



POTSDAM INSTITUTE FOR  
CLIMATE IMPACT RESEARCH

# Embedding Germany's coal phase out in the EU's emission trading scheme

## National carbon price floors and managing the waterbed effect

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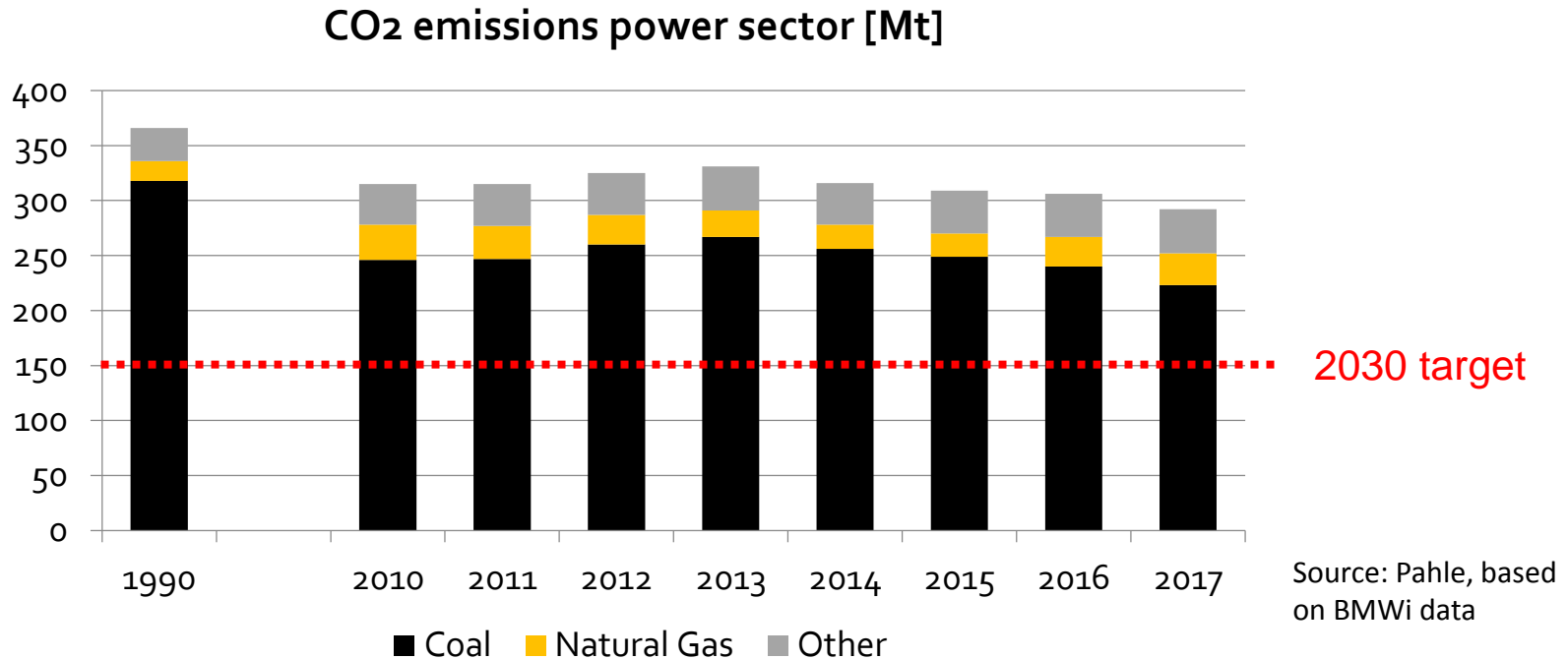
Strommarkttreffen 16.11.2018

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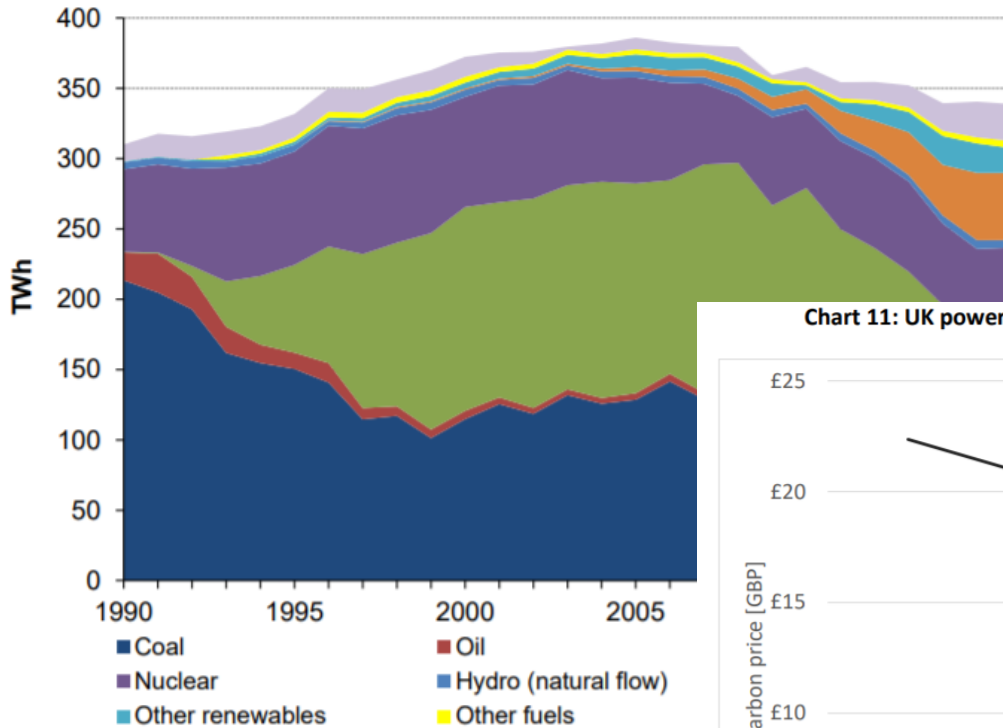
# Motivation (I)



- “Coal” Commission tasked to propose measures to achieve the 2030 climate target
- Alternative: carbon price floor (carbon support price)

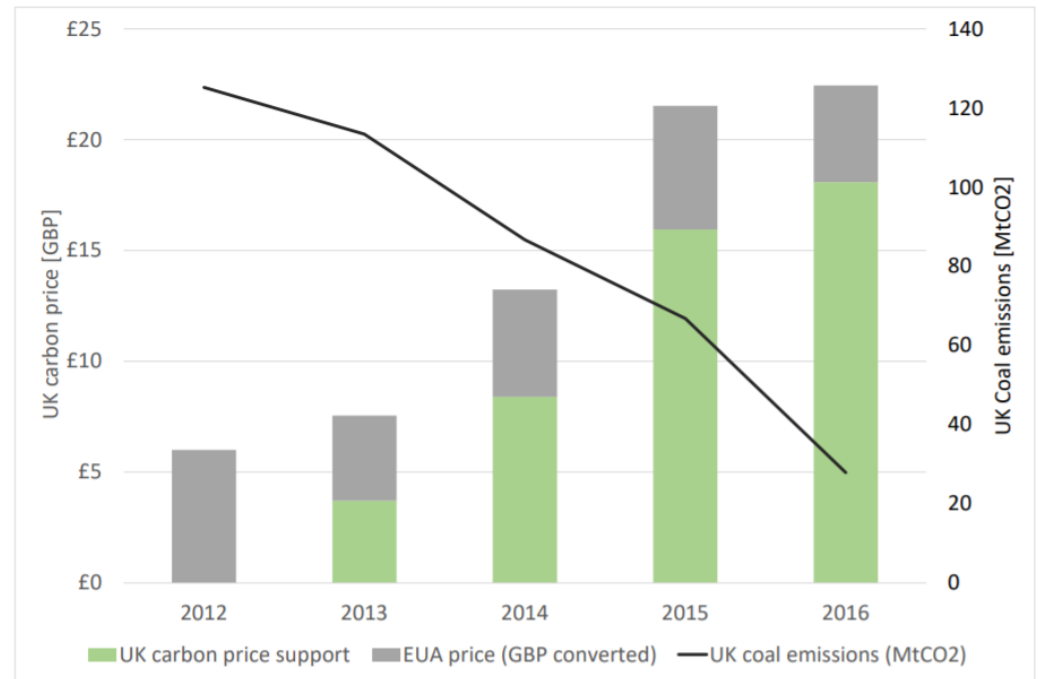
# Motivation (II): The UK case

## Electricity supplied by fuel type, 1990 to 2016



Source: Sandbag, 2017

Chart 11: UK power sector carbon prices and emissions from generation using coal



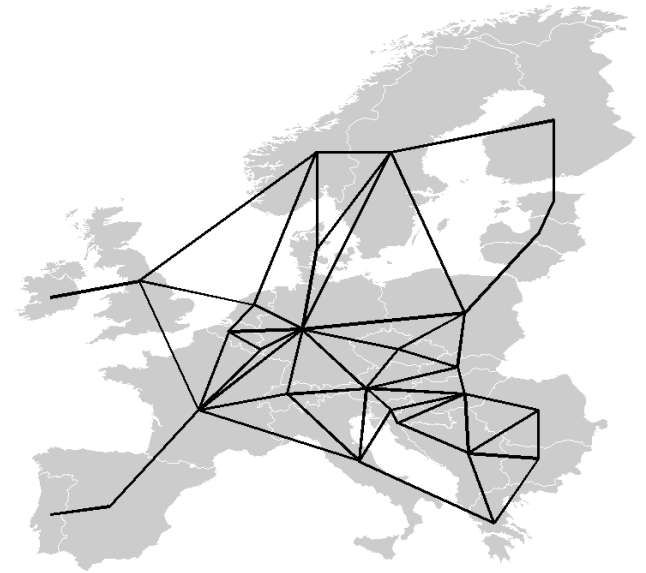
Source: Department for Business, Energy & Industrial Strategy, 2017

# Outline

- **Motivation**
- **Methodology**
- **Results**
  - **Price needed for Germany to reach target 2030**
  - **Waterbed effect from carbon price floor**
  - **Certificates to be cancelled**
- **Conclusion**
- **References**

# Methodology (I): LIMES in a nutshell

- Linear optimization model
- Minimizing the cumulated costs of electricity supply
- Temporal resolution:
  - From 2010 to 2050 in 5-year steps
  - 6 representative days per year
  - 8 time slices per day
  - Perfect foresight
- Geographical scope: Europe (29 model regions)
  - EU (w/o MT and CY) + CH + NO + aggregated Balkan
- 33 generation and storage technologies



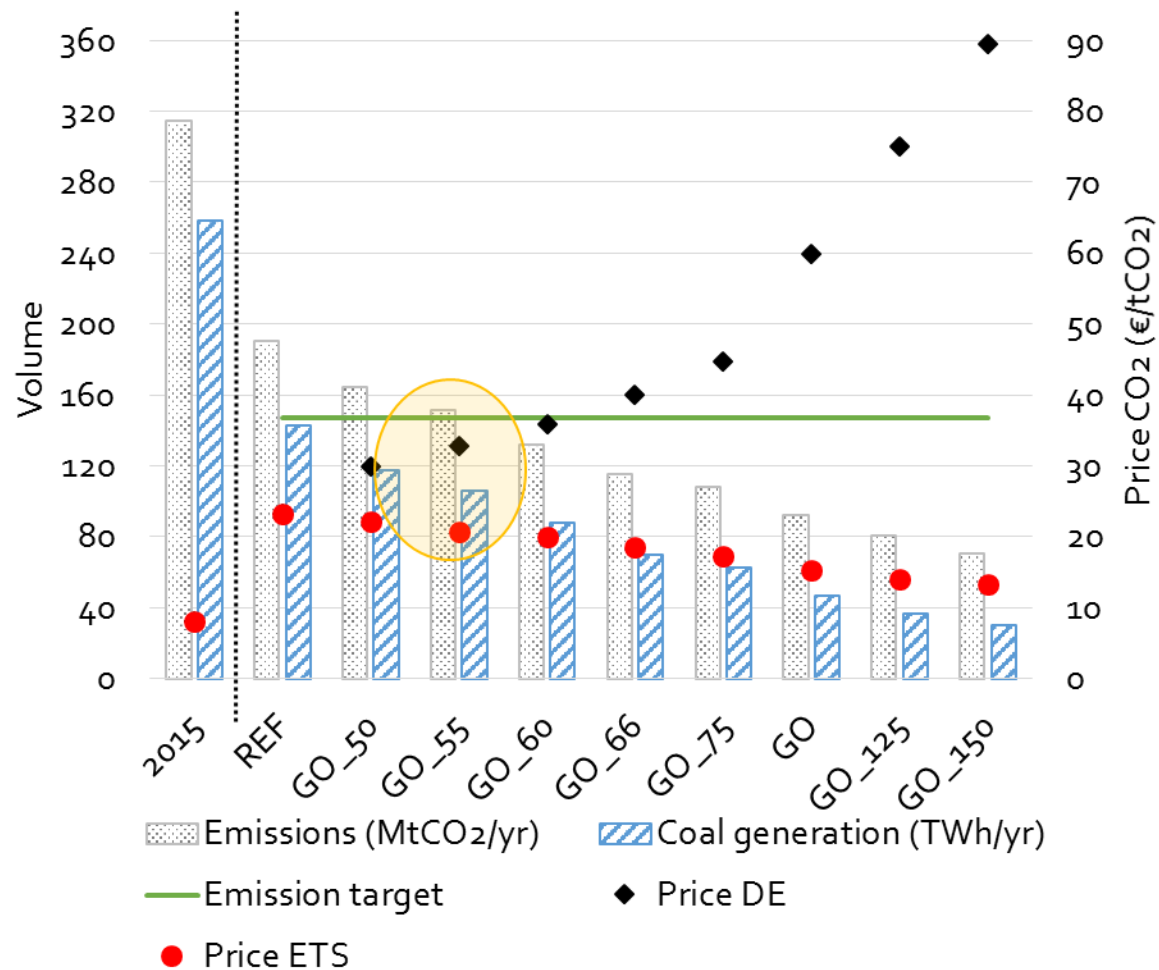
# Scenario setup

1. Target Germany 2030: Carbon price floor: from 30 €/tCO<sub>2</sub> in 2020 to 120 €/tCO<sub>2</sub> in 2050 (different scenarios: 50% to 150)
2. Waterbed effect: Countries implementing a carbon price floor (from 30 €/tCO<sub>2</sub> in 2020 to 120 €/tCO<sub>2</sub> in 2050)

Scenario name	Countries
Reference ( <i>REF</i> )	--
Germany only ( <i>GO</i> )	DE
Climate Coalition ( <i>CC</i> )	Nordic, Benelux, GB, IE, DE, AT, CH, FR, IT, PT
All member states ( <i>AMS</i> )	EU ETS + CH

# Results (I): Impact of different carbon price floors in Germany (only)

- Price needed: 33 €/tCO<sub>2</sub>
- Carbon price support: 12 €/tCO<sub>2</sub>
- Germany becomes net importer -> waterbed effect "in space"



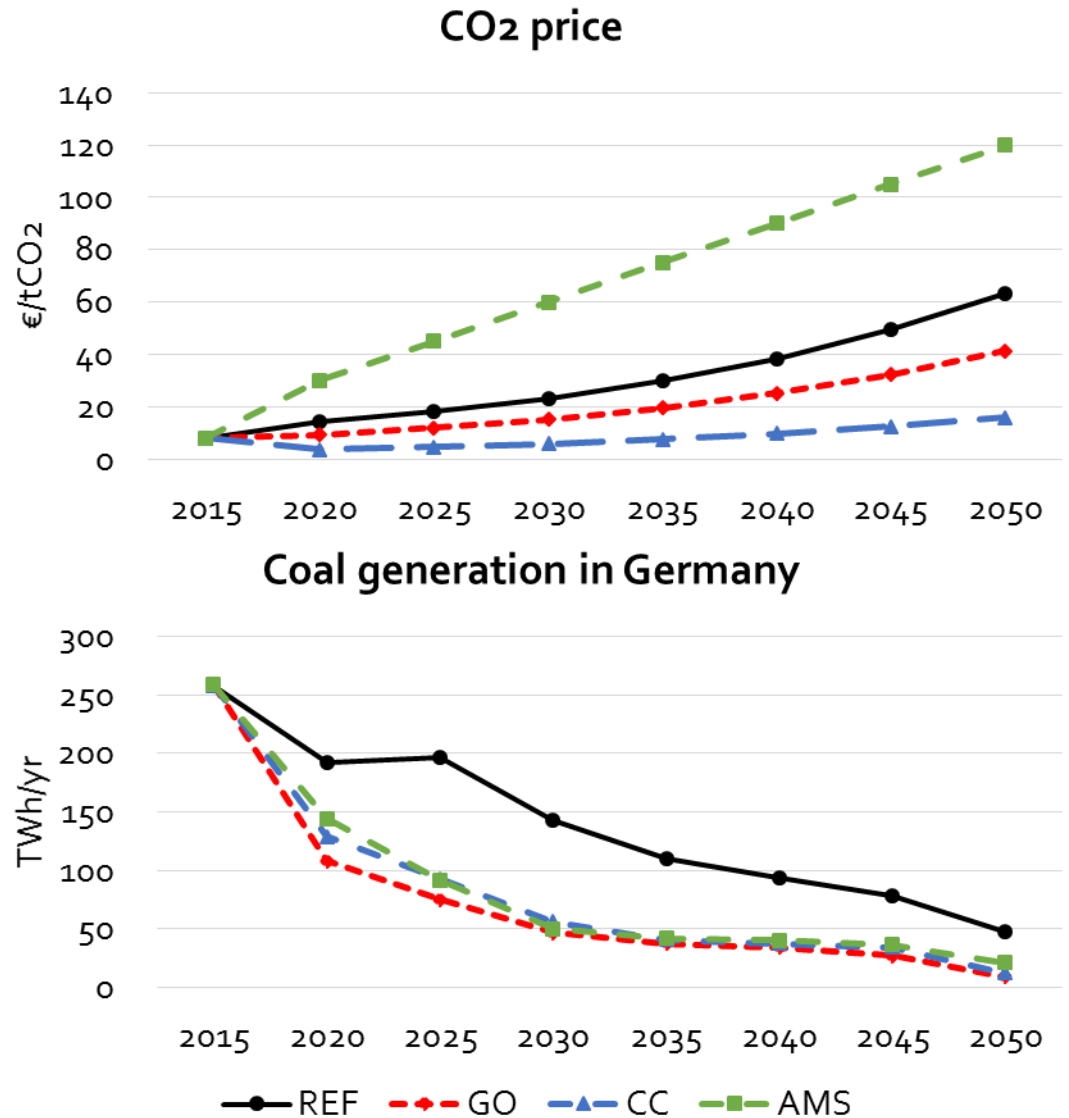
# Sensitivity analysis

Scenario	Effective price Germany (€/tCO <sub>2</sub> )	ETS price (€/tCO <sub>2</sub> )	Carbon price support (€/tCO <sub>2</sub> )
High budget (17.6 GtCO <sub>2</sub> )	32	15	17
Low budget (14.4 GtCO <sub>2</sub> )	34	28	6
Low fossil prices	35	26	9
High fossil prices	36	19	16
Low gas prices/high coal prices	34	23	11
High gas prices/low coal prices	38	21	16
Cheap vRES	25	12	13
Expensive vRES	41	27	14
CC with default price	38	11	27
Transmission fixed to 2015 NTCs	44	26	17
All bad	57	30	27
All good	25	9	16



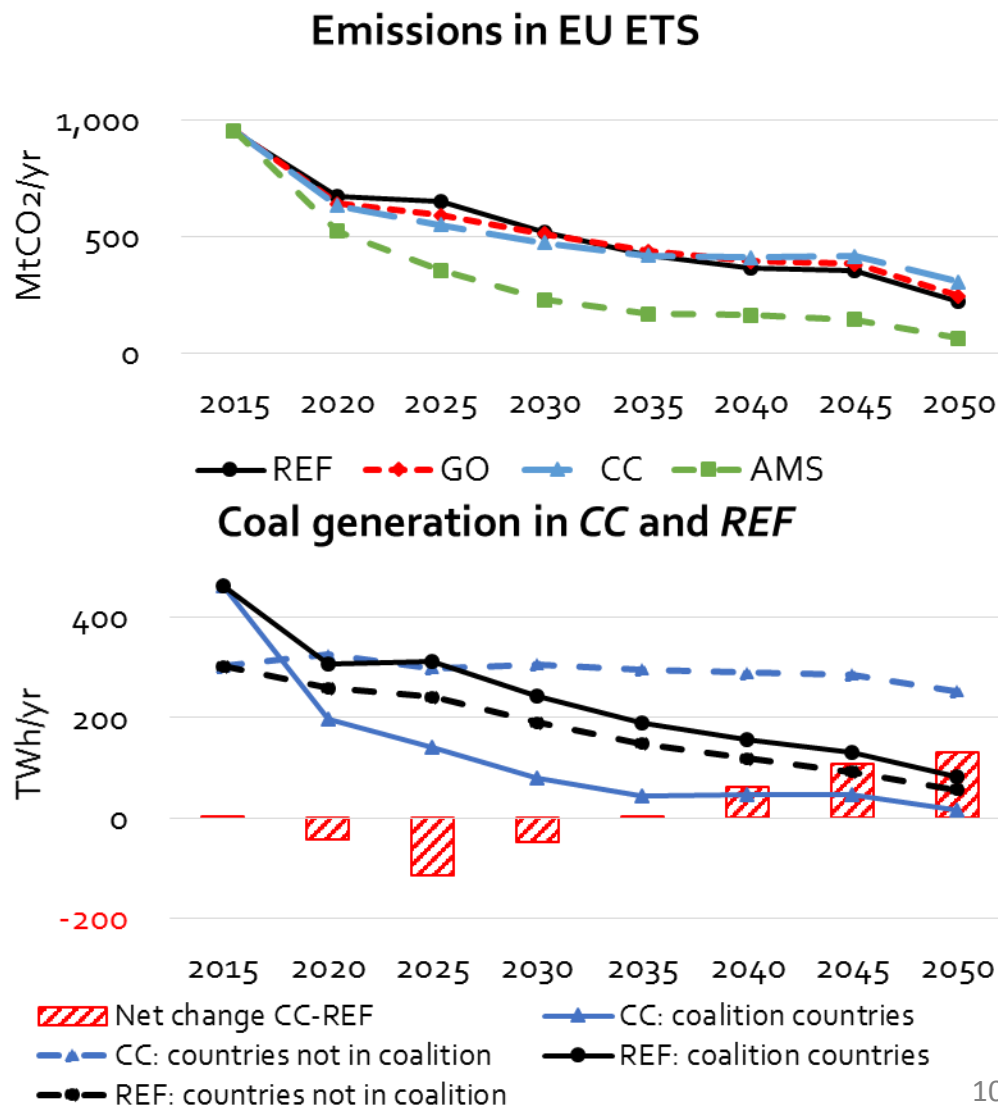
# Results (II): What if Germany is not alone?

- Medium-term German coal generation higher in larger coalitions
- Emissions (not shown) follow the same pattern of coal generation



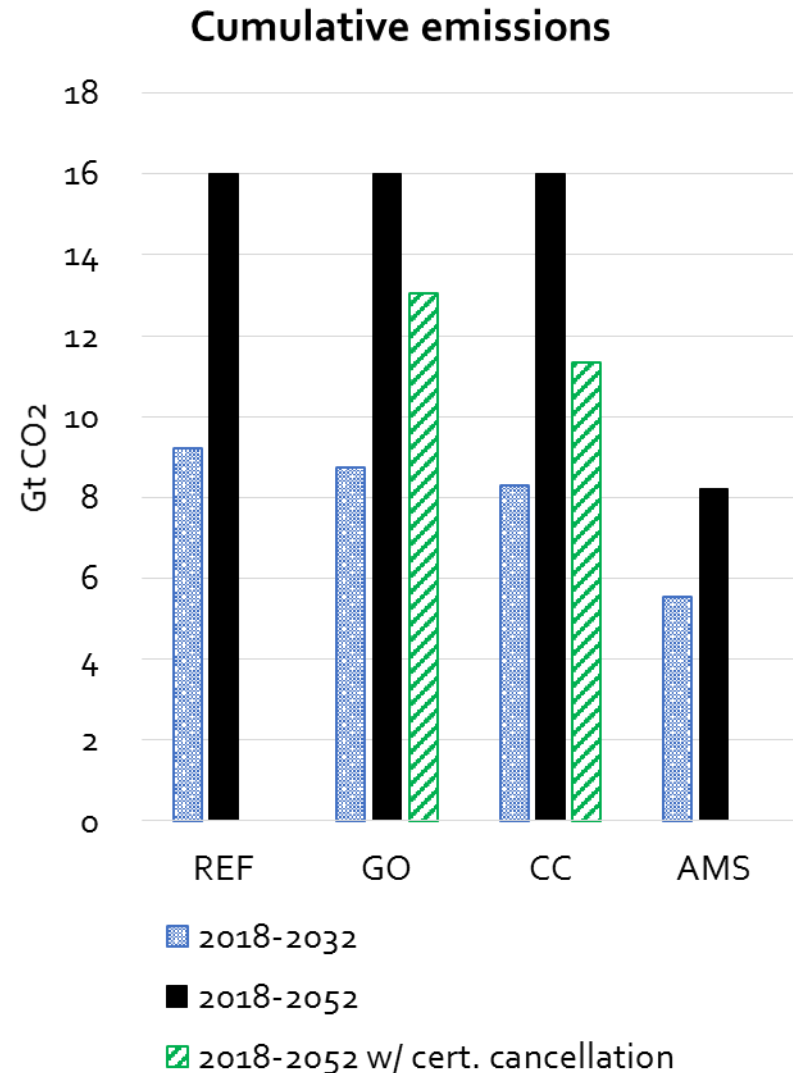
# Results (III): Impact of different coalitions on emissions in the EU ETS

- Medium-term: The larger the coalition, the larger the drop of emissions
- Long-term: rebound effect -> carbon leakage (emissions in CC higher than in REF after 2035)



# Results (IV): Temporal waterbed effect (without MSR)

- Effect of the carbon price floor on emissions varies over time:
  - Medium-term: 0.5 GtCO<sub>2</sub> (0.9 GtCO<sub>2</sub>) lower in *GO* (*CC*)
  - Long-term : Full waterbed effect except when all EU ETS involved
- A solution: Cancellation required up to 3 GtCO<sub>2</sub> (4.7 GtCO<sub>2</sub>) in *GO* (*CC*)



# Results (V): Impact of the MSR

3 main actions: withholding (bank > 833 MtCO<sub>2</sub>), backloading (bank < 400 MtCO<sub>2</sub>) and cancellation (MSR > auction)

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	SUM
<b>Summarized results from Burtraw et al. (2018)</b>														
Baseline Emissions	1,754	1,684	1,639	1,656	1,627	1,565	1,590	1,501	1,501	1,464	1,414	1,370	1,269	
Baseline cancellation		0	0	0	0	2,144	303	0	147	145	128	124	125	3,117
<b>Simulation based on LIMES-EU results – scenario where Germany implements a carbon floor price</b>														
Additional reductions	32	32	32	32	32	60	60	60	60	60	5	5	5	480
Resulting emissions	1,722	1,652	1,607	1,623	1,595	1,504	1,530	1,441	1,440	1,404	1,409	1,365	1,264	
Bank	1,765	1,446	1,316	1,116	1,186	1,093	1,172	1,203	1,165	1,142	1,089	1,060	1,100	
Intake into MSR	0	424	347	316	268	285	131	141	144	140	137	131	127	
Extra intake		250	1,300											
Cancellation	0	0	0	0	0	2,227	329	5	178	176	163	162	152	3,392
MSR level	0	674	2,321	2,637	2,904	962	764	899	866	830	804	773	748	

Change in DE: **-1339 MtCO<sub>2</sub>**; Increase in others: 860 MtCO<sub>2</sub> -> waterbed effect: 64%

Total change: **-480 MtCO<sub>2</sub>**

MSR cancellation: 275 (21% from required cancellation) -> waterbed effect: 44%

# Conclusion

- Climate target 2030 (147 MtCO<sub>2</sub>)
  - EU ETS not likely to deliver such reduction
  - Carbon price floor of 33 €/tCO<sub>2</sub> required (worst case: 57 €/tCO<sub>2</sub>)
- The waterbed effect
  - Waterbed effect up to 2030: 64% -> MSR: 44%
  - Almost full waterbed effect in the long-term (91%)
- Strengthening national vs. EU policies? Cancellation crucial to align carbon price floor to EU ETS

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