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Summary of the Bilateral Consultations with National Experts on the GAINS Input Data

TSAP Report #13

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Version history

This update is an extended version of TSAP Report #13 v1.2 produced in June 2014. While the text has not been changed, this extended version provides updated information on activities between June and August as well as minutes of all bilateral consultations with the Member States, including those that have not been available in June 2014.

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Executive Summary

In January 2014, the Council Working Party on Environment (WPE) started deliberations on the Clean Air Policy Package adopted by the European Commission on December 18, 2013. The proposal has been informed by quantitative modelling analyses of cost-effective emission reduction strategies with the GAINS integrated assessment model by the International Institute for Applied Systems Analysis (IIASA), with extensive consultation of Member States and stakeholders since 2011.

The Council Presidency, supported by the Member States and the Commission, allowed for a round of bilateral consultations to improve the understanding of GAINS model results, underlying assumptions, and any errors therein prior to developing formal positions on the overall ambition level of the Commission proposal on the Clean Air Policy Package. More than 100 experts from 27 Member States met with IIASA staff in bilateral consultations between March and July 2014 (the initial deadline of end April having been extended at the request of some Member States). Discussions aimed at eliminating potential misunderstandings, spotting and correcting obvious mistakes in input data, identifying differences in perspectives on future development, and assessing their relevance on overall outcomes.

The bilateral talks clarified a wide range of aspects, many of them specific for individual Member States. However, there were some recurring themes in the discussions.

The most prominent issue relates to perceived discrepancies between the latest national emission inventories for 2005 and the 2005 data used for the GAINS cost-effectiveness analysis. The bilateral consultations could achieve close reconciliation by clarifying the following aspects:

In most although not in all cases, the GAINS inventory for 2005 reproduces relatively well the national emission totals reported in the 2012 submission (i.e., the latest data available at the beginning of the cost-effectiveness analyses). Discrepancies in national totals could be traced back to systematic reasons, such as different coverage of emission sources, different emission calculation methodologies (Tier 1 vs. Tier 2 that is used by GAINS), and differences between national and international statistics (e.g., on energy). Larger discrepancies at the sector level are usually caused by different sector definitions of national and international energy and emission statistics.

However, there are for some Member States very substantial differences between the latest 2014 national submissions of inventories for the year 2005, and those from 2012 against which the GAINS model was calibrated after the last round of bilateral consultations in 2012. Explanations for differences offered by national experts include different calculation methodologies, new measurements, new data on capital stock, etc.

While these discrepancies on historic emissions can be transparently quantified and reconciled with latest information, there remain different perspectives of individual countries on the future emission reduction potentials. While there was little overlap of specific concerns among countries, national perspectives on future energy and agricultural activities are often different. However, only few countries indicated the ready availability of internally coherent alternative projections, and no such national projections have been received by IIASA to date.

Obviously, all these aspects could potentially have impacts on the achievability of proposed emission reduction commitments. It is planned to update the GAINS information accordingly and to explore implications thereof.

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1 Background and introduction

In January 2014, the Council (Working Party on Environment) started deliberations on the Clean Air Policy Package adopted by the European Commission on 18 December, 2013 with the aim to further reduce the impacts of harmful emissions from industry, traffic, energy plants and agriculture on human health and the environment (EC 2013b). The package includes proposal for amending the Directive on National Emission Ceilings, including national emission reduction commitments for six main pollutants.[1]

The proposal of the European Commission has been informed by quantitative modelling of baseline emissions and associated impacts, of the scope for further emission reduction options, and of cost-effective emission reduction strategies with the GAINS Integrated Assessment Modelling suite by the International Institute for Applied Systems Analysis (IIASA). The GAINS calculations were based on input data prepared by IIASA, relying on national and international statistics, additional national information and Commission-led scenario studies. Stakeholder experts were invited to review these data in 2012 before they were employed for the policy analyses in late 2012 and 2013. 14 Member States responded to that invitation in 2012. Final results are presented, inter alia, in the impact assessment accompanying the Commission proposal (EC 2013a) and the TSAP 11 report (Amann et al. 2014).

Following initial deliberations in the Council WPE, Member States expressed a desire to gain further access for the purpose of understanding model results, underlying assumptions, and any errors therein prior to developing their formal positions on the overall ambition level.

The Council Presidency, supported by the Member States and the Commission, agreed to allow for an additional round of bilateral consultations with the understanding that no negotiations would take place during such bilaterals, that the WPE will receive a comprehensive feedback and that the appropriate follow-up would be discussed and agreed in the WPE.

After short meetings between the Commission (supported by IIASA) and six Member States at the European Council on February 25, 2014, the option for further detailed consultation with IIASA was made available.

1.1 Purpose of the consultations

The bilateral discussions were purely technical in nature and had no negotiating character. The bilateral consultation meetings were held to improve mutual understanding and so provide a better-informed basis for future policy dialogue between the Commission and Member States. In particular, exchange of information should:

- eliminate potential misunderstandings (e.g., in model results, input data, or national statistics),
- spot and correct obvious mistakes in input data, and
- identify differences in perspectives on future development, and assess their relevance on overall outcomes (i.e., national emission ceilings or relative changes in emissions over time).

Consultations should focus on the air pollutants SO_2, NOx, PM2.5, NH_3 and VOC. For methane, it was understood that discussion would focus on proposed mitigation measures, but not deal with

[1] The package also includes a new Directive to reduce pollution from medium-sized combustion installations, which is discussed in parallel with the NECD.

emission inventories for the year 2005. GAINS estimates for CH_4 in 2005 have been aligned with the emissions reported by Member States to the UNFCCC (as of April 2012) in the context of the preparation of the Commission's climate policy proposals.

1.2 Bilateral meetings

On this basis, IIASA held bilaterals with 27 Member States involving more than 100 experts to review input data and results of the GAINS modelling exercise (Table 1.1).

Table 1.1: Dates of bilateral meetings between Member States and IIASA

Date	Country	# of experts visiting
March 13, 2014	Denmark	5
March 17, 2014	Malta	2
March 27, 2014	Latvia	3
March 28, 2014	Croatia	5
March 31, 2014	Cyprus	1
April 8, 2014	Sweden	4
April 10, 2014	Hungary	7
April 15, 2014	Portugal	5
April 17, 2014	Slovenia	4
April 23, 2014	Slovakia	5
April 24/25, 2014	Poland	10
April 29, 2014	Estonia	2
May 6/7, 2014	Italy	2
May 8, 2014	Lithuania	4
May 14, 2014	Ireland	3
May 15, 2014	UK	4
May 16/19, 2014	Austria	12
May 20, 2014	Bulgaria	5
May 22, 2014	Romania	6
May 23, 2014	France	7
May 26, 2014	Luxemburg	5
May 27, 2014	Spain	2
June 6, 2014	Germany (video conference)	5
July 14. 2014	Czech Republic	3
July 19, 2014	Finland	4
via e-mail	Belgium	
via e-mail	Netherlands	

Typically, meetings served to clarify elements of the GAINS methodology that were not fully clear to Member States experts, explained the origin of data sources used in the analysis, and spotted areas of potential discrepancies between recent Member States information and the GAINS input data that have been used for the cost-effectiveness analysis. Issues included, inter alia, variations in emission factors due to country-specific circumstances, omissions in international energy and agricultural statistics, assumptions on the applicabilities of emission control measures for different sectors. The meetings involved a range of IIASA experts knowledgeable on emissions from energy use, industrial processes, mobile sources, agriculture and solvents use, which enabled an in-depth review of sectorial input data with the respective sector experts from Member States.

The main issues discussed during the meetings were subsequently summarized in draft minutes, which have then been sent to the participating experts for correction and approval.

1.3 Scope and purpose of this report

This report provides a summary of the main issues emerging from the discussions, and the minutes of the meetings to the extent that approval has been received to date. Others will be circulated after approval was obtained.

As agreed with national experts and the Commission, corrections and new information will be implemented into the GAINS database during the summer period of 2014, and a report detailing the implications on the proposed emission ceilings will be prepared for end August.

2 Recurring issues

While the bilateral talks addressed a wide range of aspects, many of them specific for individual Member States, there were some recurring themes in the discussions.

2.1 Discrepancies between new (2014) national emission inventories for 2005 and what has been used in GAINS

The most prominent issue relates to perceived discrepancies between the latest (2014) submissions of national emission inventories for 2005 and the 2005 data used for the GAINS cost-effectiveness analysis (see, e.g., the TSAP 11 Report (Amann et al. 2014). While concern was raised that such discrepancies could put into question the accuracy of the GAINS calculations in general, the bilateral consultations could achieve close reconciliation by clarifying the most important reasons.

In most although not in all cases, the GAINS inventory for 2005 reproduces reasonably well the national emission totals reported in the 2012 submissions (i.e. the latest data available at the beginning of the cost-effectiveness analyses). Most discrepancies in national totals can be traced back to systematic reasons of different coverage of emission sources, different methodologies that are used for calculating emissions, and differences between national and international statistics. The main issues are dealt with successively below.

2.1.1 Coverage of national emission inventories

In principle, the GAINS model attempts to reproduce emission inventories that have been officially reported by Member States as closely as possible. At the same time, international consistency should be maintained to the extent necessary to avoid distortions in the distribution of optimised emission reductions across countries.

One principle in GAINS is that the same emission-generating activities should be included for all countries. However, not all countries report all of these sectors in their national inventories (e.g., agricultural waste burning); and some countries report additional sectors that are not included in GAINS (e.g., NO_x emissions from agricultural soils, NH_3 from crops, and NMVOC emissions from livestock manures). Such differences in the coverage of national inventories necessarily introduce discrepancies with a Europe-wide harmonised approach. It was possible in all cases to quantify differences in emissions emerging from this different sectorial coverage, which must be accounted for in a valid comparison of the GAINS numbers with national inventories.

Different coverage in the 2005 inventories will have implications for computed and reported 2030 emission ceilings, which will need to be addressed by more in-depth analysis.

2.1.2 Differences in sector definitions

While, with proper adjustments for source coverage and calculation method, national total emissions computed by GAINS are rather similar to the national inventories, larger discrepancies occur at the sector level. While, e.g., methodological differences are obviously more visible at the sectoral scale, many of these differences are also related to the sector definitions of national energy and emission statistics, which are not always compatible with the international (e.g. EUROSTAT) definitions. For instance, the categorisation and reporting of industrial waste fuels (e.g., black liquor), as well as sector definitions (e.g., attribution of industrial electricity production, or the reporting of fuels used in co-generation) differ across countries. Most of these differences could be identified and clarified during the consultations (details are provided in the minutes of the meetings).

2.1.3 Changes in reported emissions between 2012 and 2014

In addition, there are for some Member States very substantial differences between their latest 2014 national submissions of inventories for the year 2005, and those from 2012 against which the GAINS model was calibrated (see Table 2.1). In total, 35% of the figures of 2005 national total emissions reported in 2014 changed by more than 3% compared to 2012, with more than 25% of the figures changing by more than 5%. Surprisingly large changes occurred not only for pollutants for which inventory methodologies are still under refinement (e.g., for PM2.5, where national total figures changed in the range +65% to -60%), but also for pollutants for which reporting is much more mature. For SO_2, national figures changed in the range +98% to -11%; and for NOx, in the range +23% to -4%. Recent estimates are up to 35% lower for NH_3 emissions, and up to 17% lower for VOC emissions. Even larger variations occur if the 2013 submissions are considered also. Explanations for differences offered by national experts include different calculation methodologies, new measurements, new information on capital stock, etc.

Given that these changes only occurred after 2012, they clearly could not have been incorporated in the cost-effectiveness analysis. However, the new information, if properly documented and validated, could potentially have impacts on future emission ceilings and it is planned to update the GAINS data accordingly.

2.1.4 Other frequent reasons for discrepancies

- Some countries use for some sectors and pollutants the simplified Tier 1 approach for estimating emissions, while GAINS employs for all countries methodologies corresponding to Tier 2. This is of particular relevance for PM emissions from wood stoves and boilers, for NH_3 emissions from livestock (in particular for dairy cows), and for emissions from mobile sources. There are examples where emissions reported in 2014 based on Tier 2 show striking convergence with the GAINS estimate, compared to the 2012 estimate based on Tier 1.
- While in many countries large improvements in the quality of the PM2.5 inventories can be observed between 2012 and 2014, there are still several Member States with limited national expertise on emission inventories, or access to data relevant especially for PM.
- In some countries, there are significant discrepancies between energy statistics used by countries for their national emission inventories, and international sources (e.g., EUROSTAT). For instance, for some countries energy statistics differ for non-commercial fuels (e.g., fuel wood), or black liquor, etc.. Similarly, differences in livestock numbers between EUROSTAT or submissions to the UNFCCC and national data used in estimates for submission to EMEP have been identified in few cases.
- Emission factors differ between countries and international data sources, sometimes to reflect specific operating conditions, sometimes for other reasons. GAINS tries to treat all countries at the same footing, but differences within the uncertainty ranges can be accommodated.
- Often, discrepancies can be traced back to different assumptions on control measures in place in 2005 and the allocation of fuels across sectors, for instance for off-road mobile sources or allocation of diesel fuel use in road transport between cars and heavy duty trucks.

As mentioned above, while the reasons listed above apply to many countries, there are numerous national factors that are important for specific conditions where it has been possible to arrive at agreement on the underlying cause of the discrepancy. These are listed in the minutes of the bilateral consultations provided in the Annex.

Table 2.1: Comparison of inventories for 2005. (National submissions for 2014 as of March 1, 2014[2])

	SO_2			NO_x			PM2.5			NH_3			VOC		
	GAINS	National 2012	National 2014	GAINS	National 2012	National 2014	GAINS	National 2012	National 2014	GAINS	National 2012	National 2014	GAINS	National 2012	National 2014
AT	24.6	27.1	27.2	230.3	230.6	231.7	24.4	22.3	22.2	63.0	62.7	62.7	170.8	160.3	163.6
BE	139.9	145.2	143.9	295.3	291.0	290.5	28.4	24.4	35.5	74.2	71.3	72.4	157.5	142.7	145.8
BG	889.6	776.3	776.3	166.8	153.9	153.9	34.5	26.7	26.7	65.2	58.1	48.3	138.9	67.8	67.2
HR	67.7	63.4	63.6	75.9	80.3	80.1	15.0	12.6	10.7	29.3	40.4	44.3	79.1	101.2	101.0
CY	38.2	37.9	38.1	21.2	20.7	20.8	2.7	2.9	2.9	6.2	5.8	5.9	8.8	11.4	11.8
CZ	207.6	198.7	215.8	296.0	292.7	279.9	42.9	40.7	16.2	79.9	79.9	78.1	251.3	252.1	174.4
DK	20.6	22.9	24.5	182.3	181.1	186.0	28.0	25.4	26.4	73.4	82.7	87.5	129.9	108.5	112.6
EE	66.0	76.2	76.2	40.1	35.7	35.7	20.0	19.7	19.7	11.8	9.5	9.4	38.4	31.5	30.5
FI	89.6	69.2	69.2	201.2	169.4	169.4	28.5	36.0	41.4	33.9	38.8	37.8	172.6	136.5	136.4
FR	443.7	467.3	459.9	1351.4	1429.9	1403.6	271.0	304.0	245.2	674.8	660.9	686.3	1117.0	1232.3	1261.4
DE	549.4	517.3	460.5	1396.8	1465.6	1452.9	122.6	121.2	124.4	593.1	573.2	572.2	1235.4	1143.9	1123.7
GR	505.3	531.8	531.6	406.8	417.7	415.6	61.9	61.4	61.9	56.8	56.7	56.8	282.7	225.1	198.0
HU	128.5	128.2	127.7	154.9	161.9	199.1	29.4	28.7	30.3	77.6	77.3	73.4	144.4	150.2	153.0
IE	71.0	71.1	71.6	149.6	127.3	129.2	13.3	10.9	10.8	104.2	109.1	110.0	63.4	56.5	56.8
IT	381.8	402.5	405.3	1305.8	1212.2	1214.0	146.7	165.8	142.1	422.2	415.9	416.4	1237.0	1316.0	1203.8
LV	5.2	6.6	6.6	36.1	37.2	41.6	18.6	27.4	29.5	13.0	15.6	17.4	69.0	73.3	54.8
LT	41.6	47.2	43.1	61.9	59.5	62.5	15.0	13.9	22.8	44.2	44.3	39.1	84.5	75.6	68.0
LU	1.9	2.6	2.6	47.4	61.7	61.5	3.3	3.2	3.3	6.2	5.0	4.9	12.6	11.5	7.6
MT	11.1	11.4	11.4	9.9	9.3	9.3	0.7	1.3	1.3	1.7	1.6	1.6	4.0	3.4	2.5
NL	69.9	64.5	64.5	379.7	339.4	330.6	24.2	19.5	19.1	146.0	140.5	142.9	205.0	177.3	172.0
PL	1255.5	1223.9	1217.4	796.8	865.8	843.0	224.7	132.8	140.8	343.6	269.5	271.7	614.7	593.2	574.6
PT	111.3	89.3	176.5	268.0	252.6	256.1	62.7	59.4	68.2	70.9	51.3	50.3	227.2	206.0	207.0
RO	705.7	642.6	642.6	310.5	308.3	308.3	112.5	105.7	105.7	161.4	198.5	198.5	459.8	340.3	340.3
SK	91.5	89.0	89.0	94.7	101.9	101.9	32.1	36.7	36.7	28.3	28.6	28.6	77.1	72.6	72.7
SI	39.6	40.7	40.8	49.8	46.7	46.7	9.3	15.2	15.7	19.0	18.7	19.1	41.2	39.3	42.5
ES	1327.9	1325.1	1278.1	1513.4	1388.0	1407.9	156.1	97.9	93.6	365.9	365.6	379.3	934.0	817.5	829.9
SE	38.0	35.9	35.9	215.7	174.1	174.7	31.2	29.3	29.9	53.5	55.2	55.6	209.6	196.7	197.7
GB	849.5	706.0	708.6	1479.8	1580.1	1591.5	87.0	81.3	92.6	308.4	307.5	302.2	1092.9	1088.2	1082.4
EU28	**8172.0**	**7820.0**	**7808.0**	**11538.0**	**11494.0**	**11498.0**	**1647.0**	**1526.0**	**1476.0**	**3928.0**	**3844.0**	**3873.0**	**9259.0**	**8831.0**	**8592.0**

[2] Recent submissions in May/ June 2014 by Luxembourg and Hungary include major revisions of their 2005 emission inventories for NOx, SO_2, NH_3, VOC and PM2.5, not reflected yet in these tables. This new information will nevertheless be considered and incorporated in GAINS as appropriate

2.1.5 CH_4 emission inventories

GAINS inventories for CH_4 have been developed and validated for the climate policy proposals of the Commission. In 2012, DG-CLIMA invited Member States experts to comment and discuss directly with IIASA experts on a draft scenario on non-CO_2 greenhouse gases. This was shared with Member States on February 4, 2013, and presented to experts in two workshops held in Brussels. The first one was organized jointly by DG-ENER, DG-MOVE and DG-CLIMA on February 6, 2013, and the second one was organized by DG-CLIMA on Feb 7, 2013 in order for Member States to discuss on a bilateral basis with modelling experts. The two workshops were followed by a review period, which lasted until March 5 and during which member states who wished could submit comments and receive feedback from IIASA modelling experts through a webpage portal set up specifically for the EUCLIMIT project. Through the review process, IIASA experts received and responded to comments on the draft non-CO_2 scenario from Member States experts in Austria, Belgium, Finland, France, Germany, Hungary, Ireland, Luxembourg, Malta, Netherlands, Spain, Sweden and the UK. Comments received sometimes called for revisions of estimated emissions, which were incorporated into the final reference scenario for non-CO_2 greenhouse gases finalized and submitted to Member States by DG-CLIMA in September 2013.

For historical years 2005 and 2010, there remain differences between the GAINS estimates and the estimates reported by countries to the UNFCCC. The reasons are that GAINS applies a consistent methodology across all countries, whereas estimation methodologies applied by countries tend to differ in key assumptions and approaches. Another reason for differences is that Member States sometimes report emissions for minor sources, which the GAINS model structure does not capture, e.g., CH_4 emissions from thermal baths in Hungary or rabbits in Italy. 2005 was used as starting year for the reference scenario analysed within the EUCLIMIT project. Whenever there was a difference between GAINS and reported emissions, the GAINS estimate for year 2005 was aligned with the emissions reported to UNFCCC for 2005 (version submitted in April 2012) by introducing a gas-specific calibration residual. The level of the calibration residuals for year 2005 is carried over as a constant to all future years. Hence, the GAINS reference scenario for CH_4 is in the year 2005 completely consistent with emissions reported for 2005 by countries to the UNFCCC in April 2012.

The methodology applied to produce the IIASA non-CO_2 greenhouse emission scenarios for EU28 has been described in Höglund-Isaksson et al., 2013 available from:

http://www.iiasa.ac.at/web/home/research/researchPrograms/MitigationofAirPollutionandGreenhousegases/Methodology_nonCO2_GAINS_4dec2013.pdf

The report also contains a list of calibration residuals by gas and country.

2.2 Mistakes in the GAINS database

The bilateral consultations also identified a number of obvious mistakes in the GAINS database, which will be corrected accordingly. Detailed accounts of spotted issues are provided in the minutes. Mistakes that affect several countries include:

- Sulphur contents in road transport fuels in some countries.
- Too high VOC emission factor for old two-stroke mopeds.
- Too low emission factors for PM10 road abrasion from light duty vehicles.

2.3 Different perspectives on future development and emission reduction potentials

While discrepancies on historic emissions can be transparently quantified and reconciled with latest information, there remain different perspectives of individual countries on future emission reduction potentials compared to what has been assumed in the Commission Proposal. While collectively countries raised a wide range of issues, there was in general little overlap of the concerns among countries.

- In their national emission projections, a number of countries have not yet accounted for current legislation for non—road machinery (stage IV).
- Some countries consider an enforcement of the (already existing) ban of agricultural waste burning as unrealistic.
- Countries doubt the assumptions on the effectiveness and timing of the Euro 6, and consequently the assumed share of Euro6 cars in 2030 (related to late introduction).
- Some countries also doubt the assumed turnover rate of the vehicle stock, although assumptions of individual countries differ in both directions from what has been assumed for the Commission proposal.
- Some countries doubt the strong decline in gasoline consumption in the PRIMES REF scenario (although this is more important for CO_2 than for NO_x emissions).
- While the TSAP scenario assumes entry into force of an Ecodesign directive by 2016, some countries anticipate less mitigation potential in 2030 as they strive for an entry onto force by 2021.
- In most cases, countries assume no change in average emission factors for the residential combustion sector, while GAINS assumes a gradual replacement of very old stoves with currently available models and a slow increase in the penetration of pellet stoves and boilers, a trend that has been documented in several European countries.
- Some countries assume in their national scenarios that (the quantity of) personal products containing solvents (hairspray, cosmetics, household cleaning, car windshield defrosters, etc.) would follow GDP. GAINS assumes an S-curve shaped increase following GDP/capita but saturating at high income level, leading to only modest increases in rich countries (e.g., Germany, Netherlands). Important for VOC emissions, ranging from ~15 to 25% of total emission from solvent use.
- Often countries assume no change in implied emission factors for several solvent use categories. GAINS considers replacement of installations reaching the end of their technical lifetime with new equipment complying with current legislation.

Although outside the Terms of Reference for the bilateral consultation on the GAINS calculations, several countries have different perspectives on the future development of energy and agricultural activities compared to the PRIMES and CAPRI scenario that has been underlying the Commission proposal. Several countries explained that they expect different consequences of the economic crisis on future energy consumption and stock renewal, resulting in different absolute levels of energy consumption in 2030 as well as different distributions of primary energy sources. In addition, countries often have more ambitious plans for the agricultural sectors resulting in higher livestock numbers and mineral nitrogen fertilizer use compared to the CAPRI.

It is noteworthy that very little discussion (or new information) emerged on costs of emission control measures.

3 Conclusions

To improve the understanding of GAINS model results, underlying assumptions, and any errors therein prior to developing formal positions on the overall ambition level of the Commission proposal on the Clean Air Policy Package, more than 100 experts from 26 Member States met with IIASA staff for a series of bilateral consultations between March and May 2014. Discussions aimed at eliminating potential misunderstandings, spotting and correcting obvious mistakes in input data, identifying differences in perspectives on future development, and assessing their relevance on overall outcomes (i.e., national emission ceilings or relative changes in emissions over time). All meetings took place in mutually appreciative and very constructive atmosphere, were purely technical in nature, and had no negotiating character.

While the bilateral talks addressed a wide range of aspects, many of them specific for individual Member States, there were some recurring themes in the discussions.

The most prominent issue relates to perceived discrepancies between the latest national emission inventories for 2005 and the 2005 data used for the GAINS cost-effectiveness analysis (see, e.g., the TSAP 11 Report (Amann et al. 2014). While concern was raised that such discrepancies could put into question the accuracy of the GAINS calculations in general, the bilateral consultations could achieve close reconciliation in most cases by clarifying key issues:

- In most although not in all cases, the GAINS inventory for 2005 reproduces relatively well the national emission totals reported in the 2012 submission (i.e. the latest data available at the beginning of the cost-effectiveness analyses).
- For the 2012 submission, most discrepancies in national totals could be traced back to systematic reasons, such as different coverage of emission sources, different emission calculation methodologies (Tier 1 vs. Tier 2 that is used by GAINS), and differences between national and international statistics (e.g., on energy).
- While, with proper adjustments for source coverage and calculation methods, national total emissions computed by GAINS were found rather similar to the national inventories, larger discrepancies occur at the sector level. Many of these differences are related to different sector definitions of national and international energy and emission statistics.
- In addition, there are for some Member States very substantial differences between the latest 2014 national submissions of inventories for the year 2005, and those from 2012 against which the GAINS model was calibrated after the last round of bilateral consultations in 2012. In total, more than 25% of the figures changed by more than 5%, with surprisingly large changes (between -50% and +98%) also for pollutants for which reporting is considered mature. Explanations for differences offered by national experts include different calculation methodologies, new measurements, new data on capital stock, etc.

While these discrepancies can be transparently quantified and reconciled with latest information, there remain different perspectives of individual countries on future emission reduction potentials compared to what has been assumed in the Commission Proposal. While collectively countries raised a wide range of issues, there was in general little overlap of the concerns among countries. Differences in expectations emerged, e.g., for the enforcement of the (already existing) ban of agricultural waste burning, on the assumptions on the effectiveness and timing of the Euro 6 regulations, the assumed turnover rate of the vehicle stock, the timing of an Ecodesign directive.

The implications of these different perspectives are enhanced by different expectations on the development of energy and agricultural activities. However, only few countries indicated the ready availability of internally coherent alternative projections, and no such national projections have been received by IIASA to date.

Given that this new information changes including the substantial revisions of the 2005 emission inventories only occurred after the last round of bilateral consultations in 2012, this clearly could not have been incorporated in the cost-effectiveness analysis.

Obviously, all these aspects could potentially have impacts on the achievability of proposed emission reduction commitments. The proposed way forward is described in the Commission cover note accompanying this report.

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4 Annex: Minutes of the bilateral consultations

The minutes presented in this Annex have been drafted by IIASA, and subsequently corrected and approved by the experts participating in the meetings.

Since the drafting version 1 of this report, bilateral meetings at IIASA have been completed with 27 Member States (all 28 except Greece). For Greece, information has been exchanged in electronic form only.

4.1 Austria

Laxenburg, May 16 and 19, 2014

4.1.1 Comparison of GAINS and national inventories for 2005 and 2010 (2014 submission)

SO_2: GAINS emissions 2005/2010 – 10% lower/1% higher than AT total. Difference in 2005 due to lower emission factors for biomass use in SmallComb. Different distribution of emissions from PublicPower (GAINS higher) and IndustrialComb (GAINS lower) due to inclusion in GAINS emissions from industrial CHP plants in the power sector. This occurs for all pollutants. Other emissions within the ballpark.

NOx: GAINS emissions 2005/2010 – 1% / 8% lower than AT national total. GAINS – lower emissions from IndustrialComb, RoadRail and OffRoadMob. In general, match not bad.

PM2.5: GAINS emissions 2005/2010 – 10% / 9% higher than AT national total. Half of that difference in 2005 is in the SmallComb sector. GAINS emissions from IndProcess higher (controls installed in recent years not included in GAINS). Different distribution of emissions from PublicPower (GAINS higher) and IndustrialComb (GAINS lower) due to inclusion in GAINS emissions from industrial CHP plants in the power sector. Emissions from mobile sources within the ballpark. Emissions from WasteIncin included in AT inventory in SmallComb.

NMVOC: GAINS emissions 2005/2010 4% / 2% higher than in AT inventory. GAINS emissions from industrial combustion higher, emissions from SmallComb lower. Otherwise reasonable match. AT reports emissions from AgriOther, not included in GAINS.

NH3: Differences between AT inventory and GAINS emissions less than 1%. Different distribution of emissions from agriculture (AgriLivestock vs. AgriOther). Emissions from pets and humans not included in AT inventory.

4.1.2 Stationary emission sources

- ✓ AT asks about conversion of PRIMES energy projections to GAINS. IIASA clarified, link to the document explaining energy aggregation in GAINS given. In the Commission's report "TRENDS TO 2050- REFERENCE SCENARIO 2013" the projections are presented according to the EUROSTAT standard, which assigns fuel use by autoproducers' CHP plants for on-site consumption of heat to the final energy use in industry. In PRIMES (and subsequently in GAINS) total fuel input to CHP plants is included in the power sector (PRIMES category: fuel input in thermal power plants), which is consistent with the real-life processes. Division of fuel into consumed for power generation and heat sold outside the plant and fuel consumed for on-site heat generation is an accounting practice and is done after the PRIMES results are obtained.
- ✓ Some process-related activities also originate from PRIMES: fuel production, oil input to refineries, steel, cement, glass, pulp and paper production. Projections of other process activities are based on statistics and correlations with sectoral value added (also from PRIMES).
- ✓ PRIMES team presented 2013 national projections for review to the experts involved in the EUCLIMIT programme. AT experts registered on the EUCLIMIT web page and uploaded material.
- ✓ Data on gas consumption by pipeline compressors in GAINS need to be modified: AT numbers: 5.7 PJ in 2010, 7.1 PJ in 2012.

- ✓ AT will provide data on distribution of biomass and waste used in industry: fuel wood and other renewable biomass, waste fuels (black liquor and non-renewable waste). It is also necessary to check/modify SO2 emission factors from biomass (AT assumes 11 g/GJ). According to AT, assumed in GAINS sulphur content of biomass is too high. Other countries claim that IIASA uses too low emission factor for biomass. Value will be corrected based on AT input.
- ✓ Emissions from iron & steel industry – GAINS too high, especially for PM. EFs need corrections. The same for cement production.
- ✓ There are differences in emissions from industrial fuel consumption and from industrial processes due to differences in aggregation. Some differences are unavoidable because data sources are different: national inventory – reports from enterprises, GAINS projections of fuel use and production of energy – intensive products.
- ✓ NOx emissions from cement industry in the CP scenario: Requires (at least partially) the use of high efficiency measures (SCR), AT is of an opinion that although technically feasible, there are cheaper options to reduce the national emissions.
- ✓ Emissions from biomass use in the power sector: Assumption on the use of high efficiency de-dusters causes that the abated emission factors are very low, much below the ELVs for biomass combustion in the IED. EFs achievable with less stringent measures are about 8 – 15 mg/m3, which is already well below the ELV from the IED. Although by 2030 technically possible, costs of HEDs are prohibitively high. AT suggests limitation of the applicability of that technology.
- ✓ Biomass use by small combustion sources: total amount of biomass burned: historic numbers and projections – OK, but noticeable differences in pellet use 2030: REF-CLE 4 PJ, COM 23 PJ, projections16 PJ.
- ✓ Projections emissions of PM2.5 higher in the national assessment. GAINS: too optimistic assumptions about implementation of boilers and stoves using pellets. Quite a lot of fuel wood originate from own resources (forests owners) and it is unlikely that they switch to pellets. AT will provide limitations for pellet use (applicabilities) in annex.
- ✓ AT and IIASA stressed that the assessment of the emissions from small combustion installations is burdened with high uncertainty. GAINS allows the use of ESP for residential/commercial sector. IIASA explained that assumed in GAINS performance of high efficiency de-dusters and electrostatic precipitators for small combustion installations is quite uncertain. Implementation of ESPs for small sources is not necessary to achieve the national ceilings from the Commission's proposal.
- ✓ Domestic sector NOx: national projections assume higher emissions in 2030 from biomass, lower from the use of oil and gas. No suggestions to change GAINS assumptions.
- ✓ Delay on implementation of Ecodesign Lot 15 up to 2022 is expected by AT according to working document of the Ecodesign meeting including weakening of the originally proposed effort. Only marginal improvement in emissions of new boilers/stoves due to lock-in of recent update of Austrian national legislation on domestic boilers and stoves until 2022 is expected.
- ✓ GAINS assumptions on average lifetime much shorter than implemented in projections. AT will provide national data (see annex).
- ✓ WASTE_RES: emissions from WASTE_RES in COM are reduced to zero. This is not justified for bonfires (see annex).

4.1.3 Mobile sources

We went into great detail with the comparison of emissions from road transport and reconfirmed the analysis done earlier this year (available upon request). Differences can be understood and explained. Key points for NOx (and to a smaller extent PM) emissions from road transport in 2030 are:

- ✓ What is the emission performance of Euro 6c diesel cars and light commercial vehicles?
  - o When will Euro 6c come into force? Is 2018 too optimistic?
  - o What will be the share of Euro 6c in 2030?
  - o What will be the share of diesel cars in the future?
  - o What will be the share of electric cars in the future?
- ✓ While all is uncertain, Austria doubts that EURO 6c will come into force in 2017/2018 with such a low NOx EFA of 120 mg/km. Austria doubts that the share of diesel cars will be that high in 2030 (75%) and sees a greater potential in electric vehicles, which is nearly zero in the current PRIMES projection.
- ✓ The upper margin appears to be 19 kt, the lower end about 9 kt. The current GAINS projection is 12.1 kt, the best AT estimate is 13.8 kt.
- ✓ Current NOx emissions from gas turbines used by compressors in transmission lines: about 0.87 ktons NOx. Emission factors: old turbines permitted until 2017 with EF 0.3 kt/PJ; new gas turbines with primary measures have lower EFs (0.0292 kt NOx/PJ). Secondary measures for these installations are not economically viable since they are situated "in the country" and not in urban NOx hot spots. Current EF for NOx 0.15 kt/PJ (a mixture of old and new turbines). Current expectations: in 2030 all turbines should have been replaced by new turbines. EF can be reduced to 0.0292 kt/PJ if all turbines were replaced with the new ones.

4.1.4 NH_3 emissions

- ✓ Austria has provided an extensive analysis of the assumptions and national data already prior to the meeting. The key issue, valid especially for projections, is the change in number of animals (dairy cattle) kept on tight and loose systems. GAINS distinguishes between solid and liquid manure systems, but not tight and loose for which emission factors are different. Thus, future GAINS projections are biased low. No final solution was identified during the meeting, but IIASA will continue working on it in collaboration with AT.
- ✓ Also CAPRI assumptions about milk yield change (increase) over time are much less optimistic than national Austrian projection; Austria to contact CAPRI but also provide national projection to GAINS.
- ✓ We had extensive discussion of the current and future potentials for various methods of manure application. While the current situation is reflected fairly well in GAINS, the future mitigation potential in GAINS is much larger than what is assumed in the Austrian WAM (with additional measures) scenario. IIASA asked Austria to revisit the assumptions as to why there is no potential at all for high efficient methods of manure incorporation in Austrian projections. Austria also will provide detailed info about application methods in current projections as well as info about arable and grassland application potential.

4.1.5 VOC emissions

Two issues were discussed: (i) 2005-2010 solvent use inventory, and (ii) assumptions in projections.

While the match of the base year inventories at the total level is acceptable, there are some important differences for the paint sector. Activity data need to be compared and revisited; possibly the basis for calculation is different. IIASA will provide link to EGTEI documents that were used in the development of GAINS, and info about detailed assumptions used for the DECOPAINT sector in GAINS (the underlying data was developed together with EGTEI and CEPE). For several sectors GAINS used also information developed by Karlsruhe University in 1998 as part of the UN task force on BAT documents for the Convention. Unfortunately, IIASA has no electronic versions of these documents, however, parts of them were used in the EGTEI documentation that was also updated and therefore it is probably enough to use this.

4.1.6 Conclusions

- ✓ AT intends to provide national projection for agriculture. No decision as yet if to provide national view on energy development.
- ✓ AT will suggest modifications to selected emission factors and assumptions about implementation of control measures in the “Current legislation” scenario. Limitations to implementation of control measures in the MFR scenario will also be provided.
- ✓ All additional data and suggestions should be provided to IIASA until end of June.
- ✓ Agreed changes will be implemented in GAINS. Date depends on priorities to be set by the Commission and availability of time/resources at IIASA.

4.2 Belgium

There was extensive contact between IIASA and Belgium experts via email. Belgium has provided a comprehensive report analysing the main discrepancies between the GAINS and the national inventory, and suggesting specific changes that would also affect future baseline emissions and emission control potentials. The document is available upon request.

Based on these proposals, the following changes have been implemented in the GAINS database:

- All proposed changes that have been provided in the GAINS format have been implemented.
- PRIMES activity data for iron and steel industry in 2010 have been corrected to international statistics (although slightly different numbers from BE suggestions)
- Projection of future activities levels of iron and steel industry: Total steel production as in PRIMES, share of electric arc steel kept constant, production of pig iron and sinter assumed proportional to the production of basic oxygen steel.
- Production levels of cement and glass as provided by PRIMES (consistent with international statistics).
- Other process activities have been changed to the values suggested by Belgium.
- Activities and emission factors for biomass use in the domestic sector have been corrected to the latest estimate by BE (higher activity, higher emission factors.)
- Emissions from agricultural waste burning are not reported in the national inventory. GAINS estimate used.

4.3 Bulgaria

Laxenburg, May 20, 2014

4.3.1 Presentation of GAINS methodology

Main features of GAINS were presented and the cost-effectiveness approach and gap closure concept explained. It was stressed that benefits estimates play an important role in the selection of the target (ambition level). Presentation sent to BG. GAINS online was presented, activity data, control strategies and emissions results were downloaded and sent to BG experts. The use of "Emissions by control option" files for checking the effects of changes in control strategies on emissions has been demonstrated.

4.3.2 Comparison of GAINS and national inventories for 2005 and 2010 (2014 submission)

SO2: GAINS estimates for 2005/2010 are 15%/46% higher than in the BG inventory. Main reason: GAINS underestimates emission controls in PublicPower and IndProcess that have been installed in recent years. Emissions for other sectors within are the ballpark.

NOx: GAINS estimates for 2005/2010 are 8%/23% higher than in the BG inventory. GAINS: higher emissions from PublicPower, IndustrialComb, and RoadRail, lower from IndProcess. The latter are very high in BG inventory. No emissions from and OffRoadMob in the BG inventory. GAINS: What do the emissions from R_Other comprise????

PM2.5: GAINS emissions 2005/2010 are 29%/25% higher than those of the BG inventory. BG emissions from small combustion plants are higher than in GAINS. Emissions from sectors A, B, D, G, and I higher in GAINS. Emissions from other sectors are not reported by BG. Emissions from sector Q_AgriWastes are quite high relative to national total. Although banned in BG, occurrence of emissions is confirmed by satellite observations. Presentation of GAINS approach to estimate the emissions sent to BG.

NMVOC: GAINS emissions for 2005/2010 are 107%/85% higher than in the BG inventory. Large differences for RoadRail, Solvents, and IndProcess (GAINS higher); BG reports the emissions from AgriOther (not in GAINS).

NH3: GAINS emissions for 2005/2010 are 35%/57% higher than in the BG inventory. GAINS has high emissions from OtherWasteDisp (latrines) – need to be checked, probably emissions based on old estimates. High differences in 2005 emissions from agriculture (sectors O and P – 18%), differences lower for 2010 (only 4%). Change in activity levels or in the methodology of emission inventory? BG – no emissions from pets and humans ~5% of total.

4.3.3 Stationary sources

SO_2: differences due to assumptions about penetration of control measures in the power sector. BG will check distribution of lignite consumption between small and large plants and will suggest changes to control strategies to achieve consistency with BG inventory (fuel consumption in plants equipped with FGD in 2005 and 2010 was higher than assumed in GAINS). The PublicPower sector in GAINS includes also district heating plants. Thus occurrence of small plants is not unlikely.

NOx, stationary sources: Reasons for higher emissions from power sector and industry in GAINS will need to be checked. If BG confirms that the emissions are properly calculated in the national inventory, adjustments will need to be made to the GAINS emission factors and/or control strategies. BG emissions from processes are extremely high – BG please explain. BG emissions from aviation (LTO national and international only) are very high – 50% higher than for AT, which is unlikely – please check.

VOC: BG will check how emissions from VOC-specific sources (solvents use, evaporative emissions from energy production and transportation) are calculated in BG inventory and will verify the assumptions about activity levels in GAINS. Re-analysis is also required for emissions from transport.

NH3: Emissions from latrines (GNFR sector L_OtherWasteDisp) will be checked by IIASA, probably the old (high) emission factor was used. The new guidebook does not include these emissions. A (drastic) decrease of emissions from livestock in BG inventory (2005 vs. 2010) needs to be checked, cannot be explained by changes in activity levels according to Eurostat data. However, data provided by BG to the UNFCCC (latest dataset v1.3 of the 2014 submission) indicate a sharp decrease in animal numbers. BG will identify the reasons for the differences. A decision will need to be taken in which data submitted by BG to international bodied should be implemented in GAINS: Eurostat or UNFCCC?

PM2.5: Assumptions used to calculate PM2.5 emissions from SmallComb will be checked. BG will contact the inventory team (Bulgarian EPA) and ask for their assumptions. GAINS assumptions about the share of new stoves will need to be checked. BG will check if there is any assessment of emissions from agricultural waste burning (GAINS numbers are relatively high). Emissions from power sector, industry and transport need to be checked (much lower in BG inventory). If Bulgaria will not deliver well documented emissions from sectors not covered in BG inventory, emissions will be kept at a level estimated by GAINS.

BG thinks that 100% enforcement of a ban on burning of agricultural wastes is not realistic, there will always be accidental or permitted fires. Thus applicability of the ban will need to be specified.

4.3.4 Transport emissions

The following issues were discussed:

- ✓ 2005 – Difference between GAINS and BG national inventory for sector Road transport:
  - VOC emissions: BULG ~10 kt, GAINS ~45 kt: GAINS assumes 71% NOC gasoline cars without catalysts, which are responsible for the high emissions. This assumption is based on national information about a high share of used cars. If this is lower, emissions will drop significantly.
  - NOx difference: BULG ~41 kt, GAINS 59 kt. First, if much less NOC gasoline cars, then also significantly lower NOx emissions. Otherwise, possibly the share of older diesel trucks and buses could be too high.
- ✓ For 2030: Pointing out PRIMES assumption on high amount of diesel fuel consumed & major uncertainty related to NOx emissions from Euro 6 diesel LDV.
- ✓ BG wants to review data on fleet composition/age distribution for 2005, and projections on share of Euro 6/VI diesel cars and trucks in 2030.
- ✓ Reason for missing estimates of emissions from non-road sector in BG inventory needs to be clarified. If not estimated from BG are provided, GAINS numbers will be used.

4.3.5 Methane ceilings

Methane estimates for BG as developed within the EUCLIMIT Project were presented, together with the (beginning of) the marginal cost curve for CH4 reduction. The ceilings proposed by the Commission assume implementation of measures with zero marginal costs. These are no-regret measures, i.e., measures that are cost-efficient even without CH4 constraints. Cost-efficiency of such measures was assessed with a 10% (business) real interest rate. File with data sent to BG.

4.3.6 Conclusions

- ✓ BG intends to provide national projections for agricultural activities – large differences compared with CAPRI projections.
- ✓ No decision as yet whether national projections for other activities will be provided. These can be projections for selected sectors only (e.g., power plants and/or transport) and only for 2030.
- ✓ All additional data and suggestions should be provided to IIASA within one month
- ✓ Agreed changes will be implemented in GAINS. Date depends on priorities to be set by the Commission and availability of time/resources at IIASA.

4.4 Croatia

Laxenburg, March 28, 2014

4.4.1 Telephone conference with Frederic Neuwahl, DG ENV

Frederik joined the meeting via teleconference. He informed on the state of play and the further plans of the Commission with regard to the NECD. He suggested to concentrate on major differences between the MS and GAINS and on technical issues. No discussion about ambition level at this point. Croatia informed that several differences between GAINS assessment and national inventories exist. Costs for HR in terms of % GDP are high, as well the levels of reduction comparing to another countries. HR has doubts if targets are feasible in HR conditions.

4.4.2 Comparison of GAINS and national inventories for 2005 and 2010 (2014 submission)

SO2: GAINS estimates for the power sector and industry are higher than in the national inventory; does IIASA underestimate the progress in emission controls?

NOx: Differences are within accuracy limits, although differences for LTO cycles and off-road machinery exist. GAINS estimates higher emissions from the power sector and industrial combustion, and lower from processes. The Croatian Inventory collects and reports direct emissions from all power and cement plants and reported.

PM2.5: HR emissions from small combustion plants lower than GAINS; HR uses Tier 1 methodology. Emissions from industrial processes higher in GAINS. Emissions form road transport lower in GAINS. The highest difference – emissions from agricultural waste burning. Although banned in HR, occurrence of emissions is confirmed by satellite observations. Link to the GFED – Global Fire Database as well as publications on the topic will be sent to HR. While emissions from cigarettes smoking and waste incineration are included in HR inventory, emissions from barbecues are not reported.

NMVOC – There are large differences for solvents. A large discrepancy emerges for glue application, where HR assumes emission factors for all glues as if they were with solvents. GAINS assumes that a high proportion of glues used in industry are low solvent glues leading to a lower implied emission factors. A more detailed analysis of differences to the latest inventory will be attempted.

NH3: HR – much higher emissions from livestock and industrial processes. Key reason for differences in livestock emissions is the Tier 1 approach employed by Croatia. Furthermore, also assumptions about the share of animals kept on solid/liquid systems are different. HR provided information about such shares at the consultations. Important emissions from wastewater treatment (~6% of total), not present in GAINS (latrines?). Total difference for 2005 and 2010; HR estimate ~33% higher.

4.4.3 Transport emissions

Croatia reports comparably high emissions from LTO cycles. It was pointed out that in the Croatian inventory total emissions (LTO+Cruise) from civil aviation are included in the NFR 1A3a ii (i) category. Croatia will improve its inventory by dividing total emissions on LTO and Cruse and will add only emissions from LTO cycles in national total.

Emissions from road and non-road transport need to be checked. Croatia uses the Croatian vehicle database. The Ministry of Interior is responsible for gathering data on vehicle type, age, etc.

Emissions are calculated with COPERT IV model v 10.0. HR will analyse the most important differences and will suggest corrections.

Estimates for road transport are approximately consistent. Activity data for non-road sector in GAINS need corrections based on recent HR estimates.

4.4.4 NH_3 emissions

It was agreed:

- ✓ Emission from wastewater treatment (~6% of total), not present in GAINS (latrines) will be included in GAINS;
- ✓ Activity data for category 4.B.09.d Other poultry (ducks, geese and other poultry) need to be corrected in GAINS. HR inventory for other poultry beside ducks, geese sinclude other poultry - pheasants, quails, guinea fowls, ostriches, chickens other than laying hens (cockerels), while GAINS (based on Eurostat numbers) does not include them.
- ✓ Aggregated emission factor for NH_3 for category 4.B.08 Pigs (sows and fattening pigs) is lower in GAINS due to the assumption that activity data for sows include also piglets. The HR inventory takes into account only number of sows without the number of piglets. The Croatian Bureau of Statistics does not evident piglets up to 20 kg. The GAINS aggregated emission factor is weighted accounting for sows (with piglets) and fattening pigs while the Croatian aggregated emission factor takes into account sows (without piglets) and fattening pigs.
- ✓ The differences in the proportion of livestock housed on solid/slurry based system need to be resolved; HR will provide data from national sources.
- ✓ Significant differences in emission factors exist for cattle dairy, cattle non-dairy, horse, pig; For pigs see above (explanation needed as when accounting for different calculation method the emissions should come similar provided activity data is consistent). For cattle, GAINS considers specifically milk yield (dairy cattle) and arrives at lower emission factors than Tier 1 factors used in HR. IIASA commented that Tier 1 from EEA Guidebook is representative for cows with relatively large milk yield (about 6000 l) and might not be appropriate for Croatia, leading to overestimate of NH_3 emissions.
- ✓ Differences in NH_3 emissions from fertilizers production (urea and NPK) due to differences in activity data and NH_3 emission factors. HR estimates are based on activity data and eported emissions from fertilizer manufacturers from the Croatian Environmental Pollution Registry (EPR), while GAINS relies on data from the International Fertilizer Association (IFA). National data will be used

4.4.5 VOC emissions

HR experts will check activity data for glues and assumption that is used for NMVOC emission estimation in national inventory and suggest correction.

4.4.6 Methane ceilings

Methane estimates as developed within the EUCLIMIT Project were presented, together with the (beginning of) the marginal cost curve for CH4 reduction. The ceilings proposed by the Commission assume implementation of measures with zero marginal costs. These are no-regret measures, i.e., measures that are cost-efficient even without CH4 constraints. Cost-efficiency of such measures was assessed with a 10% (business) real interest rate.

4.4.7 Conclusions

- ✓ HR intends to provide national projections for agricultural activities. There are large differences compared with the CAPRI projection.
- ✓ PRIMES projections for energy data are different than national, in predicted consumption growth of energy and electricity and in relation to structure of new power capacities
- ✓ No decision as yet if national projections for other activities will be provided.
- ✓ All additional data and suggestions should be provided to IIASA within one month
- ✓ Agreed changes will be implemented in GAINS. Date depends on priorities to be set by the Commission and availability of time/resources at IIASA.

4.5 Cyprus

Laxenburg, March 31, 2014

4.5.1 Comparison of GAINS and national inventories for 2005 and 2010 (2014 submission)

SO2: Differences are within the ballpark. (Difference on A_Public Power for 2010 is almost 6%)

NOx: GAINS emissions 2005/2010 – 2% higher/7% lower than CY national. Differences occur in non-road sector, Industrial Comb, AgriOther and aviation (LTO cycles). LTO, Industrial Comb and AgriOther emissions in CY inventory are quite high, needs to be checked how they are calculated. Emissions from other sectors are within the ballpark.

PM2.5: GAINS emissions 2005/2010 8/10% lower. Difference due to much higher estimates from small combustion, industrial combustion and IndProcess in the national inventory. In turn, emissions from Q_AgriWastes higher in GAINS. GAINS has R_Other emissions ~5% of total.

NMVOC: GAINS emissions 2005/2010 26/24% lower. Difference due to much higher emissions from solvents, fugitives and AgriLivestock in the national inventory. CY calculates VOC emissions from livestock, which are not included in GAINS.

NH3: Differences GAINS vs. national inventory are small (below 5% of national total). GAINS – higher emissions from livestock, lower from AgriOther. CY will check if corrections necessary.

4.5.2 Methane ceilings

The methane estimates developed within the EUCLIMIT Project were presented, together with the (beginning of) the marginal cost curve for CH4 reduction. The ceilings proposed by the Commission assume implementation of measures with zero marginal costs. These are no-regret measures, i.e., measures that are cost-efficient even without CH4 constraints. Cost-efficiency of such measures was assessed with a 10% (business) real interest rate. File with data sent to CY.

4.5.3 Differences in emissions of NH3 and NMVOC

NMVOC: Big differences were found in the following categories: F_Solvents and O_AgriLivestock.

NH3: Differences were found in the following categories: AgriLivestock and AgriOther.

It seems that the differences are due to different activity data and different emissions factors used in the national inventory compared to the ones in GAINS.

It was agreed that CY will provide a national activity scenario for NMVOC and NH3 focusing on these differences.

Additional comments by IIASA (not yet presented to CY):

While total emissions of NH_3 show reasonable agreement, there are some differences in activity data for livestock which need to be explained. Currently the Eurostat data used in GAINS seem to be incompatible with the statistics used in the national inventory. CY uses Tier 1 approach for emission factors (higher than GAINS, especially for cattle) which in combination with lower animal numbers produces similar total estimate of emissions from agriculture.

The reasons for difference in the NMVOC emissions from solvent use were not identified at the meeting as more detailed information about activity data used in the CY inventory is needed.

4.5.4 Conclusions

- ✓ Files with activity data and emissions by control option have been downloaded from GAINS and sent to CY for further checks.
- ✓ CY suggests to investigate the PM2.5 emission factor for cement industry (0.6 kg/t) used in the national inventory. Value is based on the EF written in the Corinair Guidebook.
- ✓ CY expert will try to send all additional data and suggestions to IIASA within a month.
- ✓ Agreed changes will be implemented in GAINS. Date depends on priorities to be set by the Commission and availability of time/resources at IIASA.

4.6 Czech Republic

Laxenburg, July 18, 2014

4.6.1 Comparison of GAINS and national inventories for 2005 and 2010 (2014 submission)

SO2: GAINS emissions 2005/2010 – 4%lower/1% higher than CZ total. The CZ inventory for 2005 misses some sectors or includes them elsewhere. In 2010 different distribution of sources between power sector, industrial combustion and processes.

NOx: CZ 2005 inventory incomplete, emissions from non-road sources and industrial processes are missing. GAINS emissions 2010 5% lower than CZ national total. Large differences in emissions from transport – road vs. non-road. Different categorization?

PM2.5: GAINS emissions 2005/2010 – 165%/111% higher than CZ national total. The Czech inventory is incomplete, no emissions from agricultural waste burning, cigarettes smoking, barbecues etc. In 2005, also no emissions from waste incineration, agriculture (livestock and other), processes, and off-road mobile sources reported. Agriculture waste burning: although banned in CZ, occurrence of emissions is confirmed by satellite observations. Link to the GFED – Global Fire Database as well as to other publication on the topic is included in the presentation by Z. Klimont, which will be sent to CZ. Some of these emission categories appear in the inventory for 2010, for which year the differences compared with GAINS are much smaller. However, even in 2010, there are very high differences in the emissions from small combustion (DOMestic sector).

NMVOC: GAINS emissions 2005/2010 44%/43% higher than in CZ inventory. Problem sectors: road transport and small combustion.

NH3: 2005 inventory incomplete, no emissions from agriculture. For 2010, GAINS emissions 1.5% lower than CZ national total. No emissions from pets and humans in CZ inventory, estimates of emissions from agriculture are higher than in GAINS.

4.6.2 Stationary sources

The largest differences are for PM emissions from small combustion sources in the DOMestic sector. CZ uses very low emission factors, it is planned to revise the factors based on the Guidebook. Legislation on new boilers and stoves in the Czech Republic is quite strict, and even more ambitious limit values are planned. National policy aims at replacement of old boiler and stoves with new ones. There are about 600,000 coal and wood boilers in CZ. It is planned to replace about 100,000 combustion devices with the cleaner ones up to 2020.

CZ experts do not think that implementation of ESP for small devices is a realistic option. IIASA explained that the technology is commercially available and to some sources applied in Switzerland. However, the performance is lower than for large installations.

Prior to consultations, CZ has sent to IIASA a national energy pathway, together with suggestions for correction of current legislation control strategy. Suggestions are made mainly for 2010, thus transposition to 2005 data will be needed.

Czech experts were invited to provide info on the structure of natural gas use in the power sector for historic and projection years (boilers – GAINS category PP_EX_OTH, turbines – PP_NEW, and CCGT plants - PP_MOD).

4.6.3 Transport sources

- According to national experts, the consumption of gasoline by mopeds in GAINS appears too high in 2005, resulting in too high VOC emissions.
- Detailed national data mostly available for the year 2010. Based on these data, GAINS assumes a conservatively high share of old vehicles (cars as well as trucks and buses) for the year 2005, and is also quite conservative for the share in 2030. National data suggest that the average age of cars in the CZ is 14 years, although old cars have very low mileage. CZ wants to ask for expert judgement from their institute for transportation research and get back with a suggestion for year 2005 distribution of vehicles' fuel consumption by Euro norm.
- No data ready for emissions from non-road machinery. However, agriculture is considered the major source (in line with GAINS). Possibly some expert judgement for year 2005 consumption can be made.

4.6.4 NH_3 emissions

Total emissions from agriculture are very comparable for 2005 and 2010; However, there are some discrepancies for specific sectors, mostly due to differences in activity data (animal numbers) for poultry, horses and also rabbits for which the projection needs to be revised downwards. Especially the poultry numbers are of concern since they originate from EUROSTAT and seem to be significantly different from the national statistics used in the inventory.

Furthermore, activity data for mineral fertilizer use need to be checked as the GAINS numbers are higher, based on statistical data from industry. The open question was whether the national numbers include also urea fertilizer. To be checked and compared by both teams.

We had also discussion about the structure of farms; Czech experts indicated that animals are equally distributed between large, medium and small farms. We need to check that against our assumptions (based on EUROSTAT) in GAINS.

4.6.5 NMVOC emissions

The most recent estimate of their NMVOC emissions by the Czech Republic for 2005 is about 202 kt, compared to about 175kt as reported in the last submission to EMEP. These new numbers and revised time series will provided to EMEP in the next submission. While the new numbers are somewhat closer to GAINS estimates, GAINS is still higher mostly because of discrepancies for the transport sector.

Emissions from solvent use are very similar both for 2005 and 2010 (difference less than 5%) but there are some sector shifts that require adjustments. The key sectoral differences were identified for:

- Number of produced cars
- Emissions from decorative paint use
- Domestic use of solvents

There are few smaller discrepancies for degreasing, printing and food and drink industry. The reasons were discussed and adjustments will be made in GAINS using latest inventory submission.

The projection will be adjusted accordingly but only due to modifications in the historical years, there is no specific national projection.

4.6.6 Conclusions

- ✓ The Czech Republic provided national projections for national projections for energy and agriculture. The date of implementation in GAINS depends on priorities set by the Commission and availability of time/resources at IIASA.
- ✓ In the meantime, IIASA will use data provided by CZ experts to make adjustments to the PRIMES 2013 Reference Current Legislation scenario in GAINS.

4.7 Denmark

Laxenburg, 13 March 2014

4.7.1 Response to the general questions by DK

Questions have been sent by DK to IIASA prior to consultations (available on request). They refer to GAINS methodology and approach. Quick responses have been given, together with the links to the pollutant-specific methodologies and to GAINS tutorial. All links are available from the model.

IIASA explained how the Commission proposed the ceilings for CH4: only no-regret, i.e., cost-efficient measures were included. The list of measures has been discussed.

Denmark sees largest problems with the proposed ceiling for ammonia. Thus, the consultations focused mainly on emissions of NH_3 sources.

4.7.2 NH_3 emissions

Explanations regarding activity levels, emission factors and technology uptake were given.

4.7.3 Conclusions

- Denmark recommended that in the future results are presented in a more transparent way.
- IIASA recommended once more reading (glancing through) the GAINS tutorial, which explains many of questions Denmark had.
- Although Denmark considers delivering to IIASA the national scenario for agriculture, final decision has not been made yet. IIASA will be informed in due time.

4.8 Estonia

Laxenburg, 29 April 2014

SO_2: GAINS estimates for 2005/2010 are 13%/9% lower than the national inventories, mainly due to lower emissions from Public Power and IndustrialComb. In the national inventory, emissions from industrial processes seem to be reported together with IndustrialComb.

NOx: GAINS estimates for 2005/2010 are 12% higher/8% lower than the national inventories. The largest occurs for from RoadRail, for which GAINS estimates are higher by 9%/5.4% of national total. In 2010, GAINS emissions from PublicPower, IndustrialComb and OffRoadMob are lower (by 5.4%, 2.2% and 5.5%, respectively).

PM2.5: GAINS estimates for 2005/2010 are 1% higher/9% lower than the national inventory. Major differences in the PublicPower and IndustrialComb sectors, due to different splits compared to GAINS. Emissions from SmallComb in GAINS are lower by 6/8% of national total. No emissions from agricultural waste burning in the national inventory. Although banned in EE, occurrence of emissions is confirmed by satellite observations. Link to the GFED – Global Fire Database as well as to publications on the topic will be sent to EE. Emissions from cigarettes smoking, barbecues, and waste incineration are not included in EE inventory.

NMVOC: GAINS emissions 2005/2010 26%/20% higher than in the national inventory. GAINS is higher for SmallComb. The national inventory misses emissions from IndProcesss and Fugitive sector. Emissions from solvents are lower in the national inventory. Emissions from RoadRail are higher in GAINS. The national inventory does not report emissions from AgriWastes.

NH_3: GAINS estimates for 2005/2010 are 25%/18% higher than the national total inventories, mainly due to differences in emissions from agriculture. No nationally reported emissions from pets and humans (~5% of total).

4.8.1 Analysis by Estonian experts

Estonian experts presented an analysis of the IIASA scenarios (available upon request). The stressed untypical structure of the Estonian energy system, with large shares of oil shale in TPES and large quantities of shale oil production, which is considered to increase in the future. However, such a growth is not reflected in the PRIMES activity pathway. PRIMES assumes an increase in hydro electricity production, which – according to EE estimates – is not possible.

Major corrections suggested by EE are:

- ✓ Adjustment of 2005 emissions for NOx and VOC to inventory numbers
- ✓ Modification of emission factors for power plants using oil shale
- ✓ Proper inclusion of emissions from shale oil production and combustion of shale gase in the power sector
- ✓ Update of NMVOC emissions from oil terminals
- ✓ Correction of emission factors from biomass combustion and from gas combustion in the power sector
- ✓ Update of projections of cement and lime production.

Emissions of ammonia in the national inventory are based on a simplified (Tier 1) approach. For future assessments, EE is considering implementation of a Tier 2 methodology similar to GAINS.

4.8.2 Methane ceilings

Methane estimates for Estonia as developed within the EUCLIMIT Project were presented, together with the marginal cost curve for CH4 reduction. The emission ceilings proposed by the Commission imply implementation of no-regret measures, i.e., measures which are cost-efficient even without CH4 constraints. The cost-efficiency of such measures was assessed with a 10% (business) real interest rate. Files with emissions and a list of measures has been sent to EE.

4.8.3 Conclusions

- ✓ After discussions with IIASA, EE will review the assumptions about the turnover of vehicle stock and (possibly) suggest revised control strategies
- ✓ Additional GAINS data on VOC emissions from solvent use will be sent, to enable closer agreement with the EE inventory.
- ✓ EE intends to prepare national projections of activity levels and present them to IIASA (in GAINS format)
- ✓ IIASA will provide templates with current activity levels and control strategies to EE. A national scenario will be delivered using these templates.
- ✓ All additional data and suggestions should be provided to IIASA within one month.
- ✓ Agreed changes will be implemented in GAINS. Date depends on priorities to be set by the Commission and availability of time/resources at IIASA.

4.9 Finland

Laxenburg, July 18, 2014

4.9.1 Comparison of GAINS and national inventories for 2005 and 2010 (2014 submission)

SO_2: GAINS emissions 2005/2010 – 29%/33% higher than national estimate. GAINS – higher emissions from Public Power and Industrial Combustion. Differences for IndProcess and Fugitive (refineries) in FI inventory are due to different sector classifications – more was assigned to IndustrialComb, and a too high emission factor for coke use in iron and steel industry.

NOx: GAINS emissions 2005/2010 – 19%/17% higher than FI national total. GAINS – higher emissions from PublicPower, RoadRail and OffRoadMob. FI emission inventory for transport is undergoing changes, emissions after changes need to be checked.

PM2.5: GAINS emissions 2005/2010 – 31%/26% higher than FI national total. The highest differences are for the SmallComb - GAINS only 55% of national estimate. Not clear what is included in E_fugitive in nat. inventory, which is 13% of national total difference – GAINS is lower. Estimates for combustion in the power sector and industry plus process emissions are similar but different distribution – industrial CHP plants? Emissions from road transport are higher in FI inventory, emissions from non-road lower.

NMVOC: GAINS emissions 2005/2010 27%/31% higher than the FI inventory. GAINS emissions from SmallComb, Solvents, and OffRoadMob are much higher. FI emissions from Shipping very high, probably small motor boats with 2-stroke engines are included here. In OffRoadMob more than 2/3 of emissions originate from 2-stroke engines (machines in gardening and forestry, snow scooters, motor boats) – check the activities and emission factors. Current GAINS numbers are based on previous talks with FI.

NH_3: GAINS 10%/14% lower than FI due to lower emissions from agriculture. FI – no estimate of emissions from pets and humans.

4.9.2 Stationary sources

The original version of the CLE emission estimates was based on control strategies and emission factors that have been prepared by FI for the GAINS Finland model. Since the structure of activity levels in PRIMES is for some sectors different from the national scenario, this has caused relatively high differences in emission estimates for the base year. Besides, IIASA was informed that numbers in the 2014 submission of the FI inventory are not up-to-date anymore and are going to be revised in the next year. Thus the model needs to be calibrated to the expected new values (which are not fully available as yet, and only a preliminary version exists).

Before and during the consultations, IIASA and Finland have exchanged information on CLE emission estimates. IIASA implemented corrections to activity levels, emission factors and the CLE control strategies. The following changes have been made:

- ✓ S content of heating oil used in the DOMestic sector adjusted
- ✓ Emission factors for coke and residual oil used in iron and steel industry changed (these fuels are used mainly in blast furnaces and thus emissions are very low)

- ✓ Modification of the structure of gas use in the power sector to include gas combined cycle (CCGT) plants. Info on CCGT capacities in 2005 – 2010 is available from http://globalenergyobservatory.org/geoid/44252
- ✓ Modification of emission factors for gas boilers in the power sector to typical values in other countries. With FI-specific factor, compliance with ELVs from the LCPD and IED would have required stringent controls, which are not installed in existing boilers.
- ✓ Change of VOC emission factors in power generation and DOMestic sectors. For the latter, default factors for wood combustion were applied. FI-specific factors resulted in emissions much higher than the inventory numbers.
- ✓ Change of control strategies for SO2 and NOx in the power sector to comply with ELVs from the LCPD and IED and to achieve consistency with the inventory.
- ✓ Change of PM2.5 emission factor and control strategy for peat mining. Values adjusted to the (updated) inventory.

FI confirmed that the PM2.5 emission estimates in GAINS are consistent with the expected values from the (updated) FI inventory.

Changes were implemented in the scenario TSAP_consultation_2014, available for viewing in GAINS online, scenario group TSAP_Cons_2014.

FI experts believe that GAINS estimates of emissions from open residential waste burning is much too high in GAINS. Value will be checked and communicated to IIASA for implementation.

4.9.3 Mobile sources

The following issues were identified and corrected:

- ✓ The fuel allocation for road and non-road sectors in GAINS as discussed during consultations 2012, and as suggested by the Finnish models, only a few PJ more gasoline
- ✓ Vehicle-km (2005) exactly as in the Finnish transport model, relevant for abrasion.
- ✓ Thereby, all resulting differences in emission estimates are due to differences in assumed age structure and emission factors.

LD vehicles:

- ✓ Age structure consistent with LIPASTO.
- ✓ No big difference for NOx emissions.
- ✓ EF PM abrasion in GAINS will be increased to the Finnish value.
- ✓ VOC emissions can be reduced by ~10% by assuming slightly less mileage for oldest cars (without catalyst). Then they will be close to national reported inventory.

HD vehicles

- ✓ Age structure in GAINS adjusted to become younger (resulting in ~10% less NOx emissions).
- ✓ Remaining difference in NOx due to differences in emission factors, with FIN/LIPASTO having significantly lower values (except for NOC). Apparently, these values will however be revised upwards.

- ✓ Difference in PM mainly due to abrasion, which will be adjusted in GAINS.

Non-road

- ✓ Significantly lower emission factors for NOx and PM for agricultural and construction machinery in Finnish inventory. GAINS numbers are consistent with EEA Guidebook and can remain.
- ✓ Differences in VOC emissions seem to be caused by different allocation between shipping and NRMM – the sum of these two sectors is consistent in GAINS and the FIN inventory.
- ✓ Check of emissions from 2-stroke engines, e.g. in boats or snowscooters: the Finnish NRMM TYKO model suggests 2.1 PJ fuel to be used on 2T engines (ATV, snowscooters etc) @ 6 kt VOC/PJ = 12.6 kt VOC while GAINS assumes 2.7 PJ @ 9 kt VOC/PJ = 24 kt VOC. Adjustments in GAINS will be made.

4.9.4 NH_3 emissions

While the main discrepancies occur for agriculture, there are also issues with emissions from combustion of solid fuels in the power, industry and domestic sectors for which the default GAINS emission factors are higher than the FI estimates. For DOM (residential) combustion, the national inventory has zero emissions. These combustion sources contribute about 1 kt NH_3.

Agriculture

- ✓ Animal numbers statistics for historical years were compared and will be updated in GAINS; primarily the share of solid vs liquid systems was an issue.
- ✓ More than a third of the difference in agriculture (about 2 kt) originated from different EFs (primarily volatilization rate from housing; IIASA used the default guidebook numbers so far) for minks and foxes. New numbers were provided to IIASA and will be implemented.
- ✓ For cattle, the adjustment of emission factors to nationally established N-excretion and volatilization rates leads to a better match for both dairy and beef cattle. Also grazing days were updated.
- ✓ Another important category are pigs, for which a detailed comparison revealed the need for updated excretion rates and volatilization rates (especially for animals kept on solid systems).
- ✓ Small modification of volatilization rates for horses were introduced.

Livestock projections

- ✓ FI provided national projection, which will be implemented as a national pathway. In addition, the solid/liquid ratio of these projections will be used for the CAPRI reference/TSAP projection.
- ✓ For milk yields, CAPRI assumes a strong increase in the next decades while FI national projections assume only a very moderate growth. IIASA provided contact to Peter Witzke who leads CAPRI development to discuss this.

Other

- ✓ We have also discussed the control strategies and especially the issue of constraints, i.e, maximum application of mitigation measures. FI is going to suggest maximum application levels for key technologies like low nitrogen application (LNA [low and high]) and covered stores (CS [low and high]).

4.9.5 NMVOC emissions

- ✓ Key differences appear in emissions from residential combustion, transport, and solvents. The first two are dealt with when emissions of other pollutants were discussed (see above) and we believe the adjustments will improve also match for NMVOC. Specifically for residential combustion, FI provided national emission factors for GAINS source categories, which will be implemented.
- ✓ For solvents more discussion is needed, which will take place via phone. Based on the comparison for specific categories of solvent use there is a need for discussion of few specific sources, but there is also an issue of resolution as the categories in the FI national inventory and GAINS differ.

4.9.6 Conclusions

- ✓ Exchange of information prior to and during the consultations allowed an important improvement of the match between the national emission inventory (as expected after revisions that are in the pipeline) and GAINS. Adjustments have also changed the CLE projections up to 2030.
- ✓ IIASA will revise emissions from the transport sector and from agriculture as agreed during the bilaterals.
- ✓ Adjustments for NMVOC-specific sources (solvent use, fuel production, storage and use) will be made as needed.
- ✓ FI provided national projections for agriculture. The date of implementation in GAINS depends on priorities set by the Commission and availability of time/resources at IIASA.
- ✓ FI will provide updated info on activity levels and PM emissions from open burning of residential waste.
- ✓ Additional data and suggestions for further improvements of the updated TSAP scenario should be provided to IIASA ASAP but not later than by 22nd August 2014.

4.10 France

Laxenburg, May 23, 2014

4.10.1 Comparison of GAINS and national inventories for 2005 and 2010 (2014 submission)

SO2: GAINS emissions 2005/2010 – 4%/9% lower than FR total. GAINS – lower emissions from industry, and OffRoadMob, higher from Shipping. Other emissions within the ballpark.

NOx: GAINS emissions 2005/2010 – 4%/2% lower than FR national total. GAINS – lower emissions from RoadRail and OffRoadMob, higher from Shipping. Other emissions within the ballpark, except emissions from PublicPower (GAINS higher).

PM2.5: GAINS emissions 2005/2010 – 11%/27% higher than FR national total. The highest differences are in the IndProcess sector - GAINS higher. Including emissions that are not explicitly modelled in GAINS (R_Other), the difference is 19%/22% of national total. In 2005, GAINS emissions from SmallComb lower (9% of national total), in 2010 2.5% higher. Emissions from cigarette smoking, barbecues and fireworks higher in GAINS – makes a difference of about 3% of national total. Other emissions within the ballpark.

NMVOC: GAINS emissions 2005/2010 11%/0% lower than FR inventory. GAINS emissions from SmallComb, RoadRail, and Shipping lower. Solvents within the ballpark. Higher GAINS emissions for WasteDisp, but no emissions from WasteWater and WasteIncin. AgriWastes consistent.

NH3: GAINS 1.7%/3.8% lower than NAT due to lower emissions from agriculture. FR – no estimate of emissions from pets and humans.

4.10.2 Stationary sources

FR prepared a report “Information and questions for the bilateral meeting between France and IIASA on technical work carried out for the Air package”, which formed a very good basis for discussions during the bilaterals. The document is available upon request. The most important issues are:

SO_2:

- ✓ Flaring in refineries: is included in process emissions from refineries, not in WASTE_FLR.
- ✓ Open burning of agricultural waste: French experts suggest that the current level of open burning is legal and the ban is enforced appropriately, and therefore the future mitigation potential should be zero, i.e, applicability of GAINS ‘BAN’ option should be zero leaving basically emissions from open burning at the current level.
- ✓ S content of light fuel oil (MD) used in the DOMestic sector: FR suggests S content consistent with EU legislation (0.1%). GAINS assumes this value for 2000, for 2005 total emissions from SmallComb are in GAINS higher than NAT, thus lower S content of MD assumed. Since FR suggests lower S content of biomass fuels, this will enable to achieve consistency with the national inventory even with higher S content of MD. However, in Austria already now a high proportion DOMestic use of MD is sulphur free.
- ✓ Emissions from processes will be aligned – to the extent possible - with FR inventory.

NOx:

- ✓ GAINS underestimates emissions from waste burning with energy recovery (FRANCE will provide activities and emissions factors) and from glass.
- ✓ In GAINS, emissions from flaring in refineries are included in process emissions from refineries.
- ✓ Emissions from lime are overestimated in GAINS, will be aligned with FR inventory.

PM2.5:

- ✓ GAINS emissions from processes are overestimated, the differences for individual processes given in the FR report, numbers in GAINS will be corrected according to the French activity and emission factors.
- ✓ PM2.5 emissions from wood processing are not included in GAINS. France reports 12.6 kt of PM2.5 for 2005 in the latest submission. GAINS will include these emissions in 'PR_SMIND_F' (processes from small industries – fugitive). The current GAINS estimate for this sector is lower (about 3.3 kt PM2.5) and needs adjustment.

NMVOC:

- ✓ Except for traffic, which is discussed separately, the highest differences occur for stationary combustion in the residential sector (a check should be made to understand differences), fugitive emissions from exploration and production of oil and gas (GAINS higher) and from domestic use of solvents (GAINS lower). These differences can be eliminated through adjustments in activity levels and emission factors in GAINS.

4.10.3 Transport emissions

The discussion with the French experts was well informed by the document produced by CITEPA and INERIS. Related questions concerning the modelling of road transport can be found there. We focused our discussion on NOx emissions and the following issues:

- ✓ Comparison of assumptions on the CLE control strategy in 2030: Known difference in approach – France assumes introduction of new technologies, e.g. Euro 6c not earlier than the date of type approval; in contrast, GAINS/COPERT assume earlier introduction given the availability of the advanced technology on the market. The difference in, e.g., Euro 6c shares in 2030 can be explained by this difference in approach. It was also explained that PRIMES assumes efficiency increases, which has impact on the control strategy.
- ✓ The basis for the COPERT/GAINS emissions factors was explained, notably for high Euro 5, Euro 6 NOx emission factors for LDDV, and the assumption for Euro 6c. Also documented in TSAP report #4.
- ✓ Results of sensitivity analyses for Euro 6c emission factors were discussed. They are documented in TSAP reports #10 & 11.
- ✓ Differences with latest French scenario AME:
    - o Compare emission factors per Euro stage, notably for diesel cars and trucks.
    - o Total diesel fuel consumption: Compare respective assumptions on growth of transport volume, otherwise refer to PRIMES energy modelling.

Emissions from non-road mobile sources:

- ✓ There is a difference in emissions from household/gardening (mobile) (GAINS higher, 4% of total emissions).
- ✓ Maritime emissions: the IMO legislation (S content of marine fuels and NOx emission standards) is included in the GAINS CLE scenario. It was assumed that 50% of national sea traffic will occur within the SECA (North Sea and English Channel), the rest outside SECA. IIASA is willing to verify/modify assumptions, if new information is delivered by FR. In the Commission's proposal no additional NOx measures were allowed. The use of diesel fuel with S content <0.1% by maritime shipping should be eliminated from the solution.

4.10.4 Treatment of IED and the proposal for MCPD

- ✓ The GAINS estimate of emissions from industrial combustion sources covered by the IED is based on the national interpretation of the CLE legislation that has been presented to IIASA during the previous series of consultations. Also studies prepared by the EGTEI group were used.
- ✓ Estimates for refineries were checked by CONCAWE/Les White. As the control strategy for France was found too optimistic for SO_2, it will be revised with the addition of flares in PR-REF. FR suggests inclusion of SO2 emitted from refinery gases, which are currently counted in GAINS as LPG with zero S content. This change has been implemented for GAINS France, and can be transferred to all other countries. It should be noted that the exact content of the CONCAWE work was not known to France, and it was found that only the global consistency of the refinery sector has been checked for Europe, but not for individual countries.
- ✓ IIASA will consider the French suggestions for improved interpretation of the IED under French conditions.
- ✓ The proposal for MCPD was not included in the TSAP#11 "Current Legislation" scenario. In the Commission's Proposal, stricter control of emissions is allowed. However, emissions from the sectors covered by the MCPD were determined by the GAINS optimization (within the applicability limits in GAINS) and do not exactly correspond to the ELVs specified by the MCPD.
- ✓ Within the current series of calculations, IIASA will not be able to perform additional sensitivity analyses suggested by FR to identify the effects of different plant sizes and operating hours on emission reductions and costs for boilers for different industrial sectors. IIASA would be very much interested in the outcome of such an analysis, if done by the GAINS France team.

4.10.5 Methane ceilings

The methane estimates developed within the EUCLIMIT project were presented, together with the (beginning of) the marginal cost curve for CH4 reduction. The ceilings proposed by the Commission assume implementation of measures with zero marginal costs. These are no-regret measures, i.e., measures that are cost-efficient even without CH4 constraints. Cost-efficiency of such measures was assessed with a 10% (business) real interest rate.

4.10.6 NH_3 emissions

- ✓ For ammonia most of the discussion was linked to the parameterization of the model and projections including reasons for different emission mitigation burden in different analysed scenarios. IIASA explained that the CAPRI and GAINS models were originally not linked, and that the reference years are different, i.e. 2004 for CAPRI model and 2005 for GAINS. France reminded that data for 2005 were sent to IIASA but have not been considered yet.
- ✓ While CAPRI projections are used in GAINS, a separate discussion with P. Witzke working on the CAPRI model is needed to obtain more explanations on how CAPRI projections are developed and how they are linked with GAINS. A contact will also be needed to explain several region specific assumptions.
- ✓ The projection for livestock and fertilizer used are not necessarily a continuation of current trends but an outcome of the CAPRI model. CAPRI balances demand for agricultural products with cost-optimized production distribution within Europe considering current and decided quotas, subsidy schemes, etc. IIASA explained that the data format is not completely identical in GAINS and CAPRI; CAPRI uses average figures, whereas GAINS uses a unique number. France suggested to send national data that are more precise than EUROSTAT data.
- ✓ The same agricultural activity scenario has been used in all GAINS runs for TSAP and it has been harmonized with EUCLIMIT as well as methane calculations. The discussion pointed out that GAINS overestimates costs because it employs current costs for projections. GAINS does not take into account structural evolutions, new actions and technological changes that could be developed in the future.
- ✓ For modelling future livestock development and fertilizer application, assumptions on productivity changes are taken from CAPRI model. GAINS considers the impact of productivity changes for dairy cows (milk yields) by adapting emission factors over time. France points out potential a problem of compatibility between the two models if they are based on different hypothesis. IIASA suggested to contact P. Witzke to validate with him that the same hypothesis has been taken in the CAPRI model.
- ✓ CAPRI provides livestock numbers, but a number of other assumptions need to be done in GAINS, for example split between liquid and solid manure systems, assumptions about days animals spend grazing, emission factor calculations. These parameters are based to the possible extent on communications with national experts that took place at different fora, e.g., UNECE expert panels, bilateral consultations in the past within the UN Gothenburg Protocol work and EU CAFE programs, etc. The background document about ammonia calculation methods will be provided to the French experts. IIASA confirmed that no assumptions on climate change has been taken in GAINS. IIASA suggested to contact P. Witzke to check whether such hypothesis have been considered in CAPRI.
- ✓ We also discussed issues associated with mitigation potential and constraints used in GAINS, e.g., farm-size distribution. IIASA will provide size distribution as used in the model (based on EUROSTAT).
- ✓ French experts asked for information about fertilizer use and the allocation between urea and other fertilizers; data that serves the assumptions in GAINS about the efficiency of ‘substitution’ or ‘improved application’ of urea that is simulated as a substitution of urea with the current mix of other mineral fertilizers. Respective historical data for France will be provided to IIASA.

4.10.7 NMVOC emissions

For NMVOC total difference for 2005 is in order of 10%.

- ✓ The major difference occurs for residential combustion (lower in GAINS), probably because of different emission factors (PM estimates are not so different). IIASA will consult with France to evaluate and harmonize emission factors.
- ✓ Transport sector: GAINS is lower for road and higher for off-road.
- ✓ Oil exploration and other similar activities in GAINS are higher than in the national inventory; French oil production fields are closed or only small production; GAINS need to be updated
- ✓ There are some smaller differences in other sectors, e.g., personal solvent use, and it is planned to harmonize these in the near future.

4.10.8 Other scenarios run by IIASA and possibilities for broader uncertainty analysis

- ✓ Analyses with the PRIMES 2010 scenarios are described in the TSAP Report#7.
- ✓ IIASA has conducted a sensitivity analysis for the PRIMES 2013 Climate Package energy pathway. This demonstrated that the achievement of targets is much cheaper than for the Reference scenario. For the Climate Package scenario, it has been assumed that emissions for each country remain at the Commission's proposal scenario determined for the PRIMES 2013 Reference energy pathway. The TSAP Report #11 gives the CLE emissions for the Climate Package pathway by country. Since the analysis assumed that the national ceilings will not change compared with the ceilings determined for the Reference pathway, the benefits remain the same for the two scenarios. Only costs change. Again, the difference in costs by country is given in the TSAP Report#11. Details on energy consumption and CLE emissions by country and sector for the Climate Package pathway will be made public after the scenario is published by DG Clima.
- ✓ Benefits analysis for the scenarios corresponding to the TSAP Report #11 are described in the report by Mike Holland "Cost-benefit Analysis of Final Policy Scenarios for the EU Clean Air Package"[3].
- ✓ A review of key uncertainties of the various models used within the integrated assessment framework used for preparation of the Clean Air Policy Package and options of uncertainties treatment that would enable robust policy conclusions is presented in the report prepared within the EC4MACS Project: http://www.ec4macs.eu/; to be found in: Documents/About uncertainties/Synthesis report by Wagner and Amann, 2012. A copy of the report will be sent to FR. Besides, IIASA paper about uncertainty treatment published in a peer reviewed journal will also be provided.
- ✓ Other questions and issues are addressed– at least to some extent – in the Commission's Impact Assessment.

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3 ec.europa.eu/environment/air/pdf/review/TSAP%20CBA%20corresponding%20to%20IIASA11%20v2.pdf

4.10.9 Conclusions

- ✓ FR will examine the possibility to provide national projections for agricultural activities – there are large differences compared with CAPRI projections.
- ✓ No decision as yet whether national projections for other activities will be provided.
- ✓ All additional data and suggestions should be provided to IIASA by end of June.
- ✓ Agreed changes will be implemented in GAINS. Date depends on priorities to be set by the Commission and availability of time/resources at IIASA.
- ✓ IIASA will consider the French suggestions for improved interpretation of the IED in the French conditions.

4.11 Germany

Video-conference, Dessau/Laxenburg, 03 June 2014.

4.11.1 Changes in German inventories for historic years

(2013/2012 submissions relative to 2014)

- SO2: 2005 - 4%/12% higher; 2010 - 3%/4% higher
- NOx: 2005 - 1%/1% higher; 2010 – difference <1%
- PM2.5: 2005 - 0%/3% lower; 2010 - 1%/7% lower
- NMVOC: 2005 - 2%/2% higher; 2010 - 3%/3% higher
- NH3: 2005 - 1%/0% higher; 2010 – 1%/0% higher

4.11.2 Comparison of GAINS and national inventories for 2005 and 2010 (2014 submission)

SO2: GAINS 19%/15% higher than DE inventory. Mainly due to lower emissions from the power sector in the DE inventory. Check what is included in GAINS as R_Other emissions. Are the values still up-to date? The 2012 submission of the DE inventory was 12% higher than the 2014 submission, mainly due to a different assessment of emissions from the power generation sector.

NOx: GAINS 4%/1% lower than the DE inventory. Larger differences emerge for RoadRail and industrial sources (different distribution of sources process emissions vs. combustion). DE reports NOx emissions from agricultural soils, and it was made clear that these are not included in the comparison.

VOC: GAINS 10%/7% higher than DE inventory. Major differences for chemical industry (GAINS higher), combustion in the power sector and residential [only in 2005] (GAINS higher). Emissions from RoadRail and Exploration and production of oil are lower in GAINS. No emissions from OtherWasteDisp [open burning of residential 'garden' waste] in DE inventory.

PM2.5 – good match GAINS 1% higher/3% lower than DE Inventory. Largest differences occur in SmallComb in 2010 (GAINS lower). DE - no emissions from WasteIncin (open burning of residential waste) in GAINS 1.9 kt or 1.5% of total.

NH3: GAINS 4%/3% higher than DE inventory. Differences in emission factors for livestock – GAINS higher for O_AgriLivestock, lower for P_AgriOther. No emissions from pets and humans in DE inventory (approximately 2% of total).

4.11.3 SO_2 emissions

The German emission inventory system uses an emission model that has different aggregation than GAINS. There are also important differences in reporting emissions in the NFR format. Emissions from industry (combustion and process) are reported as process emissions. Major differences in SO2 emissions from iron and steel industry (DE inventory is lower than GAINS). Power sector – emissions from lignite fired plants are similar. Total emissions from the power generation sector in GAINS (public and industrial plants) are too high. Activity levels and control strategy need to be modified following recommendations of DE. Current legislation (CLE) SO2 projections for 2030 (GAINS vs. DE) are quite similar. However, differences in the structure of emission sources remain.

4.11.4 NOx emissions

Similarly as for SO2, emissions from industrial process are much higher in the DE inventory – aggregation issue. Emissions from transport will be checked. GAINS road transport emissions in 2005 are lower and in 2010 higher than the national inventory numbers. Differences are probably due to fuel allocation between heavy-duty vs. light duty diesel vehicles. Data from the actual version of TREMOD model will be used to make adjustments. Emissions from stationary sources will be checked to improve match. DE projection for 2030 is higher than GAINS - emissions from all sectors are higher. To check the reason, DE will provide information about assumed future activities of major emitting sectors and assumptions about penetration of emission control technologies.

4.11.5 PM2.5 emissions

DE emissions from small combustion sources are quite close to the GAINS estimates in 2005, but they increase by >50% up to 2010. Reason for that increase needs to be clarified. DE uses Tier 2 approach to estimate emissions. The weighted average emission factor is applied to total biomass consumption by small combustion sources. The DE inventory does not include emissions from open burning of municipal waste – banned in DE. It is not known to what extent the ban is enforced, according to DE experts the emissions are rather low. IIASA will reconsider its estimate for this source category. PM emissions from transport sources need to be checked, in particular for non-road mobile sources.

4.11.6 NH_3 emissions

In December 2013 IIASA had a meeting with German experts on NH3 emissions (Thünen-Institute of Climate-Smart Agriculture, Braunschweig). Several changes in the structure of farms (cattle kept on liquid vs. solid systems), emission factors, and penetration of mitigation measures have been agreed upon and implemented in a new scenario in GAINS (but not used for the TSAP work). There are important differences between CAPRI and national projections for agriculture. Thus, providing the latest national projection would be important for sensitivity analysis. Experts from the Thünen-Institute provided a national livestock and fertilizer projection up to 2020. Urea consumption in DE increased in recent years. Emission factors for mineral fertilizer application are under discussion within the Task Force of Emission Inventories (TFEIP), which might require recalculations in the near future; decision pending. With the new assumptions, a good agreement with the German inventories for 2005, 2010 and national projections was achieved. However, the latest revisions led also to increase of emissions in the CAPRI scenario.

German estimates of ammonia emissions from non-road mobile sources are much higher than in GAINS – IIASA would like to revise its factors if confirmed by DE. The same for emission factors from biomass combustion. GAINS includes emissions from pets and humans, DE inventory not, which causes a systematic difference of about 2%.

DE has estimated emissions from energy crops used for biogas production. These emissions are neither included in GAINS nor in the national total reported to EMEP. The importance of this sources will vary across EU-28. A discussion is needed on how to deal with this source in the future. DE has presented the result at the latest TFEIP meeting and the issue will be followed up.

4.11.7 NMVOC emissions

Emission factors for biomass combustion in the power sector and in the residential/commercial sector need to be checked and modified in GAINS. The assumptions on open burning of municipal (garden) waste have an effect on NMVOC emissions (currently in GAINS ~ 1.5% of national total). See discussion on PM2.5 emissions. Estimates of emissions from solvent use are consistent for historical years, while the GAINS projections decline faster than DE projections for this sector; further exchange of information planned. GAINS emissions from several sectors need to be corrected to improve consistency with recent DE inventory. These are: Food and drink, chemical industry, combustion emissions. This will bring down the differences to below 5%. VOC emissions from mobile sources (in particular from aviation – LTO) cycles need to be checked. Clarify what is included in DE inventory under "wood processing". To check projections (DE higher) data on activity levels and assumptions about changes of emission factors over time for energy-related sources and for products (Sector 3) need to be provided.

4.11.8 Conclusions

- ✓ DE will consider providing national activity projections for energy, transport and agriculture [livestock and fertilizer projections until 2020 have been already provided]. They can be developed through modification of the PRIMES/CAPRI projections – only items with major differences will be changed. For energy activities, at least aggregated projections (energy use by major fuels and sectors) will be sent to IIASA to identify differences compared with PRIMES. IIASA will provide a template for that comparison.
- ✓ IIASA has sent to DE files with activity data and control strategies as implemented in the PRIMES 2013 REF-CLE scenario. These files – after modifications - should be sent back to IIASA for further use/implementation.
- ✓ IIASA will send a brief comparison of NH_3 emissions following the adjustments made during and after the bilateral meeting with agricultural experts in December 2013.
- ✓ All additional data and suggestions should be provided to IIASA within one month.
- ✓ The agreed changes will be implemented in GAINS. Date depends on priorities to be set by the Commission and availability of time/resources at IIASA.
- ✓ In a first step, IIASA will work on improving consistency with DE inventory for 2005. Also the effects of adjustments for 2005 on emission control potential in 2030 will be analysed.

4.12 Hungary

Laxenburg, April 10, 2014

4.12.1 Telephone conference with Frederic Neuwahl, DG ENV

Frederik joined the meeting via teleconference. He informed on the State of Play and responded to questions about further plans of the Commission with regard to the NECD. Hungary informed that the methodology for emission inventories has been changed. The newest inventory is based on EUROSTAT energy statistics and adopts (where possible) Tier 2 approach. Numbers for 2005 and 2010 are now for many sectors much closer to GAINS numbers. Data for LPS are based on plant reporting, latest emission data are much lower than in previous inventories. Corrections in GAINS are required. HU intends to provide national projections for agricultural activities – large differences compared with CAPRI projections.

4.12.2 Comparison of GAINS and national inventories for 2005 and 2010 (2014 submission)

Mr. Kis-Kovacs provided an overview of the differences for all pollutants. Corrections necessary for stationary sources of SO_2, NO_x, and PM have been discussed. Will be implemented in GAINS.

4.12.3 Methane ceilings

Methane estimates for HU as developed within the EUCLIMIT Project were presented, together with the marginal cost curve for CH_4 reduction. The ceilings proposed by the Commission assume implementation of no-regret measures, i.e., measures that are cost-efficient even without a CH_4 constraints. Cost-efficiency of such measures was assessed with a 10% (business) real interest rate.

4.12.4 Transport emissions

Assumptions in TREMOVE/COPERT (as used by GAINS) and national inventory were compared. The recent HU inventory uses COPERT methodology, thus differences between GAINS and national estimates are now much smaller than before. However, some differences still remain: good agreement for gasoline consumption, for diesel 10% difference; differences in LD vs. HD trucks allocation. Impacts on emissions are small because differences in emission factors are small. No major differences in the reduction potential for 2030, because– only Euro 5/6 (V/VI) vehicles remain. Activity data for non-road sector in GAINS need corrections based on recent HU estimates.

4.12.5 PM emissions

Small combustion installations:

Current HU estimates are based on Tier 1 approach and EUROSTAT activity data. Current emissions in GAINS might be low low - measured PM ambient concentrations are higher than calculated with GAINS emissions. Necessary corrections discussed (and agreed?).

Emissions from agricultural waste burning:

Although banned in HU, occurrence of emissions is confirmed by satellite observations. Link to the GFED – Global Fire Database as well as publications on the topic will be sent to HU.

4.12.6 NMVOC emissions

Have not been discussed in detail; GAINS estimates higher than HU. HU suggests changes in emission factors from refineries, for “Other industrial emissions” and for domestic sector. HU will check if any new info on agricultural waste burning is available.

4.12.7 Conclusions

- HU intends to provide national projections for agricultural activities – large differences compared with CAPRI projections.
- No decision as yet if national projections for other activities will be provided.
- All additional data and suggestions should be provided to IIASA within one month
- Agreed changes will be implemented in GAINS. Date depends on priorities to be set by the Commission and availability of time/resources at IIASA.

4.13 Ireland

Laxenburg, May 14, 2014

4.13.1 Telephone conference with Frederic Neuwahl, DG ENV

Frederik joined the meeting via teleconference. He informed on the State of Play and responded to questions about further plans of the Commission with regard to the NEC. The current phase of the work (bilateral consultations) should identify remaining problems and issues with national assessment, which should be taken into account to provide a robust and transparent basis for the emission ceilings.

4.13.2 Comparison of GAINS and national inventories for 2005 and 2010 (2014 submission)

SO_2: GAINS emissions 2005/2010 1%/7% lower than IE total. Relatively good match. GAINS emissions from SmallComb lower. GAINS - higher emissions from PublicPower (2005) and lower from IndustrialComb (2010).

NO_x: GAINS emissions 2005/2010 16%/19% higher than IE national total. GAINS – higher emissions from PublicPower, RoadRail, OffRoadMob for 2005 and 2010. Lower emissions from Shipping.

PM2.5: GAINS emissions 2005/2010 23%/35% higher than IE national total. Main reason: emissions from SmallComb are higher in GAINS: 33%/38% difference relative to national total. Check activities (wood combustion) and emission factors. Emissions from power sector and industry higher in IE (about 30% of national total). AgriWastes: IE - no emissions from agricultural waste burning. According to IE expert, emissions are small, no ban in force. However, occurrence of emissions is confirmed by satellite observations. Emissions from cigarettes smoking, barbecues, fireworks, waste incineration and agriculture (livestock) are not included in the IE inventory or are small relative to GAINS assessment.

NMVOC: GAINS emissions 2005/2010 12%/12% higher than IE national total. Major differences in IndProcess, Solvents, and OffRoadMob.

NH_3: GAINS emissions 2005/2010 5%/8% lower than IE inventory. Differences in AgriLivestock (GAINS higher) and AgriOther (GAINS lower). IE inventory – no emissions from Other (pets and humans).

4.13.3 Stationary combustion sources

Prior to consultations, IE prepared a report with major points for consideration. For stationary sources these were:

- Contribution of coal fired plants to power generation after 2020.
- Power generation mix and the role of renewable energy carriers.
- Check if power plant parameters were properly implemented in GAINS.
- Projection of solid fuel combustion in the residential sector and the resulting emissions.
- Burning of agricultural residues.

New energy projections assume that power generation from coal might be maintained up to 2030. This will be included in the national scenario.

IE uses "old" emission factors for solid fuels combustion in the residential sector. It is planned to improve the methodology using data from the EEA Guidebook. IIASA informed about recent studies on PM emissions from small sources (Nussbaumer, EGTEI).

IE estimates of emissions from burning of agricultural residues will be checked, taking into account the methodology and assumptions made by IIASA. IE has already the IIASA presentation with the link to the GFED – Global Fire Database as well as to publications on the topic.

4.13.4 Mobile sources

- 2005: Some difference in control shares for LD4T MD. GAINS possibly too optimistic.
- 2030: Assumptions on controls for MD LD4C, HDT, HDB are very close. Possibly 1.5 kt higher NOx with a slightly older HDT fleet according to IE estimates. Controls for LD4T and HDB need to be reviewed in the national calculation.
- IE will review the allocation of diesel fuel between vehicle categories based on the national scenario that is to be finalised this summer. This may also include an estimate, how much fuel is "exported in the tank", and which fuel will burn it (i.e. which EF would be appropriate).
- Importance of successful Euro 6 performance for NOx emission controls from diesel cars & light trucks. The PRIMES assumptions of high share of diesel in car use, and of high efficiency improvement for cars in general.

TRA-OT: No specific number put forward. Will be part of IREL revision for summer, and suggestions on fuel allocation and control shares might come then.

4.13.5 Agriculture

Animal numbers (and projections)

Due to a very late request of Ireland within the EUCLIMIT project, to use average December/June animal counts instead of December counts, animal numbers used for the GAINS optimization are somewhat smaller. Using the increased animal numbers and just the control strategy from the previous optimization run ("Commission Proposal") emissions will increase by about 3 kt NH_3. While this is not an optimization, it probably comes close.

Control strategy in the Commission Proposal

The share of "low ammonia application" measures (LNA: trailing hose, trailing shoe, deep injection) in Ireland is very low, presumably due to the low applicability of these methods reported by the country (but note that, during consultation, a limit of 60% was mentioned, which coincides with what is listed in the "applicability" file but does not show in the optimization). As a consequence, the GAINS optimization results in rather small potentials of emission abatement, and in selecting higher cost measures (applying the less effective abatement measures).

Farm size limits

Applicability of measures is assumed to be limited to farms larger than 15 LSU. Ireland argued that also larger farms do operate very small sub-units (e.g., a 50 LSU farm could have 4 sheds containing less than 15 LSU each). Moreover, due to long grazing times, the efficiency of storage/application measures would rather reflect the situation of much smaller units, as simply the amount of manure stored is much smaller (therefore also the amount to be applied. Raising the limit from 15 to 50 LSU would make a difference for total cattle, as it would reduce applicability of measures by about 30% and thus reduce the abatement potential (for “other cattle”) by about a third, and likewise that of sheep by about 40%. As for other cattle, there is no difference between baseline and “Commission Proposal”, and controls for sheep are also not considered, those farms that actually have small sizes become irrelevant. Dairy farms, and even more so chicken and pig farms in Ireland are large industrial installations, such that the difference between accounting for 50 instead of 15 animals may result in higher emissions by maybe 0.03 kt NH_3 (0.025 from DL/DS). Even then it is not clear whether this really compares like with like. A 50 LSU farm clearly is a commercial enterprise operated with modern equipment, and must not be compared with a subsistence farm. Clearly, such farms would be able to subcontract manure spreading, even if manure amount were too small for purchasing their own equipment, so at least “application” would be covered.

Costs of anaerobic digestion in Ireland

Subsidies provided to anaerobic digesters in Ireland need to arrive at 17 cts/kWh electricity in order to be taken up by farmers. This break-even point is considered much smaller in GAINS, at 7 cts, thus providing a big discrepancy between the assumption of an overall cost-efficient measure vs. a very costly one. AD is quite popular in Northern Ireland, just across the border where the large Irish pig production (in industrial units) is situated. AD needs additional substrate to be added to manure. Northern Ireland in part uses sugar beets grown in the Cork area for that purpose. Unlike countries such as DK or DE, IE does not have the farmland available to grow their own substrates to be fed into AD. According to the veterinarians, food residues (e.g. from slaughterhouses) need to be pasteurized beforehand, otherwise the AD waste must not go back to the fields (potential pathogens). This is as Ireland, being highly export dependent (90% of production), is much more weary to make sure no problems occur in their agricultural production system. It is for the Commission to suggest whether such cost increase factors in AD are related to greenhouse gas mitigation or rather to food quality considerations.

4.13.6 Methane ceilings

Methane estimates for IE as developed within the EUCLIMIT Project were presented, together with the marginal cost curve for CH_4 reduction. The emission ceilings proposed by the Commission assume implementation of no-regret measures, i.e., measures, which are cost-efficient even without CH_4 constraints. Cost-efficiency of such measures was assessed with a 10% (business) real interest rate. File showing measures for IE was shown and sent to IE.

4.13.7 Conclusions

IE will concentrate on delivering the first version of the national energy scenario up to 2030 (within one month). It will include corrected projection of power generation, changes in fuel consumption in transport plus changes in the penetration of control measures. It is expected that IE agricultural scenario will be also ready within one month.

More in-depth analysis will be done until the end of August. In particular:

- A national energy scenario will be finalized

- VOC activity levels and emissions will be checked (with possible suggestions for improvement).
- Emissions for historic years (2005 and 2010) will be compared with GAINS data. Suggestions how to improve the consistency will be communicated to IIASA.
- IE will also verify the emission factors for selected sectors and pollutants. In particular, emission factors for boilers and furnaces burning solid fuels (hard coal, peat and fuel wood) in the residential and commercial sector will be checked. Also suggestions for modifications of NOx factors for turbines and CCGT plants will be made to include operations at partial (or low) load.

Agreed changes will be implemented in GAINS. Date depends on priorities to be set by the Commission and the availability of time/resources at IIASA.

4.14 Italy

Laxenburg, May 6-7, 2014

4.14.1 Comparison of GAINS and national inventories for 2005 and 2010 (2014 submission)

SO_2: GAINS emissions 2005/2010 – 6%/5% lower than IT national total. Different distribution of industrial emission sources – different categorization of industrial CHP plants. Gains: much higher emissions from power sector (both power plants and refineries), lower from industrial combustion. IT will check data and suggest corrections, concentrating on the most important issues.

NO_x: GAINS emissions 2005/2010 – 8%/0.2% higher than IT national total. GAINS emissions from power sector are higher (this depends on fuel allocation, namely coal, gas and oil, among the different technologies and on control strategies), from Industrial Comb lower (as SO2, differences in industrial emission distribution). Emissions from Road Rail 2005 consistent, for 2010 GAINS emissions are lower (3.8% of national total). No major problems but Public Power and Road Rail need to be checked and (possibly) corrected.

PM2.5: GAINS emissions 2005/2010 – 3% /39% higher than IT national total. Emissions from Small Comb – higher in IT inventory in 2005 (4% of national total) but much lower in 2010 (22% of national total less than in GAINS). Check activities (wood combustion) and emission factors. Agri Wastes – higher GAINS value will be adjusted to national estimate. Emissions from cigarettes smoking, barbecues etc. are not included in IT inventory.

NMVOC: GAINS emissions 2005/2010 3%/3% higher than in IT inventory. Main reason: higher GAINS emissions from RoadRail and OffRoadMob, lower from stationary sources. Solvents consistent.

NH_3: GAINS emissions 2005/2010 1.4% higher/1.2% lower than IT national total. Relatively good match. R_Other emissions originate from pets and humans (not included in IT inventories).

4.14.2 Stationary energy- and process sources

Differences in energy consumption in the power sector GAINS vs. EUROSTAT vs. national data

✓ GAINS employs data from PRIMES. Fuel consumption by CHP plants and public heating plants is included in the power sector. EUROSTAT allocates on-site consumption of heat generated by CHP plants to final energy use in industry and consumption of fuel by CHP plants in the power sector (see EUROSTAT IND_NRG code from B_101000 to B_101039). This causes differences at the sectoral level, while national totals are the same. Italian national data are available both according to EUROSTAT methodology as requested by the Commission and according to National Energy Balance methodology that allocates on-site fuel consumption by CHP plants to final energy use in industry. Data published by the Commission about the PRIMES Reference scenario (Trends to 2050 update 2013) follow the EUROSTAT methodology, and these were the only data made available to IT energy experts. The IIASA report TSAP #11 version 1.0 of February 2014 also refers to those data published by the Commission. Italy used the published PRIMES data aggregated as EUROSTAT. In contrast, to properly reflect physical energy flows and mitigation potentials, the GAINS-Europe model uses more detailed output from PRIMES, which however does not follow the EUROSTAT classification. These data have not been made available, and IT experts asked for more detailed data and clarification on the methodology used otherwise the whole process would lack in transparency. IIASA explained how data (e.g., split of renewable energy between biomass and other types in the final use sector) are stored in GAINS, consistent with the EUROSTAT format. In the Trends publication the renewable sources in the domestic sector are aggregated to "Other" category, which was interpreted by IT as biomass consumption according to the 2005 and 2010 historical data, that reproduce EUROSTAT consumption for solid biomass. PRIMES assumes that ~40% of "Other" will be solar thermal, not biomass, that has no emissions. These detailed data, calculated by PRIMES in 2012, have not been made available to national level, not even during the modelling exercise.

- ✓ Italy underlined that emissions from engines, especially SO2 and NOx, are underestimated in the GAINS model according to the IT emission inventory. Italy will so provide a new split of energy consumption in the power sector, taking into account new information on fuel quality and new split of power plant types as introduced in GAINS in the end of 2011.
- ✓ IIASA explained how energy consumption in the refining sector is calculated: consumption in energy industries except power plants – in CON_COMB, difference between inputs to and outputs from refineries and coke plants is included in CON_LOSS. In addition, fuel production and consumption in refinery boilers for heat only generation is included in IN_BO_CON. Electricity and heat use in the whole energy sector included in CON_LOSS. For details see http://gains.iiasa.ac.at/gains/download/Aggregation_of_energy_data_in_GAINS.pdf
- ✓ Nevertheless, total consumption in the refining sector are unaligned respect to EUROSTAT energy data. Italy will check and provide a new split for the refining sector.

Biomass consumption in the DOMestic sector

- ✓ Historic data consistent with national information.
- ✓ IT projection is higher, but in accordance with PRIMES 2030 projections for the "Other" category in the residential sector. IT national scenario is well aligned with EUROSTAT for past years.

Industrial processes

- ✓ IIASA explained which activities for process sources originate from PRIMES (steel, non-ferrous metals, cement, pulp, glass) and which are estimated by IIASA based on available statistics (e.g., nitric acid, sulphuric acid, cast iron etc.).
- ✓ IT showed that there is a compensation effect among industrial processes, in terms of emissions especially for SO2 and NOx, which are rather different in the IT national emission inventory. IT will verify activity levels and provide projections in the national activity pathway, IIASA will decide if and which numbers in PRIMES pathway will need to be corrected.
- ✓ Brick production is an important source of emissions of SO2, PM and NOx. IT will provide activities and emission factors, IIASA will consider implementation. For the time being these emissions were traditionally included in the category "OTHER" (SO2, NOx, PM) in the European implementation of the model. Recently revised structure of the brick sector in GAINS allows for specific definition of emission factors for each pollutant for this sector and provided we receive complete information IIASA will implement it directly.
- ✓ Italy will verify emission factors for process sources, especially for cement and non-ferrous metals as well as for sulphuric and nitric acid production.

Sectoral emission reductions on top of CLE in the Commission Proposal

- ✓ File with info at the GNFR level was sent to IT.

- ✓ More detailed analysis, including sectoral costs, will be provided by IT using the Emissions (Costs) by control option tables from GAINS online.

Comments and questions of industrial stakeholders

During the meeting, IT experts reported to IIASA comments and questions arisen from Italian industrial stakeholders. A full list of all the questions is reported in Annex 2. While, in the following, a brief summary of questions and answers is reported.

- ✓ Some questions regarded the sensitivity analysis: if somehow different energy scenarios have been taken into account in calculating the new emission reduction commitments. IIASA answered that an analysis with the energy scenario coming from the climate and energy package has been carried out. Detailed results are not available but a summary of the main conclusions can be found in the Impact Assessment document.
- ✓ Many questions concerned BAT and in particular how they have been translated in the GAINS model and how costs have been calculated. About BAT translation into the model, IIASA answered that the correspondence between emission factors in kt/PJ and emission factors expressed in concentration (mg/Nm^3) can been directly downloaded from the model for the energy sector, while for the industrial processes (like cement, glass, etc.) they can been calculated knowing the volumetric flow rate for each plant. About costs, IIASA answered that cost estimation derives from the work EGTEI provided almost ten years ago. The work could be outdated but cost estimation has been verified also with industrial association, as for example CONCAWE.
- ✓ Answers to questions regarding Euro 6 are reporting in the following paragraph 3.2.
- ✓ About the issue if agricultural or transport measures will not be implemented, IIASA answered that the commitment is in terms of percentage reduction respect to the 2005 base year and flexibility could be used.

Additional data and revisions to be provided by IT

- ✓ IT will provide a national activity scenario up to 2030 for energy and processes as well as PRIMES_REF_2013 pathway with revised assumptions about sectoral split of energy consumption in the power sector. Data will be according to methodology used by GAINS (energy consumed and generated by industrial CHP plants included in the power sector).
- ✓ IT will update control strategies for all sources to better reflect recent policies and types of sources.

4.14.3 Transport / mobile sources

- ✓ Question to be clarified: Where are activities from fishing allocated in the GAINS categories (AGR or OTS)? Italy counts a MD consumption of about 10 and 7.7 PJ in years 2005 and 2010. GAINS total AGR would be ok, but in OTS categories too much fuel in years 2005 and 2010. Therefore consider to reallocate MD e.g. to PP_ENG, where consumption appears low. Check fuel allocation also for year 2030.
- ✓ IIASA explained the sensitivity analysis carried out on EURO 6 car emission factors and how the possible failure of Euro 6 has been considered in the model. In the scenarios currently presented in the Impact Assessment document, EURO 6 implementation has been divided in two steps: a first step till the year 2017 where the EF (Euro 6.1 – 2014/2017) is equal to 380

mg NOs/km and a second step starting from 2017 where the EF (Euro 6.2 – 2017) is equal to 120 mg NOx/km. Both the values are higher than the Euro 6 EF coming from the homologation cycle that is equal to 80 mg NOx/km

Road transport

- ✓ Control shares in 2030: Agreement for share of Euro 6 diesel cars (IT national ~96%, GAINS ~92%), but share of HDT Euro VI considered lower: IT national 86% vs. GAINS 97%. Reasons: Higher share of imported used HDT, significant share of short trips which can also be delivered with older vehicles. (In fact, already for years 2005 and 2010 IT reports higher share of older HDT than assumed in GAINS.) IT will check assumption and provide documentation. (Would result in 31 kt NOx from HDT in 2030, compared to 15 kt NOx in the current GAINS – using GAINS fuel consumption).
- ✓ Questions about allocation of diesel fuel between HDT, LD4T and LD4C: Very good fit in 2005, but differences in 2030:

MD in 2030 [PJ]	IT national projection	GAINS (PRIMES 2013 REF)
HDT	287	323
LD4T	282	236
LD4C	447	396
SUM MD	1016	955

The absolute fuel consumption is determined by PRIMES and needs to be respected; the growth rates per vehicle category are also derived from PRIMES but there is some flexibility here. Will double-check.

Consequences on NO_x emission estimates:

- GAINS calculation for 2030 for these three categories together: 88 kt
- IT fuel distribution, but scaled to same total in 2030: 93 kt
- IT fuel distribution, scaled to same total, with higher share of older HDT: 106 kt
- IT fuel distribution & total: 100 kt
- IT fuel distribution & total, with higher share of older HDT: 114 kt

- ✓ Re-assessment of stock and usage of mopeds, finding higher usage shares for years 2005 and 2010. Should be reallocated between LD2 and M4 categories in GAINS. IT will check assumption and provide documentation.
- ✓ NOC EF for HC emissions from LD2 should rather be 7 g/MJ (instead of the current 12 g/MJ), but higher control share and higher absolute fuel consumption (should result in higher VOC emissions in 2005 (and 2010), but not relevant for 2030 level (nor for NOx emissions).

Non-road mobile sources:

- ✓ Emission from AGR tractors (and forestry machines): GAINS assumes up to Stage IV controls, the IT national inventory so far only up to Stage IIIB, hence GAINS projects lower NOx emissions from this sector in 2030. Possibly reallocation of MD between AGR, fishing and PP_ENG. IT wants to send suggestion.
- ✓ IIASA data on gas compressors are highly uncertain. IT will provide national data on consumption, emission factor and control strategy so that IIASA estimate could be updated.

Additional data and revisions to be provided by IT

- ✓ IT will provide a national activity scenario up to 2030 for the transport sector.
- ✓ IT will provide national control strategy and emission factors.

4.14.4 Activities and ammonia emissions from agriculture

As mentioned before, the agreement at the national level is fairly good, but there are few issues that needed discussion and clarification.

- ✓ Activity data for other cattle 'BEEF' for 2005 needs correction; apparently GAINS is consistent with EUROSTAT, but there is an error in EUROSTAT data as buffalos are double counted, i.e., are counted as buffalos and also as beef but only for 2005. GAINS includes buffalos separately and we will introduce the beef correction for 2005, assuming proportional OL/OS (liquid/solid systems) reduction of animal numbers.
- ✓ The activity data for open burning of agricultural waste needs adjustment. Italian experts have performed calibration of total biomass and adjusted estimated amounts that are apparently burned on the field. GAINS includes already consistent numbers in the national scenario implemented in GAINS but the 'PRIMES-CAPRI' baseline needs harmonization with the national numbers. The impact of this change will be most important for PM emissions and mitigation potential.
- ✓ IIASA has explained that category 'Other' includes for ammonia also emissions from humans and pets using an emission factor estimated in the UK (Sutton, 1995). The national inventory does not include this source yet.
- ✓ An issue with emissions from rabbit breeding was identified in the 'PRIMES-CAPRI' baseline. Since GAINS does not specifically have a category for rabbits, they were allocated to category camels and respective emission factor was used. The numbers are present in the national scenario in GAINS but have disappeared in the latest activity data set (harmonized with EUCLIMIT). This needs to be adjusted as the emissions from rabbits were actually included in earlier runs for the Commission.
- ✓ We discussed projections from CAPRI for mineral fertilizers; they are assuming slow decline rather than growth as in the national projections. IIASA uses urea/other fertilizer split from the national data but the total N fertilizers are currently projected by CAPRI and therefore we have provided contact to Peter Witzke from CAPRI group who can give more details on the projection methodology and assumptions.
- ✓ We discussed methodological issues for ammonia cost calculation (specifically the potential for negative unit costs) and IIASA provided the latest methodology report where GAINS method is documented (Klimont and Winiwarter, 2011). We have also discussed briefly COB vs CLE; IIASA has explained current approach (this in fact is not specific to ammonia as it is common for all pollutants).

4.14.5 Costs of VOC control

We have discussed the methodology of cost calculation and assumptions leading to often negative unit costs for substitution measures for VOC sources. The assumptions on investment and operating costs are consistent with the work of EGTEI (in fact for most sectors were developed together with EGTEI, even though GAINS structure is different and also technology list is not always the same).

GAINS explicitly considers saving of solvent resulting from efficiency improvements, management programs, or recover; since solvent costs are parameterized in GAINS the respective savings are calculated and subtracted from operating costs which often represent key part of the costs as many of the efficiency measures do not require significant investments. Consequently, there are several measures with negative unit costs.

We have also discussed/clarified issues of CLE vs COB.

No adjustments for specific VOC sectors were needed as key differences for VOC originate in residential combustion and transport – see separate discussion.

4.14.6 Methane ceilings

Methane estimates for IT as developed within the EUCLIMIT Project presented, together with the marginal cost curve for CH4 reduction. Proposed by the Commission ceilings assume implementation of no-regret measures, i.e., measures which are cost-efficient even without CH4 constraints. Cost-efficiency of such measures was assessed with a 10% (business) real interest rate. File was sent to IT.

4.14.7 Conclusions

- ✓ IT will provide national activity pathway and a revised Current Legislation control strategy. Also suggestions to modify emission factors will be made. All data will be provided in GAINS format/templates.
- ✓ All additional data and suggestions should be provided to IIASA within one month.
- ✓ Agreed changes will be implemented in GAINS. Date depends on priorities to be set by the Commission and availability of time/resources at IIASA.

4.15 Lithuania

Laxenburg, May 8, 2014

4.15.1 Comparison of GAINS and national inventories for 2005 and 2010 (2014 submission)

SO_2: GAINS emissions 2005/2010 – 3% lower/11% higher than LT total.
No LT emissions from IndProcess, are they included as combustion sources?
GAINS – lower emissions from SmallComb.

NO_x: GAINS emissions 2005/2010 – 7%/17% lower than LT national total.
GAINS – lower emissions from PublicPower and SmallComb, higher from RoadRail.
LT emission from Air traffic – LTO cycles unlikely high; are cruising emissions included there?

PM2.5: GAINS emissions 2005/2010 – 34%/35% lower than LT national total.
Main reason: emissions from SmallComb – higher in LT inventory – 48 – 49% difference relative to national total.
Check activities (wood combustion) and emission factors.
Emissions from power sector and industry higher in LT (about 6% of national total).
AgriWastes LT - no emissions from agricultural waste burning. Although banned in LT, occurrence of emissions is confirmed by satellite observations. Link to the GFED – Global Fire Database as well as to publications on the topic will be sent to LT.
Emissions from cigarettes smoking, barbecues, fireworks, waste incineration and agriculture are not included in LT inventory. Methodology and data sources can be found in http://webarchive.iiasa.ac.at/rains/reports/ir-02-076.pdf. Link to CEPMEIP inventory: http://www.air.sk/tno/cepmeip/

NMVOC: GAINS emissions 2005/2010 24%/21% higher than in LT inventory.
GAINS – higher emissions from SmallComb (difference 4/5% of national total), industrial sources (A, B, D, and E – 15/17% difference) and RoadRail (14/13% difference).
Emissions from Solvents are lower (16/20% difference relative to national total).

NH_3: GAINS emissions 2005/2010 13%/22% higher than LT national total. Major differences in IndProcess (emissions from fertilizer production in GAINS are assumed to be weakly controlled) contributes 17/24% to LT total). In turn, emissions from SmallComb higher in LT dataset (~4% of LT total). Emissions from agriculture similar, but different split into AgriLivestock and AgriOther. LT inventory – no emissions from AgriWastes and Other (pets and humans).

4.15.2 Presentation by Lithuanian experts on stationary combustion sources

LT presented a comparison of emissions from different versions of LT emission inventories as reported to EMEP with values calculated by GAINS (see Appendix 1). Differences in inventories result from changes in methodologies: values collected from enterprises (2012 and 2013) vs. 2014 (calculated from energy balances); in the latter method process emissions are missing.

LT inventory:

✓ For estimating emissions from SmallComb, Tier 1 methodology and default factors from the Guidebook are used.

- ✓ Assumptions about controls on emissions from industrial sources need to be checked.
- ✓ Domestic combustion:
  - SO_2 emission factor for wood combustion in LT inventory needs to be checked.
  - Average S content and calorific values of wood are different than assumed by LT sources: Calorific value of wood and S content of wood: see attached document "S content of wood.pdf". Resulting SO_2 emission factor should be about 0.038 kg/GJ.
  - Structure of boilers and stoves as assumed by IIASA and PM emission factors for individual types of combustion devices will need to be checked. LT will send comments and suggest potential revisions.
  - IIASA informed about recent studies on PM emissions from small sources (Nussbaumer, EGTEI):
    - o http://www.citepa.org/old/forums/egtei/Nussbaumer_EGTEI-Report_final.pdf
    - o http://www.citepa.org/old/forums/egtei/Options%20for%20PM%20ELVs%20for%20SCI%20%20final.pdf

LT energy projections:

There are large uncertainties regarding the future structure of the power sector (with-or without nuclear power). LT prepared four national projections, one of them will be sent to IIASA as the national pathway. It will need to be presented in GAINS template; starting point - PRIMES REF 2013 data. LT will modify only the most important entries.

4.15.3 Transport sources

IIASA presented the GAINS approach:

- ✓ Eurostat/PRIMES for energy data x TREMOVE for fleet turnover x COPERT for emission factors
- ✓ Assumptions on future development
- ✓ Highlighted uncertainty on future level of diesel cars and performance of Euro 6 NOx emissions.
- ✓ Looking at control shares for LITH in 2005: 80% is NOC for GSL cars, and 54% NOC for HDT, reflecting an old fleet and our assumption that a lot of vehicles are used, older vehicles.
- ✓ For 2030: 62% Euro 6 for diesel cars, and only 50% EURO VI for HDT, meaning that there are very many vehicles significantly older than 15 years in the fleet. This seems conservative estimates, accounting for the specific national situation.
- ✓ The increase in diesel cars, and in consumption of diesel by passenger cars, is a consequence of the PRIMES energy projection.

No specific data from Lithuania provided nor different views on 2005 or 2030 emissions from mobile sources.

During a general discussion on emission differences LT stated that (to be confirmed):

- ✓ No evaporative VOC emissions from transport are calculated – one of the reasons for differences.
- ✓ PM – no non-exhaust emission of PM are not calculated (needs to be re-confirmed).

4.15.4 Emissions from agriculture

- ✓ IIASA experts presented CAPRI model results. These do not take into account the preliminary national projections for the growth of livestock sector. Due to the differences between IIASA and Lithuanian national data there is a need to update it. IIASA experts also requested data from the oil, beer production and sugar refineries.
- ✓ Share of liquid/solid manure for key animal categories needs to be verified; national data might be submitted to verify GAINS assumptions.
- ✓ NH_3 - LT emissions from fertilizer plants are controlled (plant reports available), IIASA values are too high, info will be sent to IIASA.

4.15.5 NMVOC emissions

LT is acquiring more detailed data on activities and assumptions to compare emissions at a more detailed level than NFR in order to identify reasons for discrepancy. IIASA and LT agreed on further communication.

4.15.6 Methane ceilings

Methane estimates for LT as developed within the EUCLIMIT project were presented, together with the marginal cost curve for CH_4 reduction. The emission ceilings proposed by the Commission assume implementation of no-regret measures, i.e., measures that are cost-efficient even without CH_4 constraints. Cost-efficiency of such measures was assessed with a 10% (business) real interest rate. File showing measures for LT was sent.

4.15.7 Conclusions

- ✓ LT intends to provide national projection for energy/agriculture.
- ✓ Reasons for differences in MNVOC emissions will need to be clarified, any information on this issue from LT will be appreciated.
- ✓ All additional data and suggestions should be provided to IIASA within one month.
- ✓ Agreed changes will be implemented in GAINS. Date depends on priorities to be set by the Commission and availability of time/resources at IIASA.

4.16 Luxembourg

Laxenburg, 26 May 2014

4.16.1 Comparison of GAINS and national inventories for 2005 and 2010 (2014 submission)

SO2: GAINS estimate for 2005/2010 – 25%/5% lower than LU inventory. National estimate much higher for SmallComb. Emission factors for liquid fuels? Do the values correspond to the EU legislation? Large differences for 2010 for IndustrialComb. Ditto.

NOx: GAINS estimate for 2005/2010 – 23%/13% lower than LU inventory. LU emissions from IndustrialComb, RoadRail and OffRoad higher in 2005. In 2010 emissions from RoadRail consistent.

PM2.5: No national estimate due to lack of data. Emissions will be assessed in the next inventory.

NMVOC: GAINS estimate 2005/2010 66%/38% higher than in LU inventory. GAINS – lower emissions from IndustrialComb, Fugitive and Solvents. LU – two orders of magnitude lower emissions from RoadRail, no emissions from aviation (LTO cycles).

NH_3: GAINS estimate for 2005/2010 27%/40% higher than LU national total. In GAINS higher emissions from IndProcess – check what it is and delete if not needed. Emissions from AgriLivestock higher in LU inventory – check, adjust.

4.16.2 Stationary sources

- ✓ LU Compared GAINS with inventory at the NFR level for NOx. Main observations:
  - Planned changes in the methodology and data sources for emission inventory should bring national estimates much closer to the GAINS numbers.
  - Activity for glass production is missing in PRIMES/GAINS (probably in EUROSTAT activity is lumped together with activity for other BENELUX country). LU will provide activity data and CLE implied emissions factors plus potential for further controls.
- ✓ LU also analysed the implied emission factors for the year 2030 for the CLE and the Commission Proposal scenario.
  - Values for combustion sources in the power sector, industry and residential/commercial sources are consistent with LU national studies.
  - DOM sector – LU implied EFs lower than CP proposal. However, estimates based on EFs delivered by equipment manufacturers (very low and uncertain, correspond to values measured in test conditions), LU proposes to stick to GAINS.
  - Industrial processes:
    - Cement – negotiations with industry about potential for reduction are under way. LU proposes to use only SNCR as a feasible option (reduction efficiency about 70%). SCR is feasible but costly.
    - Glass – SNCR is planned for one installation, no information for the other. What is the achievable reduction in the MTFR case? GAINS will adopt assumptions about the emission control potential consistent for all EU countries.

- ✓ Waste incineration without energy recovery (open burning of residential waste) not in national inventory, relevance of that source for LU needs to be checked. LU will provide recommendations whether to include this source and at what level.
- ✓ Waste incineration with energy recovery needs to be included in the power sector. If relevant, LU will provide activity data and EFs. Split into renewable and non-renewable waste will be given.
- ✓ SO2 emission factors for liquid fuels (MD) in the DOM sector are quite high; for 2010 the 0.1% S limit (EU legislation) does not seem to be included in the LU inventory. This causes also a difference for 2005. Needs to be checked.
- ✓ Similar analysis will be performed for other pollutants, including PM2.5, which is not reported in the national inventory.

4.16.3 Mobile sources

We focused on the 2005 LU inventory and on NOx emissions. However, the LU inventory includes very low emissions of NMVOC from mobile sources, two orders of magnitude lower than GAINS estimate, which is based on COPERT emission factors. LU will to check inventory assumptions.

Findings on activities and emission factors/assumptions relevant for NOx emissions:

- Reallocation of 15+4 PJ from diesel cars and LDT to HDT suggested
- LU has slightly (~-10-15%) lower avg. EF for PC and HDV diesel
- Lower consumption of diesel in INW (0.018 PJ instead of 0.17 PJ)
- Higher consumption of diesel in CNS: 3.32 PJ instead of 0.68 PJ
- Higher consumption of diesel in AGR: 0.70 PJ instead of 0.22 PJ
- Overall, PRIMES/GAINS consumption of diesel/gasoil is only 87.5 PJ instead of 90.7 PJ as currently reported by EuroStat. The difference should be allocated to the sectors indicated above.
- GAINS assumes current legislation for INW meaning Stage IIIA - and CNS & AGR NRMM, meaning up to Stage IV. Hence lower EF than in current LUX inventory.
- Discussion of importance of turnover of Euro 6c diesel cars/LDT and successful on-road performance.

Suggested options for further investigation for LU

- Alternative energy projection
- Alternative control strategy, notably slower fleet turn-over
- Different emission factors for foreign fleet (concerning fuel export in tank).

4.16.4 NH_3 emissions

Activity levels and country-specific parameters used for NH_3 calculations have beendiscussed. Most important points and agreements:

- ✓ IIASA has sent information on general parameters for agriculture used by GAINS. Values need LU confirmation. In principle, some of parameters can be extracted from the CRF tables (nitrogen excretion, on the number of days animals stay indoors and on the shares of solid waste systems). However, advice of LU which set of parameters to use is expected.

- ✓ IIASA will check trends of agricultural activities; specifically milk yields do not seem plausible (increase above 10000 kg/hd; figures for 2005 and 2010 do not reflect national data, which are 6856 and 7155, respectively); national expectation of dairy cow numbers do not indicate a decrease.
- ✓ IIASA will contact Eurocare (CAPRI-modellers - Peter Witzke), Luxembourg experts attempt to provide a national projection till 2020 both for milk yield and dairy cattle numbers.
- ✓ IIASA will checks the rather irregular trend in laying hen numbers over time, as well as the outlier in mineral fertilizer dataset. The year 2010 (national data: 13.354 kt N instead of GAINS 17 fit also time series much better).
- ✓ LU will attempt to find information on the share of urea in mineral fertilizer (currently assumed to be very low).
- ✓ National projections of activities and NH_3 emissions will be prepared by LU in consultation with Michael Anderl from UBA Wien.
- ✓ LU attempts to provide estimates about the levels of implementation of certain measures, like:
  - integrated manure storage in housing – is this standard already?
  - trailing hose as low-nitrogen application technique, applied with ~10% ?? of manure, which is the same 10% that passes anaerobic digesters and in fact is the digestate).

4.16.5 Emissions of NMVOC

Estimates of NMVOC emissions have not been discussed in detail. Comments and suggestions for non-transport sources should be sent to Zig Klimont (klimont@iiasa.ac.at).

4.16.6 Conclusions

- ✓ LU intends to provide national projections for agricultural activities – important differences compared with CAPRI projections.
- ✓ No decision as yet whether national projections for other activities will be provided.
- ✓ All additional data and suggestions should be provided to IIASA until end of June.
- ✓ Agreed changes will be implemented in GAINS. Date depends on priorities to be set by the Commission and availability of time/resources at IIASA.

4.17 Latvia

Laxenburg, 27 March 2014

4.17.1 Telephone conference with Frederic Neuwahl, DG ENV

Frederik joined the meeting via video/teleconference. He informed on the state of play and about further plans of the Commission with regard to the NECD. He suggested to concentrate on major differences between the MS and GAINS and on technical issues. No discussion about ambition level at this point.

4.17.2 Comparison of GAINS and national inventories for 2005 and 2010 (2014 submission)

SO2: In general, GAINS estimate for 2005 is 21% lower than the national inventory, and for 2010 11% higher). Main reason: differences in estimates for power plants, small combustion and for industrial processes.

NOx: GAINS emissions 2005/2010 – 13 / 9 % lower than LV national total. Main reason: higher national estimates for small combustion sources. 2010 – GAINS emissions form road transport higher (by 6% of national total).

PM2.5: GAINS emissions 2005/2010 37/ 41 % lower than national inventory, mainly due to much higher emissions from small combustion sources in the LV national inventory. LV uses Tier 1 methodology. LV - no emissions from agricultural waste burning. Although banned in LV, occurrence of emissions is confirmed by satellite observations. Link to the GFED – Global Fire Database as well as to publications on the topic will be sent to LV. Emissions from cigarettes smoking, barbecues, and waste incineration are not included in the LV inventory. Emissions from other sectors are within the ballpark.

NMVOC – GAINS emissions 2005/2010 26/15% higher. GAINS – much higher emissions from small combustion plants and from road sources which are key in the difference in total. Differences in emissions from industrial combustion and processes but due to different source allocation. Total emissions from solvents agree well.

NH_3: GAINS emissions2005/2010 - 26% lower than LV national total. LV – an order of magnitude higher emissions from small combustion (needs to be checked – bug?), higher emissions from agriculture – other. Important emissions from wastewater treatment (~6% of total), not included in GAINS (latrines?).

4.17.3 Mobile sources

LV will analyse the most important differences and will suggest corrections. Estimates for road transport are approximately consistent. Activity data for non-road sector in GAINS need corrections based on recent LV estimates.

4.17.4 Methane ceilings

Methane estimates for LV as developed within the EUCLIMIT Project were presented, together with the marginal cost curve for CH4 reduction. The ceilings proposed by the Commission assume implementation of no-regret measures, i.e., measures that are cost-efficient even without CH4 constraints. Cost-efficiency of such measures was assessed with a 10% (business) real interest rate.

4.17.5 NH_3 emissions

As indicated above, there are major discrepancies between the inventories. Latvia has developed a IIR report for the 2014 submission and IIASA will consult it for identification of specific emission factors used, e.g., for combustion emissions of NH_3 as these seem to be very high in the LV inventory compared to other countries. This and the question of 'latrines' shall be resolved as they represent the two key differences in emission estimates of GAINS and LV inventory.

National expectations for the development of the agricultural sector are different from CAPRI.

4.17.6 Conclusions

- ✓ LV intends to provide national projections for agricultural activities – important differences compared with CAPRI projections.
- ✓ No decision as yet whether national projections for other activities will be provided.
- ✓ All additional data and suggestions should be provided to IIASA within one month
- ✓ Agreed changes will be implemented in GAINS. Date depends on priorities to be set by the Commission and availability of time/resources at IIASA.

4.18 Malta

Laxenburg, March 13, 2014

4.18.1 Methodological issues

J. Cofala summarized the main elements of the methodology used to prepare the Clean Air Policy Package. Meaning of the "gap closure" concept was explained. Full ppt presentation about GAINS methodology has been sent to Malta. Links to reports with pollutant-specific methodologies and to GAINS tutorial were given. All links are available from the model.

IIASA explained how the Commission proposed the ceilings for CH4: only no-regret, i.e., cost-efficient measures were included. The list of measures has been discussed.

The main concerns for MT are GAINS results for the transport and the power sectors. Agricultural emissions have not been checked as yet.

4.18.2 Mobile sources

Vehicle stock in MT is rather old, thus assumptions about penetration of Euro stages seem too optimistic. This causes that real emissions are higher than calculated by GAINS. Also, non-exhaust emissions of PM are much higher in MT inventory than in GAINS. J. Borken explained that GAINS takes into account fuel use and not the age of vehicles that are registered. Annual mileage for newer vehicles is usually higher, thus higher share of mileage and fuel consumption by vehicles with more advanced controls. MT non-exhaust emission factors are an order of magnitude higher than in other countries and need to be checked.

4.18.3 Power sector

MT power utilities plan much higher power generation from gas fired plants because national projections assume a high share of electrical vehicles in 2030. Besides, low NOx emission factors from the power sector as in the Commission's Proposal would have caused very high ammonia slip, which is not included in GAINS.

4.18.4 Agriculture

MT will compare CAPRI projections of animal numbers with national plans and - if different – provide a national scenario.

4.18.5 Conclusions

MT will check once more the assumptions in the national inventories and projections and provide (within one month) info on:

- Activity data, control strategies and emission factors for PP in 2030, and possibly also for 2010 if discrepancies are identified.
- Control strategies for pollutant emissions from power generation in 2030 together with the relative emission factors.
- Control strategies for TRA in 2030.
- Activity data for 2010 and 2030 and control strategies for agriculture.

4.19 Netherlands

There was extensive contact between IIASA and Dutch experts via email. The Netherlands have provided a comprehensive report analysing the main discrepancies between the GAINS and the national inventory, and suggesting specific changes that would also affect future baseline emissions and emission control potentials. The document can be provided on demand.

Based on these proposals, the following changes have been implemented in the GAINS model:

- All proposed changes have been implemented in GAINS.
- The comparisons of emission estimates are based on the fuel sold concept
- Emissions from agricultural waste burning is not included in the Dutch inventory, emissions from open burning of residential waste much lower than estimated according to the GAINS methodology. In the national inventory, emissions from cigarette smoking, barbecues and fireworks are much lower than the GAINS estimates.

4.20 Poland

Laxenburg, April 24-25, 2014

4.20.1 Comparison of GAINS and national inventories for 2005 and 2010 (2014 submission)

SO_2: GAINS emissions 2005/2010 3%/8% higher than national total. Differences in emissions distribution in power sector and industry. GAINS includes industrial CHP plants and heating plants in the power sector. Relatively good match for 2005, for 2010 GAINS underestimates - effects of stricter emission controls?

NO_x: GAINS emissions 2005/2010 5%/3% lower than PL national total. PL emissions from SmallComb, RoadRail, and OffRoadMob much higher, emissions from the power sector lower. The latter is partly due to differences in aggregation (see SO_2), but it seems that GAINS underestimates the effects of controls in the power sector. Emissions from AgriOther (soils) are included in PL inventory, but should not be taken into account for calculating the ceilings (since they are not included in GAINS).

PM2.5: GAINS emissions 2005/2010 60/85% higher than PL national total. Main reason: emissions from SmallComb. Check activities (wood combustion) and emission factors. IIASA increased emission factors to include garbage burning in residential stoves and boilers, as well as burning of coal of a very poor quality in southern part of PL close to coal mines (selling of coal middlings from coal beneficiation to private consumers). Assumption on high emissions are confirmed by ambient air concentrations monitoring and by modelling exercises (CHIMERE). Emissions form industry lower in GAINS, quite high emissions from WasteIncin in the PL inventory – check. In turn, emissions from AgriWastes much lower than GAINS. PL emissions from transport much higher. Link to the GFED – Global Fire Database as well as to publications on the topic will be sent to PL. Emissions from cigarettes smoking, barbecues (F_Solvents) in PL inventory are lower.

NMVOC: GAINS emissions 2005/2010 7% higher/15% lower than in PL inventory. GAINS – much higher emissions from SmallComb, also higher from OffRoadMob, smaller from Fugitive and Solvents. Rest within the ballpark.

NH_3: GAINS emissions 2005/2010 27%/24% higher than PL national total. More than 2/3 of the difference is in Agriculture. PL emissions from Small Comb and RoadRail much lower, also in relation to values in other countries. What do the R_Other emissions in GAINS represent?

4.20.2 Comments by AGH experts

The following data require more in-depth analysis:

- ✓ Share of small coal plants in the power sector – statistics and projections.
- ✓ Penetration of control measures for these plants in the CLE scenario, and the technical applicability of control measures for SO_2 and NOx for the optimal scenario.
- ✓ Maximum penetration (applicability) of measures to control emissions from solid fuels boilers and stoves in the DOMestic sector.
- ✓ Higher share of electric capacity installed in nuclear plants in 2030 compared to national plans.

4.20.3 Summary of findings and proposed corrective actions

- ✓ Differences in emissions of SO_2 and NOx for historic years are relatively low. However, checks need to be done as suggested by AGH.
- ✓ Transport – according to PL data, the assumed future turnover of vehicles (replacement with higher EURO stages) is too optimistic. GAINS values (% implementation) are for fuel use, not vehicle numbers. Control strategy will be checked, as well as the shares of light duty vs. heavy-duty trucks. It is important to include different mileage for vehicles having different age in the PL estimates (situation in PL might be different compared with the "old" EU Member States because of a high share of used cars).
- ✓ Solvents – The Polish database based on rather crude assumptions. Studies on solvent use available at IIASA for other countries will be sent to PL. VOC emissions from small combustion plants will be checked taking into account available studies (Nussbaumer and other EGTEI work – studies have been sent to PL). Transport VOC emissions are based on TREMOVE/COPERT and are consistently higher for all countries, including PL.
- ✓ PM2.5 – The Polish inventory for small combustion plants is based on rather old emission factors. Ratio PM2.5/PM10 is different than that adopted by IIASA, which is based on available (non-Polish) studies. PL is aware that inventory estimates are too low. An attempt will be made to narrow the gap between the IIASA and PL assessment. Next report to EMEP will include revised PL estimates. Emission coefficients for non-exhaust emission in transport will be checked.
- ✓ Differences for NH_3 emissions will be analysed by experts from the Ministry of Agriculture. Contact to CAPRI team will be sent to PL.

4.20.4 Conclusions

- ✓ PL will consider providing national activity projections for energy, transport and agriculture. They can be developed through modification of the PRIMES/CAPRI projections – only items with major differences will be changed.
- ✓ IIASA has sent to PL files with activity data and control strategies as implemented in the PRIMES 2013 REF scenario. These files – after modifications - should be sent back to IIASA for further use/implementation.
- ✓ All additional data and suggestions should be provided to IIASA within one month.
- ✓ Agreed changes will be implemented in GAINS. Date depends on priorities to be set by the Commission and availability of time/resources at IIASA.

4.21 Portugal

Laxenburg, April 15, 2014

Participants:

4.21.1 Comparison of GAINS and national inventories for 2005 and 2010 (2014 submission)

Currently GAINS includes energy consumption and agricultural activity for the whole of Portugal, including Madeira and Azores. The emission inventory delivered to EMEP covers only mainland PT. Activity data in GAINS need to be corrected to include only activities from the mainland PT.

SO_2: GAINS emissions 2005/2010 37% lower/10% higher than PT national total. Major differences in power plants and industrial combustion. In 2005, there was no FGD on coal power plants, which is the main reason for the difference. The control strategy in GAINS will be corrected. Check if R_Other emissions in GAINS (emissions from sectors/activities not covered by GAINS) are needed.

NOx: GAINS emissions 2005/2010 5%/5% higher than PT national total. GAINS emissions from power sector and road transport are higher (probably partly because they include emissions from Azores and Madeira). Other differences within accuracy limits. PT emissions from aviation quite high, includes not only LTO but also emissions from domestic cruise. Needs to be checked.

PM2.5: GAINS emissions 2005/2010 8/10 % lower than PT national total, mainly due to much higher emissions from small combustion sources and industry. PT – much lower emissions from AgriWastes. Although banned in PT (except burning with special permissions), occurrence of emissions is confirmed by satellite observations. Link to the GFED – Global Fire Database as well as to publications on the topic will be sent to PT. Emissions from cigarettes smoking, barbecues, and waste incineration are not included in PT inventory. Emissions from other sectors are within the ballpark.

NMVOC: GAINS emissions 2005/2010 10% higher/5% lower than PT inventory. GAINS – higher emissions from small combustion plants in 2005 and from AgriWastes in both years. In 2010 GAINS – smaller emissions from solvents (5% of total).

NH_3: GAINS emissions 2005/2010 41/39% higher than national. Differences in the structure and level of emissions from agriculture and from waste disposal.

4.21.2 Methane ceilings

Methane estimates for PT as developed within the EUCLIMIT Project were presented, together with the marginal cost curve for CH_4 reduction. The emission ceilings proposed by the Commission assume implementation of no-regret measures, i.e., measures that are cost-efficient even without CH_4 constraints. The cost-efficiency of such measures was assessed with a 10% (business) real interest rate.

4.21.3 Mobile sources

Focus on road transport and NO_x emissions in year 2005 and 2030:

For 2005, the GAINS inventory for road transport is 113kt vs. the national IIR estimate of 96 kt, i.e. 17 kt less. This difference can be completely explained as follows:

- Key difference is the allocation of diesel fuel over heavy trucks, light duty trucks and passenger cars. The allocation for the national inventory is based on detailed national stock, turnover and travel surveys, and appears plausible. That assumed average annual vehicle mileage by trucks of only 30’000 km annually is explained by a high share of international traffic, and lower diesel fuel costs in Spain; therefore, mileage with “national” fuel is low (in line with the reporting convention.
  The diesel fuel according to PT national data for 2005 is much less for trucks, and consequently higher consumption for cars (LD4C) and light trucks (LD4T). Using PT national diesel fuel allocation leads to ~10 kt lower NOx emissions.
  => PT national diesel fuel allocation should be used in the next update of the calculations, and distribution carried forward accordingly.
- Difference in the age distribution for both diesel as well as gasoline cars as illustrated by different implied emission factors: According to data from national registrations and inspections, there are less old cars (pre-Euro and Euro 1) cars in the fleet than assumed in TREMOVE/GAINS. Implementing the PT age distribution would reduce NOx from gasoline cars in the year 2005 by about 3-4 kt, down from 18.6 kt; for diesel cars the reduction would be about 3 kt, which explains the remaining difference.

The differences in the projected NOx emissions from road transport in the year 2030 can be explained as follows:

- The PT national energy modelling suggests a drop in transport activity (pkm and tkm) and associated fuel consumption. From 2015 until 2030, total consumption is projected about 20% lower than in PRIMES 2013 REF. This difference needs to be discussed in the context of the overall energy modelling.
- However, despite lower energy consumption, the PT national energy model assumes a much higher growth rate for transport volume compared to PRIMES. This means, implicitly a much higher rate of fuel efficiency improvement is assumed. This should be carefully reviewed.
- GAINS/COPERT introduces forthcoming Euro 6/VI emission norms from 2014/5 onwards. They offer step changes in NOx and PM controls, although there is some uncertainty as to when and how much Euro 6c for LDDV delivers. By contrast, the PT national modelling projects change rates in implied emission factor from the past 10 years into the future. This leads to a factor 2 (LDDV) to 10 (HDT) higher average NOx emission factors in the year 2030 – and consequently much higher projected emissions (or lower reduction rates vs. 2005). Similar for PM emissions. Suggestion: The national PT assumptions about future emission factors should be carefully reviewed.

4.21.4 NH_3 emissions

- For the base year 2005 there are large discrepancies between national (IIR) and GAINS data. The largest discrepancies are in fertilizer N application, very high also (albeit in different direction) in animal husbandry.

- Different ways of allocation were identified as a major reason. While “manure application” and “grazing” are allocated to animals, at least “application” seems to be listed with mineral N fertilizers in the IIR (still to be confirmed by national expert).
- But further differences exist. First, on statistical data – national animal statistics tend to be slightly higher, milk yield about 10%, which is surprising since GAINS / CAPRI uses Eurostat data here (to be checked by GAINS team). But emissions are higher in GAINS indicating there is more to be considered. Part may derive from higher GAINS excretion rate on poultry (IIR considers a rather low N-EXR for turkey), but also other parameters deserve evaluation. The GAINS team (Zig) will check where data on shares liquid/solid systems, housing days, N-EXR comes from, national team will confirm whether data provided in CRF table should be used.
- No result was achieved regarding the difference in sector WT_NH3_EMISS (emissions from waste treatment), as the GAINS source leading to ~10% of national emissions was unclear while IIR does not report any emissions here (6D).
- Currently, no or little abatement measures are taken, thus there is ample room for improvement in the future. No specific information is given that would allow to better understand the 2030 emissions or abatement options and implement these in GAINS.

4.21.5 Stationary sources of SO_2, NOx, and PM2.5

- It is important to correct activity data used by GAINS to exclude Azores and Madeira.
- PT will check and correct the distribution of gas consumption in the power sector (boilers, turbines and CCGT plants) according to the explanations of GAINS energy data aggregation.
- Implementation of FGD on coal power plants in 2005 in GAINS needs to be set to zero. Installations were put into operation after 2005. Other differences in SO_2 emissions are due to different allocation of CHP plants (GAINS – power sector, PT – industry) PT will suggest changes, using “Emissions by control option” files.
- NOx: corrections of control strategies will be made after excluding fuel consumption in Azores and Madeira. Check if high emissions from the commercial sector in PT inventory are due to diesel fuel use in engines (for power generation?). If yes, this fuel will need to be moved to PP_Engines.
- Structure of wood combustion devices in the residential/commercial sector and the emission factors will need to be checked using recent PT statistics and studies.

4.21.6 Conclusions

- PT intends to provide national projections for energy and agricultural activities (only mainland PT). Starting point will be PRIMES/CAPRI. Only corrections for major categories and only for 2030 will be made. Such scenario will not be fully consistent but will be good enough to illustrate effects on emissions.
- Comments and suggestions on VOC emissions will be send to Zig Klimont (klimont@iiasa.ac.at)
- All additional data and suggestions should be provided to IIASA within one month.
- Agreed changes will be implemented in GAINS. Date depends on priorities to be set by the Commission and availability of time/resources at IIASA.

4.22 Romania

Laxenburg, 22 May 2014

4.22.1 Comparison of GAINS and national inventories for 2005 and 2010 (2014 submission)

SO2: GAINS emissions 2005/2010 10%/5% higher than in the RO inventory. Reason: GAINS estimate higher emissions from the power sector, potentially because of underestimating progress in emission controls.

NOx: GAINS emissions 2005/2010 1%/1% higher than in RO inventory. Total emissions from power plants and industry (sum of combustion and processes) are consistent, but different categorization of sources. Road transport emissions are lower in GAINS, emissions from non-road sources and from shipping 2-3 times higher in GAINS. Inclusion of non-road emissions in national inventory and activities for H_Shipping needs to be checked.

PM2.5: GAINS emissions 2005/2010 6% higher/7% lower than in RO inventory. RO emissions 2005 from SmallComb ~ 37 % higher than GAINS estimate. Biomass fuel consumption consistent with EUROSTAT; RO uses Tier 1 methodology. Sum of emissions from industry (combustion and processes) similar to GAINS, but different classification of sources. Very low emissions from RoadRail in the RO inventory in 2005, but values for 2010 consistent. Emissions from non-road sources in RO inventory very low (seriously underestimated). No emissions from agricultural waste burning. Although banned in RO, occurrence of emissions is confirmed by satellite observations. Link to the GFED – Global Fire Database as well as publications on the topic will be sent to RO. Emissions from cigarettes smoking, barbecues, and fireworks not included in RO inventory. Emissions from waste incineration are an order of magnitude lower than GAINS.

NMVOC: GAINS emissions 2005/2010 8%/12%higher than in RO inventory. Large differences for solvents industrial processes and agriculture. No emissions from AgriWastes). RO reports emissions from agricultural livestock, not in GAINS.

NH3: GAINS emissions 2005/2010 19%/14% lower than in RO inventory. RO – much higher emissions from livestock, lower from AgriOther. GAINS estimates are higher for IndProcess (fertilizer production?), needs to be checked. RO reports emissions from wastewater treatment, i.e., emissions from latrines (~8 - 9% of total). Latrines are not considered in GAINS – consistent with recent Guidebook. No emissions from AgriWastes and from pets and humans (R_Other).

4.22.2 Stationary sources

RO had limited time to analyse in detail the GAINS data and results prior to consultations. Explanations given by IIASA and online GAINS presentation provided a good background for more in-depth analysis of the reasons for discrepancies, possible corrective actions and the format of suggested changes in GAINS. RO provided the report about national projections of emissions at the level of NFR. This report can be used for comparison with the PRIMES 2013 REF CLE scenario.

RO will consider providing national projections from agriculture. National projections should be delivered in the GAINS format – templates with data as in PRIMES 2013 REF CLE scenario sent to RO. It is not necessary to modify each number, national projection can be limited to the most important sectors (e.g., power plants, road transport) and only for the year 2030.

4.22.3 Mobile sources

(The match of) emission inventories could be greatly improved by reviewing the following assumptions:

- Share of old (=before Euro 1) gasoline cars in the year 2005 (and 2010). Relevant for NOx and VOC emissions in the base year.
- If possible, assumptions about annual vehicle mileage in years 2005 / 2010.
- Share of latest Euro 6 cars (diesel only) in 2030 – relevant for future NOx emissions in 2030.
- IIASA will review the S-contents in diesel (and HF) fuels in 2005 (as accession to respective sulphur directive only by 2007.)
- Highlighted importance of diesel consumption by passenger cars in 2030, and the significance of the future performance of Euro 6 diesel cars (and light trucks) for NOx emissions.

4.22.4 NH_3 emissions

There are significant differences in the estimates for livestock (GAINS lower) and for 'waste water'. Emissions from 'latrines' are not included in GAINS, while they represent about 7% in the national inventory. For livestock there is a fundamental question about how appropriate the use of the Tier 1 method is for Romanian conditions (Tier 1 is used for the national inventory.) According to FAO, dairy cow milk production in Romania is about 3400 kg/year, while for Tier 1 6000 kg/year is assumed. Since GAINS uses milk yield as indicator, GAINS results in lower emission estimates. However, at the same time there is a question whether the current rearing system in Romania, which requires cattle to walk relatively long distances to the grazing land (often uphill), is not affecting emissions too as it requires additional food. There is no information and evidence as to how big such influence could be. IIASA has proposed to contact some Austrian experts, e.g., Alfred Poellinger or Barbara Amon to discuss this and find out if they could help.

There were also issues identified in consistency of data reported to Eurostat and used in the GAINS inventory (as well as in CRF) and national data; this will be checked and communicated. Additionally there were some differences in data for mineral fertilizer use identified where national data are different from the industrial data presented by IFA and used by GAINS. Needs to be verified.

4.22.5 NMVOC emissions

There are some significant discrepancies in the estimates for the solvent sector. GAINS estimates are much higher, which is the main reason for the difference. (In addition, agricultural burning is included in GAINS). No NMVOC emissions data for agriculture in GAINS. There is a need to compare actual activity data used and completeness of sector (beyond the NFR level) to find out where the reason lies. Since we did not consultations with Romania in 2012, this was the first opportunity to discuss details.

4.22.6 Methane ceilings

Methane estimates for RO as developed within the EUCLIMIT Project were presented, together with the marginal cost curve for CH4 reduction. The ceilings proposed by the Commission assume implementation of no-regret measures, i.e., measures that are cost-efficient even without CH4 constraints. The cost-efficiency of such measures was assessed with a 10% (business) real interest rate. Spreadsheet with input data and results (list of measures) sent to RO.

4.22.7 Conclusions

- ✓ RO will perform a closer analysis of data based on inputs provided by IIASA prior to (and during) the consultations and make suggestions about necessary changes.
- ✓ RO will consider providing national projections from agriculture and macroeconomic drivers.
- ✓ Agreed changes will be implemented in GAINS. Date depends on priorities to be set by the Commission and availability of time/resources at IIASA.

4.23 Slovakia

Laxenburg, April 23, 2014

4.23.1 Comparison of GAINS and the national inventories for 2005 and 2010 (2014 submission)

SO_2: GAINS emissions 2005/2010 3%/12% higher than national total. Different distribution of emission sources – different categorizations. Process emissions are lumped with industrial emissions in the SK inventory. SK will check data and suggest corrections, concentrating on the most important issues.

NOx: GAINS emissions 2005/2010 7%/17% lower than SK national total. Main difference in emissions from RoadRail. No emissions form OffRoadMob in SK inventory, quite higher emissions from Shipping. Are the off-road emissions lumped with shipping? In 2010, SK industrial emissions much higher than GAINS.

PM2.5: GAINS emissions 2005/2010 13% lower/5% higher than SK national total. Main reason: emissions from SmallComb – higher in SK inventory. Check activities (wood combustion) and emission factors. Emissions from industrial processes are very low compared with GAINS. Different structures of emissions from power sector and industry, but totals are similar. AgriWastes: SK - no emissions from agricultural waste burning. Although banned in SK, occurrence of emissions is confirmed by satellite observations. Link to the GFED – Global Fire Database as well as to publications on the topic will be sent to SK. Emissions from cigarettes smoking, barbecues, and waste incineration are not included in SK inventory.

NMVOC: GAINS emissions 2005/2010 6%/14% higher than in the SK inventory (at the time of 2012 consultation GAINS estimate for 2005 using PRIMES2012 pathway was actually within <1% difference to national reporting). GAINS: higher emissions from PublicPower, IndustrialComb, SmallComb, IndProcesss, Fugitive and RoadRail; smaller from Solvents.

NH_3: GAINS emissions 2005/2010 1%/10% lower than SK national total. For 2010, SK emissions from agriculture are higher, which is the main reason for differences.

4.23.2 Proposed corrective actions

- The team did not include experts on transport, agriculture and VOC emissions. Thus SK comments and suggestions will be sent via email. Contacts: transport – Jens Borken-Kleefeld (borken@iiasa.ac.at), agriculture and VOC – Zig Klimont (klimont@iiasa.ac.at).
- Slovakia would like to get in touch with CAPRI modellers, contact has been sent.
- SK methodology of estimating NMVOC emissions requires improvement, SK would like to use IIASA experience.
- Differences in PM emissions from residential combustion. SK uses Tier 1 approach, intends to the improve methodology. It needs to be checked whether non-commercial fuels (wood) are included in the SK inventory. If yes, IIASA would be willing to implement a correction. Emission factors, structure of fuel use (boilers vs. furnaces) and penetration of newer combustion devices will be checked. SK will send comments and suggest potential revisions to GAINS data. Recent reports on PM emissions from small sources have been sent to SK (Nussbaumer, EGTEI).

4.23.3 Conclusions

- SK intends to provide national projections for agricultural activities.

- No decision as yet if national projections for other activities will be provided.
- All additional data and suggestions should be provided to IIASA within one month.
- Agreed changes will be implemented in GAINS. Date depends on priorities to be set by the Commission and availability of time/resources at IIASA.

4.24 Slovenia

Laxenburg, April 17, 2014

4.24.1 Comparison of GAINS and national inventories for 2005 and 2010 (2014 submission)

SO2: GAINS emissions 2005/2010 3%/5% lower than national total. Are R_Other emissions for 2005 in GAINS necessary?

NOx: GAINS emissions 2005/2010 7% higher/2% lower than SI national total. SI emissions from IndustrialComb and SmallComb are higher. Road transport within the ballpark, OffRoadMob higher in GAINS.

PM2.5: GAINS emissions 2005/2010 41/53% lower than SI national total. Main reason: emissions from SmallComb. Check activities (wood combustion) and emission factors. Different structure of emissions from power sector and industry, but totals are similar. SI - no emissions from agricultural waste burning. Although banned in SI, occurrence of emissions is confirmed by satellite observations. Link to the GFED – Global Fire Database as well as to publications on the topic will be sent to SI. Emissions from cigarettes smoking, barbecues, and waste incineration are not included in SI inventory. Emissions from other sectors are within the ballpark.

NMVOC: GAINS emissions 2005/2010 3% lower/4% higher than in SI inventory. GAINS – much higher emissions from PublicPower, SmallComb and IndProcesss, smaller from Fugitive, Solvents, and IndComb. A classification issue?

NH_3: GAINS emissions 2005/2010 1/4% lower than SI national total. For 2010, SI emissions from agriculture are higher, which is the main reason for differences.

4.24.2 Stationary sources

SI will suggest changes in NOx EFs for cement industry and check emissions form the power sector as well as other combustion sources.

4.24.3 Mobiles sources

Focus is on NO_x emissions in years 2005 and 2030:

- Total GAINS NO_x from road transport in 2005 are close to national inventory. No more specific data available, but SI is in the process of updating.
- For 2030: Quite similar total amounts of gasoline and diesel projected for road consumption in 2030. SI had exchange of data with the PRIMES group before, hence streamlining seems plausible.
- Different distribution of diesel fuel between LDV and HDV: More consumption in trucks, less in cars than assumed in GAINS. There is an important fuel tinkering in trucks in transit, which is to be included in the national balance. Fuel re-distribution leads to lower projected NO_x emissions (as avg. EF for HDT is only ~0.055 g/kg compared to ~0.155 g/kg for diesel cars.
- Age of diesel (and gasoline) cars is much higher, resulting in a lower share of most modern cars than assumed in GAINS, because of significant import of used cars. Assumption for 2030: 21% and 9% by Euro 5 and Euro 4 cars. This would lead to significantly higher NOx emissions.

- AGR tractors in SLOV are relatively low power, leading to higher allowed emissions. Double-check EF.

4.24.4 NH_3 emissions

Differences in emissions are caused to a large extent by differences in activity data. Slovenia will deliver national projections. There is a large difference in poultry and fertilizer use – CAPRI vs. national. Zig will send SI comments to CAPRI modellers. Applicabilities of control technologies were discussed (mainly small farms in SI. SI will provide suggestions how to modify GAINS assumptions.

4.24.5 Emissions of NMVOC

GAINS does not include VOC and NOx emissions from manure management, which however are reported in the SI inventory. Thus they should not be included in calculations of the ceilings.

SI emission inventory is rather uncertain, SI would like to improve the estimates. IIASA will send info on emission factors for domestic solvent use based on studies for AT and other EU countries as well as infor on decopaint use. SI includes NMVOC emissions from coal mining, but GAINS does not. SI will double check that these emissions do not include CH4.

4.24.6 PM emissions from residential combustion

SI uses Tier 1 approach to estimate emissions, intends to use Tier 2, which is similar to GANS methodology. Next year submission should include changes. SI will send comments and suggest potential revision to GAINS data.

4.24.7 Conclusions

- SI intends to provide national projections for agricultural activities – important differences compared with CAPRI projections.
- No decision as yet whether national projections for other activities will be provided.
- All additional data and suggestions should be provided to IIASA within one month
- Agreed changes will be implemented in GAINS. Date depends on priorities to be set by the Commission and availability of time/resources at IIASA.

4.25 Spain

Laxenburg, 27 May 2014.

4.25.1 Comparison of GAINS and national inventories for 2005 and 2010 (2014 submission)

All numbers should refer to Spain within the EMEP region, i.e., without Canary Islands etc.

SO2: GAINS total estimates are 4% higher for 2005 and 17% lower for 2010 than the national inventory. Different distribution of industrial sources (combustion vs. processes). In the national inventory, emissions in 2010 from combustion sources are higher than in 2005. Spanish experts explained that 2010 numbers will need to be checked, as a different source of data for estimating the emissions was used. Need to check what is included in R_Other. There is a 14% difference between the 2010 value reported in the 2012 submission compared to the 2014 national submission.

NOx: GAINS estimates are 7% higher for 2005 and 11% lower for 2010 than the national inventories. Higher emissions in GAINS from RoadRail and in 2005 for OffRoadMob. GAINS emissions from shipping are more than 50% lower than in the national inventory. Activity levels for shipping need to be checked. How is the traffic to Canary Islands included?

PM2.5: Gains 67%/76% higher than the Spanish inventories for 2005/2010 respectively. Main reason: ES does not include emissions from AgriWastes. Sata sources used by IIASA to estimate these emissions from the Global Fire Database have been sent to ES. GAINS has higher emissions from industry (total combustion and processes) and transport (road and off-road). No emissions from cigarettes smoking, barbecues and fireworks in ES inventory. Emissions from SmallComb within the ballpark.

VOC: GAINS 13%/14% higher than the ES inventories, because of much higher emissions from transport (road and non-road). Other emissions are within ballpark. GAINS has order of magnitude higher emissions from OtherWasteDisp, emissions from solvents are lower in GAINS in 2005 and higher in 2010.

NH3: GAINS 3.5%/14% lower than ES inventories. Different classifications of sources in agriculture – GAINS higher for O_AgriLivestock and lower for P_AgriOther. No emissions from pets and humans in ES inventory (1.7% of total).

4.25.2 Spanish analysis

Spanish experts presented a comparison of national projections (and resulting emission targets) with GAINS numbers (available upon request).

- ✓ In general, emission levels as used for comparison presented in Section 3 are also used in the Spanish analysis. Exception: 2005 NOx emissions in the presentation are ~100 kt lower than in 2014 inventory used by IIASA for comparison, because only emissions within the EMEP region are taken into account in the comparison.
- ✓ National projections of SO2 and NOx emissions in 2030 are higher than CLE GAINS. Spain sees only small reduction potential in 2030, and the additional measures resulting from GAINS analysis for the B7 scenario need to be analyzed more closely. IIASA informed that files “Emissions by control option” sent to ES prior to consultations can be used for such an analysis. For an in-depth comparison of the PRIMES with national projections, activity data for the national projections need to be known.

- ✓ Large differences in 2005 PM2.5 emissions and projections up to 2030 because of much higher emissions in GAINS from industrial processes and transport. Emissions from open burning of agricultural waste are missing in the Spanish inventory. Differences are considered as too high to establish a good basis for specifying the ceiling expressed in relative terms. Spain is aware that open burning of agricultural waste is an important source of emissions, and will have a closer look at the GAINS methodology and compare with national estimates and reports. The report submitted to IIASA in June 2011 does not include data on Spanish PM2.5 emissions.
- ✓ National projections of NH3 stabilize at approximately 2010 level, while in GAINS emissions decrease. More details are provided in the NH3 section. Spain would like to better understand why a large effort is required in Spain to reduce emissions of NH3, and in particular from pig farms.
- ✓ The large differences in the base year emissions influence the targets. Thus, efforts need to be made to bring GAINS and national estimates closer; at least the reasons for differences need to be well understood. It is important to identify emission sources that are missing either in GAINS or in the national inventory.
- ✓ ES suggests to present the Average Acccumulated Exceedance (AAE) indicator for eutrophication, in addition to percentage of ecosystems exceeded.

During discussion, the following points were made:

- ✓ Activity numbers and emissions should cover only emissions from territory within the EMEP area, i.e., without the Canary Islands. IIASA gets from PRIMES fuel demand from the whole Spanish territory. Then, it subtracts fuel consumption from Canary Islands according to data provided by Spain in mid-2011. Spain was invited to verify and update information that is currently used by GAINS.
- ✓ Emissions from industrial combustion are not properly estimated in the Spanish emission inventory. Fuel consumption data are different from EUROSTAT. Reasons need to be explained. Some adjustments have been made for 2005, thus 2005 numbers are considered as more reliable than those for 2010.
- ✓ Fuel consumption and emissions from national shipping (and fishing) needs to be checked. Important differences compared with values used for the Gothenburg protocol scenarios.
- ✓ Spanish estimates of emissions from cement production are based on cement clinker production. GAINS uses cement production. Currently 90% of cement is produced from clinker. Activity data will need to be checked. Production of cement in GAINS is consistent with PRIMES assumptions. CLE for cement in ES assumes 40% abatement. The Commission Proposal (60% abatement) should be achievable through a combination of primary measures with SNCR.
- ✓ Spain inquired how recovery boilers in the pulp and paper industry are taken into account. IIASA asked to provide information on the use of black liquor, which will enable a more in-depth analysis.
- ✓ Spain stressed that estimates of emission reduction potentials need to take into account the multi-firing boilers and furnaces in this industry, and that the ELV applies to refineries as a whole.

- ✓ Spain asked whether different toxicities of primary and secondary particles was taken into account in the analysis. No, because according to the WHO there is not enough evidence from epidemiological studies about the differences in impacts.
- ✓ Spain doubts whether a ban of AgriWastes burning and WasteIncin can be fully enforced..
- ✓ Comments on NMVOC emissions (from solvent use and industry) should be sent to Zig Klimont (klimont@iiasa.ac.at).

4.25.3 Mobile sources

- ✓ Fuel consumption for road transport in the Spanish inventory is 10% lower for diesel (899 vs. 999 PJ) and 7% lower for gasoline (302 vs 324 PJ) than in GAINS. Possibly because it is based on fuel consumed within the country, not on fuel sold.
- ✓ This would easily explain the differences in 2005 emissions for NOx and VOC.
- ✓ It would be helpful to review the share of pre-Euro gasoline cars in 2005 (relevant for NOx and VOC emissions).
- ✓ It would be helpful to communicate the assumed diesel consumption in trucks/HDV, LDT and passenger cars, so that GAINS estimates could be adjusted accordingly.

4.25.4 NH_3 emissions

- ✓ National projections suggest stable or slightly increasing NH_3 emissions from agriculture, while GAINS leads to a slight decrease. Recommended solution: provide national scenario – it is likely that projected animal numbers differ (GAINS uses CAPRI model projections which cover all of Europe).
- ✓ Abatement measures: "natural crust formation" on manure tanks is considered in GAINS as CS-low (covered storage at low efficiency). If this is happening already now in Spain, it would be interesting to learn which extent of total manure (in percent) is affected, as this would reduce current emissions – and at the same time decrease the future abatement potential.
- ✓ Average accumulated exceedance of N load – is this parameter available in GAINS in graphical form? That would help to argue improvements, as currently only areas of exceedance are being displayed, which offer little change for Spain even if MTFR is implemented.
- ✓ The first two items are for the Spanish experts to check, the final item will be checked by IIASA.

4.25.5 Methane ceilings

Methane estimates for ES as developed within the EUCLIMIT Project were presented, together with the marginal cost curve for CH4 reduction. The emission ceilings proposed by the Commission assume implementation of no-regret measures, i.e., measures which are cost-efficient even without CH4 constraints. Cost-efficiency of such measures was assessed with a 10% (business) real interest rate. File with measures for ES has been sent, together with other info.

4.25.6 Conclusions

- ✓ Spain intends to provide national projections for agricultural activities – there are large differences compared with CAPRI projections.
- ✓ No decision as yet whether national projections for other activities will be provided.
- ✓ All additional data and suggestions should be provided to IIASA until the end of June.
- ✓ Agreed changes will be implemented in GAINS. Date depends on priorities to be set by the Commission and availability of time/resources at IIASA.

4.26 Sweden

Laxenburg, April 8, 2014

4.26.1 Telephone conference with Frederic Neuwahl, DG ENV

Frederik joined the meeting via teleconference. He informed on the State of Play and responded to questions about further plans of the Commission with regard to the NEC.

4.26.2 Concerns of Sweden

Sweden aims for properly developed and justified emission ceilings for Europe. For countries with a lower level of advancement in emissions reductions, it is important to demonstrate how other (advanced) countries achieved the reductions. Sweden does not have major problems with the IIASA estimates of emissions for SO_2 and NH_3 (differences are within the tolerance limits). Discrepancies exist for VOC and NOx. Sweden proposes to concentrate on the reasons for these differences.

4.26.3 Comparison of GAINS and national inventories for 2005 and 2010 (2014 submission)

The most important differences were for NOx and NMVOC emissions in 2005. The Road and Non-road transport sector were in focus for NOx, and the Non-road mobile machinery and solvent use sectors were in focus for NMVOC.

4.26.4 Transport sector

Assumptions in TREMOVE/COPERT (as used by GAINS) and national inventory were compared. Differences in emissions are caused by:

- ✓ Different shares of diesel LD vehicles,
- ✓ Lower shares of cars without catalysts in 2005 in national inventory
- ✓ Faster turnover of vehicle stock in national modelling compared with GAINS
- ✓ Non-road mobile sources: activities and S content of fuels will be updated based on recent Swedish assessment.
- ✓ VOC: after correction of vehicle turnover the emissions more in par with GAINS assessment.
- ✓ Evaporative emissions from road sources – reasons for differences require further analysis.
- ✓ Evaporative emissions from non-road sources not reported in Swedish inventory; thus GAINS emissions will remain higher.

4.26.5 VOC emissions from solvent use and industry

- ✓ The overall differences were not very large, but some specific sectors showed larger discrepancies.
- ✓ Harmonizing assumptions on emission factors for combustion of biomass in industrial boilers (including power plants) has been agreed; Sweden proposes to use emissions factors similar to coal combustion - GAINS emission factors were higher.
- ✓ Based on the recent assessment of solvent emissions in Sweden, few of the source categories were adjusted, including degreasing, food and drink industry, vehicle refinishing.

- ✓ After changing some GAINS assumptions emissions are on par, except for road transport.
- ✓ After changes in the road transport sector, VOC emissions are currently lower in the GAINS calculations for 2005 than in the SMED inventory for 2005. Further checks will be needed.
- ✓

Difference per sector **(IIASA results for 2005 - SMED(inv 2014) results for 2005**	**Pre-bilateral Diff**	**Bilateral change in IIASA results**	**Post-bilateral Diff**
TOTAL DIFFERENCE (kton)	**11.89**		**-7.89**
Power+ industry+ processes stationary sources (incl. pipeline compressors)	8.41	-7.62	0.79
Domestic stationary	0.26		0.26
Non-road machinery: CNS+AGR+LD2+LB+EV+ TRA_OTS	10.26	-7.16	3.1
Non-road: air + rail	0.05		0.05
Road traffic: personal cars + evaporative	1.83	-10	-8.17
Road traffic: heavy trucks and buses	1.51	-1	0.51
Road traffic: other	-1.56		-1.56
Sector 3: solvent use	-8.75	6	-2.75
Sectors 4,6,7	0.14		0.14
Sectors not included in GAINS	-0.26		-0.26

4.26.6 Conclusions

- ✓ Sweden will make an attempt to deliver national activity pathway (within one month).
- ✓ Agreed changes will be implemented in GAINS. The agreed changes are highlighted in the annex. Date depends on priorities to be set by the Commission and availability of time/resources at IIASA.

4.27 United Kingdom

Laxenburg, 15 May 2014

4.27.1 Comparison of GAINS and national inventories for 2005 and 2010 (2014 submission)

SO2: GAINS estimates for 2005/2010 are 20%/20% higher than UK national inventories. Reason: higher emissions from Public Power, Industrial Comb, Fugitive (GNFR place emissions from refineries into this category) and from Shipping. GAINS estimates are lower for IndProcess and OffRoadMob. GAINS estimates for IndComb are higher because the model was calibrated for the national activity energy statistics delivered in 2012 to IIASA, while the TSAP analysis employed PRIMES/EUROSTAT data. The national statistics hold only little final consumption of coal and coke in the iron and steel industry, while it is much higher in PRIMES due to different accounting of coke used in blast furnaces. Possible solution: correction of S retention in ash for industrial coke use. Differences in other sectors require correction of control measures applied on emission sources.

NOx: GAINS emissions 2005/2010 – 7%/4% lower than UK national total. GAINS – lower emissions from RoadRail and OffRoadMob, higher from Shipping. In general, match not bad.

PM2.5: GAINS emissions 2005/2010 – 6% lower/3% higher than UK national total. SmallComb – GAINS lower by 7%/24% of the UK inventory total. GAINS – higher emissions from RoadRail, lower from OffRoadMob. The national inventory includes in the R_OTHER category: accidental fires – dwellings, accidental fires - other buildings, accidental fires – vehicles, bonfire night and fireworks. AgriWastes are not reported in the UK inventory. Although banned in the UK, occurrence of emissions is confirmed by satellite observations. Link to the GFED – Global Fire Database as well as to other publication on the topic is included in the presentation by Z. Klimont, which will be sent to UK. Emissions from cigarettes smoking, barbecues, fireworks much lower than GAINS. What is the source of info used?

NMVOC: GAINS emissions 2005/2010 1%/3% higher than in UK inventory. Reasonable match, also at a sectoral level. UK reports emissions from AgriLivestock, not included in GAINS.

NH3: GAINS emissions 2005/2010 2%/0% higher than UK national total. Different structure of emissions from agriculture and from waste. Emissions from RoadRail higher in GAINS. Does GAINS include emissions from WasteWater? Other emissions are higher in the UK inventory.

4.27.2 Stationary emission sources

SO2:

Industrial combustion: petroleum coke is not included in the UK energy statistics. This may cause differences when emissions are calculated from fuel use. Check if and how petcoke use is included in PRIMES.

A major difference in SO2 emissions occurs for industry – emissions from coke and other fuels use in blast furnaces. Different treatment in UK statistics compared with EUROSTAT. In 2012 GAINS used the UK national scenario. EUROSTAT includes part of coke and coal input to blast furnaces as final energy use. National statistics include these fuels as input to fuel conversion in blast furnaces, emissions occur only from the use of blast furnace gas. These emissions are much lower than the ones calculated from S content of fuels used as an input to blast furnaces. GAINS emission factors for fuels use in iron and steel industry will be changed to the pre-2012 GAINS numbers.

Use of petcoke use in the residential sector (cheap fuel) is not in the UK energy statistics – will need to be added. SmallComb – 21 kt SO2 from the use of petcoke (correction can be done for UK similarly as the use of waste fuels in refineries in BE)

Differences at the GNFR level for sectors B, D, and E result from different categorisation of sources (combustion vs. process), totals quite consistent.

NOx:

Emissions from coal use in industry need to be checked. Total – 14 kt. Emissions from power plants, industrial combustion and processes– differences in categorization (as for SO2), total consistent. Emissions from nitric acid production are lower than assumed by IIASA. Appropriate emission factors will be delivered by the UK.

Future controls on gas plants working in peak (part load) because of higher share of renewables in electricity mix. UK proposal: modify annual operating hours, which will cause higher control costs. Use applicabilities (UK proposes 70%) to include lower control possibilities. Details will be provided to IIASA.

Shipping – GAINS activity too high. OffRoadNonRpadWill be adjusted together with other data for non-road transport. Fuel will need to be reallocated to the different category.

PM:

GAINS emissions from glass lower than in the national inventory (should be about 3 kt), emissions from glass fibre production need to be added.

Controlled burning of heather in moorland areas is undertaken to keep it young (maintaining a higher nutritional value for birds and sheep). Malicious fires are included in the UK inventory as R_Other. UK will make suggestions how to treat these emissions in GAINS and what emission factor to use.

PM from charcoal use (barbecues) and from fireworks included in SmallComb. No estimates of emissions from cigarette smoking in the UK inventory.

UK includes dust from industrial coatings (PR_SMIND_F), how to include it in GAINS? The same with emissions from manure burning.

Residential sector

Emissions from coke and coal are underestimated in GAINS – emission factors need to be modified. Besides, petroleum coke is burned by households. Since it is not in EUROSTAT statistics (and thus not in PRIMES/GAINS), activities and emissions need to be added.

Measures that appear in the GAINS scenario for the Commission Proposal were discussed:

- Electrostatic precipitators – the information originates from experience and data of Swiss and Norwegian projects. The info on the Swiss development are available at http://www.minipab.ch/index.html.
- IIASA has indicated that it would be essential to review the assumptions about the structure of the residential sector in GAINS (as well as its evolution in the future) and most importantly the assumptions (applicabilities) about the maximum penetration of measures.
- End of May UK has sent additional questions and comments about assumptions taken by IIASA for that sector in the TSAP report #11. They refer to the assumptions on the effects of

the Ecodesign Directive and UK national legislations included in IIASA scenarios. These questions will be handled during the process of implementation of national inputs in GAINS.

4.27.3 Mobile sources

For 2030 – Road transport:

- Similar controls shares (=fleet turnover) are assumed in GAINS and by the UK. However, UK projections for NOx emissions from road transport are significantly higher, as Euro 6 for diesel cars (and likewise for diesel LDT) is only assumed to result in ~400 mg NOx/km (compared to 80 mg/km limit value and 120 g/km assumption in GAINS for Euro 6c). Reasoning: Euro 6c, i.e. revision of test cycle, is not yet decided, hence not in a strict "current policy" scenario. With GAINS assumption for Euro 6c from 2018ff, UK projections would result in quite similar NOx emissions in 2030, i.e. quite similar assumptions on all vehicle categories. (Using UK assumption on Euro 6b only in GAINS would result in 64 kt higher NOx emissions in 2030.
- Agreement that timing and performance level of future Euro 6 emissions from diesel LDV will be crucial for NOx emission level in 2030.

Other transport:

- UK expects an increase in diesel consumption by rail until 2030 to 32 PJ (while PRIMES assumes a decrease by 11% down to 24 PJ in the period 2005 to 2030). Fleet renewal appears similar, with GAINS assuming a reduction of about 50% in the average NOx EF for rail (2010, the year available for comparison, to 2030), while UK assumes a decrease by 40%. In addition, the absolute GAINS emission factor is lower.
- UK assumes an increase notably in freight diesel traction, i.e., probably hauled by locomotives, hence slower fleet turnover and higher unit emissions. ⇔ higher emission factor would result in +9 kt extra NOx, additionally higher MD consumption would be another +8 kt from RAI in 2030.

For 2005:

- UK has ~30 PJ lower consumption in coastal shipping and 11 PJ higher consumption in inland shipping, and ~66 PJ higher consumption in off road (AGR & CNS & LB & LD2), and ~39 PJ higher consumption in military naval and air activities, i.e. in total about 84 PJ higher consumption of liquid fuels. IIASA might reallocate GAINS fuel consumption in the base year, but we would need to respect the overall energy balance.
  For this, UK should provide the GAINS template with a revised allocation of liquid fuels (i.e. more consumed by mobile sources but then respectively less e.g. in IND, DOM and COM sectors).
- Noted: NH_3 emissions from petrol cars. The UK assumes different avg. EF probably because of different allocation of mileage across road categories. The level and trend of NH3 EF in GAINS seems ok. No action, as not relevant neither for total nor reduction target.
- Noted: SO_2 emissions from NRMM higher in 2005 and 2010 as ~90% of machines fuelled with "gas oil" that has higher S contents (2005: 0.145%, 2010: 0.0721%). From 2011 onwards S contents limited to 10 ppm, as assumed in GAINS.
- PM abrasion factor is supposed to be ~7 mg/km for LDV – but the value actually implemented in GAINS is a factor 10 too low. Hence significantly higher contribution from non-exhaust PM in 2030.

4.27.4 NH_3 emissions

The discussion focused on interpretation of GAINS results and issues related to the implementation of strategies at the country level.

UK seeks better understanding of transitions from the CLE to Commission Proposal (CP) scenario output. IIASA explained how it is secured that measures like low emission housing or storage that require investments are not prematurely retired as they have long life times. At the same time, measures requiring lower investments or performed by contractors are much less constraint. This is why measures assuming efficient application of manures are coming in the solution. Actual enforcement issues are not directly considered in GAINS, although the 'applicability' parameters could be adjusted if sufficient evidence exists that certain measures could be implemented only slowly or their penetration will be very limited.

IIASA is also working on the improved presentation of results where share of implementation will be translated to the percentage or number of farms affected also indicating their typical size. Such information should help interpreting the results and IIASA will share few example slides.

IIASA will provide the most recent document describing emission and cost methods used for ammonia in GAINS (Klimont and Winiwarter, 2011). Document sent to the UK together with this note.

IIASA has explained the assumptions behind the category COWS3000 and how to interpret results, i.e., COWS and COWS3000 should be added and both categories are representing simply COWS, there is no difference in measure types or their application rates, etc. IIASA is working to eliminate this confusing output from the GAINS model view platform.

4.27.5 NMVOC emissions

The match between GAINS and national inventories for 2005 and 2010 is pretty good at the national level, but there are some discrepancies for few sectors. While some details have been discused, further comparison work will be conducted by UK experts, and background information for key sectors will be provided to allow for better calibration of the inventory for sectors like printing, domestic solvent use, few other industrial application of solvents activities.

The difference in the estimates for large combustion plants is linked to power sector coal use; GAINS has significantly larger emissions. We have compared the emission factor used for UK with that for Germany, and there is significant difference; Germany uses a lower number. It was agreed to use the German factor for the UK in GAINS. Considering the impact of this change and the fact that UK allocation of some combustion plants between power and industrial boilers is not the same, we have compared the total emissions from boilers and they would be agreeing satisfactory after the change.

Another issue is the use of petroleum coke in residential sector which is not reflected in GAINS (but also not in the official energy statistics submitted to Eurostat), but is included in the national inventory. We will consider including this provided UK submits activity data, including projections.

There is a discrepancy for 'waste' sector, which is most likely due to a recent revision of methane leakage from landfills. As NMVOC emissions are represented as a share of CH4 there was an increase. UK will provide respective data to update emissions from this sector.

4.27.6 Methane ceilings

Methane estimates for UK as developed within the EUCLIMIT Project were presented, together with the marginal cost curve for CH_4 reduction. The emission ceilings proposed by the Commission assume implementation of no-regret measures, i.e., measures which are cost-efficient even without CH_4 constraints. Cost-efficiency of such measures was assessed with a 10% (business) real interest rate. Measures on the list for energy sector are cost-effective with energy prices as in PRIMES projection for 2030 (gas – increase from 6.8€/GJ in 2005 to 11 €/GJ in 2030, electricity – 8.7 €cents/kWh in 2005, 20.4 €/kWh in 2030). In the calculations the technical lifetime of equipment was included, which is in many cases longer than economic lifetime taken into account by industrial stakeholders. This clarifies why currently subsidies are required in the UK to implement these measures. File showing measures for the UK was sent.

4.27.7 Conclusions

- ✓ UK will consider providing national projections for energy and agriculture.
- ✓ All additional data and suggestions should be provided to IIASA by end of June.
- ✓ Agreed changes will be implemented in GAINS. Date depends on priorities to be set by the Commission and availability of time/resources at IIASA.