



UNECE Convention on Long-range Transboundary Air Pollution

# Impact of the EGTEI proposed ELVs on Emission Scenarios

Modelling analysis performed by the GAINS\_Europe Model

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*EGTEI 19<sup>th</sup> meeting, Rome, May 5-6, 2011*



## **Outline**

- Introduction
- Objective of the analysis
- Methodology
- Outcome of analysis

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## Introduction

In the frame of the UN-ECE Convention on Long Range Transboundary Air Pollution (LRTAP), the Expert Group on Techno-Economic Issues (EGTEI), technical body of the Convention, has been mandated to revise the ELVs in the Annexes IV, V, VI, VIII, to the 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (Gothenburg Protocol) and elaborate a new Annex on dust and a new Annex on solvent content in products.

The work started in April 2008 and was concluded in June 2009.

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## Introduction

Three options, corresponding to different ambition levels, were proposed by EGTEI, in the new Annexes, leaving the final choice to the negotiation process.

**Option 1:** ELV1, demanding but technically feasible option with the objective of achieving a high level of reduction. ELV1 is based upon a value ranging between the lower and upper BAT AEL (where available),

**Option 2:** ELV2, while technically demanding, pays greater attention to the costs of the measures for achieving reduction. ELV2 is based on the upper value of BAT AEL (where available),

**Option 3:** ELV 3, represents current practices based on the current legislation in a number of Parties to the Convention.

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### ***Objective of the analysis***

1. Establish a link between the work of EGTEI on ELVs and the Emission Scenarios developed by CIAM
2. Estimate the (additional) Emission Reductions and Costs, if any, to be in line the proposed ELVs. Estimate the “gap” between the Baseline Emission Scenario and the 3 Options.
3. Ultimately, provide the Delegation Experts with additional info to facilitate a choice on the EGTEI proposed Options (ambition levels).

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### **Methodology**

Starting from the Gothenburg Baseline National Scenario, detailed output emissions, by technological option, in IIASA GAINS\_Europe Model, (SO<sub>x</sub>, NO<sub>x</sub>, TSP) a proper Excel Macro has been developed to perform the following tasks:

1. *Compare the average EF (mg/m<sup>3</sup>), output of GAINS with the ELVs in the EGTEI Tables, for each source category, (Power Plant and Industrial Boilers Sectors).*
2. *Identify which source categories are NOT in line with the ELVs, respectively, for the 3 options (ELVs stricter than current average value: average EF > ELV<sub>1,2,3</sub>).*
3. *Introduce upgrades in implementation of abatement technologies, such as the average EF is line with the 3 options.*
4. *Re-calculate, for the concerned sectors, the emission reductions (and additional costs from GAINS), at the target year (2020).*

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## Example of GAINS output

Sector-Activity-Technology	Abbr.	Sectoral activity [Units]	Unabated emission factor kt NOx/Unit	Removal efficiency %	Abated emission factor kt NOx/Unit	Conversion coefficient mg/m3/g/GJ	Abated emission factor mg/m3	Capacities controlled %	Emissions kt NOx
non-IGCC new power plants-Natural gas (incl. other gases)-No control-[10 <sup>15</sup> Joules]	PP_NEW-GAS-NOC-[PJ]	1727.347	0.070	0.000	0.070	1.060	74.200	100.000	120.914
non-IGCC new power plants-Gasoline and other light fractions of oil (includes kerosene)-No control-[10 <sup>15</sup> Joules]	PP_NEW-GSL-NOC-[PJ]	0.384	0.070	0.000	0.070	3.170	221.900	100.000	0.027
non-IGCC new power plants-Hard coal, grade 1-Selective catalytic reduction on new hard coal power plants-[10 <sup>15</sup> Joules]	PP_NEW-HC1-PHCSCR-[PJ]	471.725	0.150	80.000	0.030	2.860	85.800	100.000	14.152
non-IGCC new power plants-Heavy fuel oil-Selective catalytic reduction on new oil and gas power plants-[10 <sup>15</sup> Joules]	PP_NEW-HF-POGSCR-[PJ]	71.177	0.100	80.000	0.020	3.170	63.400	100.000	1.424
non-IGCC new power plants-Medium distillates (diesel, light fuel oil)-No control-[10 <sup>15</sup> Joules]	PP_NEW-MD-NOC-[PJ]	0.384	0.050	0.000	0.050	3.170	158.500	100.000	0.019
non-IGCC new power plants-Biomass fuels-No control-[10 <sup>15</sup> Joules]	PP_NEW-OS1-NOC-[PJ]	123.867	0.065	0.000	0.065	2.860	185.900	100.000	8.051
non-IGCC new power plants-Other biomass and waste fuels-Selective catalytic reduction on new hard coal power plants-[10 <sup>15</sup> Joules]	PP_NEW-OS2-PHCSCR-[PJ]	66.373	0.065	80.000	0.013	2.860	37.180	100.000	0.863

## NOx Emissions by Control Option

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## Example of EGTEI table

Fuel type	Thermal input [MWt h]	Suggested ELV for NO <sub>x</sub> [mg/Nm] <sup>60</sup>					
		Option 1 <sup>U</sup>		Option 2 <sup>U</sup>		Option 3 <sup>U</sup>	
		Lower BAT AEL	Techniques	Upper BAT AEL	Techniques	Legislation	
>300	100 (coal, lignite)	Coal (PC): 90	Combination of Pm (air and fuel-staging, low NOx burner, reburning, etc.), in combination with SCR or combined techniques	Coal (PC): 150	Same as for option 1	EU-LCPD (licence before 2002, <300MW): 600	
	100 (biomass, peat)	Lignite (PC): 50	Combination of Pm (such as air and fuel-staging, low NOx burner, reburning, etc)	Lignite (PC): 200		EU-LCPD (licence before 2002, >500MW); until 2016: 500; after 2016: 200	
	New plants: 100 (coal, lignite)	Coal, lignite (FBC): 50	Combination of Pm (such as air and fuel-staging)	Coal, lignite (FBC): 150		New plants: 200 (coal, lignite)	EU-LCPD (licence after 2002): 200
	150 (biomass, peat)	Biomass, peat (PC): 50	Combination of Pm (air and fuel staging, low NOX burner), if necessary SNCR and/or SCR	Biomass, peat (PC): 150		UNECE-GP: 200	EU-LCPD (licence after 2002): 200
		Biomass, peat (FBC): 50	Combination of Pm (air distribution or by flue-gas recirculation), if necessary SNCR and/or SCR	Biomass, peat (FBC): 150		EU-IED (permit before 2014): 200	EU-IED (permit after 2014): 150; Lignite (PC): 200

## EGTEI Table in Annex V

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## Assumptions and caviats

**Main Assumption:** The *average* EF (mg/m<sup>3</sup>) in GAINS, derived from annual emissions, at the target year, for each source category, is **comparable** with the ELVs in the EGTEI Tables.

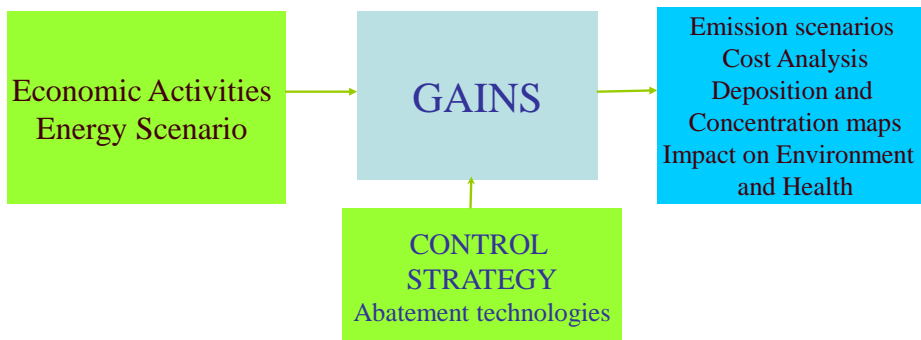
The *average* EF (mg/m<sup>3</sup>) is calculated, from GAINS output, as weighted average, taking the technology implementation rates, in each source category, as weight factors.

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## Simplified schema of GAINS



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## Example of outcome data

Test data NOT for policy use

### Results: emissions and technology costs

		Baseline	OPT 3	OPT 2	OPT 1
Exist PP (kt_TSP)	Emissions	0.632	0.632	0.628	0.514
New PP (kt_TSP)	emissions	1.708	1.708	1.653	1.217
Total PP emissions (kt_TSP)		2.340	2.340	2.281	1.731
Difference in emissions vs Base (kt_TSP)		0	0	-0.059 -2.52%	-0.609 -26.0%
Additional tech costs vs Base (M_Euro)		0	0	0.0745	1.2393
Total TSP Emissions 2020 (kt)		317.30	317.30	317.25	316.70

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## Pending Issues

While for PM (TSP) the methodology works quite well and a combination of technologies is always found to match the 3 option ELVs....

For SO<sub>x</sub> and NO<sub>x</sub>, in some cases the GAINS technology does not allow to achieve the desired target.

In principle, there are 3 potential reasons:

- 1) The ELV is too much ambitious
- 2) The EF in the GAINS Tech is not updated
- 3) The comparison is meaningless in those cases

Calculations available for IT, FR, UK, SP, NL

Advices from national experts is needed.

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## Pending Issues

Tech : CM, SCR, NO<sub>x</sub> Emissions

<b>LCP_G AS</b>	PP_EX_ OTH- GAS	Liquid fuels	<b>EX</b>	<b>&gt; 300 MWth</b>
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	mg/Nm <sup>3</sup>		mg/Nm <sup>3</sup>		mg/Nm <sup>3</sup>	<b>Av EF</b>
<b>EF_mg</b>	<b>Option 1</b>	<b>Option 2</b>		<b>Option 3</b>		mg/ Nm <sup>3</sup>
155.33 88.76	80	100		300		<b>99.8</b>

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## Conclusions

Taking in due account all the caveats concerning the comparability of GAINS output with EGTEI suggested ELVs (defined or derived in different ways)...

The methodology developed allows to identify, as first approximation, the combinations of techs which deliver concentration values (mg/m<sup>3</sup>), in line with the EGTEI proposed ELVs.

The Excel macros developed, (once finalized) can be used by everybody, to share methodology, data and results

The analysis is limited to the SO<sub>x</sub>, NO<sub>x</sub> and TSP pollutants and Power Plant and Industrial Boilers sectors.

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## Conclusions

For each Party to the Convention, the methodology developed allows to estimate the (minimum) effort (“gap”) from the Baseline to the 3 levels of ambition, proposed by EGTEI, in the revised Annexes .

The effort is expressed in terms of (additional) emission reductions, technology upgrade and related costs, for each EGTEI Option.

Such supplemental information should provide additional useful information to the negotiators.

Preliminary results are available. However, the results need to be discussed, among the EGTEI experts and with the Country experts, before making them available on the EGTEI web site.

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## Conclusions

The next EGTEI meeting, planned in Warsaw on the 21<sup>st</sup> and 22<sup>nd</sup> of November. The experts are invited to attend !

Thank you for your attention !

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