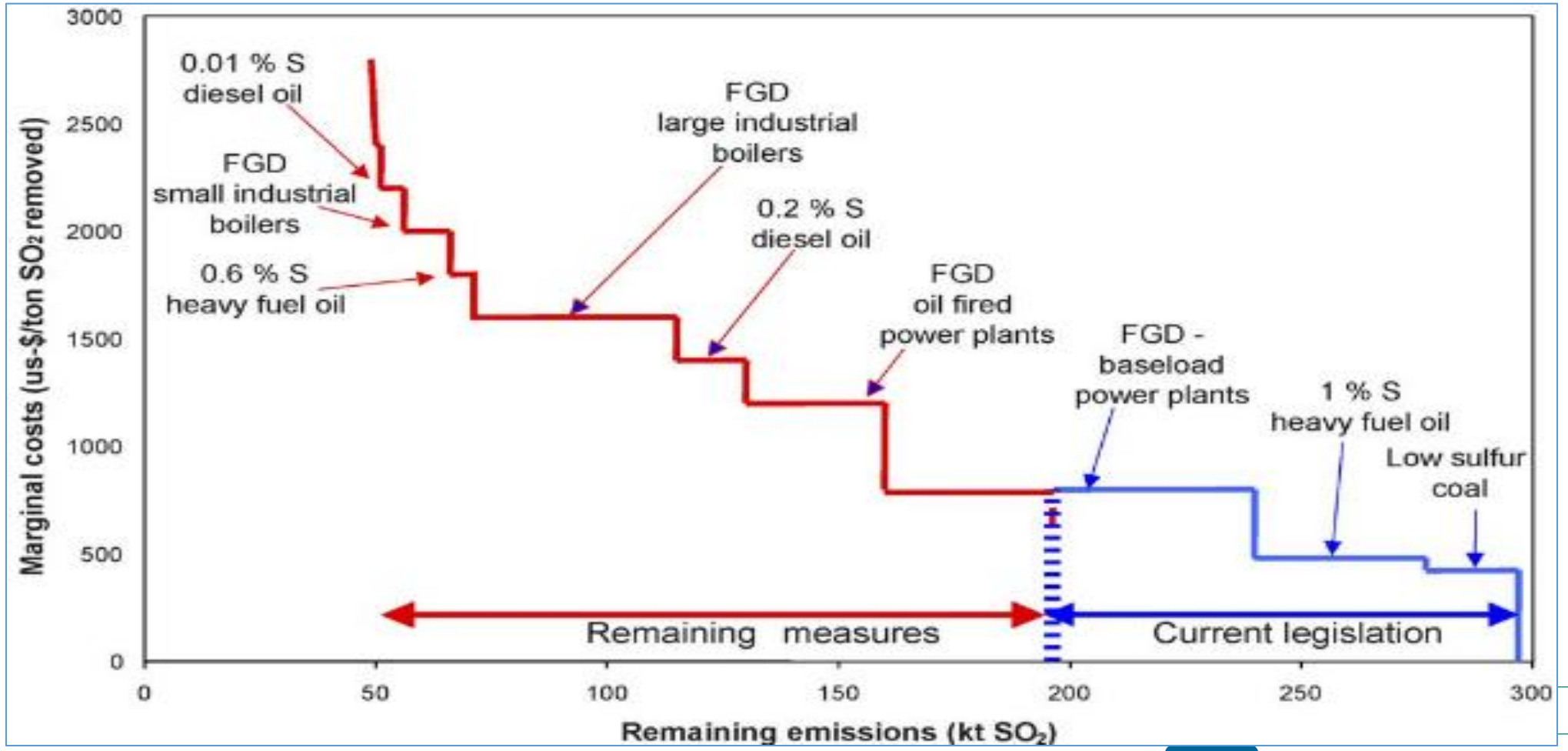
[b] Marginal costs at different levels of captured emissions (25%; 50%; 75%; ~100%).

Reasons behind inconsistent estimates

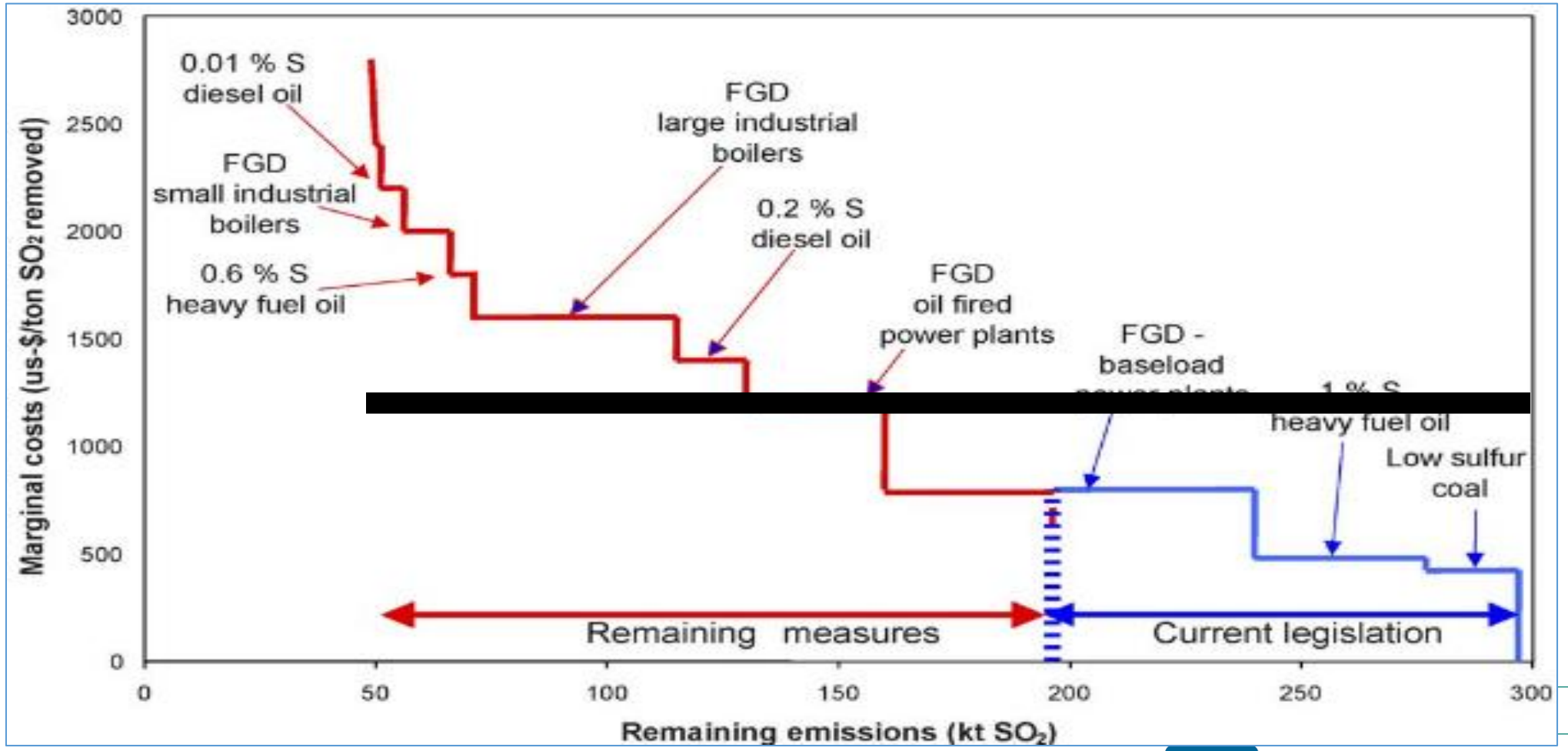
- Costs per tonne/MWe
- Marginal vs. Average cost
- Unknown initial and final emission concentrations
- Unknown assumptions about technologies (currently installed)
- Unknown utilization of installed capacity
- Inadequate data collection (models)

- **The conditions do not correspond to the situation of EU power plants after the introduction of BAT**

Marginal abatement costs



Marginal abatement costs



Need for new cost estimates

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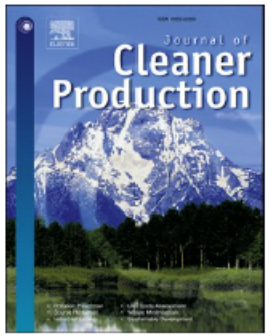

Check for updates

Costs of achieving emission limits in coal-burning power plants under the recent best available techniques regulation amendment: Evidence from national microeconomic data

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Data

- Half of Czech installed capacity (above 50 MW)
- Semi-structured interviews

- Currently installed technologies + further potential
- Current regulation (derogation schemes)
- Ease of meeting stricter emission limits
- Impact of emission reduction on installed capacity and production
- Innovation cycles of individual technologies
- Spatial possibilities
- Costs of meeting current and BAT emission targets

Costs

- Average costs between significant modifications to technology

- Yearly depreciation of the newly installed technologies
- Associated energy costs
- Associated costs of material
- Increased labour costs
- Fixed costs (e.g., insurance costs, licence fees, administrative costs, overheads)
- Indirect costs such as losses due to changes to the production and installed capacity
- Taxes and subsidies
- Costs associated with compensatory measures,[2] if such measures are allowed
- Prevented costs (e.g., lower need to purchase emission allowances; lower costs of maintenance or monitoring; lower costs of labour, material, energy etc.)

Methodology

- Comparison of past expenditures with future expenditures

- 3 scenarios
- Meeting current emission limits
- Reasonable technology modification (may not achieve BAT limits)
- Technology replacement (always achieves BAT limits)

Results (€)

Pollutant	Reasonable technology modification	Technology replacement	European Commission estimate
NO_x	Up to 9,800	35,300-390,000	1,500-2,500
SO_2	Up to 2,160	Up to 11,800	600-1,150
PM	Up to 7,850	40,000 up to hundreds of thousands	

- Reasonable modification significantly more expensive than the EU estimate
- Technology replacement cost larger by an order of magnitude

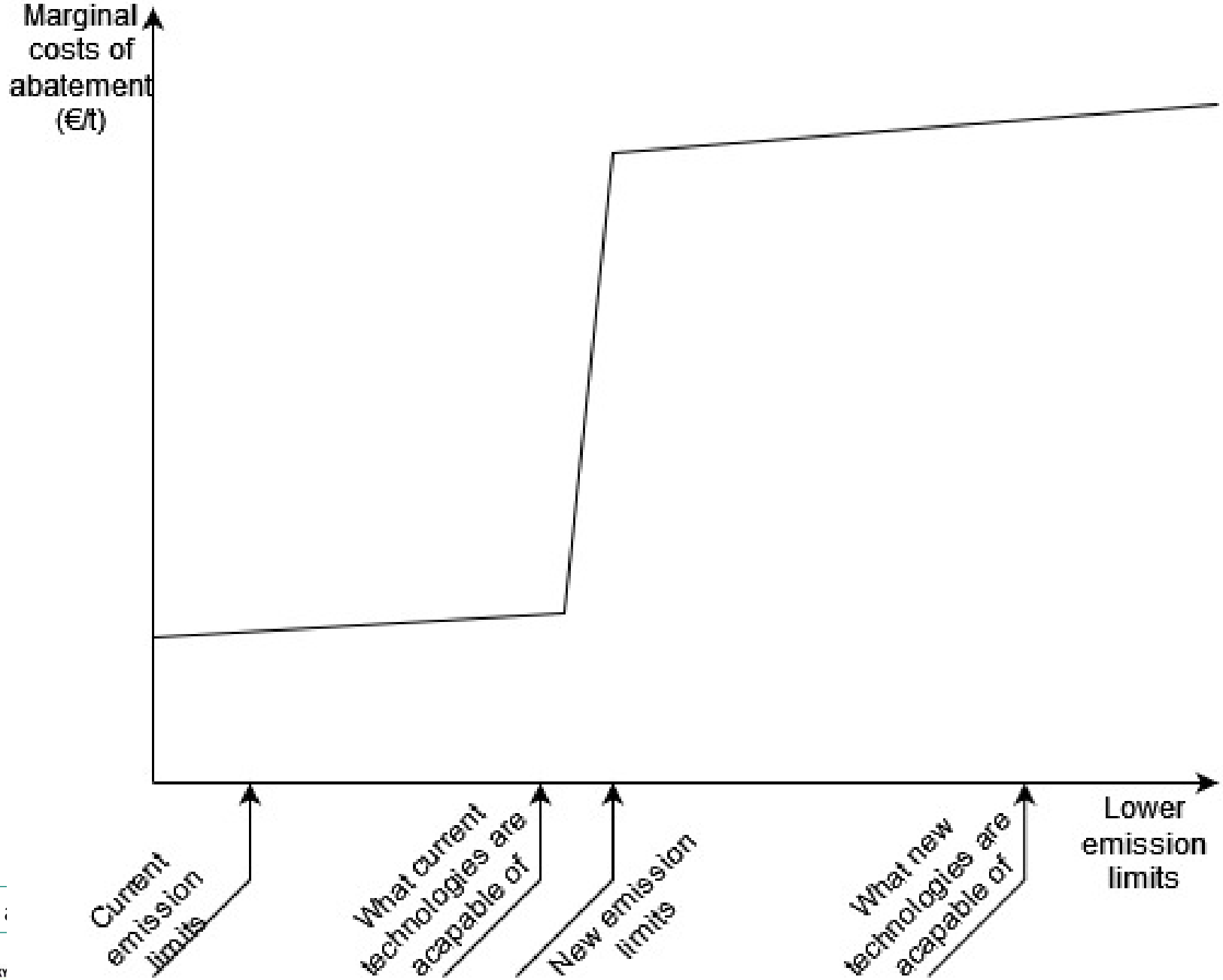
National impact of the regulation (€)

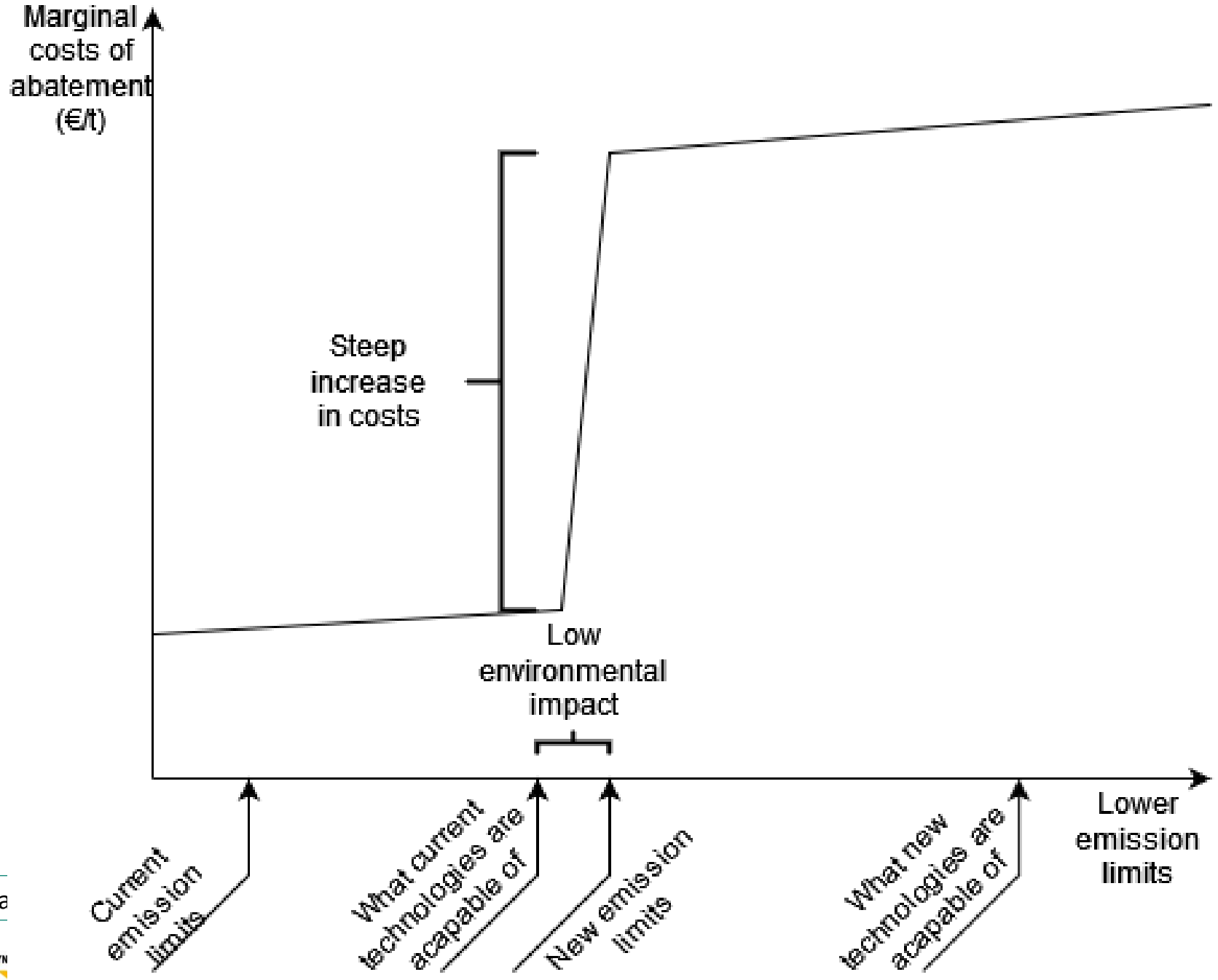
Pollutant	Emissions captured	Reasonable modification	Technology replacement
NO_x	3,878	38 mil.	137 mil.
SO_2	11,027	29 mil.	130 mil.
PM	412	3 mil.	16 mil.
Total		**70 mil.**	**283 mil.**

- Lower bound estimate
- Upper bound emission limit
- No mercury and other pollutants
- Only direct costs of regulation included (60%)
- Threat of closure → costs of capacity replacement

Findings

- The regulation does not respect investment cycle
- It is insufficient to only model cost estimates
- Improper setting of the emission limits
- Less strict emission limits → negligible environmental impact and significiantly lower costs
- Significantly stricter emission limits → large investments justified by large environmental impact
- Derogations → more pollution?


Marginal costs of abatement (€/t)
Current emission limits
What current technologies are acapable of
New emission limits
What new technologies are acapable of
Lower emission limits


Marginal costs of abatement (€/t)
Steep increase in costs
Low environmental impact
Lower emission limits
Current emission limits
What current technologies are acapable of
New emission limits
What new technologies are acapable of

Thank you for your attention!

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