Interreg Baltic Sea Region

Baltic Slurry Acidification

EUROPEAN UNION

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The policy framework and potential to implement slurry acidification in Europe

– conclusions from the Baltic Slurry Acidification project

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Overall conclusion

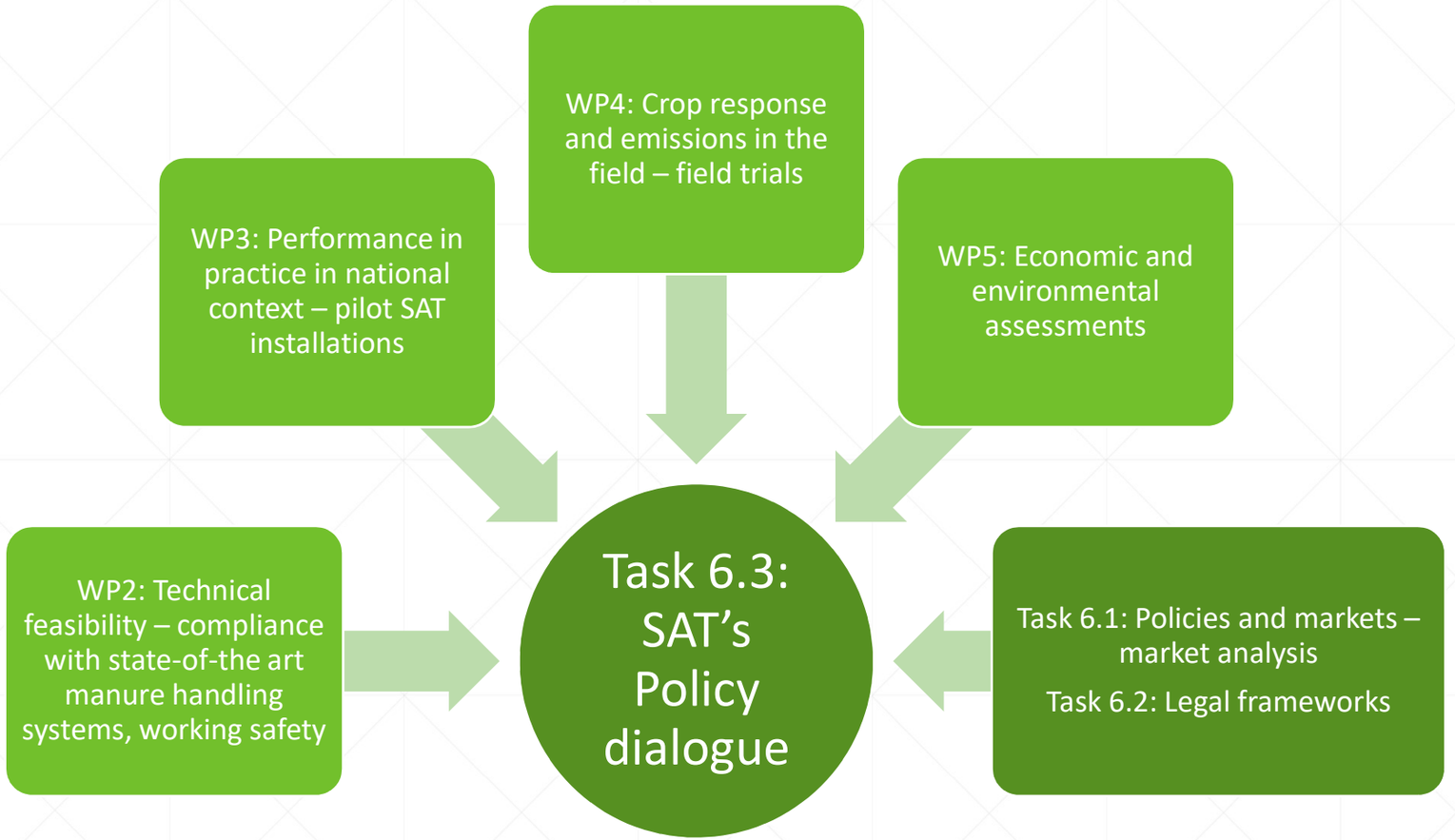
Slurry acidification technologies (SATs) have the potential to give a major lift to the economy and the environment in the Baltic Sea Region, and in the same time give substantial greenhouse gas emission reductions:

- Implementing the potential for use of SATs in the Baltic Sea Region countries would have a positive net economic effect of in total € 2.2 billion per year, to which come an estimated N abatement value of M€ 147 per year related to the aquatic environment, and positive healthcare sector effects in Russia and Belarus.
- For the entire region, the implementation of slurry acidification in accordance with the estimated, weighed potential of 245 million tonnes of slurry, would annually mean a reduced ammonia emission of 167.1 Kt, and as a result of this a reduced atmospheric N deposition of 56,000 – 91,000 tonnes. In addition, the greenhouse gas emission would be reduced with 1.5 Mt CO_{2e}.

THE OBJECTIVE

"Baltic Slurry Acidification aims to **promote the use of SATs** in the BSR. Acidification of slurry can significantly reduce the loss of nitrogen from the livestock housing, slurry storage or during field application depending on which SAT is applied. Reducing the loss of nitrogen will lead to increased nitrogen use efficiency from animal manure and this will increase the sustainability of livestock production. It will furthermore reduce the need for mineral nitrogen fertilisers and thereby increase the competitiveness of the farms."

The project has made a 360° examination of SAT's for the BSR and for the individual countries



SATs are innovative technologies, and for ensuring its implementation, our project is designed so it contain elements of a "triple helix":

- **Businesses** (farms, contractors, SAT suppliers) are represented in WP3
- **Research** is performed in WP2, WP4 and WP5
- **Authorities'** decided and current **legal frameworks** are analysed in WP6.

The legal framework for SATs

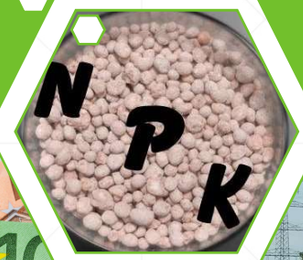
Demands for slurry injection

Relevant support schemes

Fertilisation restrictions

Demands for solid cover on slurry tanks

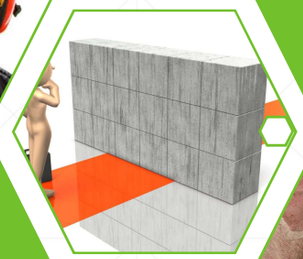
H_2SO_4 labour safety



H_2SO_4 storage and transport regulations

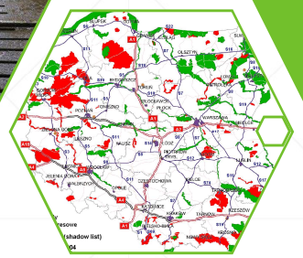
Other enablers or barriers?

Restricting stable design provisions



Role of ammonia in environmental permitting

Nitrogen sensitive areas



Ammonia emission reduction action plans

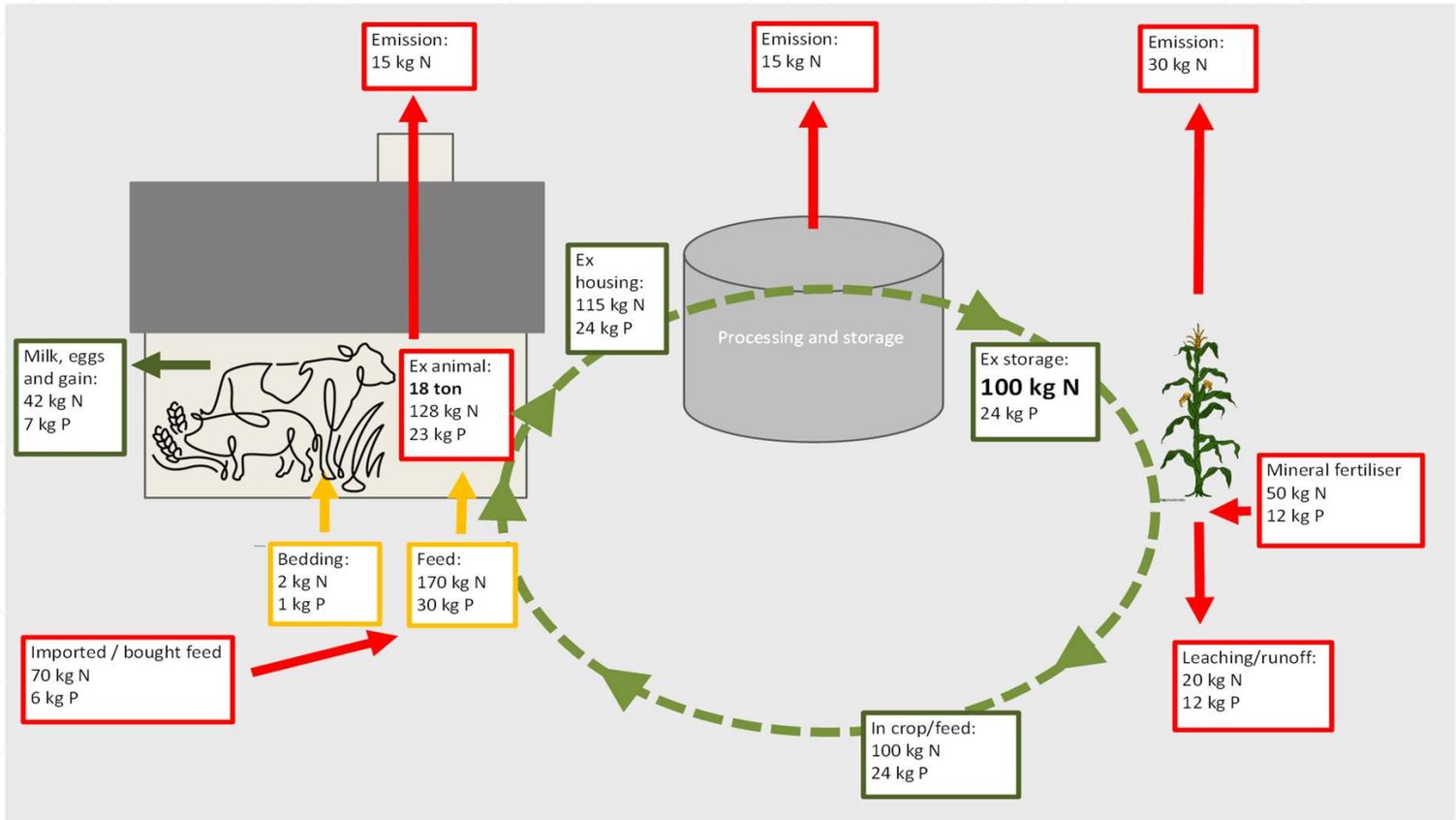
N reduction targets in water action plans

SAT specific key EU legal framework

- Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control). http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32010L0075
- Directive (EU) 2016/2284 of the European Parliament and of the Council of 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC (Text with EEA relevance). http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2016.344.01.0001.01.ENG&toc=OJ:L:2016:344:TOC
- European Commission, Joint Research Centre. 2017. Best Available Techniques (BAT) Reference Document for the Intensive Rearing of Poultry or Pigs (BREF). http://eippcb.jrc.ec.europa.eu/reference/BREF/IRPP/JRC107189_IRPP_Bref_2017_published.pdf
- European Commission. 2017. Commission Implementing Decision (EU) 2017/302 of 15 February 2017 establishing best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for the intensive rearing of poultry or pigs. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2017.043.01.0231.01.ENG
- UNECE. 1979. Convention on long-range transboundary air pollution. http://www.unece.org/fileadmin/DAM/env/lrtap/full%20text/1979.CLRTAP.e.pdf
- UNECE. 2017. European Agreement concerning the International Carriage of Dangerous Goods by Road. http://www.unece.org/trans/danger/publi/adr/adr2017/17contentse0.html

The legal framework is addressing pollution from livestock farming / manure

- As a rule of thumb: ***Currently, half of TAN in manure ex animal is emitted as ammonia in the manure handling chain.***
- Figures on the illustration are alone indications, while there are big variations between livestock types, housing systems, bedding types and productivity levels.



Slurry injection

- Legal requirements to injection is interesting because
  - spreading costs are about € 0.5 higher per ton slurry, compared to band-spreading;
  - band-spreading of acidified slurry has similar effects on ammonia emissions during spreading; and
  - it gives significant higher GHG emissions (both laughing gas and CO_2) than band-spread acidified slurry (Nørregaard Hansen, 2010).
- Denmark has the highest legal requirements to use of injection (used for about 15-20% of the slurry), which is legally equalised with band-spreading of acidified slurry.
- Finland (backed by subsidies), Germany (new fertilising regulation), and Sweden (special situations) has some limited requirements to use of injection.
- Estonia has the highest use of injection (about 60%), but it is not based on legal requirements.

Substantial environmental effects could be obtained from (higher) demands to use of slurry injection, and by equalising it with band-spread acidified slurry make it economically more acceptable for farmers, and resulting in even higher environmental effects. DK plans to increase demands dramatically (winter cereals).

Solid cover on slurry tanks

- Ammonia emissions from slurry tanks represents about 10-30% of all ammonia emissions from manure handling. In addition, there are considerable methane emissions from slurry tanks, and in specific in case of storing digestate.
- Solid cover on slurry tanks is the most effective way to prevent emissions from storage. However, solid covers will typically increase the price for the storage tank with 33-50%.
- Denmark has the highest legal requirements to use of solid cover on slurry tanks, which is legally equalised with storage of acidified slurry (in general meaning in-house acidification).
- Finland and Germany has some limited requirements to solid cover on slurry tanks.
- Apart form this, the general rule in the countries of the Baltic Sea Region is that farms should ensure a natural floating layer or similar (non-investment requiring measures).

Substantial effects on ammonia emissions as well as methane emissions could be obtained by introduction of (higher) demands to use of solid cover on slurry tanks. Farmers would have higher incentives to use in-house acidification in case this would be legally equalised with solid cover on slurry tanks.

Fertilisation restrictions

- Restrictive N fertilisation norms gives farms clear incentives to use practices and technologies that can enhance the Nutrient Use Efficiency of N in slurry (and other manures).
- Denmark had until 2016 the most restricted fertiliser norms in the Baltic Sea Region, requiring fertilisation to be between 10 and 24% under the economic optimum.
- Germany has with its new Fertilising Regulation of 2017 probably the most restricted fertilisation regulation in the BSR, among other saying that "Until 2020, the nitrogen balance for the last three years may not exceed 60 kg N / ha per year. From 2020, a balance of 50 kg nitrogen per hectare per year may not be exceeded."
- Especially Finland, and to some extent Sweden and Estonia has some restrictions on N fertilisation.
- Farmers in Lithuania, Latvia and Poland can in practice use as much N fertiliser as they like.

Farmers would have higher incentives to use SATs in case they are met with demands to respect certain fertiliser norms and in specific if there are set demands to farm nitrogen balances.

Other legal framework and enablers

- Outside Denmark, demands to ammonia emission reduction measures in environmental permitting of intensive livestock farms has limited scope in despite of the designation of nitrogen sensitive areas.
- Likewise, the Water Framework Directive has not outside Denmark led to actual N emission reduction goals. Country Allocated Reduction Targets (CARTs) that are established by HELCOM are largely considered as unimportant, not being sanctioned.
- There are not existing any “Restricting stable design provisions” in relation to use of SATs in any of the analysed countries.
- All countries have established regulations related with storage, labour safety and transport of sulphuric acid.
- None of the countries offers subsidies for use of SATs. Alone Sweden and Denmark gives subsidies for ammonia emission reduction technology (but the Danish can not be used for SATs).

Farms would be given incentives to use SATs in case environmental permitting was considering ammonia emissions to a higher degree, and in case subsidies for SATs use were available.

Current barriers

- Germany: The supplementary text to the *Ordinance on the handling of substances hazardous to water (Verordnung über Anlagen zum Umgang mit wassergefährdenden Stoffen, (AwSV))* clearly states: "... with the objective of the best possible protection of the waters, only storage and filling of liquid manure without additives is allowed ...". Although not directly said, **this is interpreted to prohibit storage of acidified slurry** (in-house and in-storage acidification). However, the interpretation of this regulation is currently being re-considered.
- Germany: *Road Traffic Regulations (StVO)* prescribes a maximal distance of 3.5 meters between the steering wheel center and the front front of the tractor. This could make it difficult to use in-field acidification. *Should this rule be re-considered? Is it justified? Is it outdated? None of the other countries in the Region have similar rules!*
- Sweden: The *Animal Protection Agency's Provisions for approval of new technology (2007: 1), also referred to as L37*, require new technique to be tested, unless it was already tested and approved abroad. It could be considered whether EU's BAT Conclusion and VERA Verification of in-house acidification is sufficient for allowing in-house acidification in Sweden. There seems to be some misunderstandings, alone.

Commission Implementing Decision (EU) 2017/302 says that "These BAT conclusions apply without prejudice to other relevant legislation, e.g. on animal welfare.". Removal of these barriers are crucial for unlocking the potential of slurry acidification in the BSR.

Overall conclusion on legal framework

- All countries can amend their legal framework and support schemes to promote the use of SATs and our report shows clearly, what the individual BSA country could do.
- Only Sweden and Germany have actual legal barriers, maybe some are based on misunderstandings.

Weighed potential for slurry acidification

Country	Weighed potential for slurry acidification, million tonnes of slurry*	Other strengths
BY	14.3	-
DA**	25	SATs are developed in Denmark, where they are well-known and used on beforehand, which is an advantage in case of upscaling. SATs are officially recognised as BATs that livestock farms can use for obtaining environmental permits.
DE	159.5	-
EE	1.1	Farmers are aware of the benefit of reducing ammonia emissions and inject about 60% of slurries although no legal requirement exists.
FI	3.9	-
LA	0.9	-
LT	1.5	-
PL	21.6	-
RU	3.3	-
SE	13.4	-
TOTAL	244.5	Experience and commercial solutions are available in the Region.

Society objectives related to slurry acidification - ammonia emissions

Figures on adjusted ammonia emissions in the years 2014, 2015 and 2016, as well as ceilings for 2020 and 2030 for the eight EU Member States in the Baltic Sea Region as well as national totals for Russia and Belarus. The table also shows the distance to the ceilings, calculated as the percentage of needed emission reductions from 2016 to 2020 and 2030. (Main source: https://cdr.eionet.europa.eu/)

Country	2014	2015	2016	2020	2030	2020	2030
	Adjusted emissions, Kt			Defined ceilings, Kt		2016 distance to ceiling, % of ceiling value	
BY*	141.17	142.64	136.06	126**	126	-8	-8
DA	66.16	66.84	67.12	63.25	63.25	-6	-6
DE	601.47	609.68	601.50	593.83	443.81	-1	-36
EE	12.07	12.60	11.92	10.62	10.62	-12	-12
FI	31.65	30.09	29.72	29.88	29.88	1	1
LV	16.64	16.39	16.25	14.75	14.75	-10	-10
LT	34.60	34.72	34.03	34.12	34.12	0	0
PL	269.86	267.31	267.11	296.58	248.65	10	-7
RU*	840.12	882.37	900.25	-	-		
SE	54.41	54.3	53.1	49.25	48.09	-8	-10
TOTAL	1,228	1,235	1,217	1,218	1,019	-	-

Society objectives related to slurry acidification – nutrient loads to the Baltic Sea

The table shows HELCOM obligations (CART – Country Allocated Reduction Targets)

Source: HELCOM

Country	2007	2013	2014	
	Country-Allocated Reduction Targets for all sub-basins, Kt/a		Extra reduction (total input) compared to ceilings for Baltic Sea basins since 1997-2003, Kt/a	Missing reduction (total input) to fulfil ceilings for Baltic Sea basins since 1997-2003, Kt/a
DA	17.21	2.89	10.17	0
DE	5.6	7.17 +0.5*	3.36	7.28
EE	0.9	1.8	0.90	1.08
FI	1.2	2.43 +0.6*	0.33	1.72
LV	2.56	1.67	7.22	5.40
LT	11.7	8.97	0.04	18.51
PL	62.4	43.61**	0.10	27.54
SE	20.78	9.24	15.97	1.87
RU	6.97	10.380*	0	24.72
Transboundary Common pool*** (including BY)	3.78	3.32 1.98	0 0	11.11 7.40

Society objectives related to slurry acidification – climate change

Only DE is under the target for 2020, whereas all countries have to reduce GHG emissions until 2030.

Country	1990*	2005*	2015*	2020**	2030**
	Actual emissions, $MtCO_{2e}$			Effort-sharing decision, % in relation to 2005-emissions / ceiling, calculated as $MtCO_{2e}$***	
DA	72	69	51	-20 / 55	-39 / 42
DE	1,263	1,015	927	-14 / 873	-38 / 629
EE	41	19	18	11 / 21	-13 / 17
FI	72	71	58	-16 / 60	-39 / 43
LA	26	12	12	17 / 14	-6 / 11
LT	48	23	20	15 / 26	-9 / 21
PL	487	400	388	14 / 456	-7 / 372
SE	73	69	56	-17 / 57	-40 / 41
TOTAL	2,082	1,677	1,530	-	-

* Source: http://ec.europa.eu/eurostat/statistics-explained/index.php/Greenhouse_gas_emission_statistics_-_emission_inventories
** Source: https://ec.europa.eu/clima/policies/effort_en
*** Own calculations.

Annual value of realising the use of SATs for the weighed slurry potential. All figures in M€.

Country	Avoided EU penalty related to ammonia, M€	Savings in the healthcare sector, M€	Value of reduced greenhouse gas emission, M€	Annual costs of investments in SAT installations, M€	Net value, M€	Additional, estimated value of N abatement, M€*
BY	NA	(102**)	1.9	-13.2	-11.3	9
DA***	1.7	58	1.9	-12.1	45.6	9
DE	11.8	2,105.4	23.1	-147.3	1,993.0	100
EE	0.4	2.0	0.2	-1.5	2.0	0.7
FI	0	7.0	0.6	-3.6	4.0	2.5
LV	0	2.2	0.1	-0.8	1.5	0.6
LT	0	1.8	0.2	-1.4	0.6	0.9
PL	0	155.5	3.1	-19.7	138.9	13.6
RU[1]	NA	(5.9****)	0.5	-3.0	-2.5	2.1
SE	2.7	56.3	1.9	-12.4	48.5	8.4
TOTAL	16.6	2,388.2 (+107.9)	33.4	212.7	2,220.3	147

[1]5 regions in the North-Western part of Russia.

Annotations

** The estimated reduced airborne deposition would further have a considerable value for the society according Hautakangas et al. (2014) and Sutton et al. (2011). The abatement costs is varying, dependent on sector and other pre-conditions, and we have here assumed it to be only € 2 per kg N.*

*** Savings in the healthcare sector was not assessed for Belarus by Sutton et al. (2011), and we have assumed the value to be the same as for the neighbour country Poland, but the figure is not included in the net value for Belarus of using SATs and is therefore placed in brackets.*

**** For Denmark, all figures are based on Foged (2017), assuming half of the Danish slurry production is acidified, which is about 17 million tonnes of slurry, whereas the weighed potential for Denmark is 25 million tonnes of slurry.*

***** Savings in the healthcare sector was not assessed for Russia by Sutton et al. (2011), and we have assumed the value to be the same as for the neighbour country Finland, but the figure is not included in the net value for Russia of using SATs and is therefore placed in brackets.*

SATs for clear waters and clean air

Policy recommendations

Based on major benefits for environment and climate, coupled with substantial, positive economic impact of SATs use, we recommend all EU Member States in the Baltic Sea Region to further explore ways to implement the use of SATs.

Politicians tools

Politicians have basically 2 tools for achieving a certain effect in the market:

- The carrot symbolises financial incentives / subsidies, as well as giving attractive advantages for certain actions = legal enablers.
- The whip symbolises regulations, penalties.
- It is in any case important that no legal barriers exists.

Thank you for your attention

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