Event Report

EPPA Regional Workshop on Directive on the reduction of national emissions of certain atmospheric pollutants –

Current Status, New Developments

16 – 17 January 2020, Vienna

This Project is funded by the European Union

The project implemented by the Consortium of NIRAS (lead) and Umweltbundesamt GmbH

TABLE OF CONTENTS

ANNEXES

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1 Introduction

The regional workshop

The regional workshop on the "Directive on the reduction of national emissions of certain atmospheric pollutants – Current Status, New Developments" took place on 16-17 January 2020, in Vienna, Austria. The workshop was organized in cooperation with TAIEX, and under the EPPA project work programme, activity 4.2 "NEC Directive capacity building".

The participants of the workshop came from the relevant authorities of the EPPA beneficiaries. They represented the relevant Ministries (Environment) and other institutions with air quality management responsibilities (Environment Agencies, Hydrometeorological Institutes). Details are available in the list of participants. Civil society was also represented by the NGO Green Home (Montenegro).

The speakers represented a wide range of EU Member States' experience. There were experts from Austria (Umweltbundesamt – an EPPA implementing consortium member), Bulgaria, Croatia and Denmark. Details are available in the agenda.

The presentations are available in both the TAIEX website[1] and in the EPPA project website[2].

The NEC Directive

Air pollution travels over long distances and over national boundaries having a negative impact on human health. In order to limit air pollution, which is also responsible for acidification, eutrophication and ground-level ozone pollution, the EU has policies in place limiting individual sources but also national totals of atmospheric emissions of the key pollutants. Together with the Ambient Air Quality Directives the National Emission Ceilings Directives and the source legislation underpinning them provide the legal framework for the EU's air policy.

In 2011-2013 the Commission conducted a review of the EU air policy which resulted in the adoption of the Clean Air Policy Package. As part of the package, the Commission proposed a Clean Air Programme for Europe, updating the 2005 Thematic Strategy on Air Pollution in order to set new objectives for EU air policy for 2020 and 2030.

The main legislative instrument to achieve the 2030 objectives of the Clean Air Programme is Directive (EU) Directive 2016/2284 on the reduction of national emissions of certain atmospheric pollutants which entered into force on 31 December 2016. This Directive sets national reduction commitments for the five pollutants (sulphur dioxide, nitrogen oxides, volatile organic compounds, ammonia and fine particulate matter) responsible for acidification, eutrophication and ground-level ozone pollution which lead to significant negative impacts on human health and the environment.

Directive 2016/2284, the new National Emission Ceilings Directive (NEC Directive), repeals and replaces Directive 2001/81/EC from the date of its transposition (1 July 2018) ensuring that the emission ceilings for 2010 set in that Directive shall apply until 2020. Directive 2016/2284 also transposes the reduction commitments for 2020 taken by the EU and its Member States under the revised Gothenburg Protocol and sets more ambitious reduction commitments as from 2030 so as to cut the health impacts of air pollution by half compared with 2005.

2 Objectives of the training and expected results

The aim of the workshop was to increase the knowledge of the Directive on the reduction of national emissions of certain atmospheric pollutants (NECD) and its implementation. The workshop built on the current state of implementation in EPPA beneficiaries. Special emphasis was given to topics such as the changes compared to the repealed Dir. 2001/81/EC, preparation of national air pollution control programmes (NAPCP), emission inventories and projections, monitoring of air pollution impacts.

[1] https://webgate.ec.europa.eu/TMSWebRestrict/resources/js/app/#/library/detail/70032

[2] https://eppanetwork.eu/regional-workshop-on-directive-on-the-reduction-of-national-emissions-of-certain-atmospheric-pollutants/

3 Highlights from the workshop

3.1 Introduction to the workshop

The workshop was opened by Mr. Christian Nagl, EPPA Air Quality Key Expert, and Mr. Mihail Dimovski, EPPA Team Leader. They established the relevance of the topic given the EPPA beneficiaries' issues with air pollution and introduced the agenda and expected outputs of the workshop. The main objective was to share experiences from EU Member States regarding the implementation of the NEC Directive (national air pollution control programmes, emission inventories and projections, monitoring of air pollution impacts). In this sense, and acknowledging the experience, role of the Environment Agency Austria (Umweltbundesamt) in the beneficiary region and the fact the Agency was host to the event, its Director, Mr. Georg Rebernig, said a few welcoming remarks. He expressed his satisfaction to welcome the workshop in Vienna and the discussed the new policy framework being developed in the EU, the Green Deal, an ambitious political message from the new EC. Climate action is the driver, but policy areas like air quality will be essential to achieve its wider goals. In Austria, the new Government also announced its programme with a strong green component. He concluded the trends visible in Europe are going in the right direction.

3.2 Current status of the implementation of the NECD, progress achieved in recent years, positive examples, lessons learned, remaining challenges

The session gave the beneficiaries the opportunity to present, and discuss in a regional setting, their current status in terms of transposition and eventual implementation of the NECD and highlight the main challenges they see ahead to achieve both those goals.

3.2.1 Albania

The Ministry of Tourism and Environment started the procedures for the partial transposition of the NEC Directive (EU) 2016/2284 in 2019. The draft Decision of Council of Ministers (DCM)[3] is ready and is currently waiting for approval from Council of Ministers. Adoption is foreseen to happen soon. The draft DCM establishes several responsible institutions, including the Ministry of Tourism and Environment for national air pollution control and reduction programmes, the National Environmental Agency for emission inventories and projections, and other line ministries.

Albania plans to set up a National Clean Air Commission (NCAC) with representatives of the Ministry of Tourism and Environment and its subordinate structures; line ministries and local government units; representatives of the industry; representatives of the civil society; representatives of the scientific community. The objective is to facilitate inter-institutional cooperation ensuring coordinated implementation of legislation as well as drafting and implementing national policies/programmes related to air pollution control and air quality improvement.

The main challenges are the need for higher administrative capacity. The Ministry of Tourism and Environment needs more human capacities, coordination mechanisms and investment in the environmental monitoring systems. The National Environmental Agency needs more human capacities, organizational development and equipment to meet delivery expectations for annual emission inventories, projections and how to determine the figures for national emission ceilings.

3.2.2 Bosnia and Herzegovina

Bosnia and Herzegovina is at a beginning stage with the NECD. Being party to the LRTAP convention, the country has some air quality regulations at entity level, including provisions for inventories and emission reduction. Under efforts to implement the requirement of the LCP Directive, the country has some emission reduction plans for some of the plants, whereby compliance with emission limit values is planned for 2027. Plants not covered by the plans are scheduled to be closed by 2024.

[3] Draft DCM "On the rules on preparation, approval, reassessment and implementation of the national programmes on reducing the emissions in the air", prepared under assistance of UNDP

3.2.3 Kosovo*

Kosovo* has not transposed the NECD. The beneficiary is currently reviewing its air protection laws, where NECD requirements are taken into account. It is possible the NECD will be transposed as a by-law.

3.2.4 Montenegro

The Montenegrin delegate presented an introductory chromoly of air protection in Montenegro, starting with the Law on Air Protection from 2010 to the most recent opening Chapter 27 (2018), with attending closing benchmarks. The presenter detailed the closing benchmarks Montenegro should attain, which include full alignment with NECD and the Directive on ambient air quality and cleaner air for Europe (Directive 2008/50/EC). Those benchmarks are now the guidance posts for the legislative transposition plan and for the update of its air pollution control programme. The costs of the programme are estimated at 960 ME. The majority of the burden will be on the private sector with the cost of modernizing the vehicle fleet and transport systems and updating heating and energy efficiency measures in residential units. The most cost-efficient measures included in the programme will be the desulphurisation and denitrification of the thermal powerplant Pljevlja (26.6 ME).

In terms of emission inventories, the country is currently updating them in cooperation with Umweltbundesamt GmbH – Environment Agency Austria. The inventories weren't updated since 2011 for lack of capacities.

Montenegro identifies as its biggest challenges the improvement of its Draft Air Pollution Control Programme, also taking into account the updated inventory, and its integration into the revised Strategy for Air Quality Management.

3.2.5 North Macedonia

The delegate presented its relevant legislative background. North Macedonia fully transposed the old NEC directive (2010/81/EC). The new one is planned to be transposed using a planned IPA project for 2020-22. North Macedonia is a party to the LRTAP Convention and its protocols.

Regarding the national inventories, the first reporting prepared in 2005. Until 2012 the work was done by a consultancy company. After that year the Ministry increased allocations that allowed to create a specialized inventories team of five members. It is important to note that the team members also have other portfolios. The inventory is now reported annually by the Ministry. North Macedonia's progress with inventories was recognized internationally. Reporting also includes regular Eionet updates.

The country has a National Emission Reduction Plan until 2020, adopted in 2012, under the old NECD. It included significant reductions in SO_x, NO_x, NMVOC and NH_3. The country also has a National emission reduction plan for LCPs 2018-2027, where emission projections for SO_x, NO_x and dust are calculated.

North Macedonia considers that foreign technical assistance and cooperation was essential to establish and develop its inventory capacity. The use of electronic tools has also boosted its technical capacity to deliver on its commitments. Establishment of QA/QC procedures was essential to maintain and increase its data production capacities.

However, challenges remain. The inventories team has to allocate its time to other portfolios which limits the possibility for improvement. There is no budget for the development of national emission factors, conduct scientific studies or engage experts from universities in air emission inventory and IIR preparation. There is insufficient detail or no activity data for calculation of some NFRs. For most of the NFR sectors, tier 1 methodology is used, due to limitation of activity data. Access to data held by other institutions of difficult for lack of legal framework mandating the data access. There is no capacity to monitor air pollution impacts on ecosystems.

3.2.6 Serbia

The delegation did not attend because of weather related airport closures. However, the delegation sent a presentation on the topic. It is available for download in the EPPA website, together with the other training materials.

3.2.7 Turkey

The Ministry of Environment and Urbanization, through its Air Quality Management Department, is the responsible institution for air issues in Turkey. Currently, Turkey has its limit values almost aligned to EU standards. There are Local Clean Air Action Plans (in 64 cities out of 81), and low Emission Zones are on the way.

In terms of monitoring and inventories, the country has a network of 339 air quality monitoring stations. The network is assisted by clean air centres which help with the identification of pollutant sources. The reporting of its air emission inventories started in 2011.

Turkey has a GIS based Air Emissions Management (AEM) Portal that covers all pollutant sources data. National and regional strategic air quality maps can be prepared by the AEM Portal. For instance, air quality maps are finalized for Marmara region until 2023. AEM will be spread to the whole country. In the future, the portal will help determine the effectiveness of measures via different scenarios. It will also make possible to complete air pollution maps and emission inventories for all regions, which will be used to forecast air quality for the next 48h.

The delegate also presented results from the 2019 emission inventory with pollutant levels by sector.

In terms of next steps for NECD implementation, the country relied on the IPA 2018 project "Improving Emissions Control". The project contributed to develop draft legislation, reporting of the emission inventory since 2012, to develop an emission abatement roadmap and strategic action plan. Full implementation date and draft national emission ceilings for NECD pollutants is in progress.

3.3 Current status of the implementation of the NECD in the EU, current developments and activities / link to LRTAP

Mr. Christian Nagl described the air quality framework in the European Union, which includes next the Ambient Air Quality Directives, source specific emission and product standards the Directive[4] (EU) 2016/2284 on the reduction of national emissions of certain atmospheric pollutants (NECD).

The NECD was part of the Clean Air Policy Package, which was published in 2013 and which was part of an extensive review of the European air quality related legislation. The scientific basis of the NECD has been the GAINS[5] model by IIASA. European Member States (MS) had to transpose the NECD into their national legislation until end of June 2018. To support MS the European Commission published a guidance document[6] on ecosystem monitoring, which is required under the NECD.

The main objectives of the NECD are to reduce the negative impact of air pollutants on human health (PM, NO_2, O_3) and the environment (acidification, eutrophication, O_3). To achieve these objectives the NECD sets emission reduction commitments (ERC) for 2020, 2030 and beyond for NH_3, NMVOC, NO_x, $PM_{2.5}$, and SO_2. Compliance with the national emission ceilings for the year 2010 of the previous NECD had to be achieved until the end of 2019. The NECD includes requirements for National Air Pollution Control Programmes (NAPCP) and has a strong link to air quality objectives and programmes.

The NECD describes several flexibility mechanisms for MS. For ecosystem monitoring the Commission already received the first datasets by MS. Reporting of emission inventories is largely aligned with the reporting requirements under the Convention of long-range transboundary air pollution (LRTP). The European Environment Agency reviews these emission inventories; the Commission has to report on the NECD every four years and has to review the NECD until the end of 2025.

Flexibility mechanisms of the NECD include possible mission inventory adjustments under specific conditions, a 3-year averaging of emissions in case of extreme weather conditions, an option for pollutant swapping, and consideration of an interruption in the power and/or heat supply system.

The NECD is strongly linked to the Gothenburg Protocol (GP) under LRTAP. The amended GP entered into force on 7 October 2019 and will be reviewed in the next two years. From the EPPA countries North Macedonia has accepted the original GP. In contrast to the NECD the GP does not include emission

[4] https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1575884115759&uri=CELEX:32016L2284
[5] https://www.iiasa.ac.at/web/home/research/researchPrograms/air/GAINS.html
[6] https://ec.europa.eu/environment/air/reduction/ecosysmonitoring.htm

reduction commitments for 2030; however, the GP includes emission limit values for stationary sources and requirements for solvent management plans, limit values for fuels and new mobile sources.
The European Commission regularly undertakes a so called Clean Air Outlook[7]; the 1st outlook was published in June 2018 and was based on four reports by IIASA[8]. The next will analyse the NAPCP. There are a number of activities and possibilities for support by the European Commission such as workshops[9], a clean air dialogue[10], clean air forum[11].
According to the IIASA analysis for the Clean Air Outlook, additional efforts are necessary by MS to comply with the 2030 ERC for NH_3, $PM_{2.5}$; in some MS also for NO_x. For $PM_{2.5}$ emission reductions, MS should address agricultural waste burning and domestic heating (solid fuels).
Compliance with the NECD ERC will lead to substantial improvements of air quality and thereby a reduction of loss of statistical life expectancy and slight improvement of critical load exceedances for eutrophication.
According to the latest emission inventory data MS are mainly on track to achieve the 2020 ERC for SO_2 and NMVOC; further efforts are needed for $PM_{2.5}$, NH_3 and NO_x.

3.4 NEC / LRTAP reporting of NEC pollutants, flexibilities, adjustments, inventory review

Ms. Katarina Mareckova presented the reporting requirements and procedures under the UNECE / CLRTAP, which entered into force 1983. It was the first international legally binding instrument to deal with air pollution on a regional basis. It has 8 Protocols[12] and there are 51 Parties. The aim of the CLRTAP is that Parties shall endeavour to limit and, as far as possible, gradually reduce and prevent air pollution. Among other requirements Parties are to monitor and report pollutant emissions.
Under CLRTAP, the EMEP (European Monitoring and Evaluation Programme) provides scientific support to the LRTAP Convention on atmospheric monitoring and modelling, emission inventories and emission projections, and integrated assessment modelling. The EMEP hosts the CEIP (Centre on Emission Inventories and Projections), who is responsible for coordinating the emission related work of EMEP. The centre contributes to scientific assessment of past trends and current status in air pollution throughout the ECE region and to evaluation of the implementation of the Protocols of the Convention.
The complexity of data flows among various Convention bodies and parties is enormous. The reporting panorama is further fed by other international monitoring and reporting requirements, such as the Aarhus (1998) Convention (protocol on PRTRs), EU Directives (NECD, IPPC, LCP, E-PRTR regulation, etc), the EIONET portal (EEA), and the UNFCCC/ Kyoto protocol (emission inventories GHGs and NIR, projections and measures, adaptation strategies).
In order to avoid duplication of efforts, the NECD Directive aligned reporting formats and timelines with the CLRTAP. Details are available in the presentation document.
Ms. Katarina Mareckova then presented the current status of reporting under CLRTAP, including for the EPPA beneficiaries, which can be seen below in summarized form.

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[7] https://ec.europa.eu/environment/air/clean_air/outlook.htm
[8] https://www.iiasa.ac.at/, and https://www.iiasa.ac.at/web/home/research/researchPrograms/air/policy/Clean_Air_Outlook_2018.html
[9] https://ec.europa.eu/environment/eir/p2p/index_en.htm
[10] https://ec.europa.eu/environment/air/clean_air/dialogue.htm
[11] https://ec.europa.eu/environment/air/clean_air/forum.htm
[12] The 1984 Protocol on Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP); Ratified by 44 Parties. Entered into force 28 January 1988.
The 1985 Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 per cent; 25 Parties. Entered into force 2 September 1987.
The 1988 Protocol concerning the Control of Nitrogen Oxides or their Transboundary Fluxes; 34 Parties. Entered into force 14 February 1991.
The 1994 Protocol on Further Reduction of Sulphur Emissions; 29 Parties. Entered into force 5 August 1998.
The 1998 Protocol on Persistent Organic Pollutants (POPs); 33 Parties. Entered into force on 23 October 2003.
The 1998 Protocol on Heavy Metals; 33 Parties. Entered into force on 29 December 2003.
The 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone; 25 Parties. Entered into force on 17 May 2005. (Guidance documents to Protocol adopted by decision 1999/1, Revised guidance document on ammonia). Amended 2012

Membership to UNECE	No	ISO	PARTY	Submission	Resubmission	Projection submission	Grid submission	LPS submission	IIR	NFR template	Notification form to UNECE
14-Dec-55	1	AL	Albania	15.02.2019						2009-1	np
22 May 1992	2	BA	Bosnia & Herzegovina								
28 June 2006 [56]	3	ME	Montenegro								
08-Apr-93	4	MK	North Macedonia	15.02.2019	16.04.2019				10.05.2019	2014-1	15.02.2019
1 Nov 2000 [56]	5	RS	Serbia	13.02.2019	04.03.2019				14.03.2019	2014-2[(a)]	13.02.2019 04.03.2019
28-Mar-47	6	TR	Turkey	15.02.2019					15.03.2019	2014-2	15.02.2019
	7	XK	Kosovo 2018	15/02/2018						2014-1	

		Years reported								
ISO	PARTY	SO2, NOx, CO, NH3, NMVOC	Cd,Hg, Pb	additional HM	PM2.5, PM10	TSP	BC	POPs: Total PAHs, DIOX, HCB, PCB	Activity data	Comments
AL	Albania	1990-2017	1990-2009	1990-2009	1990-2017*	2005, 2008, 2009	np	1990-2009	np	* PM2.5: only 1990-2009
BA	Bosnia & Herzegovina									no data at all
ME	Montenegro									last reporting before 2011
MK	North Macedonia	1990-2017*	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	* NOx additionally 1987, NMVOC additionally 1988, SOx additionally
RS	Serbia	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	1990-2017	
TR	Turkey	1990-2017*	1990-2017	np	1990-2017**	np	np	np	np	* CO: 1990-2016, ** PM2.5: 1994 missing
XK	Kosovo 2018	2000-2016[a)]	2000-2016	2000-2016	2000-2016	2000-2016	2000-2016	2000-2016	np	

Table 1 - EPPA Beneficiaries status of reporting

Another important update regarding CLRTAP reporting, since 2017, the EMEP grid has been extended and its reporting resolution enhanced from 21 000 cells (50x50km) in 1999 to 624 000 cells nowadays (0.1° x 0.1° (long/lat)).

The inventories submitted by the countries under the Convention and the NECD are reviewed by EMEP since 2008 and the EU since 2017, respectively. EMEP and the EU are coordinating the review of submitted inventories. Although differences exist in the processes, both reviews seek to ensure inventory quality through the criteria of transparency, accuracy, consistency, comparability and completeness. Review reports are available in the CEIP website[13]. Some challenges have been found during the reviews, with irregular reporting of data, insufficient completeness, late feedback from parties. For EPPA Beneficiaries, the review teams had specific recommendations, as follows:

Albania (2019): The inventory is partly in line with the EMEP/EEA Emission Inventory Guidebook and the UNECE Reporting Guidelines. There is a need to improve the inventory in the areas of accuracy, transparency, completeness, comparability and consistency and in number of sub-sector specific issues. The ERT recommends Albania to ensure the correlation of both GHG and AP inventories inconsistencies in the inventory, however, it was not possible to propose technical corrections due to missing data and rather limited information.

North Macedonia (2016): The 2016 submission was of good quality and showed improvements in a number of issues. Emissions are not estimated for all categories, "0" values should not appear in Annex 1. Tier 1 was used for Key categories (not desirable). The notation keys are not used according to their definitions and not-consistently for all pollutants and over all categories and years.

Serbia (2019): The inventory is generally in line with the EMEP/EEA air pollutant emission inventory guidebook 2016. The ERT recognizes improvement of the transparency but recommends to include more detailed information on emission factors, activity data, methodologies and emissions trends in the IIR , also descriptions of recalculations are very limited. A number of categories and pollutants are reported as not estimated ("NE") despite the EMEP/EEA GB 2016 providing methodology. Tier 1 used for number of key categories (not desirable). There was no technical corrections proposed by ERT.

Turkey (2019): the ERT noted that the inventory and IIR is generally in line with the EMEP/EEA Emission Inventory Guidebook, and it is generally transparent and partly complete. The inventory is partly

[13] https://www.ceip.at//review_results/review_reports/

consistent over the time series - Emissions of pollutants already included in the inventory are missing for several years and especially for several categories, some of which are potential key categories. Turkey does not currently include projections, LPS data or gridded data in the submissions. The accuracy of the inventory is compromised due to the use of tier 1 methods for key categories.
Ms. Katarina Mareckova concluded with a few key ideas regarding reporting inventories under LRTAP and NECD by the EPPA beneficiaries. Montenegro and Bosnia and Herzegovina do not report emission data to EMEP. Macedonia, Serbia, Turkey are improving their inventories, but not all recommendations of review teams are implemented so far. In general, CLRTAP inventories are not always considered priority by Parties due to limited resources for national inventory teams to follow up recommendations of ERTs. In-depth review is an important element in the process of verification of inventories and efficient capacity building for country experts. For some countries (generally not EU MS), there are many emissions without estimations. It is time consuming for ERT to deal with these cases by providing estimates, which is often not possible for lack of data.

3.5 National Air Pollution Control Programmes in Europe – legal requirements, reporting and examples

Mr. Christian Nagl presented the legal requirements for the National Air Pollution Control Programmes (NAPCP), which are laid down in the Directive[14] (EU) 2016/2284 on the reduction of national emissions of certain atmospheric pollutants (NECD).
A common format for the NAPCP was provided in the Commission Implementing Decision[15] (EU) 2018/1522. The first NAPCP had to be sent to the European Commission by 1 April 2019. The NAPCP have to updated at least every four years. Policies and Measures (PaM) have to be updated within 18 months if there is a non-compliance with the emission reduction commitments or a risk thereof.
In addition, NAPCP shall assess impact on air quality (AQ) in their territory and in neighbouring Member States (MS). When reducing $PM_{2.5}$ emission, MS have to prioritise emission reduction measures for black carbon. The NAPCP have to be coherent with other plans and strategies such as for climate, energy, air quality, traffic. To reduce NH_3 emissions from agriculture, MS have to take into account specific measures that are based on the UNECE Framework Code[16] for Good Agricultural Practice. In addition, MS have to establish a national code of good agricultural practice. Larger agricultural installations have to use best available techniques according to the Industrial Emissions Directive[17] 2010/75/EU.
All NAPCP, which have been developed by MS so far, are available at the Commission's website[18], who also provides an English version of all NAPCP. The Central Data Repository[19] (CDR) by the European Environment Agency (EEA) additionally provides further documents and data accompanying the NAPCP. Currently, 18 NAPCP are available from MS; two additional NAPCP are available as drafts.
As good practice examples the presenter showed NAPCP from Germany, Sweden, Estonia and Slovenia.
Possible future improvements of NAPCP by MS include more detailed information on the actual implementation, the ambition level for the measures and a strong political commitment.

3.6 Review of European NAPCP

Mr. Ole-Kenneth Nielsen presented the result of a review study of National Air Pollution Control Programmes (NAPCP), under art.6 of NECD, commissioned by the EC. The review sought to clarify of the reporting requirements under NECD were met, especially if the data is transparent, accurate, complete, consistent and comparable. The review focused on projections (submitted in 2019) for all NFRs for 2020, 2025, 2030 and 2040 and 2050 where available. The NAPCP were also checked for format compliance and timely submission.

[14] https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1575884115759&uri=CELEX:32016L2284
[15] https://eur-lex.europa.eu/eli/dec_impl/2018/1522/oj
[16] http://www.unece.org/fileadmin/DAM/env/documents/2015/AIR/EB/ECE_EB.AIR_129_ENG.pdf
[17] https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1576226633883&uri=CELEX:32010L0075
[18] https://ec.europa.eu/environment/air/reduction/NAPCP.htm
[19] http://cdr.eionet.europa.eu/

The review was performed by 4 teams, each working on 7 MS. Each team consisted of a Lead Reviewer (LR), sectoral experts reviewing projections for individual sectors and an expert reviewing the NAPCP. The review was predominantly desk based, i.e. experts were working from the normal offices and questions/answers were exchanged through the EEA Emission Review Tool (EMRT).

TRT 1 (Ricardo)							
Lead Reviewer: Anne Misra							
	BG	CY	FR	EL	LU	LV	SE
NAPCP	Hetty Menadue (FR, LU) Andrea Illes (CY, BG) Natalia Anderson (EL, LV, SE)						
Energy (stationary)	Robert Stewart						
Energy (mobile)	Yvonne Pang						
IPPU	Neil Passant						
Agriculture	Jeremy Wiltshire						
Waste	Mark Broomfield						

TRT 3 (DCE)							
Lead Reviewer: Ole-Kenneth Nielsen							
	DE	FI	HU	BE	LT	NL	PT
NAPCP	Anna-Liisa Kaar (DE, FI) Hetty Menadue (NL, PT) Peter Szuppinger (HU, LT) Tim Williamson (BE)						
Energy (stationary)	Marlene S. Plejdrup						
Energy (mobile)	Morten Winther						
IPPU	Marianne Thomsen						
Agriculture	Steen Gyldenkærne						
Waste	Marianne Thomsen						

Counterparts

TRT 2 (Aether)							
Lead Reviewer: Justin Goodwin							
	ES	AT	RO	EE	CZ	IT	PL
NAPCP	Tim Williamson (ES, RO, CZ) Natalia Anderson (PL, IT) Hetty Menadue (AT, EE)						
Energy (stationary)	Katrina Young						
Energy (mobile)	Melanie Hobson						
IPPU	Richard Claxton						
Agriculture	Beatriz Sanchez						
Waste	Richard Claxton						

TRT 4 (CITEPA)							
Lead Reviewer: Julien Vincent							
	DK	SK	IE	SL	UK	HR	MT
NAPCP	Hetty Menadue (DK, SK, IE) Andrea Illes (SL) Anna-Liisa Kaar (MT) Peter Szuppinger (UK, HR)						
Energy (stationary)	Laetitia Nicco						
Energy (mobile)	Jean-Marc André						
IPPU	Coralie Jeannot						
Agriculture	Anais Durand						
Waste	Celine Gueguen						

Counterparts

QA/QC Managers: Chris Dore (projections), Ben Grebot (NAPCP)
Project Manager: Natalia Anderson

Figure 1 - Review team composition and MS assignment

In contrast to inventory review, the review phase was very long lasting from May to September. Based on the outcome of the review, two reports were produced for each Member State. The one for the projections review contained an assessment of the quality as well as specific recommendations for improvement. This was commented by the Member States. The one for the NAPCP review containing an assessment of the quality of the reporting.

To ensure that all Member States (MS) are treated in a consistent manner, the review was carried out based on developed review guidelines. To enhance the consistent treatment of MS, checklists were developed that each expert should complete in the course of the review. There were separate checklists for projections experts, NAPCP experts, Lead Reviewers and the QA/QC manager. For projections experts, the checklist also included the priority of the checks, so that checks with high priority was carried out first followed by checks with medium priority.

The review used the information submitted by MS, i.e. the NFR, the Informative Inventory Report (IIR) and the NAPCP. All information reported was made available to the review teams in a tool that made it easy to compare data between MS, check trends including between the inventory and projections, check consistency of data reported under NECD with that reported under the greenhouse gas monitoring mechanism regulation, projected compliance with reduction commitments.

This was the first time ever that projections have been reviewed and, as expected, there is room for improvement. Important to always ensure consistency in terms of inventory vs. projection, projection vs. NAPCP, and air pollution reporting vs. greenhouse gas reporting. In the future, it will also be critical that documentation is provided to allow for a basic understanding of the quality of the reporting. Based on the experiences from inventory reviews, it will take several iterations to improve the quality of reporting.

The review is scheduled to be made public in April 2020 in the European Commission website.

3.7 Projections of air pollutant emissions as used for the Danish NAPCP

Mr. Ole-Kenneth Nielsen gave a second presentation about the projections of air pollutant emissions as used for the Danish NAPCP. Aarhus University has carried out official projections of emissions for the Ministry of Environment since 2003. It is also responsible for the reporting under the NECD and the UNECE. Aarhus University provided the projections used in the NAPCP but was otherwise not involved in the preparation.

The projections cover the pollutants for which there are reduction commitments and black carbon. The scope of the projections in terms of emission sources is the same as for the inventory on which the projections are based. The timeframe covered by the projections have been extended over the years - the latest projections covered the period until 2040.

The Danish base projections are based on a frozen policy scenario. That means that only adopted policies and measures are considered in the projection – this corresponds to a 'with measures' projection, which is the mandatory requirement to report under the NECD and UNECE. This has some shortcomings in that some politically unfeasible developments show as economically optimal in later years of the projection period. Most often only the base projections have been carried out and no other scenarios have been calculated. However, in the latest projections underpinning the NAPCP an alternative energy scenario was developed and reported as a 'with additional measures' scenario. This scenario mostly effected the electricity generating sector and, to a smaller extent, road transport. No decision on whether future projections will include both a 'with measures' and 'with additional measures' scenario.

In terms of data sets used for the projections, official activity data projections were used when it exists. For instance, energy projections[20] covering fuel consumption projections, agriculture projections covering number of animals and agricultural area, waste projections, projection of industrial growth in various sectors. In terms of emission parameters, the basis are the inventory, but taking into account change in technology (e.g. car fleet) and adopted legislation coming into force in the future (emission values).

It is important to note the role of Aarhus University is not political. They merely contribute with calculation of emission reduction potentials and the specific effects of policies and measures.

Mr. Ole-Kenneth Nielsen then presented the results of the Danish projections for nitrogen oxides, sulphur oxides, non-methane volatile organic compounds, ammonia, and fine particulate matter. In the case of Denmark, it is clear that additional measures are needed to reach the targets especially for ammonia and fine particulate matter.

Mr. Ole-Kenneth Nielsen concluded his presentation with a few key messages. The projections allow to assess the progress towards targets. It is important to have close cooperation between inventory and projection – integrate the work if possible. The effect of policies and measures can only be reflected to the extent that the modelling allows for it. Often there is a need for higher tier methods in the projections to give a credible result, but that is not always possible because the inventory methodology is simple, e.g. tier 1. There is a need to include information from many different organisations and remember that it is a projection (needs sensitivity analysis, different scenarios, etc.). Work is never completed, there is always the need for updated projections, as assumptions and historic emissions change.

3.8 NAPCP implementation in Bulgaria

Mr. Ivan Angelov presented the implementation of the National Air Pollution Control Programme (NAPCP) Implementation in Bulgaria. The main goal of the NAPCP is to meet country's emission reduction commitments set out in Directive (EU) 2016/2284 from 2020 to 2029 and from 2030. This has to ensure progress towards the gradual achievement of levels of AAQ that do not lead to significant adverse effects and risks to human health and the environment.

[20] For more information on the Danish Energy and Climate Outlook models check: https://ens.dk/en/our-services/projections-and-models/denmarks-energy-and-climate-outlook

The Bulgarian National Programme was developed on the basis of a previous Agreement between the Ministry of Environment and Water and the International Bank for Reconstruction and Development. This agreement was ratified by the National Assembly. The Agreement provides for the development of a National Air Quality Improvement Programme, which was developed and adopted by the Council of Ministers *prior to the NAPCP*. The development, adoption and scope of this Programme are country specific, and it has a considerable influence on the process of preparation of the NAPCP, especially regarding the achievement of the national ceiling for $PM_{2.5}$. In addition, there were other basis for the NAPCP preparation, namely Bulgaria's compliance with the requirements of the old NEC Directive 2001/81 /EC as well as other requirements for limiting emissions of harmful substances into the air, the requirements of other EU legislation (Directive 2008/50) on air quality (PM10 issue), the national inventory of emissions of harmful substances into the ambient air (Tier 1 issue), and the existing (if any) national programmes, strategies, etc., for different sectors of economy.

During the development of the Programme, experts from the World Bank had numerous consultations with all interested parties – Ministry of Environment, other ministries (energy, economy, agriculture), industry chambers, individual enterprises, etc. The aim was to close the existing gap due to the lack of national strategies and programmes, not good enough national inventory, etc. In the end the National Programme identifies six major sectors, which were significant sources of emissions in 2016:

- domestic heating - a major source of PM2.5 and NMVOC;
- agriculture - the main source of ammonia emissions;
- energy production - considered to be still a major source of sulphur and nitrogen oxides;
- road transport - a major source of nitrogen oxides and NMVOC;
- industrial processes and fugitive emissions - sources of NMVOC and sulphur oxides;
- solvents use - a source of NMVOC.

Using existing and newly collected information, the NAPCP analysed what would be the overall national emissions of the controlled pollutants if only the policies and measures already adopted at different levels would be implemented by 2030. According to the analysis:

- Total national sulfur dioxide emissions are expected to be into compliance throughout the whole period;
- Total emissions of nitrogen oxides, NMVOCs, ammonia and $PM_{2.5}$ are not expected to be into compliance, especially in 2030 and the period thereafter.
- Reduction of $PM_{2.5}$ will be only 1% under the ceiling but, according to the World Bank analyzes, in the absence of additional measures, including legislative, exceedances of PM_{10} air quality standards are likely to continue, even in 2030. If this is allowed, the main objective that Bulgaria has set in relation to air quality management - to solve the national problem of high levels of PM_{10}, will not be achieved.

The following table shows the expected levels of national emissions for pollutants controlled by Directive 2016/2284:

Pollutant	Emissions (kt) 2016 Inventory				Emissions reduction, %			Reduction obligations, %	
	2005	2020	2025	2030	2020	2025	2030	2020-2029	2030+
Nitric oxides	183.2	97.3	90.3	85.4	47%	51%	53%	41%	58%
NMVOC	80.7	67.8	62.5	55.9	16%	23%	31%	21%	42%
SO_2	771.3	81.4	82.2	85.6	89%	89%	89%	78%	88%
Ammonia	51.6	46.3	47.0	47.0	10%	10%	9%	3%	12%
$PM_{2.5}$	30.9	28.9	24.5	18.5	6%	21%	40%	20%	41%
Projections Date	27th of January, 2019								

Figure 2 - Bulgarian emission projections with existing measures

As the measures already adopted will not be sufficient to meet the national ceilings, the Programme analyses options to further reduce emissions by implementing measures beyond those under the current legislation. The solution has to take into account what are the problematic pollutants (all, excluding sulphur dioxide), what are the main sectors - sources of pollution, and what are the goals that the country has set itself. The proposed solutions differ to some extent from the possible measures that were considered in the process of setting emission ceilings for the country under Directive 2016/2284.

Сектор	Additional Policies and Measures
Residential heating National Air Quality Improvement Programme (NAQIP)	- R1: Introduction of national requirements for coal quality, measures to reduce the moisture content of firewood used by people in municipalities that fail PM10 air quality criteria; - R2: Bring forward the date at which Regulation (EU) 2015/1185 with regard to ecodesign requirements for solid fuel local space heaters comes into effect; and a compulsory, accelerated phase-out of traditional, polluting solid-fuel heating appliances (stoves) in municipalities where ambient air quality has not complied with PM10 LVs; coupled with: - R3: Households affected by the compulsory phase-out of traditional stoves to switch to heating by natural gas, district heating, electricity or ecodesign-compliant heating appliances.
Road transport	- RT1: Modernization of vehicle fleet through allowing "cleaner" imports only; - RT2: Establishing low emission zones (LEZs) in Sofia and Plovdiv to limit the demand for access of older, polluting types of road vehicle.
Agriculture	Implement Good Agricultural Practice Rules to reduce ammonia emissions from agricultural sources, based on the United Nations Economic Commission for Europe Framework Code for Good Agricultural Practice for Reducing Ammonia Emissions. The Rules will recommend good practices for applying nitrogen containing fertilizers to soils and good practices for managing cattle manure. - The Rules will be disseminated through agricultural outreach. - The impacts will be monitored by survey, the results feeding back into the National Inventory of Emissions of harmful substances in the ambient air and into future emissions projections.
	- A1: concerns the application of fertilizers (and manures) to soils.
	- A2: concerns the management of manure.

Figure 3 - Additional measures for pollutant reduction

The summation of the emission reductions expected from the implementation of existing and additional policies and measures results in projections that are satisfactory, given the country's obligations under Directive 2016 /22.

Pollutant	Emissions (kt), on the basis of 2016 Inventory				Emissions Reduction, in %			Reduction Obligations, %	
	2005	2020	2025	2030	2020	2025	2030	2020-2029	2030+
Nitric Oxides	183.2	93.8	84.4	74.7	49%	54%	59%	41%	58%
NMVOC	80.7	62.1	53.3	46.3	23%	34%	43%	21%	42%
Sulphure Dioxide	771.3	79.6	80.2	83.4	90%	90%	89%	78%	88%
Ammonia	51.6	45.0	44.1	43.8	13%	15%	15%	3%	12%
PM2.5	30.9	22.2	13.3	7.8	28%	57%	75%	20%	41%
Projections Date	27th of January 2019								

Figure 4 - Bulgarian emission projections with existing and additional measures

Mr. Ivan Angelov concluded that the NAPCP is a living document. In the case of a considerable change in circumstances, the Programme will be modified accordingly, with the aim to make it more adequate and ultimately conducive to better results.

3.9 New requirements and developments for emission inventories such as condensables and Black Carbon

Ms. Sabine Schindlbacher gave a presentation on the reporting of the condensable component of PM emissions and the emissions of black carbon under the LRTAP convention and NECD. Condensables are a class of compounds of low volatility that exist in equilibrium between the gas and the particle phase. Such compounds are not consistently included in emission inventories for fine particulate matter so far. This has significant implications for the modelling of organic aerosols and might also have implications on the compliance with emission ceilings under the NECD/CLRTAP and on the emission control strategy and cost-benefit analysis.

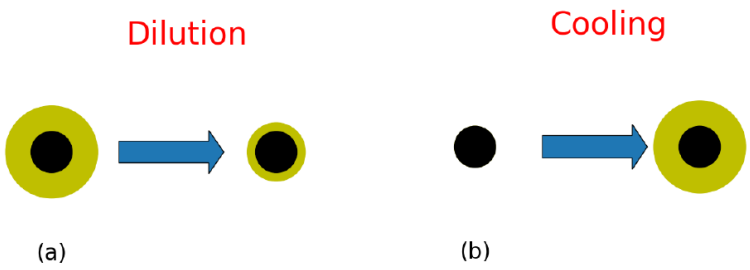

Figure 5.1: Sketch (very simplified!) of condensable issues, in which POM measured in or near the source can either lose or gain mass, depending on the importance of dilution or cooling. Case (a) illustrates the case where high gaseous loading of SVOC in the measurement device promotes condensation to form a substantial liquid phase SVOC (green) around the more solid core (black). When such an exhaust plume is diluted to ambient conditions, much of this condensed SVOC will evaporate, leaving a smaller mass of SVOC in the particle phase. Case (b) on the other hand represents a situation with very high temperatures at the point of measurement, in which essentially only the solid core is present. Upon cooling SVOC from the surrounding exhaust gases condense onto this core.

Figure 5 - Condensable component in PM emissions

Parties were asked to include a table with information on the inclusion of the condensable component in PM_{10} and $PM_{2.5}$ emission factors for the reporting under the CLRTAP convention in 2019. This table was added to the revised recommended structure for informative inventory reports. Seventeen Parties provided information on the inclusion of the condensable component. The reporting in 2019 showed that in many cases Parties do not have information on whether or not the PM emissions of a specific source category include the condensable component. The status of inclusion or exclusion is best known for the emissions from road transport, whilst it is less clear for small-scale combustion sources.
Modelling and use of expert-emissions strongly suggests that PM emissions in Europe are currently underestimated (Simpson et al, 2019)[21], and that condensables from the residential combustion sector, in particular wood burning, are a key source for these missing emissions (Simpson et al, 2019). Notable differences were found between officially reported emissions of $PM_{2.5}$ from small-scale combustion for 2010, and expert estimates made by TNO, which include condensables, in a consistent way across all countries for several Parties (see Figure 6)[19].

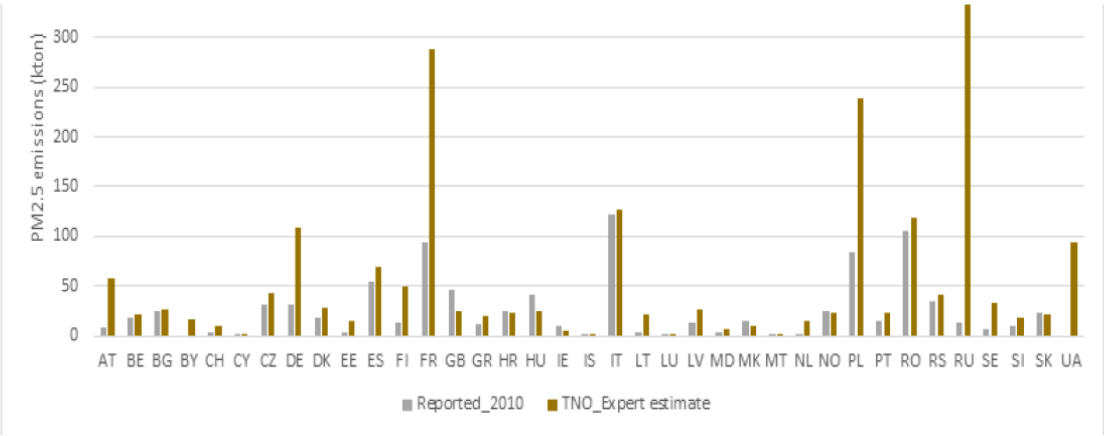

Figure 6 - Reported vs estimated condensable component of PM emissions

Ms. Sabine Schindlbacher then continued with the reporting of black carbon. Black carbon is a distinct type of carbonaceous material, formed only in flames during the combustion of carbon-based fuels[22]. black carbon is a significant air pollutant in terms of both climate change and air quality. Black carbon has an absorption spectrum in the visible range and warms the atmosphere directly by absorbing solar radiation and indirectly by accelerating snow/ice melt when deposited (Bond et al., 2013). The direct radiative forcing effect of black carbon emissions during the industrial era may be comparable to that of methane (CH_4) emissions[23]. Epidemiological studies suggest that certain pulmonary and cardiovascular conditions are more strongly associated with exposure to black carbon rather than aggregate PM2.5
Since the Executive Body Decision 2013/04, Parties to the LRTAP Convention have been formally encouraged to submit inventory estimates of their national black carbon emissions. In 2015 the reporting templates were updated to include black carbon data emissions. Black carbon was consequently voluntarily reported for the first time in 2015 by 28 countries. The number of Parties reporting black

[21] Simpson, D.; Bergström, R.; Denier van der Gon, H.; Kuenen, J.; Schindlbacher, S. & Visschedijk, A. Condensable organics; issues and implications for EMEP calculations and source-receptor matrices Transboundary particulate matter, photo-oxidants, acidifying and eutrophying components. EMEP Status Report 1/2019, The Norwegian Meteorological Institute, Oslo, Norway, 2019, 71-88 (https://emep.int/publ/reports/2019/EMEP_Status_Report_1_2019.pdf).
[22] Bond, T.C., S.J. Doherty, D.W. Fahey, P.M. Forster, T. Berntsen, B.J. DeAngelo, M.G. Flanner, S. Ghan, B. Kärcher, D. Koch, S. Kinne, Y. Kondo, P.K. Quinn, M.C. Sarofim, M.G. Schultz, M. Schulz, C. Venkataraman, H. Zhang, S. Zhang, N. Bellouin, S.K. Guttikunda, P.K. Hopke, M.Z. Jacobson, J.W. Kaiser, Z. Klimont, U. Lohmann, J.P. Schwarz, D. Shindell, T. Storelvmo, S.G. Warren and C.S. Zender, 2013. Bounding the role of black carbon in the climate system: A scientific assessment. Journal of Geophysical Research: Atmospheres, 118:5380-5552.
[23] Baumgartner, J., Zhang, Y., Schauer, J. J., Huang, W., Wang, Y., and Ezzati, M.: Highway proximity and black carbon from cookstoves as a risk factor for higher blood pressure in rural China, PNAS 111, 36, 13 229–13 234, doi:doi:10.1073/pnas.1317176111, 2014.4)

carbon raised to 39 countries in 2019. Twenty-two Parties submitted a full time series (1990-2017) of black carbon. EU Member States are also encouraged to submit black carbon emissions estimates as part of their emissions reporting under the National Emissions Ceilings (NEC) Directive (2016/2284/EU).
The analysis of reported data so far has raised issues of consistency, completeness, comparability, and complexity of used methodology (tier level of methodology).The EMEP/EEA Emission Inventory Guidebook contains emission factors for the calculation of black carbon emissions. Tier 1 emission factors are usually given as a percentage of PM emissions. For key categories a higher tier method should be used.
Nevertheless, there are possible conclusions. In the EMEP West area the dominating key category for black carbon is 1A4bi (Residential – Stationary) whereas in the EMEP East area 1A1a (Public electricity and heat production) and 1A4bi (Residential – Stationary) are the main sources of black carbon[24].
Ms. Sabine Schindlbacher finished the presentation with a quick glance over PAHs and field burning of agricultural waste. Polycyclic aromatic compounds (PAH) are a very large number of naturally occurring and man-made chemicals. The pure compounds are white or yellowish crystalline solids. They are insoluble in water but dissolve readily in fats and oils. POPs, including PAHs, are recognised as being directly toxic to biota. POPs are also of concern for human health because of their toxicity, potential to cause cancer and ability to cause harmful effects at low concentrations.
According to the reporting obligations under CLRTAP[25], for the purposes of emission inventories, the following four indicator compounds shall be used for PAHs: benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indenopyrene. Often only the total PAHs are reported. This issue was raised under the NECD Review 2019 and will be followed-up in the future.
Regarding the field burning of agricultural waste, it leads to the emission of a number of atmospheric pollutants:

- NH_3
- NO_x
- NMVOCs
- SO_x
- CO
- particulate matter (PM) including black carbon (BC).
- Heavy Metals and dioxin

Member States are obliged to report emissions from the open burning of agricultural residuals in their emission inventory submissions. The EMEP/EEA Guidebook provides a method for estimating emissions from field burning. However, less than half of the Member States provided emission estimates for this source category in their 2019 submission. By combining satellite data with emission factors from literature (consistent with the EMEP/EEA Emission Inventory Guidebook), alternative estimates have been derived by IIASA. In 2015 it was estimated that the burning of agricultural waste accounted for 3.3% of total PM2.5 emissions in the EU-28. The larger contributions are from some Mediterranean countries and some Eastern European countries[26].

[24] CEIP, 2019. Inventory Review 2019. Review of emission data reported under the LRTAP Convention and NEC Directive: Stage 1 and 2 and review, Status of gridded and LPS data. European Monitoring and Evaluation Programme, Centre on Emission Inventories and Projections (CEIP). Technical Report No. 4/2019.
[25] Guidelines for Reporting Emissions and Projections Data under the Convention on Long-range Transboundary Air Pollution ECE/EB.AIR/125
[26] Amann M., Gomez-Sanabria A.,Klimont Z.,Maas R.,Winiwarter W.,Measures to address air pollution from agricultural sources. Report under Specific Agreement 11 under Framework Contract ENV.C.3/FRA/2013/00131 of DG-Environment of the European Commission. Available at: https://ec.europa.eu/environment/air/pdf/clean_air_outlook_agriculture_report.pdf

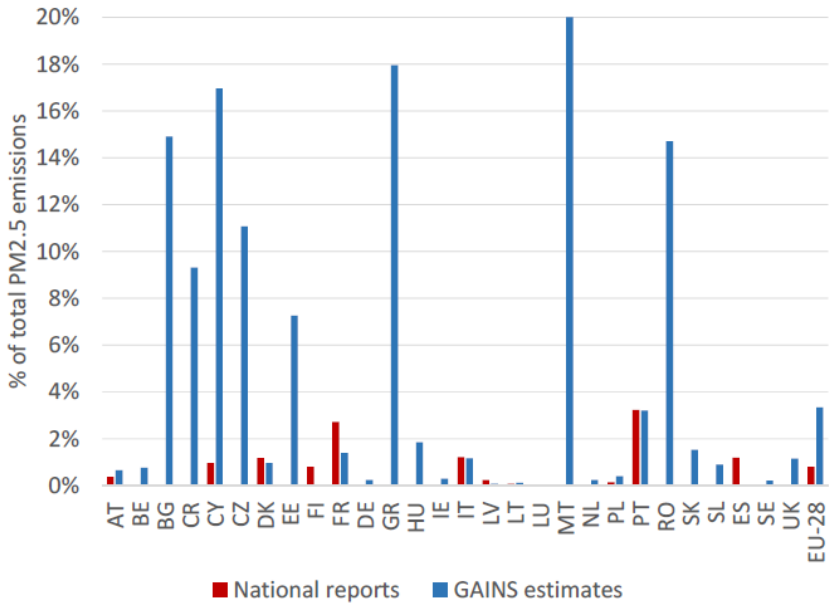

Figure 7 - PM2.5 emissions from agricultural waste burning (reported vs. estimated)

3.10 Monitoring of air pollution impacts upon ecosystems according to Article 9 NECD in Europe and Austria

Mr. Thomas Dirnböck and Ms. Ika Djukic delivered a presentation of Austrian experience regarding NECD related ecosystem monitoring.

Article 9 of the NEC-Directive (2016/2284) requires the Member States to set up and operate a network of monitoring sites negative impacts of air pollution upon ecosystems based on a network that is representative of their freshwater, non-forest natural and semi-natural habitats, and forest ecosystem types, taking a cost-effective and risk-based approach. The Member States were expected to first report in July 2018, and every four years thereafter, the location of the monitoring sites and the associated indicators used for monitoring air pollution impacts. Starting 1 year later (July 2019), and every four years thereafter, the MS also have to report the monitoring data referred to in Article 9 (Article 10(4)(b)). The monitoring and reporting is associated with the EU's strategic policy goals, namely in the 7th EAP, to ensure "air pollution and its impacts on ecosystems and biodiversity are further reduced with the long-term aim of not exceeding critical loads and levels". Furthermore relates to the Clean Air Programme for Europe with its target for a reduction by 35 % of the ecosystem area subjected to eutrophication by 2030, compared with 2005.

Mr. Thomas Dirnböck then gave some examples of how N deposition can affect ecosystems and biodiversity, leading to increased nitrate leaching to the groundwater or the decrease in species diversity including lags in recovery. Another example was the exceedance of critical loads for eutrophication in significant parts of continental Europe.

In terms of site selection for monitoring, they should cover major ecosystem types. Six categories of ecosystems are relevant: grasslands, cropland, forests and woodlands, heathland and shrub, wetlands, and rivers and lakes. The sites should be typical for an ecosystem type. The sites should be such that the impacts of aerial deposition can be distinguished from other pressures (no local pollution, low management impacts, etc.). The sites should be sensitive to air pollution (i.e. low Critical Loads) and exposed to high and low (reference sites) critical loads/levels. The EU recognizes the importance of taking a cost-effective and risk-based approach by taking full advantage of existing monitoring networks (CLRTAP, EU FFH, EU WFD, research networks such as LTER). In the Communication EU COM 2019/C

92/01[27], it is stated that "…fully operational network for air pollution impact monitoring is a matter of incremental improvement." In addition, synergies in monitoring are encouraged between NECD and CLRTAP.

The presentation continued with looking at NEC-D monitoring site selection using Austria as an example. The site selection had to reflect the territorial division of 47% forest, 32% agricultural use (½ crops, ½ grassland), 7% lakes, rivers, alpine-nival zone and 14% settlement area. In addition, existing data on exceedances of critical loads was used to identify potential monitoring areas. Of particular interest was to reflect the high atmospheric nitrogen loads in the northern limestone alps, and ozone exceedances along the country's western and southern rims. The final selection of sites was based on all the above concerns, the availability of long-term data and existing monitoring activities, including:

- ICP Forests (6 level II sites, since ~1985, partly LTER)
- ICP Integrated Monitoring (2 terrestrial sites + 1 freshwater since ~1992, partly LTER)
- WFD reference stations (9 sites, since 2003)
- AREC Alpine grassland site to be included during the next reporting period

The presentation was concluded with the example of the Integrated Monitoring Station at Zöbelboden. It was established in the year 1992 as Austrian's contribution to ICP Integrated Monitoring (UN-ECE LRTAP Convention) of air pollution effects in Europe. It is located in a forested are of 90ha Karst catchment (550 - 950 m a.s.l) in the Northern Limestone Alps. The station combines high quality air measurements (Austrian air pollution monitoring (IG-L), EMEP) with integrated ecosystem monitoring. Today Zöbelboden station serves as an ecosystem monitoring and research site for the effects of air pollution and climate change including biodiversity.

There are remaining issues for the Austrian NEC-D monitoring. Impact monitoring of ozone does not exist, and non-forest ecosystems are not well represented.

As a conclusion, it is recommended that site selection for the NEC-D ecosystem monitoring adheres to a cost-effective and risk-based approach. Incremental improvement of the network is key. Priorization of existing monitoring sites is a useful approach, but they should cover the relevant ecosystem types, and the most sensitive ecosystems (low critical load), where deposition is high.

At the end of the presentation Mr. Christian Nagl invited the EPPA beneficiaries to share their experiences with ecosystem monitoring[28].

Montenegro stated there is some data available, but there is no overall picture of either the data available not of the effects of air pollution over ecosystems. The scope of data involves different organizations/sources and it would require an effort to combine existing monitoring through an integrated monitoring plan. Montenegro recommended the 2nd NECD workshop under EPPA be focused on this issue, and that, as a first step, a questionnaire be used to query who owns what information in the country.

Albania does not perform any monitoring for this purpose, nor any system exists, except for some sporadic academic studies performed by the universities. Albania recommended that a future workshop could focus on bringing different monitoring sectors together to start discussions on how existing monitoring can be used, integrated and, possibly, further developed.

North Macedonia supported both Montenegro's and Albania's suggestion of bringing together the different sectors with monitoring functions. In North Macedonia, monitoring is divided and there is difficulty in accessing existing data. If integration could be achieved, based on currently available data, the country could possibly launch the monitoring of ecosystems under NECD.

Ms. Sonja Vidič encouraged the EPPA beneficiaries to look at their existing research institutions, or management organizations for nature issues. It is her experience, from Croatia, that a network of credible

[27] Communication from the Commission — Commission Notice on ecosystem monitoring under Article 9 and Annex V of Directive (EU) 2016/2284 of the European Parliament and of the Council on the reduction of national emissions of certain atmospheric pollutants (NEC-Directive)

[28] Summarized by order of intervention in the discussion.

scientific institutes, forest and water management companies existed, that, in the pursuit of their missions, already collected and held a lot of the data needed to report under NECD. Each country should take the initiative to start an internal dialogue on integrated monitoring to bring the relevant stakeholders to the table and to identify funding. Ms. Sonja Vidic also encouraged EPPA beneficiaries to use available data form EMEP and CORINE land cover in order to get first impression of the pollutant distributions and land cover categories for their countries. This information would be a basic prerequisite for targeted consultation for sites selection relevant for monitoring of ecosystems under NECD.

3.11 Monitoring of air pollution impacts upon ecosystems according to Article 9 NECD in Croatia, link LRTAP and NEC in general

Ms. Sonja Vidič delivered a presentation of Croatian experience regarding NECD related ecosystem monitoring. She started by highlighting how the CLRTAP played a vital role in advancing Croatian efforts to manage air quality. She compared the situation in the 1980's, when she was the only assigned person to real with the issue, to know, when there is a specialized team dealing with monitoring and reporting. The effects of governance improvement are visible not only in Croatia, but across Europe. In the 40 years of the convention there has been a drastic reduction of critical loads for acidification and eutrophication (Gothenburg Protocol).

Ms. Sonja Vidič then looked at the synergies between the convention and NECD for ecosystem monitoring. The determination of the extent of ecosystem impacts of air pollution in the EU is based on exceedance of critical loads and levels for sulphur, nitrogen and ozone based on predominantly long range transport of pollutants. The objective of the ecosystem monitoring scheme in NECD is to provide the knowledge base for the assessment of the effectiveness of the NEC-Directive in protecting the environment. The intention is thus to reinforce an ecosystem monitoring network needed to determine the state of, and predict changes in, terrestrial and freshwaters ecosystems in a long-term perspective with respect to the impacts of sulphur oxides (SOX), nitrogen oxides (NOX), ammonia (NHy), and ground level ozone (i.e. acidification, eutrophication, ozone damage or changes in biodiversity).

The calculation of these effect thresholds has relied on the work of the Working Group on Effects under the Gothenburg Protocol, including the work of the Coordinating Centre for Effects (CCE) and the International Cooperative Programmes (ICPs) on Waters, Forests, Vegetation, Integrated Monitoring, and the monitoring networks established for that purpose in the area of participating Parties to the Gothenburg Protocol.

Ms. Sonja Vidič then explored the parameters to be monitored, and their frequency, for each type of identified ecosystem.

The presentation continued to the case of Croatia. Croatia used atmospheric pollution as a criteria for the evaluation of risks, including modelling of air quality, to identify the best/most feasible sites for monitoring. The selection of potential monitoring stations according to the NEC Directive was divided into two levels, assuring coverage of geographical, biogeographic and gradients:

1) Aquatic and terrestrial forest ecosystems covering the load ranges/environmental gradients within each biogeographic region: existing ICP Forests Level II locations (7 plots) and reference stations for monitoring purposes in accordance with WFD (12 locations/stations).

2) Other representative ecosystems: selected measuring stations located near the larger areas of such ecosystems (buffer 5 km) and classified by the level of air pollution loads, thus creating a list of potential locations for establishing additional monitoring of the impact of air pollutants on ecosystems, depending on the results of future monitoring and in accordance with the development of a system for monitoring the conservation status of species and strains within the Habitats Directive.

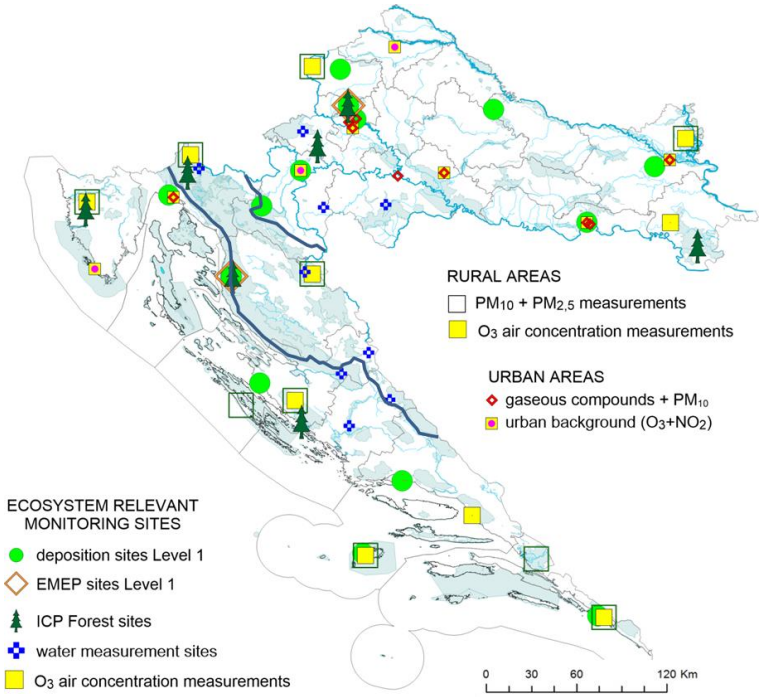

Figure 8 - CRLTAP ICP Forests network and Water Framework Directive (WFD) monitoring networks - the basis for selection of monitoring locations

Croatia still needs to identify and set up additional measuring locations for other representative ecosystems (grassland, cropland, heathland and shrub) and the need remains to ensure stable, permanent financing since relying on project-oriented schemes does not fit permanent monitoring needs.

3.12 General discussion: Share of experience in preparing emission inventories, projections and programmes in EPPA countries (based on short presentations by EPPA countries representatives)

The beneficiaries briefly presented their experience so far with the preparation of emission inventories, projections and programmes.

3.12.1 Albania

Albania prepared the 1st inventory for the years 1992-2009 using a subcontractor. The inventory for 2010 to 2016 will be made under a EU-funded project. The country has encountered some difficulties with the inventory calculations for 2017 in their spreadsheets. The 2017 inventory was therefore prepared with the assistance of another project and with EPPA experts (from Umweltbundesamt). At the moment there is no IIR, but it will be prepared until February 2020 with Umweltbundesamt's assistance. For previous years, the inventory raw data was not shared with the Ministry nor with the National Environment Agency by the subcontractor, creating a bottleneck to prepare IIR for that time series.

3.12.2 Bosnia and Herzegovina

Bosnia and Herzegovina has not transposed the NECD. Inventories are not dealt at national level, but entity level. The speaking delegate[29], from the Hydrometeorological Institute of Republika Srpska, expressed interest in the tools being used by the other EPPA beneficiaries. The lack of staffing makes the use of time saving tools an important measure to build and maintain capacities.

Most data comes from the country's statistical offices, for which there is a Memorandum of Understanding. Some of the data used in the inventories is "background", unpublished data by the

[29] The information given refers to Republika Srpska.

statistical offices, used for their work, but not published. The Hydrometeorological Institute uses default emission factors, but also data collected from operators via reporting templates, especially for thermal power plants, district heating plants and some other specific industries. The data used for transport comes from the Ministry of Transport, in particular, a database that keeps information on the vehicle fleet.
There are gaps in the data, especially in the waste sector, the most problematic for the inventory. In those cases, surrogate data is used, for instance, population.
Hydrometeorological Institute publishes the data and issues the IIR according to the template.

3.12.3 Kosovo*

The Kosovo* delegation did not intervene.

3.12.4 Montenegro

In Montenegro, the National Environment Agency, is responsible for the inventories. The main challenge is to have sustained resources, including staff, to create and maintain the inventories through data collection and treatment. A system for quality assurance/control is still missing, as well as the basic technological infrastructure to archive the data. NEPA is also responsible for air emission projections, while the Ministry is responsible for GHG projections. For the future, the country might consider assigning responsibility for projections to one team only.
The submission of inventory series 1990-2011 was made with the assistance of the Government of Italy, through technical assistance. The tables and IIR report were delivered by a subcontractor, but due to copyright restrictions, Montenegro stopped using that subcontractor's system and no reporting was done since then. Currently, the inventory is being updated for the time series 1990-2018, in cooperation with UBA, and it will be provided during the next reporting period to CLRTAP. It is considered to be a high priority for the country, also taking into account Chapter 27 negotiations with the EU.
Montenegro has plans for future capacity building projects to improve air emission inventories.

3.12.5 North Macedonia

North Macedonia presented its inventory preparation process from planning, to preparation, to management, and finally, reporting. The country divides the process into tasks, clearly attributed to someone with a deadline. The country has some difficulties with the preparation of inventories. There is no legal requirement for other institutions (for instance, the Ministry of Interior) to provide needed data in their possession. This makes it difficult or slow to get the necessary data. In addition, automated measurements are limited, the measurements have low coverage, the structure of statistical data has changed through the years, not always is the same methodology used through the whole time serial, and there is a need to use surrogate data in some cases. As a consequence, mostly default emission factors from EMEP/EEA Guidebook are used in the inventory and national or implied emission factors are used in Energy and Industry sectors.
The calculations are conducted in Excel sheets by NFR. NFRs are linked to Excel file for trends calculations and to reporting table. Excel tables for calculating of KCA, recalculations and uncertainties was created by Austrian experts and are updated regular on yearly base. RepDap by CEIP is used to check the reported emissions.
There are Quality Assurance/Quality Control procedures in place, leaving a paper trail that includes:

- Workflow matrix
- QA/QC check list
- Personal files of the experts
- Inventory Calculation file
- Check log file
- Cross checking between experts

	Date	Sheet	Change description	Change made by:
1	14.11.2018	Calculations	Create sheet Calculations and Calculate 2017 emissions	Aleksandra N.Krsteska
2	20.08.2019	Calculations	Create sheet Calculations and Calculate 2018 emissions	Aleksandra N.Krsteska

Personnel file		
1	Personnel data	
	Name, title	Aleksandra Nestorovska - Krsteska, MSc
	Date of birth	08.10.1976
2	Allocation within Macedonian Inventory	
	Entry	2012
	Division	Analysis and reporting
	function	Advisor on emission data, analysis, presentation and reporting
3	Training and experience at the beginning of inventory work	
	training	Training
	experience	8 years
	knowledge	General, Energy, Industry, Solvents
	practice	High level
	miscellaneous	/
4	Development during inventory work	
	General training	TFEIP meetings
	Specialist training	• Trainings during Twining project" Further strengthening the capacities for effective implementation of the acquis in the field of air quality" – October 2015 – January 2017 • Training on use of COPERT V – 2 days • Capacity building on climate change mitigation and adaptation for western Balkan program for 2017 financed by the Austrian federal ministry of agriculture, forestry, environment and water management - Face to face training on QA/QC procedures in preparation of emission inventory 4-7.12.2017
	Future training	Training on uncertainties calculations of projections in Energy sector

Inventory calculation file	
Year of the submission	2018
Type of inventory	Air pollutant inventory under CLRTAP
Source category	1.A.2.a Manufacturing industries and construction (combustion) (Iron and steel)
Time series	1990-2016
SOP (Standard operating procedure)	*in progress*
Covered by the SOP	*not yet*
Original file name	1.A.2.amkfev
Prepared by	Aleksandra N. Krsteska
Prepared on	
Current file name	1.A.2.amkfev
Updated by	Aleksandra N. Krsteska
Status	Complete
Last change on	18.01.2018
Description of the calculation file	
Calculation file for - 1.A.2.a according to Tier 1.	
Changes compared to the previous version:	
Check logfile included	
Info file included	
Links to other files:	
..\..\..\Podgotovkalnventar2016\EnergyEnergetika\1A2EmissionCalculation_v03.xlsx	

Contents of the file		
Worksheet	**Type**	**Description**
biomass	Calculation sheet	Calculation of 2016 emissions and recalculation of 2015 emissions coming from biomass combustion in this sector due to use of final energy balans

Figure 9 - QA/QC procedures for air emission inventory

North Macedonia plans to keep building capacities for air quality management through twinning and IPA projects. Those include: Guidance Document for Elaboration of National Air Emission Projections in Macedonia, Review and remarks on the National program for emission reduction 2012-2020, National emission reduction commitments, and National air pollution control program (Inter-sectorial approach).

3.12.6 Serbia

The delegation did not attend because of weather related airport closures. However, the delegation sent a presentation on the topic. It is available for download in the EPPA website, together with the other training materials.

3.12.7 Turkey

Turkey has a network of 339 air quality monitoring stations. The network is assisted by clean air centres which help with the identification of pollutant sources. The reporting of its air emission inventories to LRTAP started in 2011. Turkey has a GIS based Air Emissions Management (AEM) Portal that covers all pollutant sources data. National and regional strategic air quality maps can be prepared by the AEM Portal. AEM will be spread to the whole country. It will make possible to complete air pollution maps and emission inventories for all regions. Next year, COPERT V will be used for transport emissions, the number of vehicles is provided by Turkey's statistical office. In addition four sectors have been upgraded from Tier 2 and 3. Agricultural waste burning is forbidden; hence the emissions from this sectors have not been included so far but will be in future.

3.13 Working groups based on topics raised in previous sessions

Within three working groups, specific topics were discussed in more detail.

Working Group 1 discussed main challenges regarding emission inventories and projections.

The working group concluded that detailed activity data is difficult to be obtained, it is easier to get data on an aggregated level. In addition, it is often difficult to get answers to questionnaires sent out by the administration. Furthermore, in some countries there are difficulties in sharing data between different authorities as well as regarding confidentiality of data. For projections of emissions, more advanced tools would be necessary.

Some of these difficulties could be overcome by dedicated Twinning projects and expert missions.

The EPPA project could help by specific workshops for transport emissions and further sectoral workshops. In addition, a workshop regarding Article 9 of NECD would be helpful. In addition a workshop for gridding of emissions including practical examples would be helpful

Working group 2 discussed the implementation of the new NECD and developing NAPCP
The main challenges are the transposition of the Directive in national legislation even though a strategy is already in place, which has to be followed. In one country, no emission inventory is in place yet on national level, therefore capacity building is still needed, also legislation has to be improved.
Montenegro offered to share the first draft of a NAPCP with other EPPA countries. Montenegro also offered to share their experience how they overcame main obstacles in setting up an emission inventory and developing the NAPCP.

Working group 3 discussed ecosystem monitoring in EPPA countries.
The members of the working group identified as a main challenge the lack of experience so far. It was agreed that the countries should take stock of what already monitoring systems already exist. In case data is missing, modelling might be used.
The working group concluded that this workshop should be seen a starting point, and the countries should take stock of existing monitoring systems, data (land cover, sites) until the next meeting. The countries should also participate in working groups such as LRTAP ICPs.
Regarding resources for new infrastructure, the countries should develop a questionnaire for what data is needed, what has to be reported and what instruments are needed.

4 Conclusions

The EPPA Beneficiaries welcomed the workshop. All beneficiaries are doing efforts to improve or start their monitoring and reporting of emission inventories under the LRTAP convention and the NEC Directive. Some beneficiaries need further technical assistance with the preparation of the inventories, while all seem to benefit for added capacities (human, budgetary) to improve the inventory quality in the long term by, for instance, increasing data available and using upper tier methodologies.
Beneficiaries are also at a beginning stage of projection use. Further capacities are needed to enable the adoption and use of projection methodologies and data, which also have ramifications in defining the NECD national ceilings.
Complimentary work also needs to be done regarding the monitoring of air pollution impacts on ecosystems (NECD Art. 9). The Beneficiaries monitoring networks and data collection procedures are not yet in place to respond to that requirement.
Some beneficiaries might benefit from legal assistance to develop draft laws to transpose the NECD.
The development and implementation of National Air Pollution Control Programmes will require assistance and exchange of experience with EU MS.

Workshop outputs
The workshop's main outputs were:

- Review of the existing situation regarding the state of inventories under LRTAP (monitoring, data, reporting) in EPPA beneficiaries
- Review of the state of alignment with the NEC Directive in EPPA beneficiaries
- Enhanced understanding of the challenges and tasks connected with the implementation of the NECD and response to obligations under LRTAP
- Enhanced exchange of experiences and knowledge between the beneficiaries and EU Member states in air quality management, especially NECD topics (national air pollution control programmes, emission inventories and projections, monitoring of air pollution impacts)
- Identified key challenges for the implementation of the NEC Directive in EPPA beneficiaries

5 Evaluation

The participants were asked to evaluate the workshop post-factum. They received a paper format questionnaire at the end in order to assess the impact of the workshop in light of the EPPA project objectives. Later, the participants also filled in a second questionnaire circulated electronically by TAIEX, asking them to provide feedback on technical and logistical aspects. This report presents the results of both evaluations.

5.1 The EPPA impact evaluation

The EPPA impact evaluation questionnaire is composed of six questions, the first five looking at the specific impacts of the workshop, and one asking the respondents to offer their opinion on their country's priorities and suggestions for future EPPA events.

The first five questions are "agree/disagree" questions, in a scale from "strongly disagree" to "strongly agree". Each includes a space allowing the respondents to explain or offer more information about their level of agreement. The final question is of open-ended type.

The results of each question are presented here, one by one. Nineteen participants filled in the paper-based questionnaire, as follows.

Beneficiaries	Nr of answers
Albania	2
Bosnia and Herzegovina	2
Kosovo*	3
Montenegro	3
North Macedonia	2
Serbia	0[30]
Turkey	4
Undisclosed	2

Table 2 - Answers per beneficiary

Question 1 - The event agenda, and corresponding outcomes, were relevant to my country's priorities and needs in the given subject

The totality of the respondents found the agenda and its outcomes relevant, showing the adequacy of its design for current beneficiaries' needs.

[30] The delegation did not attend because of weather related airport closures.

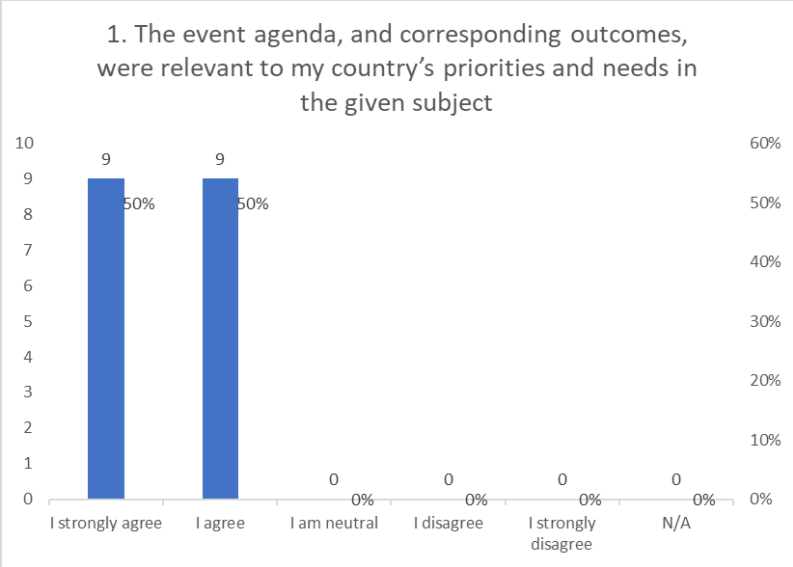

Figure 10 - Agenda and outcomes relevance

Question 2 - My work performance will benefit from the event in terms of knowledge/expertise gained, contacts established, best practices, others

Underlining the trend detected in question 1, most participants strongly agreed (28%) or agreed (61%) that the workshop contributed to improve their work performance. Only 11% were neutral in this regard.

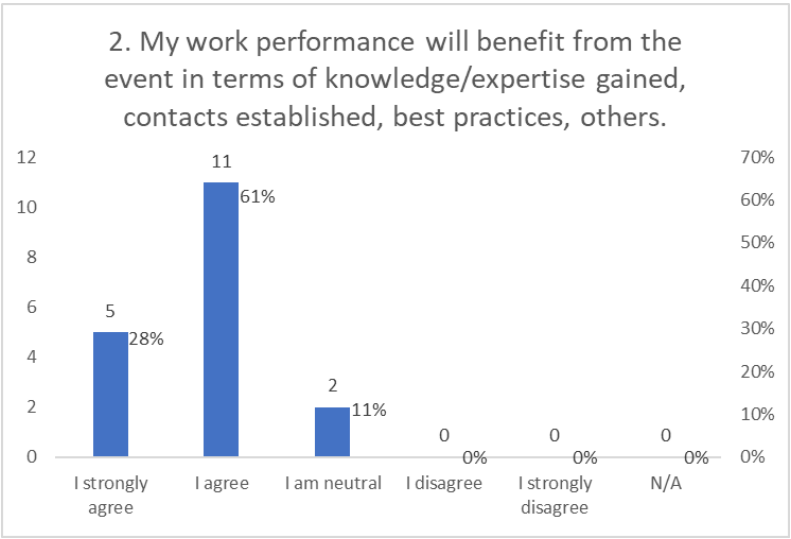

Figure 11 - Better work performance

Question 3 - This event contributed to enhanced regional cooperation in the EU candidate countries and potential candidates in the implementation of the EU environmental acquis

The results in terms of contribution of the workshop to enhanced regional cooperation between EPPA beneficiaries and EU MS was also overwhelmingly positive with 61% strongly agreeing and the remaining 39% agreeing.

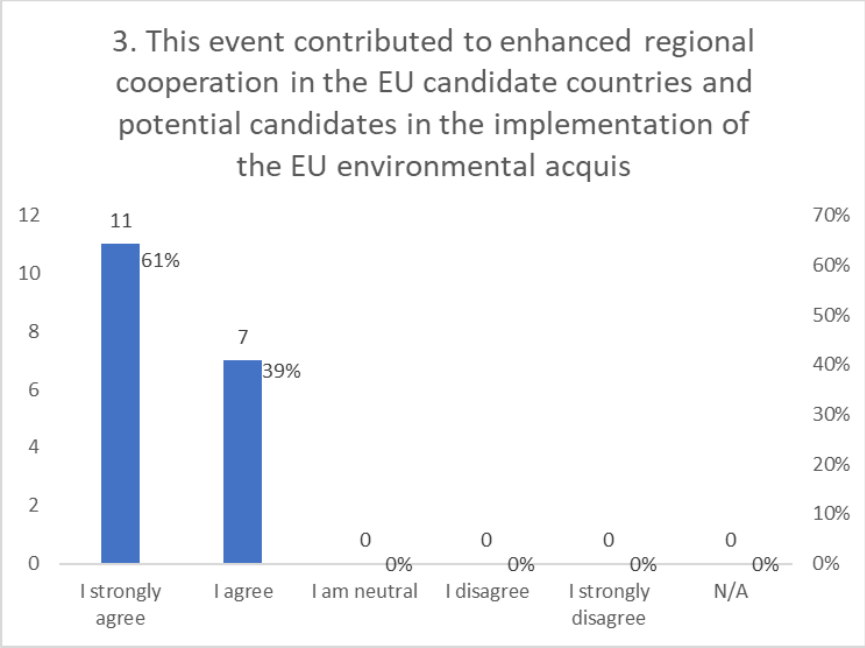

Figure 12 - Regional cooperation

Question 4 - This event contributed to increased alignment of my country's legislation with the EU environmental acquis, and its enforcement

The workshop was also very highly rated in its contribution to better prepare the beneficiaries to align with the relevant EU Directive. 88% of respondents either strongly agreed or agreed. The remaining were neutral or did not answer the question. There was one comment from Montenegro requesting further EPPA assistance to the "functioning" of its Air Pollution Control Programme.

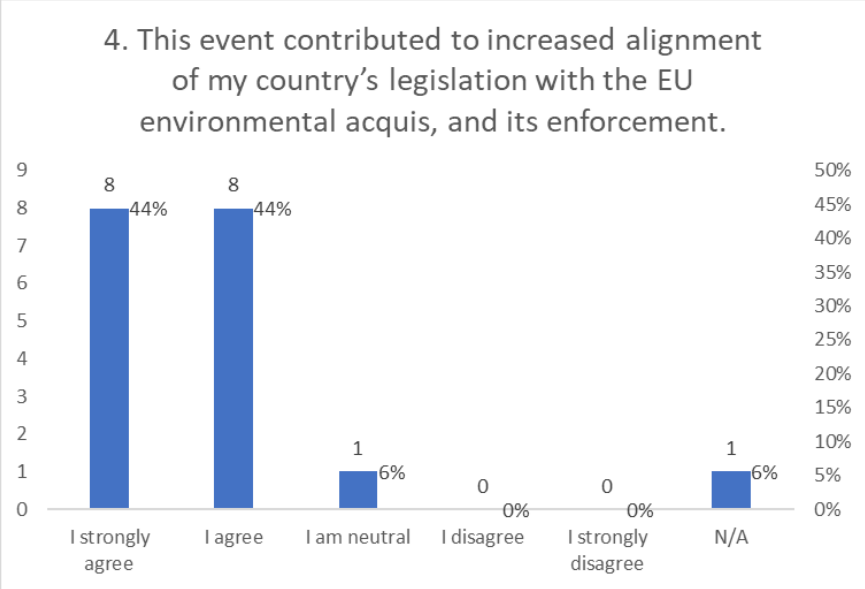

Figure 13 - Alignment with the EU acquis

Question 5 - This event contributed to increased capacity and technical knowledge of my organization to deal with transboundary environmental issues, in line with EU acquis

The almost totality of participants (94%) rated the event highly in its contribution to increase organizational capacities to deal with air pollution, the topic at hand. Only 6% (one participant) was neutral.

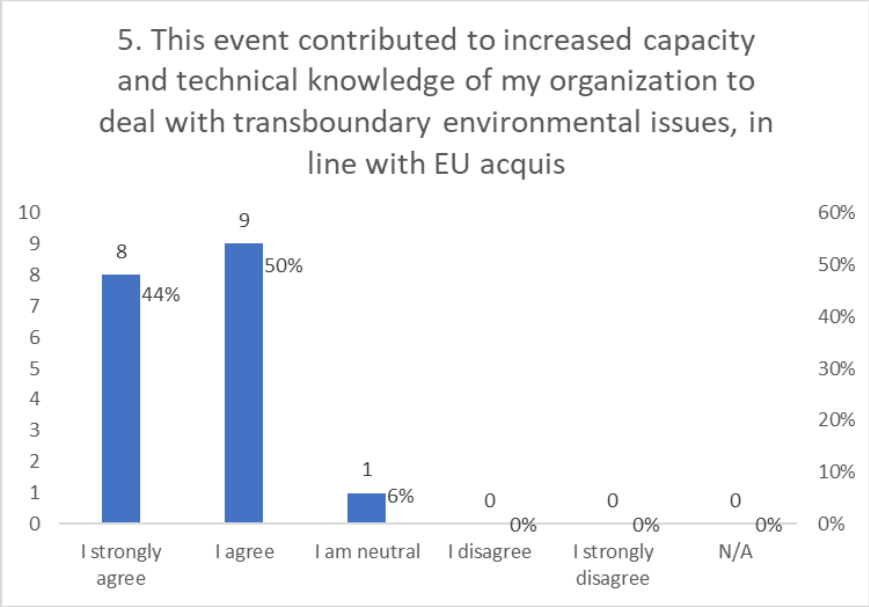

Figure 14 - Capacity for transboundary issues

Question 6 - Do you have general recommendations, for the future, regarding the topic and how best to address your country's needs?

In the final question, several respondents pointed the need to concentrate future workshops on monitoring the impact of air pollution on ecosystems (NECD Art. 9), a topic that seems to require a comparative, bigger need for capacity building in the beneficiaries.

Other topics mentioned as important for further development, by more than one respondent, were the need to improve air inventories under CLRTAP, and the production and use of projections. In addition, there were some concrete requests to perform legislative and implementation assessments regarding air quality management, to support the beneficiaries developing legislation (transposing NECD), defining NECD national ceilings, raising capacities to implement the Gothenburg Protocol, and to implement Air Pollution Control Programmes.

Finally, one participant requested that future working group sessions be better prepared. The project team would like to note that the beneficiaries were not as pro-active as it would wish in the run up to the workshop. The preparation and success of a workshop are dependent on the active participation of participants, as well as their feedback before/during the event.

5.2 The TAIEX technical and logistical evaluation

To be completed once TAIEX evaluation data is made available.

Endnotes

* This designation is without prejudice to positions on status, and is in line with UNSC 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.

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