

Trouble in the air: Recent developments under the 1979 Convention on Long-Range Transboundary Air Pollution

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The 1979 Geneva Convention on Long-Range Transboundary Air Pollution (CLRTAP) is a significant regional treaty under which eight protocols have been developed. The Convention offers a case study on the legal and political challenges that can occur when addressing air pollution. This article explores the recent history of the CLRTAP regime, drawing on the conceptual lens of regime effectiveness. First, the article considers how the legal framework has been modernized over the past decade to reflect changes in the sources and effects of air pollution. This has predominantly occurred through amendments to the 1999 Protocol to Abate Acidification, Eutrophication and Ground-Level Ozone, the 1998 Protocol on Persistent Organic Pollutants and the 1998 Protocol on Heavy Metals, which were negotiated in 2009–2012. The amendments are an important point in the regime's history, as they set more stringent pollution limits. Particular attention is paid to their prospective entry into force and their broader impact on European law. Second, the geographic coverage of the legal instruments has long been an issue of concern, with a number of former Soviet Union States choosing to not participate in the pollution-specific protocols. The article reviews efforts to boost participation through the creation in 2011 of a coordinating group to promote action in the countries of Eastern Europe, the Caucasus and Central Asia. Third, the article explores recent developments in compliance and inventory adjustments under the Gothenburg Protocol, as a demonstration of how the system approaches changes in scientific knowledge on the sources and levels of air pollution, and how this affects compliance.

1 | INTRODUCTION

The 1979 Convention on Long-Range Transboundary Air Pollution (CLRTAP)¹ is fast approaching its 40th anniversary since its signing and has been in force for just under 35 years. The Convention was negotiated under the auspices of the United Nations Economic Commission for Europe (UNECE), an organization that was set up to aid the reconstruction and redevelopment of Europe after the Second

World War.² In practical terms, the UNECE attempts to tie together a heterogeneous range of geopolitical groupings: North America, Western Europe, Eastern Europe, the Balkans and parts of West and Central Asia. The Convention therefore has the potential to extend transboundary air pollution law over a geographic range of 47 million square kilometres, encompassing 20 percent of the world population.³

¹Convention on Long-Range Transboundary Air Pollution (adopted 13 November 1979, entered into force 16 March 1983) 1302 UNTS 217 (CLRTAP).

²The UNECE was created and given its terms of reference by UN Economic and Social Council, Economic Commission for Europe (UNESCO Res 36 (IV) (28 March 1947), document E/402); for a history of the UNECE, see Y Berthelot and P Rayment, *Looking Back and Peering Forward: A Short History of the United Nations Economic Commission for Europe, 1947–2007* (UN 2007); see also AS Bishop and RD Munro, 'The UN Regional Commissions and Environmental Problems' (1972) 26 International Organization 348.

³UNECE 'Geographical Scope' <<https://www.unece.org/oes/nutshell/region.html>>.

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The CLRTAP mainly came into existence as a response to the phenomenon of acid deposition (acid rain). Over time, the range of pollutants and environmental phenomena that the law addresses has expanded through seven protocols to include the regulation of sulphur oxides (SO_x) (particularly sulphur dioxide or SO₂),⁴ nitrogen oxides (NO_x) (particularly nitrogen dioxide or NO₂),⁵ non-methane volatile organic compounds (NMVOCs),⁶ ammonia (NH₃),⁷ fine particulate matter (PM_{2.5}),⁸ heavy metals (lead, cadmium, mercury)⁹ and persistent organic pollutants (POPs).¹⁰ The European Monitoring and Evaluation Programme (EMEP) aids the Convention process through the monitoring, measuring and modelling of air pollution and receives funding through the 1984 EMEP Protocol.¹¹ Speaking purely in terms of codification, the developments under the Convention point to it being one of the most successful examples of a multilateral environmental agreement (MEA) that has ever existed. Although the regime has played a major role in efforts to reduce acidification, photochemical smog, ground-level ozone, eutrophication and toxic pollution, significant challenges remain.

In a previous publication I analysed and explored the history of the CLRTAP in detail through the analytical framework of regime design and effectiveness.¹² Based on current thinking in international

law and politics, effectiveness can be divided into three strands – legal effectiveness,¹³ institutional design¹⁴ and normative effectiveness.¹⁵ In total, criteria of 12 effectiveness sub-headings were used. In this shorter article, I focus on recent developments under the regime (focusing on the past 10 years), and return to three areas of concern – entry into force, State participation and compliance.

1.1 | Entry into force

A central argument was that for an environmental treaty to be legally effective, there would need to be high levels of compliance with ambitious and precise commitments, although a close reading of the history of the regime suggested that soft law and institutional innovations can bolster participation and improve environmental effectiveness over the long term.¹⁶ Between 2009 and 2012, the parties negotiated amendments to the 1998 POPs Protocol,¹⁷ the 1998 Heavy Metals Protocol¹⁸ and the 1999 Gothenburg Protocol.¹⁹ These amendments attempted to improve the legal framework and reflect changes in the sources and effects of air pollution, potentially improving the air quality of the UNECE region. The analytical framework of legal effectiveness does not, however, adequately address issues of entry into force. The amendments and their entry into force must therefore be given prominence in any effectiveness assessment as their legal status reflects momentum, legitimacy and State support for multilateral action on transboundary air pollution; this also enables formal assessments of compliance.

1.2 | State participation

The geographic coverage of the legal instruments has long been an issue of concern, with a number of the former Soviet Union States choosing to not participate in the pollution-specific protocols adopted after the end of the Cold War. I have previously argued that 'state participation is a key area where the regime needs to make substantial improvements'.²⁰ I return to this subject and

⁴Protocol to the 1979 CLRTAP on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at Least 30 per cent (adopted 8 July 1985, entered into force 2 September 1987) 1480 UNTS 215 (Sulphur Protocol I); Protocol to the 1979 CLRTAP on Further Reduction of Sulphur Emissions (adopted 14 June 1994, entered into force 5 August 1998) 2030 UNTS 122 (Sulphur Protocol II); Protocol to the 1979 CLRTAP to Abate Acidification, Eutrophication and Ground-Level Ozone (adopted 30 November 1999, entered into force 17 May 2005) 2319 UNTS 81 (Gothenburg Protocol). See RR Churchill, G Kutting and LM Warren, 'The 1994 UN ECE Sulphur Protocol' (1995) 7 *Journal of Environmental Law* 169; J Wettestad, 'The 1999 Multi-pollutant Protocol: A Neglected Break-through in Solving Europe's Air Pollution Problems?' in OS Stokke and ØB Thommessen (eds), *Yearbook of International Co-operation on Environment and Development* (Earthscan 2002) 35.

⁵Protocol to the 1979 CLRTAP Concerning the Control of Emissions of Nitrogen Oxides or their Transboundary Fluxes (adopted 31 October 1988, entered into force 14 February 1991) 1593 UNTS 287 (NO_x Protocol); Gothenburg Protocol (n 4) Annex II.

⁶Protocol to the 1979 CLRTAP Concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes (adopted 18 November 1991, entered into force 29 September 1997) 2001 UNTS 187 (VOCs Protocol); Gothenburg Protocol (n 4) Annex II.

⁷Gothenburg Protocol (n 4) Annex II.

⁸Included in UNECE 'Decision 2012/2 on Amendment of the Text of and Annexes II to IX to the Protocol and the Addition of New Annexes X and XI' (adopted 4 May 2012, not yet in force) UN Doc ECE/EB.AIR/111/Add.1 (2012 Gothenburg Protocol Amendments).

⁹Protocol to the 1979 CLRTAP on Heavy Metals (adopted 24 June 1998, entered into force 29 December 2003) 2237 UNTS 4 (Heavy Metals Protocol).

¹⁰Protocol to the 1979 CLRTAP on Persistent Organic Pollutants (adopted 24 June 1998, entered into force 23 October 2003) 2230 UNTS 79 (POPs Protocol). See K Hillman, 'International Control of Persistent Organic Pollutants: The UN Economic Commission for Europe Convention on Long-Range Transboundary Air Pollution, and Beyond' (1999) 8 *Review of European Community and International Environmental Law* 105.

¹¹Protocol to the 1979 CLRTAP on Long-Term Financing of the Co-operative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe (EMEP) (adopted 28 September 1984, entered into force 28 January 1988) 1491 UNTS 167 (EMEP Protocol).

¹²A Byrne, 'The 1979 Convention on Long-Range Transboundary Air Pollution: Assessing its Effectiveness as a Multilateral Environmental Regime after 35 Years' (2015) 4 *Transnational Environmental Law* 37. The theoretical underpinnings of regime effectiveness are detailed more fully in that longer article, but draw upon D Bodansky, *The Art and Craft of International Environmental Law* (Harvard University Press 2011) 262–271; and PH Sand (ed), *The Effectiveness of International Environmental Agreements: A Survey of Existing Legal Instruments* (Grotius 1992) 4–7. I apply the term regime following the political scientist and international relations theorist EB Haas, who used the term to capture the 'norms, rules, and procedures agreed to in order to regulate an issue-area'; EB Haas, 'Why Collaborate?: Issue-Linkage and International Regimes Source' (1980) 32 *World Politics* 357, 358.

¹³Subdivided into (i) the commitments and compliance; (ii) the use of binding/non-binding instruments; (iii) the precision of the rules; and (iv) the implementation strategies.

¹⁴Focusing on (i) the core institutions; and (ii) the international implementation procedures, which included dispute settlement and reporting, review and non-compliance procedures.

¹⁵Subdivided into (i) legitimacy and the rules on decision making and participation; (ii) State participation; (iii) the assignment of implementation responsibilities; (iv) the degree of burden sharing and financial assistance; and (v) the empowerment of domestic stakeholders.

¹⁶Byrne (n 12) 44.

¹⁷UNECE 'Decision 2009/1 on Amending the Text of and Annexes I, II, III, IV, VI and VIII to the POPs Protocol'; 'Decision 2009/2 on Listing of Short-Chain Chlorinated Paraffins and Polychlorinated Naphthalenes in Annexes I and II to the POPs Protocol'; 'Decision 2009/3 on Amending Annexes V and VII to the POPs Protocol'; 'Decision 2009/4 on the Guidance Document on Best Available Techniques to Control Emissions to the POPs Protocol' UN Doc ECE/EB.AIR/99/Add.1 (18 December 2009) (2009 POPs Protocol Amendments).

¹⁸UNECE 'Decision 2012/5 on Amendment of the Text of and Annexes other than III and VII to the 1998 Protocol on Heavy Metals'; 'Decision 2012/6 on Amendment of Annex III to the 1998 Protocol on Heavy Metals' UN Doc ECE/EB.AIR/113/Add.1 (13 December 2012) (2012 Heavy Metals Protocol Amendments).

¹⁹UNECE 'Decision 2012/1 on Amendment of Annex I to the Protocol' (adopted 4 May 2012, entered into force 5 June 2013) UN Doc ECE/EB.AIR/111/Add.1; Decision 2012/2 (n 8).

²⁰Byrne (n 12) 60.

consider the efforts to boost participation through the creation in 2011 of a coordinating group to promote action in the countries of Eastern Europe, the Caucasus and Central Asia (EECCA). Having now existed for six years, enough time has passed to make some tentative conclusions as to whether this approach has improved participation.

1.3 | Compliance

This article explores the recent history of compliance and inventory adjustments under the Gothenburg Protocol, as a demonstration of how the system approaches changes in scientific knowledge on the sources and levels of air pollution. I suggest that an assessment of compliance should be read more broadly than simply the achievement of the objectives as approved by expert assessments and/or implementation committees, but rather should include some discussion of the manner in which States reached compliance, and whether this is in keeping with the spirit of the law and broader environmental principles.²¹

2 | A BRIEF OVERVIEW OF THE CONVENTION AND RECENT DEVELOPMENTS

It was within a context of great reluctance to acknowledge the problem of acid rain that the CLRTAP was negotiated.²² The Convention was consequently a 'loose' framework agreement²³ or a proto-framework agreement with an aspirational tone. Article 1(b) defined long-range transboundary air pollution (LRTAP) as:

*air pollution whose physical origin is situated wholly or in part within the area under the national jurisdiction of one State and which has adverse effects in the area under the jurisdiction of another State at such a distance that it is not generally possible to distinguish the contribution of individual emission sources or groups of sources.*²⁴

This definition captures a broad range of pollutants and scales, from potentially a single source positioned along a national border, to a number of sources in an industrial zone, to diffuse pollution (e.g., vehicle emissions). It does not set an upper limit on the geographical scope of what can be considered transboundary. It also appears to suggest that the sources of transboundary air pollution cannot be identified, but it was possible to identify the general

sources by the late 1970s, if not the specific point sources.²⁵ Where there were a number of national borders converging the difficulties increased however (e.g., the Benelux region). This creatively ambiguous definition was bound up in the *realpolitik* that action on transboundary air pollution would avoid discussion of liability,²⁶ with a general acceptance by the negotiating parties that a focus on collective action would be more conducive to multilateral action. Article 2 of the Convention created the general obligation on the contracting parties to 'endeavour to limit and, as far as possible, gradually reduce and prevent air pollution including long-range transboundary air pollution'.²⁷ The other major achievements of the Convention included provisions on notification, consultation, monitoring and an embryonic version of the requirement to use best available technology which was qualified by economic feasibility.²⁸

Although it is very difficult to directly ascribe cause and effect to an MEA, and perhaps not appropriate given that the amelioration of environmental problems relies on a range of interconnected and interdependent social, political, technological, economic and cultural factors, as well as legal ones,²⁹ it is reasonable to conclude that the Convention process played its part in producing significant declines in air pollution.³⁰ The most remarkable achievement to date has been the decline in SO₂ emissions: European emissions stabilized in the 1980s and then dropped from 60 million tonnes/year (t/y) in 1990 to 20 million t/y in 2000, with current levels at ~13 million t/y.³¹

²⁵See, e.g., H Rodhe, 'A Study of the Sulfur Budget for the Atmosphere over Northern Europe' (1972) 24 *Tellus* 128; B Bolin and C Persson, 'Regional Dispersion and Deposition of Atmospheric Pollutants with Particular Application to Sulfur Pollution over Western Europe' (1975) 27 *Tellus* 281; JN Galloway and DM Whelpdale, 'An Atmospheric Sulfur Budget for Eastern North America' (1980) 14 *Atmospheric Environment* 409; G Handl, 'National Uses of Transboundary Air Resources: The International Entitlement Issue Reconsidered' (1986) 26 *Natural Resources Journal* 405; see also United Nations Environment Programme (UNEP), *Air Pollution: Promoting Regional Cooperation* (UNEP 2010) 42–44.

²⁶The Article 8(f) footnote, inserted at the request of the UK, stated that the 'present Convention does not contain a rule on State liability as to damage'. See M Pallemerts, 'International Legal Aspects of Long-Range Transboundary Air Pollution' (1988) 1 *Hague Yearbook of International Law* 189; and JG Lammers, 'The European Approach to Acid Rain' in DB Magraw (ed), *International Law and Pollution* (University of Pennsylvania Press 1991) 265.

²⁷CLRTAP (n 1) art 2.

²⁸A Rosencranz, 'The ECE Convention of 1979 on Long-Range Transboundary Air Pollution' (1981) 75 *American Journal of International Law* 975, 977.

²⁹The energy transitions literature has highlighted the complex and contingent nature of large-scale change; see generally FW Geels et al, 'The Enactment of Socio-technical Transition Pathways: A Reformulated Typology and a Comparative Multi-level Analysis of the German and UK Low-Carbon Electricity Transitions (1990–2014)' (2016) 45 *Research Policy* 896, 897. For the influence of the regime in spurring technological change, see T Dekker, HRJ Vollebergh, F de Vries and CA Withagen, 'Inciting Protocols' (2012) 64 *Journal of Environmental Economics and Management* 45; HRJ Vollebergh and E van der Werf, 'The Role of Standards in Eco-innovation: Lessons for Policymakers' (2014) 8 *Review of Environmental Economics and Policy* 230.

³⁰For the history of the regime, see Byrne (n 12); S Marsden and E Brandon, *Transboundary Environmental Governance in Asia Practice and Prospects with the UNECE Agreements: Practice and Prospects with the UNECE Agreements* (Edward Elgar 2015) 201–237; HC Bugge, 'The Principle and Duty to Cooperate: The Case of Conventions on Transboundary Air Pollution in Europe' in S Jayakumar, T Koh and HD Phan (eds), *Transboundary Pollution: Evolving Issues of International Law and Policy* (Edward Elgar 2015) 263; and J Wettestad, 'The Improving Effectiveness of CLRTAP: Due to Clever Design?' in R Lidskog and G Sundqvist (eds), *Governing the Air: The Dynamics of Science, Policy, and Citizen Interaction* (MIT Press 2011) 39.

³¹D Fowler et al, 'Acidification of Lakes and Forest Soils' in R Maas and P Grennfelt (eds), *Towards Cleaner Air: Scientific Assessment Report 2016* (EMEP Steering Body and Working Group on Effects of the CLRTAP 2016) 7, 7.

²¹EB Weiss, 'Understanding Compliance with International Environmental Agreements: The Baker's Dozen Myths' (1999) 32 *University of Richmond Law Review* 1555, 1563.

²²The UK, West Germany and later the Reagan administration in the United States were particularly indifferent. J McCormick, *Acid Earth: The Global Threat of Acid Pollution* (Earthscan 1990) 76.

²³Wettestad (n 4) 35.

²⁴CLRTAP (n 1) art 1(b).

Nitrogen dioxide emissions have also declined markedly, although perhaps less spectacularly, reducing from ~29 million t/y in 1990 to ~17 million t/y presently.³² Emissions of volatile organic compounds (VOCs), heavy metal pollution and POPs have also declined, and there is also growing evidence that implementing the CLRTAP protocols may have contributed to modest reductions in carbon dioxide.³³

The UNECE was an extremely useful institutional home for tackling certain types of transboundary air pollution, such as acid rain, which fitted, or could be made to fit, into its boundaries. Choosing to adhere to these membership criteria was diplomatically shrewd given its East–West membership, and politically convenient given the limited interest in tackling the problem on a global scale at the time.³⁴ The CLRTAP reflects how the problem was being approached, by scientists and politicians, as a regional problem rather than a global one.³⁵ The membership criteria have become a limitation in recent years, however, as the hemispheric nature of POPs, mercury, ozone and particulate matter mean that the CLRTAP protocols which address these pollutants can only ever be partially successful, and points towards the need for global approaches to air pollution.³⁶ Discussions on whether the CLRTAP could be opened up to non-UNECE States were unsuccessful

in the mid-2000s.³⁷ The Global Atmospheric Pollution Forum (GAP Forum, active between 2005 and 2012), based at the Stockholm Environment Institute, commented in 2010 that there was ‘no realistic prospect of achieving [a more effective inter-regional and global framework] through negotiation of a new global air pollution treaty, nor by widening the scope of existing conventions’.³⁸ Regardless of the potential benefits and the desirability of a global approach, there is little prospect in the short term for a global treaty.³⁹ Regional approaches to air pollution are likely to remain important and dominant over the coming decade.

From the 1990s onwards, the policy focus broadened out from ecosystem protection to include human health co-benefits (e.g., particulate matter) and the range of sectors that received attention also expanded (e.g., agriculture). A major achievement for the regime was the adoption of amendments to the late 1990s protocols. These were of key importance because they extended the framework to 2020 and beyond, increased the stringency of the commitments and incorporated more chemicals. The original 1998 POPs Protocol banned eight POPs (e.g., toxaphene), whilst four were scheduled for elimination and four had severe restrictions placed on them (including DDT⁴⁰ and PCBs⁴¹). A deadline was created for the introduction of incineration emission limit values, whilst the Protocol also set rules for the disposal of the banned substances. The 2009 POPs Protocol Amendments⁴² put in place further restrictions and regulate additional POPs, targeting solvents, brominated fire retardants, pesticides and industrial chemicals. The amendments also provide new emission limit values for waste incineration and provide best available technique (BAT) guidance to control emissions.

The original 1998 Heavy Metals Protocol set reductions on cadmium, lead and mercury emissions and set emission limit values and BAT for new and existing major stationary sources. The 2012 Heavy Metals Protocol Amendments⁴³ created stricter emission limit values and also included more emissions sources. The original 1999 Gothenburg Protocol required parties to control and reduce emissions of sulphur, NO_x, VOCs and NH₃, with the 2010 emission ceilings/targets based on critical loads.⁴⁴ The Protocol also established

³²ibid.

³³A Slechten and V Verardi, ‘Measuring the Impact of Multiple Air Pollution Agreements on Global CO₂ Emissions’ (2016) 92 *Land Economics* 534. There are potential economic, environmental and health co-benefits between air pollution reduction and climate change mitigation, which suggests that an international law approach to air pollution would be useful. R Swart, M Amman, F Raes and W Tuinstra, ‘A Good Climate for Clean Air: Linkages between Climate Change and Air Pollution: An Editorial Essay’ (2004) 66 *Climatic Change* 263; P Tollefsen et al, ‘Air Pollution Policies in Europe: Efficiency Gains from Integrating Climate Effects with Damage Costs to Health and Crops’ (2009) 12 *Environmental Science and Policy* 870; GF Nemet, T Holloway and P Meier, ‘Implications of Incorporating Air-Quality Co-benefits into Climate Change Policymaking’ (2010) 5 *Environmental Research Letters* 4535. Reflecting the importance of climate change, the UNECE became a partner in the Climate and Clean Air Coalition to reduce short lived climate pollutants; see <<http://www.ccacoalition.org>>.

³⁴For a critical analysis on the importance of science in diplomacy and the Convention, see R Rothschild, ‘Détente from the Air: Monitoring Air Pollution during the Cold War’ (2016) 57 *Technology and Culture* 831.

³⁵See, e.g., GE Likens and FH Bormann, ‘Acid Rain: A Serious Regional Environmental Problem’ (1974) 184 *Science* 1176.

³⁶The impacts of POPs have disproportionately fallen on the polar environment given the phenomenon of global distillation which leads them to concentrate in the higher latitudes. See F Wania and D Mackay, ‘Tracking the Distribution of Persistent Organic Pollutants’ (1996) 30 *Environmental Science and Technology* 390. It was suggested in the early 2000s that the CLRTAP was a model for a potential hemispheric air pollution treaty which could tackle intercontinental transport of air pollution, although it was argued that regional approaches would be more politically palatable. T Holloway, A Fiore and MG Hastings, ‘Intercontinental Transport of Air Pollution: Will Emerging Science Lead to a New Hemispheric Treaty?’ (2003) 37 *Environmental Science and Technology* 4535; H Selin, ‘Comment on “Intercontinental Transport of Air Pollution: Will Emerging Science Lead to a New Hemispheric Treaty?”’ (2004) 38 *Environmental Science and Technology* 1912. In Asia, pollution was already high in 1979, accounting for around 10 percent of global sulphur emissions, and the continent overtook Western European emissions in the 1980s. China and India now account for ~40 percent of global SO₂ emissions (~30 and 10 percent, respectively). DI Stern, ‘Global Sulfur Emissions from 1850 to 2000’ (2005) 58 *Chemosphere* 163, 169; Z Klimont, SJ Smith and J Cofala, ‘The Last Decade of Global Anthropogenic Sulfur Dioxide: 2000–2011 Emissions’ (2013) 8 *Environmental Research Letters* 014003. Pollution from Asia crosses regional borders, and there is increasing evidence that it has hemispheric impacts. PM_{2.5} pollution produced in China in 2007 has been linked to 64,800 external premature deaths, including more than 3,100 in Western Europe and the United States, whilst internally Chinese PM_{2.5} pollution has been linked to 108,600 premature deaths. V Ramanathan and Y Feng, ‘Air Pollution, Greenhouse Gases and Climate Change: Global and Regional Perspectives’ (2009) 43 *Atmospheric Environment* 37; SK Guttikunda and P Jawahar, ‘Atmospheric Emissions and Pollution from the Coal-Fired Thermal Power Plants in India’ (2014) 92 *Atmospheric Environment* 449; Q Zhang et al, ‘Transboundary Health Impacts of Transported Global Air Pollution and International Trade’ (2017) 543 *Nature* 705.

³⁷UNECE ‘Possibilities for Opening the Convention: Note by the Bureau in Consultation with the Secretariat’ UN Doc ECE/EB.AIR/2006/8 (29 September 2006).

³⁸Stockholm Environment Institute (SEI), ‘Atmospheric Pollution: Developing a Global Approach’ (SEI 2010). Rather than reordering air pollution law by adopting a general framework, States have preferred to tackle pollutants dependent on their particular characteristics, following the CLRTAP precedent of pollutant-specific instruments, and there have been sustained efforts to develop international law with the Stockholm Convention on Persistent Organic Pollutants (adopted 22 May 2001, entered into force 17 May 2004) 2256 UNTS 119; and Minamata Convention on Mercury (adopted 10 October 2013, entered into force 16 August 2017) (2016) 55 *ILM* 582.

³⁹See PH Sand and JB Wiener, ‘Towards a New International Law of the Atmosphere’ (2016) 7 *Goettingen Journal of International Law* 195, 212; see also PH Sand, ‘The Discourse on “Protection of the Atmosphere” in the International Law Commission’ (2017) 26 *Review of European, Comparative and International Environmental Law* 201.

⁴⁰Dichlorodiphenyltrichloroethane.

⁴¹Polychlorinated biphenyls.

⁴²2009 POPs Protocol Amendments (n 17).

⁴³2012 Heavy Metals Protocol Amendments (n 18).

⁴⁴Gothenburg Protocol (n 4). For the rationale, see P Grennfelt, Ø Hov and D Derwent, ‘Second Generation Abatement Strategies for NO_x, NH₃, SO₂, and VOCs’ (1994) 23 *Ambio* 425.

emission limits for a range of sources, along with the BAT requirement. The 2012 Gothenburg Protocol Amendments⁴⁵ set new 2020 emissions ceilings for existing pollutants as well as for PM_{2.5}. European Union (EU) Member States are jointly required to reduce SO₂ emissions by 59 percent, NO_x emissions by 42 percent, VOCs by 28 percent, NH₃ by 6 percent and particulate matter by 22 percent.⁴⁶

A further development of note was the introduction of 'flexible transitional arrangements' in the 2012 Heavy Metals Protocol Amendments⁴⁷ and the 2012 Gothenburg Protocol Amendments,⁴⁸ which were to appeal to new parties to the protocols. The amended Gothenburg Protocol⁴⁹ affords new parties an extension for the development of implementation plans with a final implementation deadline of 31 December 2030. The 2012 amendments to the Heavy Metals Protocol contained similar extensions for the implementation of BAT and limit values to existing stationary sources. The deadline for new parties to take advantage of these arrangements is by the end of December 2019.

3 | ENTRY INTO FORCE OF THE AMENDMENTS

The entry into force of the amendments will signpost State commitment to tackling transboundary air pollution, strengthen the regime's legitimacy and credibility,⁵⁰ and will enable formal assessments of compliance. What then is the current situation regarding the entry into force of the amendments? For certain non-binding elements, the parties agreed that they could enter into force via decisions of the Executive Body (EB); the remainder would require the parties to formally accept them. The amendments to Annexes V and VII of the 1998 POPs Protocol which provide guidance on BAT entered into force in 2010.⁵¹ The amendments to Annex I of the 1999 Gothenburg Protocol are in force and adjusted the level of critical loads.⁵² Amendments to Annex III of the 1998 Heavy Metals Protocol on guidance for BAT have also entered into force.⁵³

The outlook for the amendments which require the parties to formally accept them (e.g., the emissions targets) is somewhat

disconcerting, but there are grounds for optimism. The threshold for entry into force is that two-thirds of the parties at the time of their adoption formally accept them.⁵⁴ It appears that the 2009 amendments to the text and to Annexes I–IV, VI and VIII to the 1998 POPs Protocol might enter into force first, as eight years since the EB adopted the amendments by consensus it has 13 parties, including the EU and Canada. A total of 19 acceptances will be required.⁵⁵ This seems likely to occur if the majority of EU Member States accept. The 2009 Amendments to Annexes I and II to the 1998 POPs Protocol has currently 10 acceptances, including the EU. Likewise, it will require 19 for entry into force.

The 2012 Heavy Metals Protocol Amendments⁵⁶ have been accepted by 11 parties including the United States and the EU, and require 22 acceptances to enter into force.⁵⁷ Perhaps surprising given its prominent position and flagship status is the acceptance rate for the 2012 Amendment of the text and Annexes II–IX, and the addition of new Annexes X and XI to the Gothenburg Protocol. Currently only six parties have accepted, although the recent acceptance of the United States and the EU may give some momentum and aid its entry into force. These amendments require 17 parties to accept.⁵⁸

A crucial role is played by the EU in bolstering action on LRTAP through the incorporation of these amendments into EU law.⁵⁹ The EU amended its regulation on POPs in 2010,⁶⁰ and the bloc has also completed the process for the acceptance of the 2012 Gothenburg Amendments,⁶¹ now that it has agreed the 2016 National Emission Ceilings (NEC) Directive.⁶² The 2020–2029 commitments in the new

⁵⁴Recently, the EB has tasked an ad hoc group of legal experts to 'provide advice on the legal implications of the ratification by a State of an amended protocol to the Convention by a State not Party to the original protocol, before the amendments have entered into force'. The group concluded that '[i]f non-Party States choose to ratify the Protocols in question and upon ratification declare that they only ratify the amended version of the Protocols, this would mean that they would not be Parties to the Protocols until the amendments entered into force. Their ratifications could not therefore be counted towards the number of acceptances necessary to bring the amendments into force.' UNECE 'Ratification of Amended Protocols that have not yet Entered into Force, Note by the Ad Hoc Group of Legal Experts' UN Doc ECE/EB.AIR/2016/5 (22 February 2016) paras 20–22.

⁵⁵UNECE 'Report of the Executive Body on its Thirty-Sixth Session' UN Doc ECE/EB.AIR/137 (16 March 2017) para 31. The original 1998 POPs Protocol had 29 parties in December 2009. Currently it has 33 parties.

⁵⁶2012 Heavy Metals Protocol Amendments (n 18).

⁵⁷UNECE 'Report of the Executive Body on its Thirty-Sixth Session' (n 55) para 30. The original Protocol had 33 parties at the time of adoption in December 2012 (currently the Protocol has 34 parties in total).

⁵⁸ibid para 31. The Protocol had 25 parties at the time of the amendments adoption in May 2012 (the Protocol currently has 26 parties).

⁵⁹Byrne (n 12) 41–43.

⁶⁰Commission Regulation (EU) No 756/2010 of 24 August 2010 amending Regulation (EC) No 850/2004 of the European Parliament and of the Council on persistent organic pollutants as regards Annexes IV and V [2010] OJ L223/20; Commission Regulation (EU) No 757/2010 of 24 August 2010 amending Regulation (EC) No 850/2004 of the European Parliament and of the Council on persistent organic pollutants as regards Annexes I and III [2010] OJ L223/29.

⁶¹See Council of the European Union, 'Improving Air Quality: EU Acceptance of the Gothenburg Protocol Amendment in Sight' (17 July 2017) <<http://www.consilium.europa.eu/en/press/press-releases/2017/07/17-agri-improving-air-quality/>>.

⁶²Directive (EU) 2016/2284 of the European Parliament and of the Council of 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC [2016] OJ L344/1.

⁴⁵2012 Gothenburg Protocol Amendments (n 8 and n 19).

⁴⁶C Ågren, 'New Gothenburg Protocol Adopted' (Acid News, June 2012) <<http://www.airc.lim.org/acidnews/new-gothenburg-protocol-adopted>>.

⁴⁷2012 Heavy Metals Protocol Amendments (n 18).

⁴⁸2012 Gothenburg Protocol Amendments (n 8).

⁴⁹Gothenburg Protocol (n 4).

⁵⁰See D Bodansky, 'The Legitimacy of International Governance: A Coming Challenge for International Environmental Law?' (1999) 93 *American Journal of International Law* 596.

⁵¹POPs Protocol (n 10), Entry into force of the amendments to Annexes V and VII to the Protocol (C.N.554.2010.TREATIES-2 of 14 September 2010 (Amendments to Annexes V and VII), 20 December 2010) <<http://treaties.un.org/doc/Publication/CN/2010/CN.554.2010-Eng.pdf>>.

⁵²Gothenburg Protocol (n 4), Entry into force of amendments to Annex I to the Protocol (C.N.171.2013.TREATIES-XXVII.1.h of 7 March 2013 (Adoption of Amendments to Annex I to the Protocol), 19 September 2013) <<http://treaties.un.org/doc/Publication/CN/2013/CN.171.2013-Eng.pdf>>.

⁵³Heavy Metals Protocol (n 9), Entry into force of amendment to Annex III to the 1998 Protocol on Heavy Metals (C.N.711.2013.TREATIES-XXVII.1.f of 11 October 2013 (Amendment to Annex III to the 1998 Protocol on Heavy Metals), 27 January 2014) <<http://treaties.un.org/doc/Publication/CN/2013/CN.711.2013-Eng.pdf>>.

Directive are the same as the Gothenburg Protocol Amendments,⁶³ seen at the time as not particularly ambitious,⁶⁴ although the Directive set more stringent 2030 targets. The 2016 NEC Directive is an important development as it means that the 2012 Gothenburg Protocol Amendments⁶⁵ will apply to the EU Member States even if they do not enter into force.

Whereas the early period of the regime was largely driven by the leadership of the Nordic States,⁶⁶ replaced by the EU in the 1990s and 2000s,⁶⁷ it is now becoming an increasingly difficult task to identify leadership in Europe for enhanced action on transboundary air pollution since the great recession, with most momentum currently emanating from city mayors who are better positioned to respond to local concerns, but are not formally involved in national or European decision making.⁶⁸ Traditional economic arguments have been in the ascendency over the recent period and explain why States have not accepted the amendments in sufficient numbers, with concerns over cost-effectiveness, austerity and the effects of environmental regulations on the economy being dominant. The 2016 NEC Directive, for example, struggled with the problem of enforcing emission limit values for vehicles and also experienced a strong lobby from industry, agriculture⁶⁹ and some governments (e.g., the United Kingdom (UK)), that led to the European Commission's proposals being watered down.⁷⁰

The EB has maintained focus on the amendments and from indications from the parties, it appears that the amendments for the POPs Protocol and the amended Heavy Metals Protocol may enter into force by 2018, and the amended Gothenburg Protocol by 2019.⁷¹ This is predicated on the parties following through on their words. If the amendments do not enter into force, it would raise serious questions as to the commitment of the UNECE States to cooperate on transboundary air pollution and would represent something of a setback for the regime, which risks the law becoming fixed in the 1990s.

⁶³2012 Gothenburg Protocol Amendments (n 8).

⁶⁴S Reis et al, 'From Acid Rain to Climate Change' (2012) 338 *Science* 1153, 1154; C Ågren, 'Editorial' (*Acid News*, June 2012) <<http://www.airclim.org/acidnews/2012/AN2-12>> 2.

⁶⁵2012 Gothenburg Protocol Amendments (n 8).

⁶⁶McCormick (n 22) 79–80.

⁶⁷S Biesenbender and J Tosun, 'Domestic Politics and the Diffusion of International Policy Innovations: How does Accommodation Happen?' (2014) 29 *Global Environmental Change* 424.

⁶⁸See, e.g., A Hidalgo and S Khan, 'City Air is Silently Killing Us – But Mayors are Now Stepping Up' (*Climate & Clean Air Coalition* 2017) <<http://www.ccacoalition.org/en/blog/city-air-silently-killing-us-mayors-are-now-stepping-up>>; M McGrath, 'Four Major Cities Move to Ban Diesel Vehicles by 2025' (*BBC News*, 2 December 2016) <<http://www.bbc.co.uk/news/science-environment-38170794>>; London City Hall, 'Cleaning Up London's Air' (2017) <<https://www.london.gov.uk/what-we-do/environment/pollution-and-air-quality/cleaning-londons-air>>.

⁶⁹See, for example, the UK's National Farmers Union response: <<https://www.nfuonline.com/cross-sector/environment/ippc/final-vote-on-the-national-emissions-ceilings-directive/>>.

⁷⁰T Goulding, 'UK among EU Nations "Watering Down" Air Quality Proposals' (*airqualitynews.com*, 21 June 2016) <<http://www.airqualitynews.com/2016/06/21/uk-among-eu-nations-watering-air-quality-proposals/>>.

⁷¹UNECE 'Report of the Executive Body on its Thirty-Sixth Session' (n 55) paras 29–31.

4 | IMPROVING STATE PARTICIPATION IN THE REGIME

An effectiveness assessment of international environmental law stresses that getting the relevant States to participate is a key marker for success.⁷² However, the term 'relevant State' is open to interpretation for transboundary air pollution law. Relevance is determined by science and the specific domestic and geopolitical context. In its early history, the CLRTAP regime focused on the key polluting States of Northern Europe, and due to industrial secrecy and meteorology, the European border of the former Soviet Union became one of the main areas of attention, as opposed to the Soviet Union as a whole.⁷³ With the optimism of the end of the Cold War, the principle of regional unity and increasing standardization across the UNECE region came to the fore. With the breaking up of the Soviet Union and Yugoslavia in the early 1990s, a great deal of effort was put into getting the newly independent States (NIS) to accede to the Convention. This was largely successful, by 2006 out of potentially 56 member States to the UNECE, the Convention had 51 parties, with only Andorra, Israel, San Marino, Tajikistan, Turkmenistan and Uzbekistan not becoming parties to the CLRTAP. Furthermore, the NIS of Eastern Europe, the Caucasus and Central Asia, particularly those who did not become members of the EU, or were heavily industrialized prior to gaining membership, such as Poland, did not become parties to the protocols adopted after the end of the Cold War. The next step has been to increase the accessions to the protocols so that the legal framework would apply more fully to the entire UNECE region, and not just predominantly to Western Europe and North America. What were considered the 'relevant States' changed due to geopolitics and changes in scientific knowledge, but it remains the case that there is limited motivation for supporting EECCA States in their pollution reduction activities, and no formal funding mechanism exists in the protocols, despite the issue being known for at least 25 years.⁷⁴ The Regional Air Pollution Information and Simulation model developed by the International Institute for Applied Systems Analysis, which provides estimates of the environmental and economic effectiveness of the abatement strategies to inform the negotiations, had found that large emission reductions in Eastern Europe (e.g., Poland) were the most effective. As Reis and colleagues have suggested, however, 'low average incomes in Eastern European countries could prohibit ambitious policy measures'.⁷⁵

There are a number of caveats when trying to implement environmental law in the NIS, especially in the Central Asian States. As Marsden has noted, the region has 'a prevailing culture of secrecy, corruption and political authoritarianism, under which opposition to

⁷²Bodansky (n 12) 264–265.

⁷³McCormick (n 22) 80.

⁷⁴See, e.g., J Sliggers and G Klaassen, 'Cost Sharing for the Abatement of Acidification in Europe: The Missing Link in the New Sulphur Protocol' (1994) 4 *European Environment* 5; MA Levy, 'International Co-operation to Combat Acid Rain' in HO Bergesen and G Parmann (eds), *Green Globe Yearbook of International Co-operation on Environment and Development* 1995 (Oxford University Press 1995) 59, 65.

⁷⁵S Reis et al, 'Institutional Arrangements' in Maas and Grennfelt (n 31) 33, 35; see also C Albin, 'Rethinking Justice and Fairness: The Case of Acid Rain Emission Reductions' (1995) 21 *Review of International Studies* 119.

the various regimes has often been brutally suppressed'.⁷⁶ The UNECE does have experience with working in such circumstances, having been able to successfully engage with the Soviet Union in the late 1970s and 1980s, however. The creation of the Russian-led EECCA Coordinating Group was a significant step forward, and it held its first meeting in 2011.⁷⁷ This work was also complemented by meetings and workshops jointly held with the CLRTAP Task Force on Techno-Economic Issues.⁷⁸ In terms of accession to the CLRTAP, Tajikistan, Turkmenistan and Uzbekistan made optimistic noises in the early 2010s,⁷⁹ but are yet to become parties. There were signals that the other EECCA countries might accede to the protocols, for example, in 2010 Belarus, Kazakhstan and the Russian Federation signed a Memorandum 'On Development of Eastern Dimension of the Convention on Long-Range Transboundary Air Pollution'.⁸⁰

How has the UNECE fared in its ambition to get more parties to the protocols? The 1984 EMEP Protocol⁸¹ appears to have been the biggest beneficiary of this drive, and suggests that the EECCA countries view the monitoring of air pollution as requiring international cooperation. An optimistic interpretation could be captured by the maxim 'monitoring first, emissions reductions later'. Since 2011, the EMEP Protocol has gained four parties, taking the total to 47: Albania (2011), Armenia (2014), Georgia (2013) and Moldova (2016). This means that Eastern Europe is now included in the funding regime on a voluntary basis, and further work with Azerbaijan and the States of Central Asia would take this Protocol to the ratification levels of the Convention.

The trends in ratification and the geographic scope of the most recent protocols (the late 1990s protocols) suggest that the attempts by the UNECE to get further ratifications have not been a great success. Poland became a party to the NO_x Protocol in 2011, whilst Macedonia became a party to both the Sulphur Protocol II and the Gothenburg Protocol in 2014. Montenegro, Serbia and Spain became parties to both the Heavy Metals Protocol and the POPs Protocol in this period, whilst Portugal became a party to the Heavy Metals Protocol in 2017. Generally speaking, Northern Europe is at the centre of the regime and there is also a corridor of parties in Central and South-eastern Europe from the German border to Bulgaria who are parties to the late 1990s protocols. The EU accession process for the Eastern European countries is likely a contributing factor.⁸²

A major problem remains with the industrial, coal-dependent and oil-producing regions of the former Soviet Union. Poland could not be swayed into ratifying the late 1990s protocols despite EU accession, whilst Ukraine, Belarus, Russia, the Southern Caucasus and the Central Asian States also remain indifferent. There was some optimism that the EECCA Coordinating Group might make progress, with Belarus, Kazakhstan, Moldova and Russia signalling their intention to become parties to the later protocols.⁸³ As yet, these accessions have not materialized.

Turkey and Israel should be mentioned, as they are part of the UNECE area. Turkey, a founding member of the UNECE, ratified the Convention in 1983 and became a party to the EMEP Protocol in 1985 but has not participated since. Israel joined the UNECE in 1991 and has been active in other UNECE areas, most recently acceding to the Protocol on Pollutant Release and Transfer Registers to the Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Aarhus Convention) in 2013.⁸⁴ It has not ratified the CLRTAP and consequently does not participate in any of the protocols. It is not clear why a number of Eastern Mediterranean countries do not participate; it may be that because the region is not completely represented by the UNECE boundary,⁸⁵ States have a disincentive to take on the commitments, or it may be that Turkey's indifference to LRTAP has therefore diminished political will in the surrounding region.⁸⁶ Cyprus is somewhat of an outlier, having ratified the later protocols, but the absence of Greece, Israel, Malta and Turkey leaves most of the region outside the scope of the late 1990s protocols.

The recent history of the developments under the CLRTAP suggest that the past 10 years have been something of an impasse with regards to State participation. The lack of substantial financial incentives for the EECCA countries may be a contributing factor, but it is unlikely that in the future mechanisms will be established beyond the development support already offered by Western parties.⁸⁷ It is entirely possible that in the short to medium term (for the next 20 years) the Eastern UNECE region will remain outside the scope of the protocols. The UNECE and the EB of the CLRTAP need to reconsider how they interact with the EECCA States if any progress is to be made, in particular by creating a more dynamic approach that enables front runners in the EECCA to emerge. This may increase the application of transboundary air pollution law across the entire bloc.

5 | ADJUSTMENTS UNDER THE 1999 GOTHENBURG PROTOCOL

Compliance and implementation are of central importance to the notion of legal effectiveness, as are the precision and stringency of

⁷⁶Marsden and Brandon (n 30) 296; see also E Neumayer, 'Do Democracies Exhibit Stronger International Environmental Commitment? A Cross-Country Analysis' (2002) 39 *Journal of Peace Research* 139.

⁷⁷UNECE 'Decision 2010/17, Establishment of a Coordinating Group on the Promotion of Actions Towards Implementation of the Convention in Eastern Europe, the Caucasus and Central Asia' UN Doc ECE/EB.AIR/106/Add.1 (24 February 2011); EECCA Coordinating Group, 'Report, First Session of the Coordinating Group on Promotion of Actions towards Implementation of the Convention on Long-Range Transboundary Air Pollution in Eastern Europe, Caucasus and Central Asia', Informal Doc No 21 (11–15 April 2011).

⁷⁸See <<http://tftei.citepa.org/en/cooperation-with-eecca>>.

⁷⁹Marsden and Brandon (n 30) 292–293.

⁸⁰EECCA Coordinating Group (n 77) 2.

⁸¹EMEP Protocol (n 11).

⁸²H Selin and SD VanDeveer, 'Institutional Linkages and European Air Pollution Politics' in Lidskog and Sundqvist (n 30) 61, 61–67.

⁸³EECCA Coordinating Group (n 77).

⁸⁴Protocol on Pollutant Release and Transfer Registers to the Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (adopted 21 May 2003, entered into force 8 October 2009) 2626 UNTS 119.

⁸⁵Lebanon, for instance, is outside the UNECE region.

⁸⁶Organisation for Economic Co-operation and Development (OECD), *Environmental Performance Reviews: Turkey* (OECD 2008) 207.

⁸⁷Byrne (n 12) 59–62.

the commitments.⁸⁸ The manner of compliance tends to be overlooked in effectiveness assessments, however. The issue that I address here is how expert-led technical changes have a significant effect on whether a State is considered to be in compliance. That compliance is co-produced by law and science is not in dispute,⁸⁹ but how we interpret and assess such occurrences within the effectiveness framework remains controversial.

A vivid example of the important role of expertise in the regime is the principle of adjustments to national emissions levels and ceilings, which became part of the legal framework from the 1994 Sulphur Protocol II onwards. Article 11(1) provided that '[a]ny Party to the Convention may propose an adjustment to annex II to the present Protocol to add to it its name, together with emission levels, sulphur emission ceilings and percentage emission reductions'.⁹⁰ Any such proposal would need to be adopted by consensus by the parties present at a session of the EB.⁹¹ New parties to the protocols used this provision. For example, Monaco and Lithuania requested and were granted an adjustment to Annex II of the 1994 Sulphur Protocol II prior to joining,⁹² as did Cyprus, who additionally requested an adjustment to Annex II of the 1999 Gothenburg Protocol,⁹³ along with Macedonia.⁹⁴ Adjustments had been made to European emission inventories for POPs and mercury by the EMEP Chemical Coordinating Centre in consultation with national experts in order to meet EMEP requirements since the early 2000s, but this was for modelling purposes.⁹⁵

The 2012 Amendments to the Gothenburg Protocol⁹⁶ contained an enhanced adjustment process, allowing the application of 'adjustments to emission reduction commitments, or to inventories for the purposes of comparing total national emissions with them', which can be applied in extraordinary circumstances when 'such a circumstance contributes to a Party being unable to meet one of its reduction commitments contained in annex II'.⁹⁷ The EB decided to bend the rules for these amendments and provisionally act upon them without the

required instruments of acceptance being received.⁹⁸ The process is overseen by the EMEP Centre on Emission Inventories and Projections (CEIP) in accordance with EB Decisions 2012/3, 2012/4 and 2014/1, and the EB has to agree on any adjustments.⁹⁹ There are three extraordinary circumstances: (i) when the emissions source categories were not accounted for when the emission reduction commitment was set; (ii) a significant difference in emission factors for source categories between when the emission reduction commitments were set and when they were to be attained;¹⁰⁰ and (iii) significant changes in the methodologies for determining emissions from specific sources between the time that emission reduction commitments were set and when they are to be achieved.¹⁰¹

The basic idea with adjustments is given developments in knowledge and monitoring, the available information is superior now to what was known when the Gothenburg Protocol was agreed in 1999. Therefore, the argument goes, any changes in the reported data should be adjusted for compliance purposes to focus on what was known in 1999. Adjustments allow continued State participation and enable the parties to improve their emissions data free from the threat of non-compliance. The adjustments process points to the weakness of the precautionary principle within the regime – governments are seen responsible only for the obligations agreed with the available knowledge, and not for any pre-existing uncertainty or scientific progress leading to the identification of new sources, better emission factors or better calculation methodologies.¹⁰²

At the time, this development was not seen as particularly problematic,¹⁰³ but the significance of these decisions has increased due to the actions of the parties. By 2013, the available data suggested that a number of States would be found in non-compliance with the 2010 emission ceilings/targets under the Gothenburg Protocol,¹⁰⁴ amounting to about a third of the parties to the protocol having a problem with at least one of the pollutants. The States that were likely to be in non-compliance for NO_x were Belgium, Denmark, France, Luxembourg and Spain; for NMVOCs, Germany and Luxembourg; and for NH₃, Croatia, Denmark, Finland, Germany, Norway and Spain.¹⁰⁵ The culprits for NO_x have been road transport and

⁸⁸ibid 39.

⁸⁹See generally S Jasanoff, 'Making Order: Law and Science in Action' in EJ Hackett et al (eds), *The Handbook of Science and Technology Studies* (MIT Press 2008) 761; see also W Tuinstra, L Hordijk and C Kroeze, 'Moving Boundaries in Transboundary Air Pollution Co-production of Science and Policy under the Convention on Long Range Transboundary Air Pollution' (2006) 16 *Global Environmental Change* 349; G Sundqvist, M Letell and R Lidskog, 'Science and Policy in Air Pollution Abatement Strategies' (2002) 5 *Environmental Science and Policy* 147; Lidskog and Sundqvist (n 30); R Lidskog, 'Representing and Regulating Nature: Boundary Organisations, Portable Representations, and the Science-Policy Interface' (2014) 23 *Environmental Politics* 670.

⁹⁰Sulphur Protocol II (n 4).

⁹¹ibid art 11(6).

⁹²UNECE 'Report of the Nineteenth Session of the Executive Body' UN Doc ECE/EB.AIR/75 (16 January 2002) para 13 (Monaco); UNECE 'Report of the Executive Body on its Twenty-Fifth Session' UN Doc ECE/EB.AIR/91 (27 February 2008) para 19 (Lithuania).

⁹³UNECE 'Report of the Twenty-Third Session of the Executive Body' UN Doc ECE/EB.AIR/87 (27 January 2006) para 11.

⁹⁴UNECE 'Report of the Executive Body on its Thirty-Second Session' UN Doc ECE/EB.AIR/122 (20 February 2014) para 66.

⁹⁵UNECE 'Report of the 18th Session of the Executive Body' UN Doc ECE/EB.AIR/71 (18 January 2001) Annex IV, 33.

⁹⁶2012 Gothenburg Protocol Amendments (n 18).

⁹⁷UNECE 'Decision 2012/3, Adjustments under the Gothenburg Protocol to Emission Reduction Commitments or to Inventories for the Purposes of Comparing Total National Emissions with Them' UN Doc ECE/EB.AIR/111/Add.1 (1 November 2012) para 1.

⁹⁸UNECE 'Decision 2012/4, Provisional Application of Amendment to the Protocol to Abate Acidification, Eutrophication and Ground-Level Ozone' UN Doc ECE/EB.AIR/111/Add.1 (1 November 2012).

⁹⁹Decision 2012/3 (n 97); Decision 2012/4 (n 98); UNECE 'Decision 2014/1, Improving the Guidance for Adjustments under the 1999 Protocol to Abate Acidification, Eutrophication and Ground-Level Ozone to Emission Reduction Commitments or to Inventories for the Purposes of Comparing Total National Emissions with Them' UN Doc ECE/EB.AIR/127/Add.1 (22 January 2015). See <http://www.ceip.at/ms/ceip_home1/ceip_home/adjustments_gp/>.

¹⁰⁰For details on the emissions factors, see European Environment Agency (EEA), 'EMEP/EEA Air Pollutant Emission Inventory Guidebook – 2016' (EEA 2016) <<http://www.eea.europa.eu/publications/emep-eea-guidebook-2016>>. This is used for both the CLRTAP and EU law.

¹⁰¹Decision 2012/3 (n 97) para 6.

¹⁰²See also Byrne (n 12) 46.

¹⁰³See, e.g., Ågren (n 64) 3.

¹⁰⁴Gothenburg Protocol (n 4).

¹⁰⁵M Gauss et al, 'Status of Transboundary Pollution in 2011' in M. Schulz et al (eds), *Transboundary Acidification, Eutrophication and Ground Level Ozone in Europe in 2011* (Norwegian Meteorological Institute 2013) 17–42; see Byrne (n 12) Annex, Table 1.

agricultural sources (manure, soils and fertilizers); for VOCs it has been manure management and crops; and for NH₃ it has been road transport, stationary sources, fertilizers and crops.¹⁰⁶ There was an expectation that the Implementation Committee would therefore have an increased workload. The threat of non-compliance has resulted in a swathe of applications to adjust the reported data on national total emissions. Applying for an adjustment suspends any investigations by the Implementation Committee.

CEIP coordinates the expert technical review of the applications and from 2014 has received applications from Belgium, Croatia, Denmark, Finland, France, Germany, Luxembourg and Spain.¹⁰⁷ These adjustments have led to a number of countries switching from being (likely) non-compliant to being in compliance. For example, as a result of this process, Germany appeared to have achieved its 2010 commitment for NO_x, with the adjustment knocking off a staggering 20 per cent of reported 2010 emission, whilst it achieved compliance for NMVOCs by 2014, but may not be in compliance for NH₃.¹⁰⁸ Luxembourg appeared to be in compliance after its adjustment for NMVOCs, but not for NO_x.¹⁰⁹ France, after adjustment, appeared to have missed the 2010 NO_x target but achieved compliance by 2013.¹¹⁰ After the adjustment of its data, Belgium appeared to be in compliance for both NO_x and NMVOCs.¹¹¹ Spain appeared to be in compliance for its 2010 NO_x commitment after adjustment.¹¹² It has not been completely plain sailing, however: the Croatian submission was not seen as sufficiently extraordinary to warrant acceptance.¹¹³ As a result of these adjustments, the Implementation Committee closed its investigations into Belgium, France, Luxembourg and Spain.¹¹⁴

From a legal effectiveness approach which prioritizes compliance, the adjustment process and the subsequent shift to compliance is an indicator of success. It would not be helpful to the parties or the regime if the impression was given that compliance was being achieved through obscure technocratic adjustments. Because the technical assessment is overseen by experienced experts in emission inventories, the process has credibility. Having said this, the CEIP

struggled with the initial workload and the adjustment procedure appears to have had a wider impact on the regime. The procedure did not come with its own funding source; consequently, limited EMEP resources were spent on reviewing the applications, and this contributed to the CEIP being unable to complete all its tasks in the 2014–2015 work plan for the implementation of the Convention.¹¹⁵ The fundamental problem is that the sectoral data for emissions is not the evidence of monitoring for every single source or installation, as this is not possible, but will only ever be the best available data at a given time derived from supposedly representative sampling.¹¹⁶ Reviewing the inventory sectors is therefore a time-consuming affair and a continuous process to improve emission data quality.

Through the adjustment procedure technical data and scientific knowledge have an enhanced role in determining whether a State is compliant. A broader interpretation that focuses on the manner in which a State achieves compliance would consider the balance between actual emissions reductions (and environmental integrity, therefore) with the need for historic fairness on the issue of changes in knowledge. Indeed, the Implementation Committee Chair 'expressed the Committee's appreciation for the decision by one Party to not submit an application for the use of the inventory adjustment procedure and to *concentrate instead on actual emission reduction measures*'.¹¹⁷

The 2016 NEC Directive incorporated the adjustment procedure into EU law, and nongovernmental organizations and activists have responded critically. A joint policy position paper by ClientEarth, the European Environmental Bureau and AirClim, argued that the adjustment procedure 'is likely to result in higher absolute emissions compared to what is expected at the time the Directive is adopted'.¹¹⁸ They later reiterated the weakness of the adjustment procedure stating that '[i]nstead of pushing Member States to take immediate action to compensate for possible unforeseen emissions from one sector, the new rules are likely to leave any increased emissions and associated health and environmental impacts unaddressed'.¹¹⁹ The same arguments hold for the adjustments under the Gothenburg Protocol.

Adjusting the inventories is a compromise to ensure continuing progress is made in air pollution reductions. Now that the low-hanging fruits of technical fixes and end-of-tailpipe solutions have been exploited,¹²⁰ air pollution policy is under significant pressure to come

¹⁰⁶UNECE 'Report of the Second Joint Session of the Steering Body to the Cooperative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe and the Working Group on Effects' UN Doc ECE/EB.AIR/GE.1/2016/2-ECE/EB.AIR/WG.1/2016/2 (12 January 2017). See also L Duprez, *Clearing the Air: A Critical Guide to the New National Emission Ceilings Directive* (European Environmental Bureau 2017) 21.

¹⁰⁷See <http://www.ceip.at/ms/ceip_home1/ceip_home/adjustments_gp/adj_country_data/>.

¹⁰⁸Review of the 2016 Adjustment Application by Germany: Expert Review Team Report for the EMEP Steering Body, CEIP/Adjustment RR/2016/Germany (draft) (24 August 2016).

¹⁰⁹Review of the 2016 Adjustment Application by Luxembourg: Expert Review Team Report for the EMEP Steering Body, CEIP/Adjustment RR/2016/Luxembourg (draft) (24 August 2016).

¹¹⁰Review of the 2015 Adjustment Application by France: Expert Review Team Report for the EMEP Steering Body, CEIP/Adjustment RR/2015/France (draft) (1 September 2015).

¹¹¹Review of the 2015 Adjustment Application by Belgium: Expert Review Team Report for the EMEP Steering Body, CEIP/Adjustment RR/2015/Belgium (final) (1 September 2015).

¹¹²Review of the 2015 Adjustment Application by Spain: Expert Review Team Report for the EMEP Steering Body, CEIP/Adjustment RR/2015/Spain (final) (1 September 2015).

¹¹³Review of the 2014 Adjustment Application by Croatia: Expert Review Team Report for the EMEP Steering Body, CEIP/Adjustment RR/2014/Croatia (V1) (14 August 2014).

¹¹⁴UNECE 'Report of the Executive Body on its Thirty-Fifth Session' UN Doc ECE/EB.AIR/135 (31 August 2016) para 22.

¹¹⁵UNECE 'Report of the Executive Body on its Thirty-Third Session' UN Doc ECE/EB.AIR/127 (22 January 2015) para 39.

¹¹⁶See, e.g., R O'Driscoll et al, 'A Portable Emissions Measurement System (PEMS) Study of NO_x and Primary NO₂ Emissions from Euro 6 Diesel Passenger Cars and Comparison with COPERT Emission Factors' (2016) 145 *Atmospheric Environment* 81.

¹¹⁷UNECE 'Report of the Executive Body on its Thirty-Third Session' (n 115) para 26(b) (emphasis added).

¹¹⁸A Andrews, L Duprez and C Ågren, *Flexibilities in the National Emission Ceilings (NEC) Directive: Undermining Effective Law Making* (Client Earth, European Environmental Bureau and AirClim 2016).

¹¹⁹Duprez (n 106) 20.

¹²⁰As foreseen by A Kelly et al, 'Setting National Emission Ceilings for Air Pollutants: Policy Lessons from an Ex-Post Evaluation of the Gothenburg Protocol' (2010) 13 *Environmental Science and Policy* 28, 40; a vivid example of this phenomenon is the UK government's mistaken promotion of diesel vehicles which increased the levels of air pollution; see M Weaver, 'Fuel Duty Cut for Diesel Cars was Wrong, Says Ex-Chief Science Adviser' (*The Guardian*, 4 April 2017).

up with cost-effective solutions over the next decade that appeal to governments in a time of budget austerity. It is unsurprising perhaps that during this challenging period, States have given themselves an easy technical fix for what is a substantial and difficult problem. For environmental lawyers, the results are frustratingly ambiguous and add to the complexity of assessing effectiveness in this area.

6 | CONCLUSION

The CLRTAP is a useful legal and institutional framework for the reduction of air pollution, and in light of the UK decision to leave the EU, it may play an enhanced role in the future. In exploring three areas of concern (entry into force, State participation and compliance), I have argued that effectiveness assessments should take a more nuanced approach, and suggested ways in which this might be achieved. The successful negotiation of the amendments to the late 1990s protocols was a high point in recent times, and over the next few years it will become clear whether States are committed to continuing their cooperation under this framework. A clear sign for this will be if the remaining Western economies and at least some of the EECCA countries become parties to the late 1990s protocols, and the parties also accept the amendments that were adopted between 2009 and 2012.

There appear to be signals that the public are becoming re-engaged with the air pollution problem, specifically around the issue of children's health,¹²¹ and this may lead to reinvigorated national debates over air pollution and transboundary air pollution. If the CLRTAP regime

remains fixed in the 1990s, beyond stabilizing pollution, it will have little to offer the diverse populations of the UNECE bloc. Further efforts are required to extend the framework into the Eastern UNECE region, and this can be aided by clear signals from the West that tackling air pollution and transboundary air pollution remains a priority and is achievable, despite difficult economic and political times.

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¹²¹See World Health Organization, *Effects of Air Pollution on Children's Health and Development: A Review of the Evidence* (World Health Organization Regional Office for Europe 2005); ClientEarth, 'Air Pollution and Your Health – What are the Facts?' (2016) <<https://www.clientearth.org/air-pollution-health-facts/>>.