United Nations ECE/CEP–CES/GE.1/2021/6

Economic and Social Council

Distr.: General
2 September 2021

Original: English

Advance copy

Economic Commission for Europe

Committee on Environmental Policy — Conference of European Statisticians

Joint Task Force on Environmental Statistics and Indicators

Eighteenth session
Geneva, 18 and 19 October 2021
Item 5 of the provisional agenda
Ongoing developments with relevance for the work of the Joint Task Force

Draft assessment of atmospheric air and climate change in the pan-European region*

Note by the secretariat

Summary

At its twenty-fifth session (Geneva, 13–15 November 2019), the Committee on Environmental Policy requested the secretariat and the United Nations Environment Programme, working in close cooperation with the European Environment Agency, to prepare a limited indicator-based and thematic pan-European environmental assessment.

This document sets out the draft content of two sections of the assessment, covering (a) atmospheric air and (b) climate change.

The Joint Task Force is invited to review and comment upon these sections.

* An agreement was reached to publish the present document after the standard publication date so as to include the most recent information. This document has not been formally edited due to resource constraints.

I. Introduction

1. At its twenty-fifth session (Geneva, 13–15 November 2019), the Committee on Environmental Policy requested the secretariat and the United Nations Environment Programme (UNEP), working in close cooperation with the European Environment Agency, to prepare a limited indicator-based and thematic pan-European environmental assessment.[1] The Committee also welcomed document ECE/CEP/AC.10/2019/6, which identified the environmental topics to be addressed by the assessment, together with the two themes of the Ninth Environment for Europe Ministerial Conference (Nicosia, 5–7 October 2022).

2. This document sets out the draft content of two sections of the assessment, covering atmospheric air and climate change.

II. Draft assessment of atmospheric air and climate change in the pan-European region

A. Atmospheric air

1. Key messages and recommendations

Key messages

3. The health impact of long-term exposure to fine particulate matter with a diameter less than 2.5 µm ($PM_{2.5}$) in 41 European countries was reduced by 13 per cent in the period 2009–2018 and that of nitrogen oxides (NO_x) by 54 per cent. However, the number of premature deaths due to ground-level ozone exposure increased in that period by an estimated 24 per cent, possibly caused by higher mean temperatures.[2]

4. The Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal Protocol) has had positive effects on human health and the environment. The phasing out of hydrochlorofluorocarbons present as coolant in refrigerators and air conditioning systems remains incomplete, especially in countries with economies in transition.

5. Emissions measurement and ambient air pollution monitoring have improved in the past decade, with more appropriate equipment, advanced portable sensors and network strategies leading to greater efficiency and lower costs of ground-level monitoring stations, and are increasingly available.[3] In the pan-European region, there are still monitoring gaps, especially in the measurement and analysis of fine PM.

6. Countries in the region are expanding policies to tackle air pollution. The evaluation and fitness check of existing European Union air quality legislation in 2019[4] led to proposals to strengthen provisions on monitoring, modelling and air quality plans to achieve cleaner air. The European Union air quality standards will be revised to align them more closely with the World Health Organization (WHO) Air Quality Guidelines, which are to be updated in

[1] ECE/CEP/2019/15, para. 37 (k) (ii).

[2] European Environment Agency (EEA), *Air Quality in Europe – 2020 report*, EEA Report No. 9/2020 (Luxembourg, Publications Office of the European Union, 2020), available at www.eea.europa.eu/publications/air-quality-in-europe-2020-report/at_download/file.

[3] Real-time air polluting concentrations and air pollution indices are available and are published on maps by different providers (for example, http://iqair.com). Since 2015, the European Copernicus Atmosphere Monitoring Service (http://atmosphere.copernicus.eu) has provided continuous satellite data and information on atmospheric composition. The Service tracks air pollution, solar energy, greenhouse gases and climate forcing globally.

[4] European Commission, *Fitness Check of the Ambient Air Quality Directives*, Commission Staff Working Document (Brussels, 2019), available at https://ec.europa.eu/info/publications/fitness-check-eu-ambient-air-quality-directives_en.

2021.[5] The Russian Federation is implementing the "Clean Air" project,[6] which provides for significant reduction of pollutants in 12 large industrial centres by 2024, as well as a radical modernization of the State system for monitoring air pollution in these cities.

Recommendations

7. Cooperation should be enhanced so that non-European Union countries in the region could have the possibility to benefit from the experience on the European Union zero-pollution action plan.[7]

8. Governments should develop additional technical and organizational measures to achieve target 3.9 of the Sustainable Development Goals, especially for fine particulate matter and ground-level ozone. Key responses are the sharpening and application of best available techniques to prevent emissions of particulate matter, nitrogen oxides (NO_x) and hydrocarbons by industry and emission reduction from traffic (by implementing Euro-6 and 7 measures).

9. Governments should contribute or urge donors to contribute to the adequate replenishment of the Multilateral Fund for the implementation of the Montreal Protocol in order to accelerate the phasing out of hydrochlorofluorocarbons globally.

10. Governments should promote the use of appropriate and standardized methods for monitoring air pollution emissions[8] and the public availability of monitoring data in the pan-European region, while also strengthening cooperation and national investment to fill monitoring gaps in countries with economies in transition.

2. Context

11. Emissions of substances such as sulfur dioxide (SO_2), carbon monoxide (CO) and lead (Pb), which were problematic in the second half of the twentieth century, have been reduced worldwide. Others, such as PM, NO_x and ammonia (NH_3), have increased in many areas. In the past 40–50 years, policy measures to reduce air pollution have been developed at the national level and through successful international cooperation, such as European Union directives and guidelines and the multilateral environmental agreements of the United Nations Economic Commission for Europe (ECE).[9] Since 2016, 27 countries and various organizations have submitted commitments to the Batumi Action for Cleaner Air.[10]

12. For the pan-European region, the Convention on Long-range Transboundary Air Pollution (Air Convention), with its 51 Parties and its various protocols, has initiated actions, founded on scientific arguments, to deal with the long-term challenges of air pollution. The Convention's 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone, as amended in 2012, is the leading instrument for setting national emission ceilings for SO_2, NO_x, NH_3, volatile organic compounds (VOCs) and $PM_{2.5}$ to be achieved by 2020 and beyond. As black carbon (soot, a short-lived climate pollutant) is included in the PM fraction, climate co-benefits are also achieved. Other key protocols of the Convention are the Protocol on Heavy Metals and the Protocol on Persistent Organic Pollutants.

13. Air quality in the pan-European region remains moderate and unhealthy for sensitive groups in many regions, particularly in urban and industrial areas, despite some sizable reductions in ambient concentrations, and air pollution is still considered as the most important environmental risk to human health. At present, PM, nitrogen dioxide (NO_2) and

[5] Sentence to be reviewed in 2022.

[6] Full information on the project is available (in Russian) at https://rpn.gov.ru/activity/fresh-air/info/.

[7] European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Pathway to a Healthy Planet for All EU Action Plan: "Towards Zero Pollution for Air, Water and Soil", COM(2021) 400 final.

[8] For example, as described in European Union Best Available Techniques reference documents and their equivalents in the Russian Federation.

[9] To be described in Chapter I of the published pan-European environmental assessment.

[10] Available at https://unece.org/baca.

ground-level ozone (O_3) are the substances that most seriously influence human health, even when concentrations do not exceed current established limit values.

3. Status, main trends and recent developments

14. Air pollution in Europe has in general decreased in European Union and European Free Trade Association countries in recent decades and, mainly through economic growth, increased in the countries of the Caucasus, Central Asia and Eastern Europe. Joint efforts of national and regional authorities have not yet led to all desired results as some air quality standards are still exceeded, especially in urban areas.

15. The health impact of long-time exposure to $PM_{2.5}$ in 41 European countries was reduced by 13 per cent in the period 2009–2018 to 417,000 premature deaths (4.8 million years of life lost). For NO_x, the health impact was reduced by 54 per cent to 55,000 premature deaths (624,000 years of life lost) in the same period. However, the number of premature deaths due to ground-level ozone exposure increased in this period by an estimated 24 per cent to 20,600 (247,000 years of life lost), possibly caused by higher mean temperatures.[11]

16. In the Russian Federation, the number of cities with high and very high air pollution decreased by 70 per cent in the period 2010–2019 (based on air pollution indices). The Government of the Russian Federation has instructed the authorities in big cities like Moscow and St. Petersburg to develop a road map to set up restrictions for heavily polluting traffic (under Euro-3).[12] In other countries of the Caucasus, Central Asia and Eastern Europe, there have been similar developments in the field of fuel quality. In Uzbekistan, over 50 per cent of private cars and trucks use cleaner natural gas as fuel.[13]

17. The global BreatheLife campaign,[14] led by WHO, UNEP and the Climate and Clean Air Coalition, calls on Governments to commit to achieving the WHO Air Quality Guidelines targets in 2030. The aim is to halve the number of air pollution-related deaths by 2030, while helping to slow the pace of climate change. Within the Coalition, over 70 States have founded a voluntary partnership together with intergovernmental organizations, non-governmental organizations, cities and financial and business institutions, aimed at reducing emissions of short-lived climate pollutants (black carbon, methane, hydrofluorocarbons and tropospheric ozone).

18. The Second European Union Clean Air Forum (2019) discussed differences between the European Union air quality guidelines and their mostly more stringent WHO equivalents and ways to close this gap. The European Union clean air policy framework to abate air pollution includes three pillars: air quality standards, national emission ceilings for key pollutants and emission limit values for key sources of pollution. The 2019 fitness check of the European Union Ambient Air Quality Directive[15] showed that not all the Directive's targets have been met and that the gap to achieve air quality standards is wide in some cases, thus requiring improvement of existing legislation. In specific cases, stricter emission ceilings in the National Emission Ceilings Directive[16] or more stringent emission limit values in the Industrial Emissions Directive[17] and for mobile sources could be necessary to meet the policy challenge to achieve all European Union air quality standards as a first step to

[11] European Environment Agency, *Air Quality in Europe – 2020 report*.

[12] Konstantin Fomin, "How Russian cities are cleaning up their air", Greenpeace, 30 April 2019.

[13] *Environmental Performance Reviews: Uzbekistan – Third Review* (United Nations publication, Sales No. E.20.II.E.26).

[14] See https://breathelife2030.org.

[15] Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe, *Official Journal of the European Union*, L 152 (2008), pp. 1–44.

[16] European Union Directive 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, *Official Journal of the European Union*, L 344 (2016), pp. 1–31.

[17] Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control), *Official Journal of the European Union*, L 334 (2010), pp. 17–119.

achieving their WHO equivalents in 2030. In 2021, the European Commission adopted a Zero Pollution Action Plan.

19. The European Environmental Agency and the European Commission launched the European Air Quality Index in 2017, which provides on-line information on the air quality situation, based on measurements from more than 2,000 air quality monitoring stations across Europe. An interactive map shows the local air quality situation at station level, based on five key pollutants: $PM_{2.5}$, PM_{10}, ground-level ozone, NO_2, and SO_2.

20. At the global level, the General Assembly adopted resolution A/RES/74/212 on the International Day of Clean Air for blue skies (first held on 7 September 2020). UNEP, in collaboration with the Climate and Clean Air Coalition and WHO, coordinated activities for the International Day, to raise public awareness, demonstrate the connection with the Sustainable Development Goals and promote and facilitate solutions for air protection.

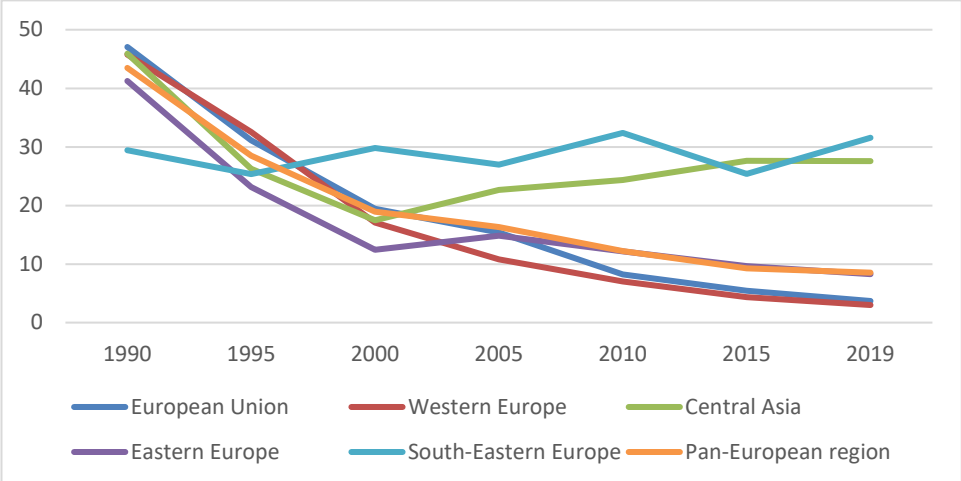
4. Indicators

Emission of pollutants into the atmospheric air (ECE, pressure indicator)

21. Within the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP), 43 out of 51 Parties to the Air Convention submitted their emission inventories in 2020. Nevertheless, the quality of data varies widely, generating uncertainty. Experts and modellers are working on a solution towards a harmonized emission methodology.

22. In the period 2000–2018, emissions of the main pollutants (SO_2, NO_x, NH_3, non-methane VOCs, PM_{10}, $PM_{2.5}$, PM_{coarse} and black carbon) have shown a major decoupling from economic growth and an absolute decrease in the western part of the region. In the countries of the Caucasus, Central Asia and Eastern Europe and Turkey, emissions have increased since 2000, but these emissions are often based on expert estimates extrapolated from gross domestic product growth trends, due to the lack of plausible reporting. Figures I (below) and II and III (overleaf) show strong decreases in emissions of SO_2 and NO_x, while decreases for $PM_{2.5}$ are much smaller.

Figure I
Emission trends for SO_2, kg per annum per capita (1990–2018)



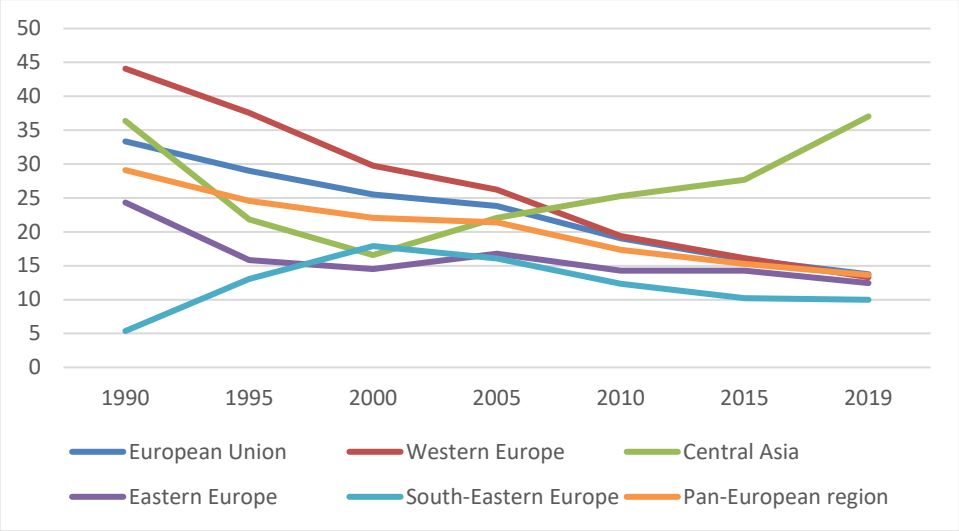
Source: EMEP Centre on Emission Inventories and Projections, 2021, Officially reported emission data, available at www.ceip.at/webdab-emissions-database/reported-emissiondata. Population data from ECE Statistics Database, 2019 or latest.

Notes: No data for Andorra, Bosnia and Herzegovina (except 1992), Israel or San Marino; data only for Kazakhstan and Kyrgyzstan in Central Asia; gaps for Armenia, Azerbaijan, Belarus and Ukraine; 2017 instead of 2019 data for Azerbaijan and Kyrgyzstan.

23. The largest decoupling between economic growth and production and air polluting emissions in recent decades has occurred in the energy-producing sector and manufacturing

industry. Emissions from the road and non-road transport sector also decreased considerably by stringent emission standards set at the European Union level and, with some delay, also in the pan-European region. The agriculture and waste sectors had significantly less reductions in emissions. The residential, commercial and institutional sector did not reduce its emissions very much except for SO_2 emissions.

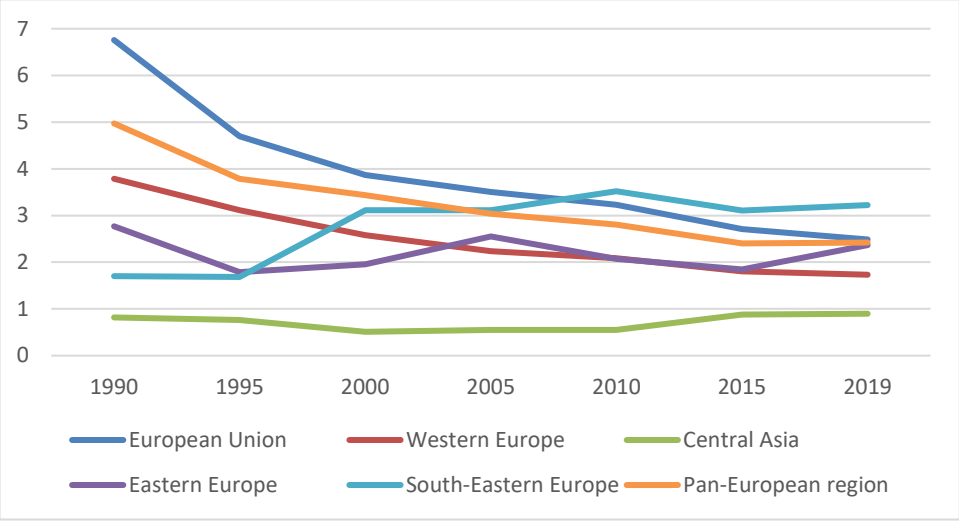
Figure II
Emission trends for NO_x, kg per annum per capita (1990–2018)



Source: EMEP Centre on Emission Inventories and Projections, 2021, Officially reported emission data, available at www.ceip.at/webdab-emissions-database/reported-emissiondata.

Notes: No data for Andorra, Bosnia and Herzegovina, Israel or San Marino; data only for Kazakhstan and Kyrgyzstan in Central Asia; gaps for Armenia; 2017 instead of 2019 data for Azerbaijan and Kyrgyzstan.

Figure III
Emission trends for $PM_{2.}$, kg per annum per capita (1990–2018)



Source: EMEP Centre on Emission Inventories and Projections, 2021, Officially reported emission data, available at www.ceip.at/webdab-emissions-database/reported-emissiondata.

Notes: No data for Andorra, Bosnia and Herzegovina, Israel or San Marino; no data for 1992 and 1995 for Estonia, Hungary, Slovenia and Spain; data only for Kazakhstan and Kyrgyzstan in Central Asia; gaps for Armenia, Belarus, the Russian Federation and Ukraine; 2017 instead of 2019 data for Azerbaijan and Kyrgyzstan.

Ambient air quality in urban areas (ECE, state indicator)

24. Improvements in air quality monitoring and reporting in the past 15–20 years make it possible to assess and report air quality trends in a qualitative, good statistical way. Long-term records of concentrations of the limited number of air polluting substances regulated in the European Union Ambient Air Quality Directive are available for European Union Member States, Iceland, Norway, Switzerland and the United Kingdom of Great Britain and Northern Ireland.[18] Countries in the Caucasus and Central Asia and some Eastern European countries perform reporting of air quality by a different method in the form of air pollution indices, in which three different indicators are used to assess air quality. These indicators make it possible to characterize both short-term air pollution and the chronic impact of air pollution on public health and the environment. The assessment of the air quality in the countries of the Caucasus, Central Asia and Eastern Europe also includes specific pollutants for which hygienic standards have been established (more than 700 substances, for 160 of which State regulation measures are applied). The air quality category established by a set of indicators considers the main pollutants for each city, as assessed relative to standards. Assessments for specific pollutants that make the greatest contribution to air pollution levels in cities are regularly published online.[19]

25. SO_2 concentrations show the largest decrease of the main pollutants in the pan-European region over the past 20 years, with mean European Union values showing a 70 per cent reduction at traffic monitoring stations and 85 per cent at monitoring stations in urban background and industrial areas. In the past few years, the decrease of SO_2 concentrations has slowed. For ambient NO_x concentrations in the European Union, the mean reduction of 25–35 per cent over the past 20 years is similar for all station types, with rural stations having the largest decrease. The phasing out of combustion engines in automobiles is expected to accelerate the decrease of NO_x concentrations in urban and suburban stations in the next 10 years. Annual mean ground-level ozone trends in Europe over the past 20 years did not show significant trends or increased around 20 per cent for traffic stations, with 25 per cent of these sites showing increases of 40 per cent or more, while high ozone peaks have decreased by about 10 per cent except at traffic stations. The increase of mean ozone concentrations is coupled with the reduction of NO_x and VOC emissions. From 2000, annual mean PM_{10} concentrations in Europe have decreased by 40–50 per cent for all stations, with the largest reduction at industrial monitoring stations, while the reduction of $PM_{2.5}$ was around 30 per cent (measured relative to 2008). Regional differences occur with seasonal peaks of PM concentrations in areas where mostly wood is used for domestic heating, such as South-Eastern Europe, Eastern Europe and Central Asia. Figure IV overleaf illustrates the changes in the period 2010–2016.

Consumption of ozone-depleting substances (ECE, response indicator)

26. Ozone-depleting substances (ODS) are being phased out, although certain limited essential uses are still allowed, such as laboratory use and firefighting in special cases. Consumption of ozone-depleting substances in the 27 Member States of the European Union (production, plus imports, minus exports and destruction) has been negative since 2012, falling from 343,000 ozone-depleting potential (ODP) tons in 1986.[20] In the countries of the Caucasus, Central Asia and Eastern Europe, the consumption of ozone-depleting substances fell from 243 to 34 tons and in the Russian Federation from 684 to 287 tons in the period 2014–2019.[21] Figure V overleaf provides an overview hydrochlorofluorocarbon consumption per capita in the period 2010–2019.

[18] Augustin Colette and Laurence Rouïl, *Air Quality Trends in Europe: 2000–2017: Assessment for surface SO_2, NO_2, Ozone, PM_{10} and $PM_{2.5}$*, European Environment Information and Observation Network Report ETC/ATNI 2019/16 (Kjeller, Norway, European Topic Centre on Air pollution, Transport, Noise and Industrial Pollution, 2020)

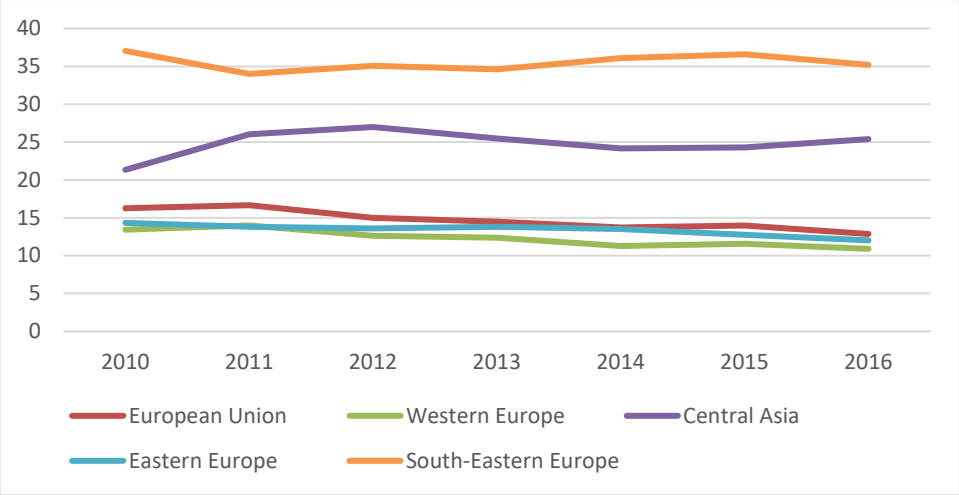
[19] Russian Federation, Sanitary Rules and Norms, State standards for air pollution.

[20] European Commission, *Evaluation of Regulation (EC) No 1005/2009 of the European Parliament and of the Council of 16 September 2009 on substances that deplete the ozone layer*, Commission Staff Working Document (Brussels, 2020), available at https://ec.europa.eu/clima/sites/default/files/ozone/docs/swd_2019_406_en.pdf.

[21] See http://ozone.unep.org.

27. The emission of ODS today has been reduced by 98 per cent compared to 1990 levels. Obligations for parties to the Montreal Protocol are the gradual phase-out of production and consumption of the controlled substances according to specific timelines, reporting of data on the production, use, import and export to the Ozone Secretariat and establishing an import- and export licensing system.

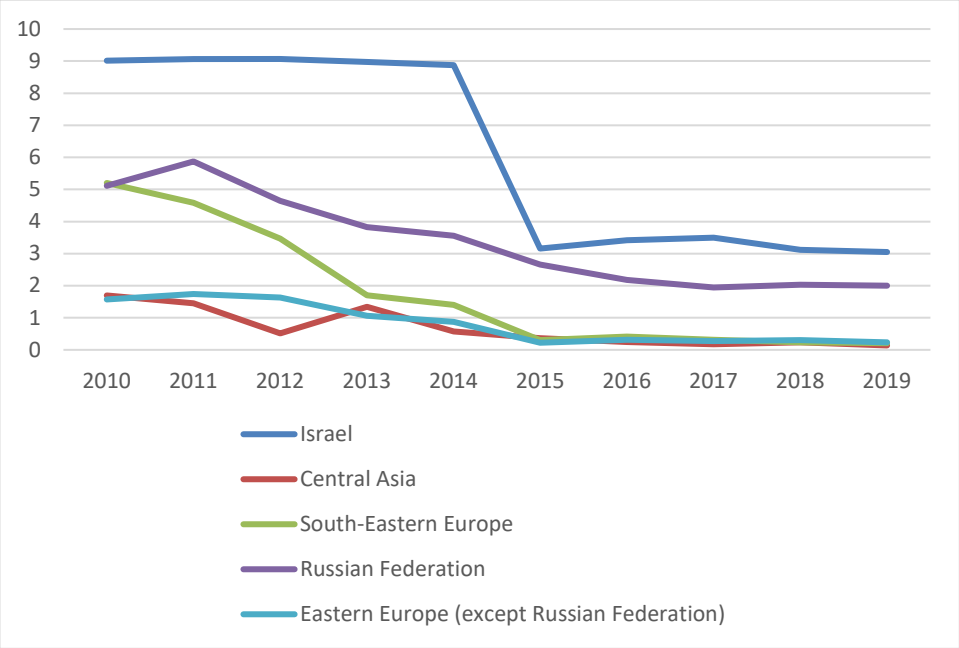
Figure IV
Concentrations of fine particulate matter ($PM_{2.5}$), all areas, mg/m3 (2010–2016)



Source: WHO Global Health Observatory, www.who.int/data/gho/data/indicators/indicator-details/GHO/concentrations-of-fine-particulate-matter-(pm2-5), last update 7 May 2021.

Notes: Regional values are population weighted. No data for Liechtenstein. Corresponds to Sustainable Development Goal indicator 11.6.2.

Figure V
Consumption of hydrochlorofluorocarbons, ODP g per capita (2010–2019)



Source: UNEP Ozone Secretariat, http://ozone.unep.org.

Notes: European Union net consumption below zero since 2010; Western Europe except Israel, zero consumption since 2015, Azerbaijan and Belarus achieved zero consumption in 2019, Kyrgyzstan in 2020.

28. In the countries of the Caucasus, Central Asia and South-Eastern and Eastern Europe, and Turkey, the consumption of chlorofluorocarbons has been phased out completely in the

period 2005–2010. Consumption of hydrochlorofluorocarbons has been reduced in the period 2014–2019 from 90 to 27.5 tons ODP (the Caucasus, Central Asia and Eastern Europe), from 14.5 to 12 tons ODP (South-Eastern Europe) and from 124 to 8.5 tons ODP (Turkey). For the implementation of the Kigali amendment to the Protocol, Belarus, Kazakhstan, Tajikistan and Uzbekistan follow the same rules as the Russian Federation.

5. Case studies

29. Three possible sources for case studies are suggested. The first is the recently published "Measures to Green the Post-Pandemic recovery", by the Issue-based Coalition on Environment and Climate Change, which includes interesting examples under the categories "Transport and Mobility, Climate Action" measure 10 (Chisinau), "Transport, Air Quality, Climate Action" measure 11 (Milan (Italy), Amsterdam, Ukraine and Belarus) and "Transport and Mobility, Air Quality, Biodiversity action" measure 13 (Barcelona (Spain)).[22] The second and third sources are the City of London's Air Quality Strategy 2019–2024[23] and a case study from South-East Europe under the UNEP regional air quality policy update report for the pan-European region (forthcoming).

B. Climate change

1. Key messages and recommendations

Key messages

30. In spite of the commitments related to the reduction of greenhouse gas emissions, expressed by all countries in the pan-European region, net greenhouse gas emissions in the region are still rising.

31. Efforts and achievements are unevenly distributed throughout the region. Reductions, which are mostly achieved in the western part of Europe (2014–2018), are three times less than the increase in emissions in the rest of the region.

32. National commitments under the Paris Agreement were renewed by 35 countries in the region with more ambitious targets. However, some countries still do not have firm, quantifiable commitments or mechanisms to follow the progress towards them, which results in significant data gaps.

33. While decarbonization becomes a new narrative for Europe, there is a widening gap between rhetoric and action. The use of renewables was increased in 29 countries in the pan-European region in the period 2013–2017, but the region still largely relies on fossil fuels – some 78 per cent of the total final energy consumption on average comes from fossil fuels. The penetration of renewables in the energy mix rises more slowly than the increase in the total final energy consumption in the region.

34. The estimated population covered by local disaster risk reduction (DRR) strategies in the pan-European region is about 65 per cent. Only 15 countries in the region reported that all their local authorities are implementing DRR strategies under the Sustainable Development Goal target 13.1, while 23 countries, which jointly represent a quarter of the region's population, do not report on that target.

Recommendations

35. The principle of "common but differentiated responsibilities" should be followed, but not necessarily when it comes to reporting obligations.

[22] Available at https://unece.org/sites/default/files/2021-02/IBC%20Env%20Green%20post-pandemic%20measures%2031.1.21.pdf.

[23] Available at https://www.cityoflondon.gov.uk/services/environmental-health/air-quality/air-quality-strategy.

36. Governments should establish the conditions for medium- and long-term sustainable mobilization of funds for climate action, both by accelerating the use of available regional and global funds and mechanisms and by creating national financial instruments.

37. Governments should deepen decarbonization by phasing out fossil fuel subsidies and shifting promotion of investments towards renewable energy.

38. Governments should strengthen awareness of climate hazards, especially among poorer communities, and establish conditions to report regularly on the Sustainable Development Goal target 13.1 and under the Sendai Framework for Disaster Risk Reduction 2015–2030.

2. Context

39. Within the scope of global climate action, all countries of the pan-European region have committed to cut their greenhouse gas emissions to limit the increase in global temperature to 1.5 °C, as stated in the Paris Agreement.

40. According to the International Energy Agency (IEA),[24] despite a slowing trend, global energy demand may still expand by 30 per cent between 2017 and 2040. Energy use is expected to continue to be the main cause of anthropogenic greenhouse gas emissions. The European Union has defined its pathway to decarbonization, with the long-term vision to reduce its greenhouse gas emissions by 80–95 per cent by 2050 compared to 1990. In that context, several European Union Member States have already stated their intention to phase out coal and lignite completely between 2025 and 2035. Such an objective may be too ambitious and difficult for countries that rely heavily on coal. The countries in the region are in very different situations in terms of their fossil fuel reserves and renewable energy potentials, technological capacities, energy demand patterns, infrastructure and labour and capital markets. While the decarbonization process brings an impetus for development of new low- and zero-carbon technologies, it is necessary to address energy poverty and a just transition.

41. Urgent adaptation approaches that are systemic, multidimensional and transformative are required to address the impacts of climate change, especially on the most vulnerable communities. The development of local adaptation strategies is increasing throughout Europe. As of April 2019, over 1,900 local authorities in the European Environment Agency member and collaborating countries have made commitments related to adaptation within the Covenant of Mayors for Climate and Energy.[25] A further challenge is to implement those strategies.

3. State, main trends and recent developments

42. Emissions of greenhouse gases in the pan-European region increased by 1 per cent in the period 2014–2018, while the average carbon footprint per person rose by 0.2 per cent. The Climate Action Progress Report of the European Union "Kick-Starting the Journey Towards A Climate Neutral Europe" states that in 2019 greenhouse gas emissions were down by 24 per cent from 1990 levels[26] and that the European Union remains on track to achieve its target of reducing greenhouse gas emissions by 20 per cent by 2020.

[24] International Energy Agency (OECD/IEA), *The World Energy Outlook 2018* (OECD/IEA, 2018), available at https://www.iea.org/reports/world-energy-outlook-2018.

[25] European Environment Agency, *The European environment — state and outlook 2020: knowledge for transition to a sustainable Europe* (Luxembourg, Publications Office of the European Union, 2019), available at https://www.eea.europa.eu/soer/2020

[26] According to the approximated greenhouse gas inventory of the European Environment Agency. See European Environment Agency, "EU on track to meet greenhouse gas emissions and renewable energy 2020 targets, progress in 2019 shows more ambitious long-term objectives are reachable", press release, 30 November 2020, available at https://www.eea.europa.eu/highlights/eu-on-track-to-meet.

43. According to IEA most recent data[27] the coronavirus pandemic (COVID-19) situation generated a 6 per cent overall decline in global energy-related greenhouse gas emissions in 2020, hitting a low in April that year. However, in December 2020, global emissions were 2 per cent, or 60 million tons, higher than they were in the same month a year earlier. Globally, financing for climate action has increased substantially, but it continues to be surpassed by investments in fossil fuels.

44. While renewables are increasing, so is energy demand. The share of modern renewable energy in global final energy consumption has stayed around 10 per cent since 2010. Adding traditional uses of bioenergy, the share of all renewable energy in total final energy is 18 per cent.[28] The IEA *Net Zero by 2050: a Roadmap for the Global Energy Sector* sets out more than 400 milestones which include, from today, no investment in new fossil fuel supply projects and no further final investment decisions for new unabated coal plants. The pathway calls for annual additions of solar photovoltaic to reach 630 GW by 2030, and those of wind power to reach 390 GW. Together, this is four times the record level set in 2020. The Roadmap also sets as targets that, by 2035, there will be no sales of new internal combustion engine passenger cars and, by 2040, the global electricity sector has already reached net-zero emissions. Included in the Roadmap is a major worldwide push to increase energy efficiency, resulting in improvements of the global rate of energy efficiency averaging 4 per cent a year through 2030 – this is about three times the average over the last two decades.

45. The European Union set a new target for increasing renewable energy in final energy consumption to at least 32 per cent by 2030, while non-European Union parties of the Energy Community (Albania, Bosnia and Herzegovina, Georgia, Montenegro, North Macedonia, the Republic of Moldova, Serbia and Ukraine) could not agree on new targets for decarbonization, renewables and energy efficiency for 2030.

46. The share of energy from renewable sources used in transport activities in the European Union reached 8.9 per cent in 2019,[29] although it is still uncertain if the 10 per cent target for renewable energy use in transport by 2020 will be met. Technological development can enable a switch from fossil-fuelled vehicles to clean vehicles. Electric vehicles combined with renewable electricity generation are seen as a promising approach to decarbonize a substantial fraction of road transportation. However, electric vehicles represent only 0.2 per cent of the European Union's total vehicle fleet and, if they continue to penetrate the market at the current growth rate, it will take around 60 years for them to reach 50 per cent of the current passenger car fleet.[30] At global level, the share of renewables in the transport sector was at 3.3 percent in 2017, the majority of which was consumed in the form of liquid biofuels, predominantly crop-based ethanol and biodiesel.

47. The pan-European region is attractive to tourists from all over the world and the carbon footprint of tourism is significant. The application of the principles of circular economy in the tourism sector in-country or in-resort could reduce the footprint a little, but the major burden remains from travelling itself.

---

[27] International Energy Agency, "After steep drop in early 2020, global carbon dioxide emissions have rebounded strongly", press release, 2 March 2021, available at https://www.iea.org/news/after-steep-drop-in-early-2020-global-carbon-dioxide-emissions-have-rebounded-strongly#:~:text=Global%20emissions%20plunged%20by%20almost,for%20road%20transport%20and%20aviation.

[28] International Renewable Energy Agency, *Global Renewables Outlook – Energy transformation 2050* (Abu Dhabi, 2020), available at https://www.irena.org/publications/2020/Apr/Global-Renewables-Outlook-2020.

[29] Eurostat, Renewable energy statistics, Highlights, available at https://ec.europa.eu/eurostat/statistics-explained/index.php/Renewable_energy_statistics#:~:text=In%202019%2C%20renewable%20energy%20represented,of%20gross%20final%20energy%20consumption).

[30] S. Tagliapietra, G. Zachmann, *Addressing Europe's failure to clean up the transport sector* (Bruegel, 2018), available at https://www.jstor.org/stable/resrep28617?seq=1#metadata_info_tab_contents.

4. Indicators

Greenhouse gas emissions (ECE indicator)

48. The indicator shows the extent to which countries have achieved their specified goals for emissions and the response to country policies for achieving the emissions target.

49. Table 1 overleaf shows available greenhouse gas emission data for pan-European subregions, for the period 2014–2018. The overall changes in the pan-European region, both positive and negative, are highly dependent on "big players", i.e. highly industrialized, populous countries.

Table 1
Total greenhouse gas emissions in the pan-European region (without land use, land-use change and forestry) by subregion, million tons of CO_2 equivalent (2014–2018)

Subregion	*2014*	*2015*	*2016*	*2017*	*2018*	*Trend*
European Union	3,783	3,835	3,834	3,860	3,771	↘
Western Europe	714	699	673	659	648	↘
Central Asia	351	360	361	382	397	↗
Eastern Europe	2,550	2,501	2,526	2,569	2,651	↗
South-Eastern Europe	534	552	577	602	600	↗
Pan-European Region	7,856	7,868	7,891	7,994	7,989	↗

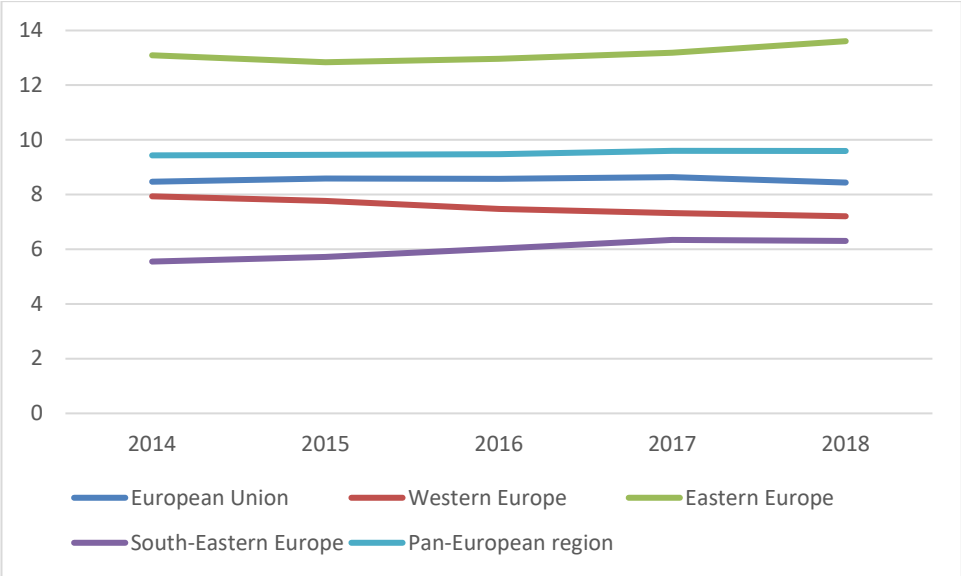
Legend: ↗ – increase in greenhouse gas emissions; ↘ – reduction in greenhouse gas emissions.

Source: Global Sustainable Development Goal Indicators Database and national submissions to the United Nations Framework Convention on Climate Change.

Note: Only countries with available data for the whole period 2014–2018 were counted in sub-regional totals

50. During the observed period (2014–2018) greenhouse gas emissions were reduced in the European Union by 11.24 Mt of CO_2 equivalent, mostly in Germany but with an increase of emissions in 15 other European Union Member States (see figure VI overleaf for an overview). Non-European Union high-income countries including Israel ("Western Europe") also achieved emissions reduction, with the United Kingdom of Great Britain and Northern Ireland accounting for 98.5 per cent of reductions. In Eastern Europe, the increase of greenhouse gas emissions is dominated by an increase in the Russian Federation, while Ukraine reduced emissions by 23.26 Mt of CO_2 equivalent. The trend in South-Eastern Europe and Central Asia is dominated by increase in greenhouse gas emissions in Turkey and Kazakhstan, while data is inexistent for several countries.

Figure VI
Greenhouse gas emissions (without land use, land-use change and forestry) per capita, tons of CO2 equivalent (2014–2018)



Source: Global Sustainable Development Goal Indicators Database and national submissions to the United Nations Framework Convention on Climate Change.

Note: Central Asia not shown as only Kazakhstan reported (21.4 tons CO_2 eq. per capita in 2018, with 25 per cent of the subregion's population); Eastern Europe includes here only Belarus, the Russian Federation and Ukraine (91 per cent of the population); and South-Eastern Europe has only Turkey (alone 84 per cent of the population), which has lower emissions per capita than other countries in the subregion. The pan-European emissions per capita are based on these countries, together with the European Union and Western Europe countries.

Renewable energy share in the total energy consumption (Sustainable Development Goal indicator 7.2.1)

51. The renewable energy share in total final consumption is the percentage of final consumption of energy that is derived from renewable resources. Table 2 overleaf shows this indicator by subregion for the period 2014–2018.

52. Although the consumption of energy from renewable sources in the pan-European region raised between 2014 and 2018 for 1.3 petajoules, the share of renewables stayed the same due to a parallel rise of consumption of energy from non-renewable sources.

53. The renewable energy share in the total energy consumption varies from 4 per cent in Eastern Europe and Central Asia, to 18 per cent in the European Union and Western Europe. The average share for the whole pan-European region is 13 per cent. Only Western Europe saw a stable rising trend in the five-year period (2014–2018).

54. To remain on the 1.5°C pathway requires the share of renewable energy in primary supply to increase globally at an annual growth rate, from 0.25 per cent to 2 per cent.[31]

Proportion of local governments that adopt and implement local DRR strategies in line with national DRR strategies (Sustainable Development Goal indicator 13.1.3)

55. Target E of the Sendai Framework aims at increasing the proportion of local governments that adopt and implement local DRR strategies. Data on Sustainable Development Goal indicator 13.1.3, in the period 2015–2019, indicates that 31 countries from pan-European region reported such strategies, covering 41,850 local communities (see

[31] International Renewable Energy Agency, *World Energy Transitions Outlook: 1.5°C Pathway* (Abu Dhabi, International Renewable Energy Agency, 2021), available at https://www.irena.org/publications/2021/March/World-Energy-Transitions-Outlook-

table 3 below). More than 600 cities in the pan-European region (out of 4,360 cities globally) participate in the "Making Cities Resilient" initiative coordinated by United Nations Office for Disaster Risk Reduction.[32] Moreover, 9,919 local communities from 33 countries of the pan-European region participate in the Global Covenant of Mayors for Climate and Energy initiative. In 2018, about 41 per cent of the European Union population was living in municipalities that are signatories of the Covenant of Mayors for Climate and Energy.

Table 2
Renewable energy share in the total energy consumption, per cent (2014–2018)

Subregion	*2014*	*2015*	*2016*	*2017*	*2018*	*Trend*
European Union	18%	18%	18%	18%	18%	→
Western Europe	15%	16%	16%	17%	18%	↗
Central Asia	3%	4%	4%	4%	4%	↗
Eastern Europe	4%	4%	4%	4%	4%	→
South-Eastern Europe	14%	15%	15%	13%	14%	→
Pan-European Region	**13%**	**13%**	**13%**	**13%**	**13%**	→

Legend: ↗ – increased share of renewables; → – no change in the share of renewables in the total final energy consumption

Source: United Nations Statistics Division – Energy balances, https://unstats.un.org/unsd/energystats/pubs/balance/

Table 3
Number of countries and behaviour regarding local disaster risk reduction strategies, as number of countries per category (2019)

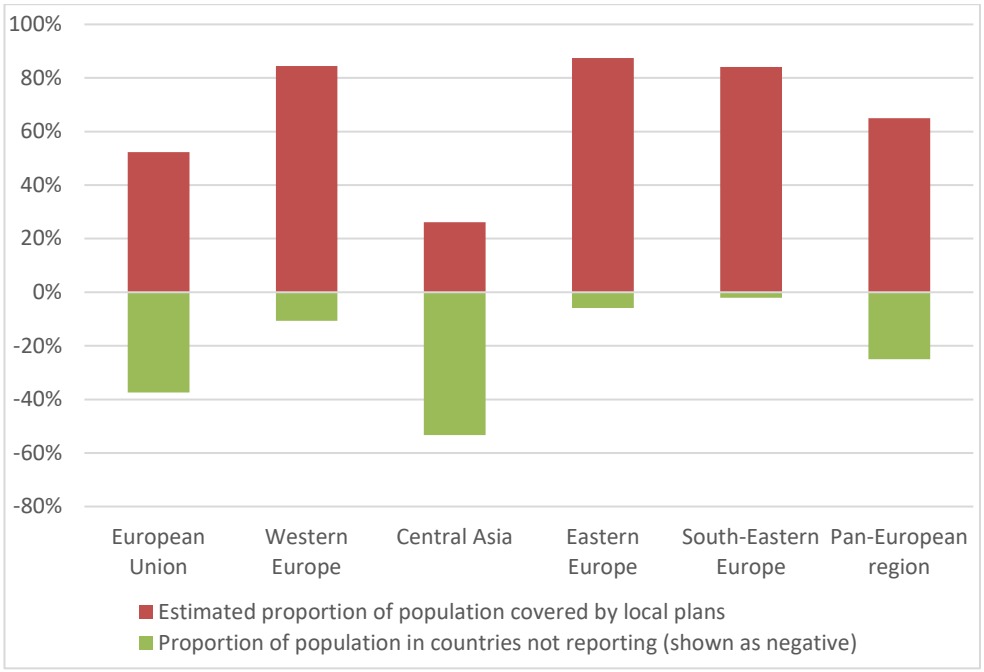
Subregion	*In the subregion*	*Not reporting*	*Having less than 5% of local governments implementing DRR strategies*	*With a stable trend*	*With a rising trend*	*Having 100% of local governments implementing DRR strategies*
European Union	27	13	4	1	0	9
Western Europe	9	5	0	1	1	2
Central Asia	5	2	0	0	2	1
Eastern Europe	7	2	1	0	2	2
South-Eastern Europe	6	1	4	0	0	1
Pan-European Region	**54**	**23**	**9**	**2**	**5**	**15**

Source: Global Sustainable Development Goal Indicators Database, https://unstats.un.org/sdgs/indicators/database/

[32] See https://www.unisdr.org/campaign/resilientcities/cities.

56. The estimated population covered by local DRR strategies in the pan-European region is 65 per cent, due to the large population of countries that do have strategies (for example, France, Germany, the Russian Federation, Turkey, Ukraine and the United Kingdom of Great Britain and Northern Ireland). Coverage greater than 80 per cent is achieved in Eastern and South Eastern Europe, as well as in Western Europe (85 per cent), while Central Asia coverage is below 26 per cent (see figure VII below).

Figure VII
Estimated proportion of population covered by local disaster risk reduction strategies, or for which no data is available, per cent (2019)



Sources: Global Sustainable Development Goal Indicators Database, https://unstats.un.org/sdgs/indicators/database/. Population data from ECE Statistics Database, 2019 or latest.

Note: The estimated proportion of the population covered by local plans is the estimated population covered by plans divided by the subregion's total population.

5. Case studies

Fossil-fuel free Stockholm 2040

57. Stockholm, the capital of Sweden aims to be fossil-fuel free by 2040. As the city's strategy document explains, "Stockholm's ambition is to be totally fossil-fuel free by 2040 at the latest, precluding the use of fossil fuels within the city's geographical boundaries. However, the municipal authorities recognize that it may prove difficult to eliminate fossil fuels in the aviation and international shipping industries, and that some fossil-based plastics will still be incinerated in heating plants in 2040. Nevertheless, climate neutrality or zero net emissions can be achieved by compensating for these residual effects, for example by investing in carbon sinks. Climate neutrality permits the use of fossil fuels provided that CO2 emissions are offset by measures that in some way bind the carbon or carbon dioxide."[33]

58. The plan is that, by 2040, natural gas will be entirely phased out of the city's energy grid and heating system, replaced primarily by biogas. The district heating company has decided to phase out fossil fuels by 2030. To increase the use of renewable energy in transportation from the current 16 per cent to 100 per cent by 2040, the city plans to double

[33] City of Stockholm, *Strategy for a fossil-fuel free Stockholm by 2040*, (Stockholm, City Executive Office, 2016), available at https://international.stockholm.se/globalassets/rapporter/strategy-for-a-fossil-fuel-free-stockholm-by-2040.pdf

the capacity of the public transport system, while improving walking and bicycling infrastructure.

Covenant of Mayors

59. The Covenant of Mayors is the initiative launched by the European Commission in 2008 with the ambition to gather local governments voluntarily committed to achieving the European Union's climate and energy targets. With about 2,000 cities gathered in 2010, the European Commission launched the Covenant of Mayors East initiative that now operates in Armenia, Azerbaijan, Belarus, Georgia, the Republic of Moldova and Ukraine. Nowadays the Global Covenant of Mayors for Climate and Energy is the largest movement of local governments committed to going beyond their own national climate and energy objectives. There are 9,919 members from 33 countries of the pan-European region participating in this initiative. During the Climate Summit in Paris, the European Commission announced the geographical extension of the Covenant of Mayors for Climate and Energy, with new regional offices in Sub-Saharan Africa, North and South America, Japan, India, China and South-East Asia.