Proposal how to analyze technical annexes by GAINS

Work in progress in cooperation with IIASA

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Prologue

EGTEI revised the Annexes IV, V, VI, VIII, elaborated a new Annex on dust (VII) and a new Annex on solvent content in products [XI], to the 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (Gothenburg Protocol), on mandate by WGS&R.

The work started in April 2008 from the existing Annexes and the original structure was maintained. The work was carried out in cooperation with experts from the Expert Group on PM and the Task Force on Heavy Metals. Concluded in June 2009. Guidance Documents also revised. (see docs WGS&R_45)

Three options, corresponding to different ambition levels, were proposed by EGTEI, in the new Annexes.

Prologue

Later on, in the discussion, the following issue was raised:
"How to compare the new ELVs suggested in the Annexes with the IAM scenario Analysis ?".

At the last TFIAM meeting (October 2009) the development of ad hoc scenarios calibrated on the 3 options suggested by EGTEI, resulted infeasible, due to too much time and human resources needed.

At its last meeting, EGTEI (November 2009) decided NOT to be involved in scenario analysis, because out of its expertise

The original question remains, therefore, unanswered !

Prologue

On the other hand, in Italy there is interest in knowing which is the “relative position” with respect the new suggested ELVs, in IAM analysis.

Moreover, there should be an added value for the upcoming negotiation, in the Gothenburg Protocol process.

During an informal conversation with Zig Klimont (IIASA) a new chance appeared.

The Proposal

Conversion of GAINS emissions in concentrations by appro priate conversion factors retrieved by IIASA and now implemented in GAINS.

Development of an algorithm able to search for comparable “homogeneous elements“ in GAINS output list and EGTEI Tables

Application of the algorithm (by an Excel Macro) to Italy’s scenarios, as a test

Generalization of the application to other countries.

The Proposal –more details

Conversion factors allow to switch from specific emission (g/GJ) to concentrations (mg/m^3)

Algorithm can be developed by the Visual Basic Editor, in Excel

The suitable GAINS output list in NOT the same for all countries, depending upon the structure of the control technologies implemented, and the energy structure. The EGTEI tables have their own structure (bubble concept, plant size, etc)

…… making the task more difficult

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

Example of EGTEI table

Fuel type	Thermal input [MWth]	Suggested ELV for NO_x [mg/Nm³][b]							
		Option 1[1]			Option 2[1]			Option 3[1]	
			Lower BAT AEL	Techniques		Upper BAT AEL	Techniques		Legislation
	>300	New plants: 100 (coal, lignite) 100 (biomass, peat)	Coal (PC): 90 Lignite (PC): 50 Coal, lignite (FBC): 50 Biomass, peat (PC): 50 Biomass, peat (FBC): 50	Combination of Pm (air and fuel-staging, low NOx burner, reburning, etc.), in combination with SCR or combined techniques Combination of Pm (such as air and fuel-staging, low NOx burner, reburning, etc) Combination of Pm (such as air and fuel-staging) Combination of Pm (air and fuel staging, low NOX burner), if necessary SNCR and/or SCR Combination of Pm (air distribution or by flue-gas recirculation), if necessary SNCR and/or SCR	New plants: 150 (coal, lignite) 150 (biomass, peat)	Coal (PC): 150 Lignite (PC): 200 Coal, lignite (FBC): 150 Biomass, peat (PC): 150 Biomass, peat (FBC): 150	Same as for option 1	New plants: 200 (coal, lignite) 200 (biomass, peat)	EU-LCPD:(licence before 2002, <500MW): 600 EU-LCPD:(licence before 2002, >500MW): until 2016: 500; after 2016: 200 EU-LCPD:(licence after 2002): 200 UNECE-GP: 200 EU-IED (permit before 2014): 200 EU-IED (permit after 2014): 150; Lignite (PC): 200

EGTEI Table in Annex V, page 10

Example of GAINS output

Sector-Activity-Technology	Abbr.	Sectoral activity [Units]	Unabated emission factor kt SO2/Unit	Removal efficiency %	Abated emission factor kt SO2/Unit	Coversion coefficient mg/m3/g/GJ	Abated emission factor mg/m3	Capacities controlled %	Emissions kt SO2
Fuel production other than in power plants: Combustion-Natural gas (incl. other gases)-No control-[10^15 Joules]	CON_COMB-GAS-NOC-[PJ]	50.626	0.000	0.000	0.000	3.170	0.000	100.000	0.000
Fuel production other than in power plants: Combustion-Hard coal, grade 2-Industry - wet flue gases desulphurisation-[10^15 Joules]	CON_COMB-HC2-IWFGD-[PJ]	17.778	0.648	85.000	0.097	2.860	0.278	36.000	0.623
Fuel production other than in power plants: Combustion-Hard coal, grade 2-No control-[10^15 Joules]	CON_COMB-HC2-NOC-[PJ]	17.778	0.648	0.000	0.648	2.860	1.855	64.000	7.378
Fuel production other than in power plants: Combustion-Heavy fuel oil-Low sulphur fuel oil (0.6 % S)-[10^15 Joules]	CON_COMB-HF-LSHF-[PJ]	153.804	2.000	85.000	0.300	3.170	0.951	80.000	36.913
Fuel production other than in power plants: Combustion-Heavy fuel oil-No control-[10^15 Joules]	CON_COMB-HF-NOC-[PJ]	153.804	2.000	0.000	2.000	3.170	6.340	20.000	61.522
Fuel production other than in power plants: Combustion-Medium distillates (diesel, light fuel oil)-Low sulphur diesel oil - stage 1 (0.2 % S)-[10^15 Joules]	CON_COMB-MD-LSMD1-[PJ]	5.000	0.376	75.000	0.094	3.170	0.298	35.500	0.167
Fuel production other than in power plants: Combustion-Medium distillates (diesel, light fuel oil)-Low sulphur diesel oil - stage 2 (0.045 % S)-[10^15 Joules]	CON_COMB-MD-LSMD2-[PJ]	5.000	0.376	94.375	0.021	3.170	0.067	64.500	0.068

SOx Emissions by Control Option

Example of EGTEI table

ANNEX IV

Table 1. Suggested options for limit values for SO_X emissions released from refineries using the bubble concept

Plant type	Suggested ELV for SOx [mg/Nm³]							
	Option 1/			Option 2/			Option 3/	
Mineral oil refinery	200	Lower BAT AEL: (*individual* processes) -refinery fuel gas: 5; -Liquid fuels: 50 BREF: NO CONSENSUS ON BAT-AELs	Use of sulphur removal techniques for fuel gas And use of monitoring Combination of: Hydrodesulphurization Use of FGD techniques (where feasible and cost-effective)	600	Upper BAT AEL: (*individual* processes) -refinery fuel gas: 20; -Liquid fuels: 850 BREF: NO CONSENSUS ON BAT-AELs	Same as Option 1	1000	EU-LCPD (licence after 2002): 600; (licence before 2002): 1000 UNECE-GP: 1000

7. Combustion plants (boilers and process heaters) with a rated thermal input exceeding 50 MWth or combustion plants when combined to a common stack with a total rated input exceeding 50 MWth[c]:

EGTEI Table in Annex IV, page 4

Conclusions

It is worthy to make an attempt !

If successful, a lot of additional information for comparison, between IAM scenario analysis and EGTEI revised Annexes, would be available for the discussion/negotiation

Envisaged results at TFIAM_38, in May 2010

Thank you for your attention !