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### Working Group on Strategies and Review

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Item 6 of the provisional agenda

#### Progress in the implementation of the workplan 2012-2013

#### Integrated assessment modelling

### Steering Body to the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP)

#### Thirty-sixth session

Geneva, 17–19 September 2012

Item 7 (b) of the provisional agenda

#### Progress in activities in 2012 and future work:

## Integrated assessment modelling

### Report by the co-chairs of the Task Force on Integrated assessment modelling\*

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\* The present document is being issued without formal editing.

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## **I. Introductory remarks**

1. This report describes the results of the forty-first session of Task Force on Integrated Assessment Modelling, held on 7 - 9 May 2012 in Bilthoven, the Netherlands<sup>1</sup>.

### **A. Attendance**

2. Forty five experts attended the meeting, representing the following Parties to the Convention: Belarus, Belgium, Croatia, Denmark, Finland, Germany, France, Ireland, Italy, Netherlands, Sweden, the Ukraine, the United Kingdom of Great Britain and Northern Ireland. Also the Working Group on Effects, the Network of Experts on Benefits and Economic Instruments (NEBEI), the European Monitoring and Evaluation Programme (EMEP) Centre for Integrated Assessment Modelling (CIAM), the Coordination Centre for Effects (CCE), the European Commission, and the European Environment Bureau (EEB) were represented. Five participants from Italy, Croatia, Germany and Spain took part via video link.

### **B. Organization of work**

3. Ms. A. Engleryd (Sweden) and Mr. R. Maas (Netherlands) chaired the Task Force meeting.

## **II. Objectives**

4. The co-chairs of the Task Force opened the forty-first meeting and presented its objectives:

- (a) To reflect on achievements;
- (b) To discuss directions for further research;
- (c) To report to the Working Group on Strategies and Reviews on the impacts of the revised Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (Gothenburg Protocol).

5. At the thirtieth session of the Executive Body, a revised Gothenburg Protocol was agreed on 4 May 2012. The Protocol could be seen as a step towards further improvements of the air quality in the UN Economic Commission for Europe (ECE) region.

6. Instead of emission ceilings for 2020, the revised Protocol included emission reduction commitments as a percentage relative to 2005. PM2.5 was now included with additional consideration for the black carbon fraction. Technical annexes had been updated. A revised Annex I (critical loads and levels) was adopted without much debate. Annex IX (ammonia) had not been updated and would be reviewed when the revised Protocol enters into force. Procedures for adjustments of commitments were included in the revised Protocol. Countries of Eastern Europe, the Caucasus and Central Asia were allocated more time to improve their emission estimates. For these countries a delay of up to five years for

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<sup>1</sup> Presentations made during the meetings and extended chair's reports are available at: <http://gains.iiasa.ac.at/index.php/tfiam/past-tfiam-meetings>.

reporting emissions from large combustion sources and volatile organic compound (VOC) emissions from mobile sources and fuel conversion was accepted.

7. Annex II includes the emission reduction commitments for Parties to the Protocol. It contains commitments for all European Union twenty seven member states, as well as Belarus, Croatia, Norway, and Switzerland. The United States of America, the Russian Federation and other countries of Eastern Europe, the Caucasus and Central Asia will include their commitments in the course of the ratification process.

8. The Executive Body at its thirtieth session requested the EMEP Steering Body to develop provisional guidance on the extraordinary circumstances in which the revised Protocol would allow adjustments to be made to the reduction commitments or emission inventories for compliance purposes, for consideration during the Executive Body session in December 2012.

9. The Task Force confirmed the point of view expressed in the Executive Body that new activity projections should not be viewed as an extraordinary circumstance and as a reason to adjust emission reduction obligations.

10. The European Commission announced that it was considering developing new ambitions beyond 2020 in the course of 2013, the year of “air” in the European Union. Currently, the European Union Thematic Strategy on Air Pollution (TSAP) is under review.

### III. Analysis of the revised Gothenburg Protocol

11. CIAM<sup>2</sup> presented the results on the analysis of the impacts of the revised Protocol. The GAINS model<sup>3</sup> calculations for the revised Protocol showed environmental improvements for the entire model region compared to the year 2000, although for all environmental endpoints they were lower than what had been estimated earlier by GAINS for the current legislation baseline based on the PRIMES<sup>4</sup> energy scenario. The current GAINS estimates did not include potential impacts of the use of the adjustment opportunities in the revised Protocol, which could further reduce the environmental benefits calculated in the first analysis.

12. For the EU-27, emissions implied by the revised Protocol up to 2020 would remain significantly above the emission trajectories laid out in the 2050 roadmap. As a consequence, improvements of health effects from particulate matter (PM), as well as ecosystems protection against eutrophication and forest acidification would remain below the ambitions set out in the Thematic Strategy on Air Pollution. Results would be summarized in CIAM-report 1/2012.

13. Although the available emission reduction commitments of non-European Union countries were in general closer to the earlier baseline projections than those of many European Union countries, health impacts from ground-level ozone were expected to increase in the future due to growing emissions of non-European Union countries that had not provided reduction commitments.

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<sup>2</sup> EMEP Centre for Integrated Assessment Modelling.

<sup>3</sup> Greenhouse Gas and Air pollution Interactions and Synergies.

<sup>4</sup> As a partial equilibrium model for the European Union energy markets, PRIMES is used for forecasting, scenario construction and policy impact analysis up to the year 2030. For more information, see <http://ec.europa.eu/environment/air/pollutants/models/primes.htm>.

14. The Coordination Centre for Effects (CCE) presented its tentative analysis of ecosystem impacts of the revised Protocol. The ecosystem area where acidity critical loads were exceeded would decrease from 9.3% in 2005 to 4.2% in 2020. For eutrophication it would decrease from 51% to 42% in 2020. A preliminary analysis for a subset of the ecosystems showed a reduction of the nature area with more than 5% biodiversity loss from 8.4 to 3.3% in 2020. Overall, reductions in environmental impacts were achieved compared to 2010, but a lot remained to be done, especially with regard to nitrogen. The CCE has also looked at emissions per country area, per capita and per GDP, which showed large differences between countries. The CCE would continue to investigate the impacts of equitable emission reductions. Work on aspirational long-term emission reduction targets indicated how large the deposition reduction needed to be to virtually eliminate negative environmental impacts. First results indicated that for acidification, a 50-60% reduction in acid deposition would leave less than 1% of the ecosystem area with critical load exceedances.

15. NEBEI<sup>5</sup> presented their analysis of the economic benefits of the revised Protocol. It was found that, in addition to the emission reduction commitments of the revised Protocol, significant scope remained for further cost-effective measures for which the benefits exceeded the costs by a factor of eight and more. The TFIAM was reminded of the large benefit-cost ratios for all the scenarios that had prepared for the negotiations. In monetary terms, most of these benefits would emerge from reduced mortality if long term exposure were reduced further. However, even a smaller share in total benefits, such as improved labour productivity from fewer work days lost, would balance the additional control costs. In addition, further benefits would arise from improved ecosystem services, better protection of cultural heritage and lower costs of local emission control measures if stricter emission reductions were implemented at the European scale. These areas should be considered for future analysis, as well as the quantification of damages caused by countries to other countries in comparison to the costs they would have to incur to reduce such damages.

16. The editor of the background document to the revised Protocol produced by the Task Force presented its progress. Results from integrated assessment modelling, cost-benefit analysis, and effects analysis were to be included. The background document had the objective to show the impact of the Protocol. It would also specify the data and methods used. The document would cover emissions from 1990, 2000, 2005, 2010, 2020 (four scenarios, including the revised Protocol), and 2050. Pollutants would include sulphur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), ammonia (NH<sub>3</sub>), volatile organic compounds (VOCs), fine particulate matter PM<sub>2.5</sub>, black carbon (BC), carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O). Results would be presented for the counties in the EMEP area, as well as for the EU-27 total. It was planned to finalize the document by the session of the Working Group on Strategies and Review in September 2012. Efforts would be made to include projections up to 2030 into the report.

17. Funding for translation into Russian would be sought. Interested experts were invited to review the draft report.

#### **IV. Lessons learned and future plans**

18. The Task Force discussed the role science had played in the revision of the Protocol. Science had formed an important part in framing the problem. At the same time, modelling analysis was not the only information taken into account in the final negotiations.

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<sup>5</sup> The Network of Experts on Benefits and Economic Issues.

19. The Task Force acknowledged that communication should be improved in five areas:

(a) Communication between integrated assessment experts and experts developing energy, transport and agricultural scenarios within the countries in order to improve consensus on the baseline scenario. The expectation was that PRIMES would remain the basis for review and revisions, but that more national knowledge should be taken into account. This required a better communication with national energy analysts involved in the development of PRIMES scenarios;

(b) More and well-prepared bilateral consultations between national experts and CIAM on emission inventories and other input data could help to reduce misunderstandings and different interpretations of statistical and technical facts. This could avoid bargaining on technicalities during political negotiations, and facilitate a stronger focus on environmental improvements, cost-effectiveness and risk management;

(c) Communication between national experts and CIAM needed to be improved. A stronger commitment of the Working Group on Strategies and Review was important to improve participation of national experts in the bilateral consultations

(d) Communication between integrated assessment experts and national policy makers could be improved. A stronger commitment of the Working Group on Strategies and Review was important to improve participation of national experts in the bilateral consultations;

(e) Improved communication with the broader public was important, especially through the choice of understandable indicators (e.g. on health effects and biodiversity loss).

20. The results of the bilateral consultations were outdated by the time of the final negotiations. A clear project plan of the process would be helpful to avoid this in future Protocol revisions.

21. Integrated Assessment Modelling identified economically efficient strategies to reduce the value of damage caused by transboundary air pollution and showed the added value of international agreements compared to unilateral or local actions to meet air quality limit values and the protection of Natura2000 areas.

22. Emission reduction commitments for the medium term should be derived, inter alia form long term (aspirational) targets, together with an analysis of the required phase-in of emerging technologies. This would avoid a lock-in of outdated technologies and provide reliable long-term planning horizons to industry.

23. A recent political development was the strong and emerging interest in short lived climate pollutants (SLCPs). In this context it could be useful to draw attention to the Coalition for Short Lived Climate Pollutants. This was an attempt to seriously integrate climate change and air quality, which would achieve near term climate benefits and air quality improvements. This global coalition started with six countries and has now grown to ten countries, the European Commission, UN Environment Programme (UNEP) and the World Bank with a number of additional countries considering joining. A stronger co-operation between the Task Force, the Task Force on Hemispheric air Pollution, the Task Force on Emission Inventories and Projections and Expert Group on Techno-economic Issues could help in developing cost-effective control strategies for SLCPs.

24. The chair of the EMEP Steering Body presented the work plan for the coming years. It had been recognised that more efforts to improve communication were required.

25. The extended Executive Body Bureau was discussing the implementation of the long term strategy of the Convention on Long-Range Transboundary Air Pollution including a

possible reorganisation and communication strategy. The Task Force on Integrated Assessment Modelling and CIAM will remain central in the work. Several new options for reorganization were being discussed. The current activities were planned to remain, while the work might be performed under a renamed or regrouped body.

26. The Task Force suggested that a new organisational scheme of the Convention would support the core tasks of the Convention, i.e. on integrated assessments, emissions inventories, monitoring of air quality and assessment of effects. A separate diagram showing how the Convention worked and what it did would be a valuable communication tool.

27. The EMEP model was being implemented with enhanced spatial resolution, useful for future work in the framework of the Convention. The spatial resolution of the model to be used in support of the Convention had not been decided. Improved communication between the CCE and the Meteorological Synthesizing Centre-West was encouraged.

28. The Task Force advised EMEP to communicate changes in the spatial resolution of model outputs as soon as possible to the Working Group on Effects. The Task Force on Integrated Assessment Modelling recognised that fine scale emission dispersion modelling was still dependent on equally fine resolution in emission inventories.

29. A representative of the Expert Group on Techno-economic Issues (EGTEI) presented the recent work and work plans for the coming years. Recent work has focused on developing technical annexes to the Convention, the guidance documents as well as document on PM emissions from Small Combustion Plans. The Expert Group would continue to work on emerging technologies in combustion plants and provide a report in September 2012. The Expert Group was also involved in capacity building in countries of Eastern Europe, the Caucasus and Central Asia. Plans were being made for the organization of training sessions. In co-operation with the Co-ordination Group for countries of Eastern Europe, the Caucasus and Central Asia, key documents would be translated into Russian. Sector specific developments related to improving the estimation of costs from large combustion plants input data into the GAINS model (e.g. for power installations >50 MW). The Expert Group on Techno-economic Issues would update the guidance document for reduction techniques of black carbon. Its next meeting was to be held on 11-12 June 2012 in Nice, France.

30. The Task Force acknowledged the active network and capacity building activities of the Expert Group.

31. A representative of NEBEI presented the workplan for the coming years. First of all, the cost-benefit analysis of the revised Protocol would be finalised. Also methodological differences in benefit assessments would be reviewed, and the emphasis on economic instruments would continue. NEBEI communicated with a number of bodies of the Convention to broaden the economic valuation of environmental effects to ecosystem services. It was planned to launch a website. Ideas for new activities were to be explored: options for national benefit models; promotion of work linked to co-benefits of the broad base covering climate, transport and energy security. Some measures in the supporting analysis for the revised Protocol had been shown to be very cost effective but were excluded from policy implementation, which called for further analysis.

32. The representative of the Task Force on Reactive Nitrogen presented the workplan. The latest addition was the Expert Panel on Nitrogen in countries of Eastern Europe, the Caucasus and Central Asia. The current workplan comprised the finalisation of the guidance document for preventing and reducing emissions of ammonia, updating the Framework Code on Good Agricultural Practice, providing technical information on making and using nitrogen budgets, and also to strengthen the co-operation with countries of Eastern Europe, the Caucasus and Central Asia. Furthermore, the Task Force on

Reactive Nitrogen was exploring the relationships between “greening” the economy and nitrogen emissions which regarded as an item suitable co-operation with the Task Force on Integrated Assessment Modelling.

## V. European modelling experiences

33. CIAM and the European Commission presented the scientific work that would take place to support the forthcoming review of the Thematic Strategy on Air Pollution. The timeline for the update of the Thematic Strategy on Air Pollution was tight, with the analytical work to be completed by early 2013. The review included an evaluation of the Thematic Strategy on Air Pollution and the current air quality legislation and the National Emission Ceilings Directive. Urban hot spots and the impacts of the climate and energy package were considered, as well.

34. A number of scenarios were being produced. Currently there were consultations regarding the PRIMES 2012 scenarios which needed to be co-ordinated internally in the member States. It was important that all key figures that were being fed into the PRIMES and GAINS models were reviewed by national experts.

35. The modelling work for the review of the Thematic Strategy would contain the following aspects: The main issue of linking transboundary emissions with local scale air quality issues had been finalised in the end of the European Consortium for Modelling of Air Pollution and Climate Strategies (EC4MACS) project. In EC4MACS, a new methodology had been developed that allowed for European scale compliance assessments with CHIMERE<sup>6</sup>/EMEP<sup>7</sup> models for air pollutants. This implied an improved ‘city-delta’ type methodology with enhanced spatial resolution. The main improvements related to fine-scale meteorology, and street canyon contributions. The addition of these elements should allow for an indication on where local air quality limit values might occur.

36. Results from fine scale PM<sub>2.5</sub> emission inventories showed systematic problems in winter throughout Europe. Corrections were done for domestic heating emissions (related to degree days and urban population adjustments). A street canyon increment was being used, developed by regression of monitoring data. From the analysis it had been possible to show the difference in emission reductions between urban and national traffic. Emissions were being reduced slower in urban traffic due to different driving patterns than in rural (national) traffic.

37. From the final assessment of the EC4MACS project, emission projections to 2030 would be delivered including results for the Current Legislation baseline and Maximum Technically Feasible Reductions scenarios. The results would be based on the PRIMES 2010 scenarios. Secondly, the results on air quality impacts and economic benefits would be added.

38. For the Thematic Strategy on Air Pollution there would be two scenarios developed before the meeting of the stakeholders’ expert group in June 2012. Emissions for Europe up until 2050 would be delivered. There would be two main groups of emission scenarios, PRIMES baseline and PRIMES low carbon scenarios. The emissions from the low carbon scenario were based on the European Union 2050 road map. In each group, there would be three ambition levels: Current Legislation baseline, Maximum Technically Feasible Reductions scenario, and Maximum Control Effort scenario.

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<sup>6</sup> <http://euler.lmd.polytechnique.fr/chimere/>

<sup>7</sup> [http://www.emep.int/index\\_model.html](http://www.emep.int/index_model.html)

39. Based on these scenarios, IIASA<sup>8</sup> invited European Union member States to bilateral consultations in the period July – October 2012 with a focus on a number of questions related to emissions to air, not based on PRIMES data. Discussion on PRIMES needed to be conducted with the national PRIMES model expert groups.

40. The Task Force took note of the LIAISE (Linking Impact Assessment Instruments to Sustainable Expertise) Network of Excellence<sup>9</sup> and the development of the toolbox for policy impact assessment. The network has the purpose to expand, and experts on impact assessments were invited to engage with LIAISE. LIAISE considered possibilities to improve the efficiency impact assessment tools, and to facilitate a structured dialogue between the wider research communities and policy makers. Several exercises to review and link tools were ongoing, in particular structured around specific cases (e.g. on agriculture and resource use efficiency). The outcome of these cases would be used to improve the toolbox, provide key lessons learned for the improvement of the impact assessment process, and for the science-policy interaction in general. The Conference “Evidence for sustainable development” would be jointly organised by LIAISE.<sup>10</sup>

41. The Task Force took note of a Dutch analysis on interactions between air and climate policies. Cost-effective air quality policies could achieve long reaching climate impacts even without additional climate policies. In an optimal strategy a large part of these cost-effective measures would have climate impacts. End of pipe measures would only contribute 33% of the air pollution emission reductions. Especially emission reductions from small scale combustion emission sources offered synergies between climate and air pollution policy.

42. The Task Force took note of the presentation of results of the Megapoli project funded by the European Union Directorate General on Research and Technological Development about the integrated assessment of air pollution control policies in European megacities. Impacts stemming from air pollution, greenhouse gas emissions and indoor air pollution were simultaneously assessed using the integrated assessment model ECOSENSE.<sup>11</sup> European-wide modelling was accompanied by new approaches to estimate the urban increment and the distribution of the street canyon increment of PM concentrations. Taking into account indoor air pollution the study revealed that insulation improvements of existing buildings, without taking care of increasing the air exchange rate, would produce considerable health impacts. Expansion of district heating networks, electric vehicles, improvements in traffic management and substituting small combustion sources using wood and coal would be some of the most efficient measures in megacities to control and limit air pollution.

43. The Task Force took note of an international analysis for the nitrogen oxides emission control area in the North Sea. Similar work had been performed earlier for sulphur dioxide and for the Baltic Sea. The study compared the cost-effectiveness of reducing sea based emissions with reductions from land based sources. In the baseline NO<sub>x</sub> emissions in the North Sea would be reduced by 5% between 2009 and 2030. Additional measures could reduce emissions by over 30% in 2030 and 70% after 2045. The analysis included the marine contribution to PM and NO<sub>x</sub> air quality levels in coastal regions. The human health benefits were larger than the abatement costs. But for land based sources there was still significant potential for cost-effective abatement measures with a larger benefit-cost ratio

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<sup>8</sup> The International Institute for Applied Systems Analysis.

<sup>9</sup> <http://www.liaise-noe.eu>

<sup>10</sup> 5-6 October 2012 in Berlin, Germany, <http://www.berlinconference.org/2012/>

<sup>11</sup> [www.externe.info](http://www.externe.info), [www.integrated-assessment.eu](http://www.integrated-assessment.eu)

than emission removal from the marine sources, although the costs per tonne were approximately the same.

44. The Task Force took note of a Dutch analysis on the impact of changes in the energy system on the concentrations of air pollutants. The analysis took into account daily production conditions for renewable fuels and therefore the timing of the remaining fossil fuel combustion for electricity production. The results showed that the decrease in air pollutant concentrations was smaller than previously anticipated. The reason for this seemed to be that emissions during the night (when fossil fuels were used) would not be as effectively dispersed as emissions during the daytime. The study also showed that increased land use for biofuel production could have an impact on European ozone concentrations.

## VI. National modelling experiences

45. The Task Force took note of the recent modelling of PM<sub>2.5</sub> concentrations in the United Kingdom. Contributions from primary emissions, secondary inorganic aerosols (SIA, such as SO<sub>4</sub>, NO<sub>3</sub> and NH<sub>4</sub>), and other components (including water, secondary organic aerosol, and fine fractions of urban and mineral dusts) had been summed and compared with measurements. The primary contribution was enhanced in urban areas, but overall made a small contribution to population exposure compared with the long-range SIA. Investigation of future trends to 2020 using emission projections for other countries from GAINS scenarios illustrated how the attainability of targets for reducing exposure to PM<sub>2.5</sub> set in the European Commission Air Quality Directive critically depends on reduction of precursor emissions of SO<sub>2</sub>, NO<sub>x</sub> and NH<sub>3</sub>, and hence on the ceilings agreed under the revised Gothenburg Protocol.

46. The Task Force took note of the current developments of Network for national integrated assessment modelling. The next network meeting will be held on 29 June 2012 in Brescia, Italy.

47. The Task Force considered the Dutch analysis of the environmental impacts of the economic crisis. During the financial crisis (2007–2011) exports and investments declined largely and private consumption modestly, while the public consumption actually increased. The results showed emission reductions somewhere between -5 to -10% for all air pollutants. The projected impact of the financial crisis was for most sectors larger than the actual outcome for the period analyzed. In the short term, the crisis reduced emissions, but this might not be the case in the long term. Reasons for this were that financial institutions are being less eager to give loans to environmental technologies, governments have less financial resources to subsidize environmental technologies, and the fossil fuel prices and CO<sub>2</sub> prices decline. The effects of the crisis on premature scrapping of less efficient older installations with high emission factors have not yet been investigated.

48. The Task Force took note of the presentation of the APPRASIAL project to begin by June 2012 and last for three years. The project will review the air quality and health assessment methodologies at regional (sub-national) and local scale. The expected outcome of the project is a database on integrated assessment methodologies with identification of its limitations. Different decision support model approaches will be identified. Furthermore, case studies will help develop a decision support framework for regional (subnational) and local policy makers.

49. The Task Force noted the development on emission control legislation in the Ukraine. According to current legislation, a hundred and thirty pollutants were being controlled. There were emission standards for a number of emission sources, with more standards being developed. A Ukrainian representative identified that the old and energy intensive technological equipment made it difficult to ratify the Protocols of the

Convention. Also the lack of modern emission monitoring technologies made it difficult to gather the necessary information. There were difficulties in reporting to EMEP, e.g. because of differences in statistical format. An EMEP monitoring station was being installed in the Karadag Nature reserve, together with EMEP Chemical Coordinating Centre. The use of the GAINS model in the Ukraine would make it possible to facilitate emission control choices in the Ukraine. It would also make it possible to perform emission projections and analyze possible time frames for the ratification of the revised Gothenburg Protocol.

50 The Task Force appreciated information on the official national emission projections for Belarus, produced by the Institute of Ecology in Minsk, Belarus, and the challenges to meet the emission reduction targets in the revised Gothenburg Protocol. The Task Force noted the progress in national integrated assessment modelling in Belarus. Comparisons had been made between available national statistics and estimates and the CIAM scenarios. Of special concern was the difference in estimates for the emission removal potential for PM, which differed both in absolute number as well as its allocation by sector. Belarus was working on a technical paper devoted to PM abatement technologies applicable in countries of Eastern Europe, the Caucasus and Central Asia for the Expert Group on Techno-Economic Issues. The Task Force noted that integrated assessment modelling work in Belarus had significantly developed through the Swedish-Belarusian co-operation project.

51. The Task Force also took note of progress in the Swedish-Russian bilateral project. The current activities in the Russian Federation took place in collaboration with IIASA and the Norwegian Meteorological Office. The GAINS Russia model was now better representing the administrative bodies of the Russian Federation, making it more suitable as a decision support tool. Work had also been done on introducing updated data and estimates into the model, and comparisons had been made to identify differences between the IIASA estimates and the national estimates.

52. The Task Force took note of the Irish analysis of the air quality impacts of greenhouse gas emission reductions in sectors that were not part of the emission trading system (ETS) for CO<sub>2</sub>. For these non-ETS sources Ireland needed a 20% greenhouse gas emission reduction in 2020 relative to 2005. Delivering this target was identified as a significant challenge for complex multi-agent sectors such as agriculture and transport. It was expected that non-technical measures would have to comprise a significant portion of the effort given the existing menu of technical measures. The combination of technical and non-technical measures that delivered the target would also have substantial impacts on air pollutant emissions. Further research efforts to advance analysis and incorporation of non-technical measures into the process were necessary. Emission scenario developers should be aware of the imminent impact of the emission reduction targets for non-ETS sources between 2013 and 2020.

## **VII. Further work**

53. The main points of attention of integrated assessment modellers would be:

- (a) To develop a wider notion of benefits of environmental improvement as well as measures and clarification of contribution to other environmental targets (water, energy security, biodiversity, etc.);
- (b) To assess abatement costs for local hot spots of air pollution in relation to European wide emission reduction efforts;
- (c) To conduct biodiversity projection in Natura2000 and other protected areas;

- (d) To research (background) ozone, related to northern hemispheric emissions;
- (e) To address climate and air pollution (policy) interactions, e.g. black carbon, biofuel use;
- (f) To consider the consequences of structural changes in the energy, transport and agricultural system, including the economic impacts;
- (g) To define key measures to be taken in the short run.

54. A workshop on global 2030–2050 scenarios together with the Task Force on Hemispheric Air Pollution would be held on 8–10 October 2012 in Austria, back to back with a Global Nitrogen Scenario workshop on 11 October 2012.

55. The forty second session of the Task Force on Integrated Assessment Modelling is planned to be held in May 2013.

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