

Enforcement of the North European SECA (and NECA)

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Health damage without the ECA

Shipping in the North Sea and Baltic Sea would cause 80-85 % of all health damage in Denmark from shipping.

Without the ECA (2.7 % sulphur)	Shipping on the Northern hemisphere		Shipping in the North Sea and Baltic Sea	
	DK	Europe	DK	Europe
Years of lost living	6,900	550,000	5,600	210,000
Airway diseases	430,500	30,800,000	360,600	11,795,000
Sick days (B-days)	660,000	49,000,000	560,000	18,750,000

Economic potentials of ECA

Without the ECA (2.7 % sulphur)	Europe (billion euro)			Total (billion euro)
	SO ₂	NO _x	PM _{2.5}	
Health costs related to air pollution from shipping:				
Northern hemisphere	27	28	4.6	60
North Sea and Baltic Sea	9.5	10	0.7	20

2017: Cost-benefit of the SECA

- **Health costs** of SO₂ in the SECA: 20 \$ per kg
- **Removal costs** (replacing 2.7 % S fuel with 0.1 % S fuel):
(470\$ - 300 \$) / 52 kg SO₂ = 3,3 \$ per kg
- Every time society invests 3.3 \$ in 0.1 % S fuel instead of 2.7 % S fuel society saves (= earns) 17 \$ from less health damage – this is a very positive business case !!!

The SECA challenge

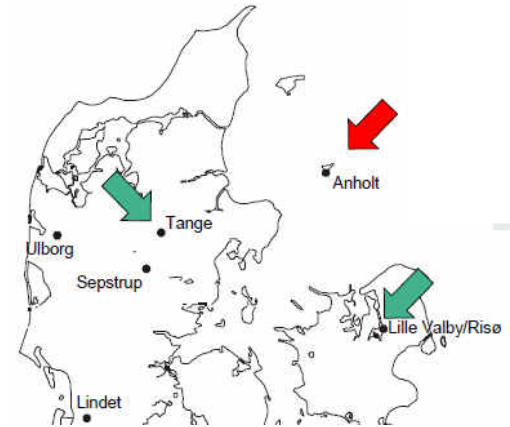
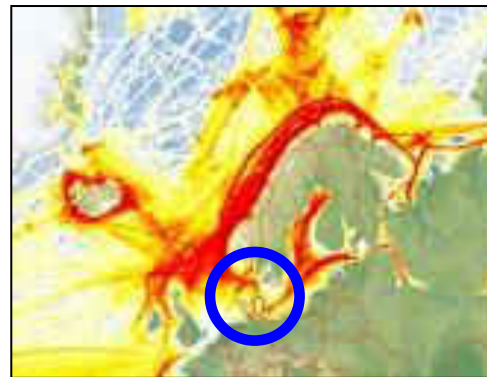
- A large ship can save about **1,000 \$** per hour by not being in compliance.
- The potential saving is **100,000 \$** by not being in compliance (English channel to Gdansk and back).
- **Giving shipowners 100,000 reasons to cheat !**
- Only way to avoid cheating is by efficient enforcement: Control and sanctions must make cheating a very bad business case.

Danish SECA enforcement

- Mandatory port state control (inspections/fuel samples).
- “Sniffers” controlling ship emissions from bridges.
- Airplanes randomly controlling emissions from ships.
- International cooperation on enforcement.
- The first violators are now taken to court.

The SECA is a success

- Control shows > 98 % compliance if accepting late fuel switch and < 0.3 % S fuel as compliance.
- The measured drop in sulphur air pollution indicates more than 95 % compliance.



SECA: Effects of 2015 limit	Anholt	Risø	Tange
Mean 2011-14, 1 % S ($\mu\text{g S}/\text{m}^3$)	0.33	0.34	0.22
Mean 2015-16, 0.1 % S ($\mu\text{g S}/\text{m}^3$)	0.13	0.17	0.10
Reduction ($\mu\text{g S}/\text{m}^3$)	0.20	0.17	0.12
Reduction (%)	60 %	50 %	55 %

Future control: CEMS / EC

S-control by CEMS: Continuous Emission Monitoring Systems
Measuring devices for SO₂/CO₂ are mandatory for all ships with scrubbers (to prove the efficiency).

- Price: About 50,000 \$ - online measuring data.
- Device is sealed in the chimney to avoid manipulation.
- It would be very efficient control to require CEMS on all ships in SECA ... and on a global level from 2020.

NO_x-control by EC (and CEMS): Engine Control

- Engine data controlled by independent approved authority.
- Could be combined with some kind of CEMS in the future.

Conclusion

- Reduced air pollution from shipping in ECAs provides people longer and healthier lives and benefits society from an economical point of view.
- Successful enforcement is needed to realize the health benefits ... and to allow shipowners to pass on extra fuel costs to cargo owners.
- Denmark has measured large reductions in sulphur pollution due to the SECA and look forward to NO_x reductions when the NECA is fully implemented.

Questions

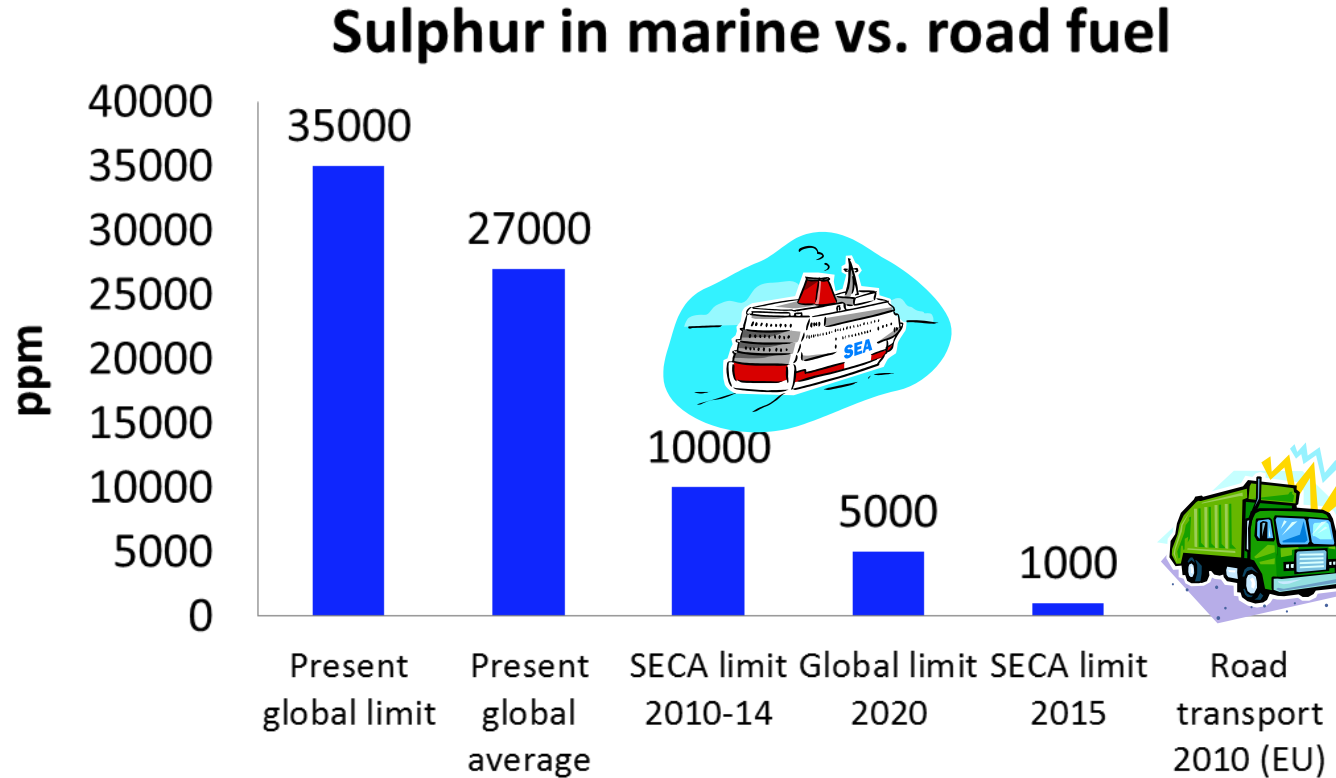
Our work related to shipping is funded by:



The polluter pays principle

- Using 1 ton bunker fuel in the Northern hemisphere emits about 54 kg SO₂, 70 kg NO_x and 1.5 kg PM_{2.5}.
- Health externalities 1,900 \$ per ton.
- Present price on bunker fuel: 300 \$ per ton.
- If shipping companies paid for health damage from air pollution then the price of bunker fuel would be 7 times higher than today + other externalities.
- **What would happen if shipping had to pay ?**

Is shipping regulated too strict ?



New trucks in EU have SCR & particulate filters !

Will regulation sink all ships ?

- If 0.1% S fuel, SCR and filters would double shipping costs.
- What would be the price increase on wine from New Zealand ?
- The price today is about 50 kr. Shipping costs is 0.5 kr. If the price on shipping doubles the wine will cost 50.62 kr (incl. 25 % VAT).
- Will I buy less wine ?



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How about Sirena Seaways

- Going from Esbjerg to UK since 1875.
- Now the route has been taken out ...



- Was this route taken out due to the new sulphur regulation as claimed by some interests ?
- Or was it the drop in passengers from 300,000 to 80,000 per year ... as a result of many low price flights and the stop of tax-free sale ...

Drop in Danish S-concentrations

Januar-maj	Anholt $\mu\text{g S/m}^3$	Risø $\mu\text{g S/m}^3$	Tange $\mu\text{g S/m}^3$
2011	0,35	0,34	0,27
2012	0,26	0,28	0,17
2013	0,29	0,31	0,17
2014	0,43	0,42	0,25
2015	0,14	0,18	0,10
2016	0,11	0,16	0,09
Middel 2011-2014	0,33	0,34	0,22
Middel 2015-2016	0,13	0,17	0,10
Faldet med ($\mu\text{g S/m}^3$)	0,21	0,17	0,12
Ændring %	62	50	56