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Attaining Carbon Neutrality in the United Nations Economic Commission for Europe Region: Project Update

Summary

This document provides an update on the implementation of the extrabudgetary project on "Enhancing the understanding of the implications and opportunities of moving to carbon neutrality in the ECE (United Nations Economic Commission for Europe) region across the power and energy intensive industries by 2050" (Carbon Neutrality project). The document summarizes the key findings from project's major activities and lists tools that were developed by the ECE Task Force on Carbon Neutrality during this project implementation. This document also discussed the key project findings and the impact that the Carbon Neutrality project has had across the ECE region in helping countries to attain carbon neutrality.

2.0 Background

In its twenty-eighth session, the Committee asked the Group of Experts on Cleaner Electricity Systems (the Group of Experts) to draft a position paper on carbon neutrality and to initiate a dialogue about the challenges in delivering on the 2030 Agenda in all its dimensions in an integrated way that is pragmatic and rational economically, socially and environmentally with a particular focus on carbon capture and storage technologies (ECE/ENERGY/123, para. 34-41).

As a consequence, the Group of Experts discussed the request in its fifteenth session on 5-6 November 2019 and recommended that priority areas include carbon capture, utilization and storage (CCUS), negative emissions technologies (e.g. biomass with CCS (BECCS)), smart grids, energy efficiencies, energy storage, demand side management, environment-focused R&D, and a "just" transition coupled with new business models and innovation (ECE/ENERGY/2019/2, para. 11-25).

In April 2020, the Group of Experts launched an extrabudgetary project[1] on "Enhancing the understanding of the implications and opportunities of moving to carbon neutrality in the ECE region across the power and energy intensive industries by 2050" (Carbon Neutrality project) and initiated consultations on the concept of carbon neutrality with the wider energy expert community. To implement the project the Group of Experts formed a Task Force on Carbon Neutrality (Task Force) to develop the framework on carbon neutrality that is presented in this document.

The framework on carbon neutrality (ECE/ENERGY/GE.5/2020/8) was prepared by the Task Force on Carbon Neutrality for the Group of Experts for the sixteenth session of the Group of Experts on Cleaner Electricity Systems held on 23-24 November 2020 at the workshop on "Attaining Carbon Neutrality". The framework served as a basis for further Carbon Neutrality project implementation.

2.0 Carbon Neutrality Toolkit

During the two-year project implementation process, the Task Force organized over ten capacity building workshops for the ECE member States to raise awareness about a role of CCUS, nuclear power and hydrogen to achieve net-zero. The Task Force also organized a number of consultations with a wider project stakeholder community to identify and assess technology and policy options to attain carbon neutrality in the ECE region by 2050.

Based on the multi-stakeholder dialogues and in consultation with the member States, the Task Force tailored the ECE Carbon Neutrality Toolkit[2] with an aim to support policymakers to make informed decisions towards the

implementation of the 2030 Agenda for Sustainable Development and the Paris Agreement.

The ECE Carbon Neutrality Toolkit consists of a number of technology briefs that provide an in-depth analysis on a role of selected low- and zero-carbon technologies to attain carbon neutrality:

(a) Technology Brief on CCUS[3] – Carbon capture use and storage (CCUS) is the process of capturing carbon dioxide emissions from fossil power generation and industrial processes to store it underground or re-use. The Task Force concluded that the CCUS is essential to unlock the full potential of decarbonization and attain carbon neutrality. Large scale deployment of CCUS technologies in the ECE region would allow countries to decarbonize the energy sector and hard-to-abate industrial sectors in the medium term to bridge the gap until next generation low-, zero-, or negative- carbon energy technologies become available to meet the goals of the Paris Climate Agreement;

(b) Technology Brief on nuclear power[4] – Decarbonizing energy is a significant undertaking that requires the use of all available low- and zero-carbon technologies. The world's climate objectives will not be met if nuclear technologies are excluded. The Task Force concluded that for countries that decide to deploy nuclear power, this technology can play an essential role in decarbonizing the ECE energy systems and the carbon neutrality attainment;

(c) Technology Brief on hydrogen[5] – Hydrogen is considered as an innovative solution to attain carbon neutrality. It is a bulk chemical that is used primarily today in petroleum refining and in the production of ammonia (for fertilisers) and methanol. In the future, hydrogen can be used as an energy carrier and energy storage medium. It has vast, viable applications across a range of sectors that need to be decarbonized, such as transport, industry, power generation and heat for buildings.

In cooperation with the Task Force on Industrial Efficiency[6] the Task Force launched a series of events on carbon neutral energy intensive industries and has drafted a Policy Brief on Carbon Neutral Energy Intensive Industries. The focus was on the energy intensive industries because they are one of the key greenhouse gas emitters, accounting for about 25% of total CO_2 emissions globally and 66% of the industrial sector. Cement, iron and steel, and chemicals and petrochemicals industries are singled out as the most significant industrial CO_2 emitters, with shares in the sector reaching 27%, 25%, and 14%, respectively. The decarbonization of these industries is a top priority to attain carbon neutrality and the Paris Agreement targets.

In addition, the Task Force has also prepared a series of publications under the Carbon Neutrality project implementation. These publications include:

(a) The publication on the Geologic CO_2 storage in Eastern Europe, the Caucasus and Central Asia[7] highlighted the significant potential for CO_2 storage in these regions. Deep saline aquifers, depleted oil and gas fields, unmineable coal seams have been identified as suitable for CO_2 storage. A number of countries in the ECE region have been recognized as regions with high CO_2 storage potential. In the Russian Federation, storage capacity has been identified in the Volga, Western Siberia and Yamal regions with combined storage potential of over 10,000Mt CO_2 in oil reservoirs. Smaller suitable carbon sinks were also identified in Kazakhstan, Turkmenistan, and Azerbaijan;

(b) The publication on Carbon Neutrality in the ECE Region: Integrated Life-cycle Assessment of Electricity Sources[8] is the first step towards a solid, agreed upon definition of sustainable energy and provides a unique categorization of energy technologies and their environmental impact. The results show that all energy technologies impact the environment and subsequently have economic and social implications. Such impacts need to be considered when developing policy frameworks and long-term strategies;

(c) The publication on Technology Interplay under the Carbon Neutrality Concept[9] identifies technology and policy options for the policymakers to attain carbon neutral energy systems by 2050. The Task Force has concluded that all low- and zero-carbon technologies will play a role and require both policy and financing support to deliver on a carbon neutral energy system by 2050. Energy efficiency improvements, renewable energy, high-efficiency fossil fuel technologies with CCUS, nuclear power, hydrogen and integrated and sustainable management of natural resources are all part of the solution to attain carbon neutrality.

3.0 Key Findings and Project Impact

The work conducted under the Carbon Neutrality project and the climate models indicate that current national actions and international climate targets set in the Paris Agreement and at COP26 fall short of delivering on carbon neutrality and limiting global warming to 1.5-2°C.

While the challenge is vast it is still possible to deliver on climate objectives and there are achievable pathways for governments to design and attain carbon neutral energy systems through technology interplay. Policymakers have clear pathways to attain carbon neutral energy systems by

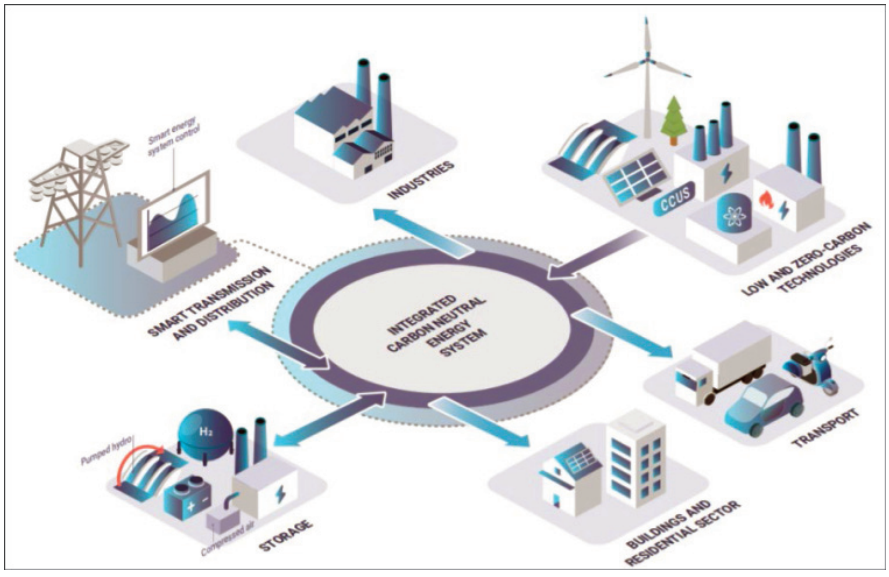

Figure 1: Carbon-Neutral Energy System of the Future

combining existing and new technologies within integrated energy systems. All low- and zero-carbon technologies will play a role in interconnected systems where no energy system will exist in isolation. Innovation and digitalization enable energy systems that are efficient, resilient, and capable of delivering a net-zero region.

The Task Force concluded that carbon neutral energy systems require: i) the diversification of primary and final energy supply; ii) an accelerated phase-out of conventional fossil fuels; iii) the electrification of all sectors through renewable energy and nuclear power; iv) the widespread innovation of low- and zero-carbon technologies (incl. CCUS, hydrogen and next generation of nuclear power, energy storage solutions).

In order to attain a carbon neutral energy system, the ECE region must increase: (i) technology transfer and deployment; (ii) institutional capacity to plan and drive ambitious transformation of energy systems; iii) buy-in and adoption from all stakeholders to build secure, affordable, and carbon neutral energy systems.

The action must start now to maximize the use of all low- and zero-carbon technologies to achieve carbon neutrality by 2050. Policymakers across the ECE region need to: (i) raise awareness about the merits of all low- and zero-carbon technologies; (ii) develop policy frameworks in support of carbon neutrality; iii) create a level-playing field to finance a just transition toward carbon-neutral energy systems aligned to the needs of member States

This integrated approach that is based on the interplay of all low- and zero-carbon technologies will also serve as a basis for the ECE work on designing and implementing resilient energy systems across the ECE region. The Task Force contributed to the development of a list of technical considerations and national actions on how to achieve greater energy security, affordability, and environmental sustainability of energy systems in the ECE region. These technical considerations will be presented at the thirty-first session of the Committee on Sustainable Development and will further define the work of the ECE Programme on Sustainable Energy (CSE-31/2022/INF.4)[10].

ECE has a key role to play as coordinated international cooperation will be essential to attain carbon-neutral energy systems. ECE provides a much-needed inclusive and neutral platform for developing rules, standards, and norms for systemic lifestyle and infrastructural changes. Supportive policies, incentives, and regulatory frameworks encourage regional and sub-regional technical cooperation across power, industry, buildings, and transport sectors for projects of common interest and public-private partnerships.

Over the two-year implementation period, through numerous capacity building workshops and tailored awareness raising tools, the Carbon Neutrality project contributed towards enhancing the understanding of the implications and opportunities of moving to carbon neutrality in the ECE region across the power and energy intensive industries by 2050. The Table 1 lists key performance indicators and elaborates on achieved impact across the ECE member States.

The document on Building Resilient Energy Systems: Technical Considerations and Actions for Achieving Greater Energy Security, Affordability and Net-zero in the ECE Region can be accessed here: https://unece.org/documents/2022/08/informal-documents/building-resilient-energy-systems-technical-considerations-0

References

1. On 19-20 May 2020, the Group of Experts on Cleaner Electricity Systems and UNECE Task Force on Carbon Neutrality organised a two-day consultation workshop and launched the project on Carbon Neutrality. The Workshop gathered over 100 policy makers, industry experts and academia representatives. A number of countries across the ECE region: Austria, Bosnia and Herzegovina, Estonia, Kazakhstan, Kyrgyzstan, Latvia, Montenegro, North Macedonia, Poland, Portugal, Russian Federation, Tajikistan, United Kingdom, presented their national concepts to attain carbon neutrality.

Table 1 : The Carbon Neutrality project in numbers

Indicator	Impact
2020	
Number of member States	National focal points were nominated for the Task Force on Carbon Neutrality
Number of capacity building workshops	Six capacity building workshops were delivered on carbon neutrality framework and CCUS technologies
2021	
Number of capacity building workshops	Eight capacity building workshops were delivered on low- and zero-carbon technologies
Tools for member States to attain carbon neutrality	Technology briefs on Carbon Capture, Use and Storage, Hydrogen and Nuclear Power
	The publication on the Geologic CO_2 storage in Eastern Europe, the Caucasus and Central Asia
2022	
Tools for member States to attain carbon neutrality	Policy brief on Carbon Neutral Energy Intensive Industries
	The publication on Carbon Neutrality in the ECE Region: Integrated Life-cycle Assessment of Electricity Sources
	The publication on Carbon Neutrality in the ECE Region: Technology Interplay under the Carbon Neutrality Concept
Outreach and impact on subregional and national level	Outreach and dissemination of the ECE Carbon Neutrality Toolkit at a series of international events, such as the Clean Energy Ministerial, COP27, Almaty Energy Forum, International Forum on Energy for Sustainable Development, Carbon Neutrality in the ECE Region etc.
	Launch of the activity carbon neutrality attainment in Central Asia
	Launch of the activity on rebuilding the energy system in Ukraine under the carbon neutrality concept

List of the ECE member States actively participating in Carbon Neutrality project implementation: Albania, Armenia, Austria, Azerbaijan, Belarus, Bosnia and Herzegovina, Croatia, Czech Republic, Estonia, Georgia, Germany, Hungary, Kazakhstan, Kyrgyzstan, Latvia, Montenegro, Netherlands, Poland, Portugal, Republic of Moldova, North Macedonia, Russian Federation, Serbia, Spain, Switzerland, Tajikistan, Ukraine, United Kingdom of Great Britain and Northern Ireland, United States of America, Uzbekistan

2. UNECE Carbon Neutrality Toolkit can be accessed here: https://carbonneutrality.unece.org/
3. Technology Brief on Carbon Capture, Use and Storage can be accessed here: https://unece.org/sites/default/files/2021-03/CCUS%20brochure_EN_final.pdf
4. Technology Brief on Nuclear Power can be accessed here: https://unece.org/sites/default/files/2021- 08/Nuclear brief_EN.pdf
5. Technology Brief on Hydrogen can be accessed here: https://unece.org/sites/default/files/2021-10/Hydrogen brief_EN_final_0.pdf
6. More information about the Task Force on Industrial Energy Efficiency that is functioning under the auspices of the Group of Experts on Energy Efficiency could be found here: https://unece.org/sustainable-energyenergy-efficiency/energy-efficiency-industry-sector
7. The Geologic CO_2 storage in Eastern Europe, the Caucasus and Central Asia can be accessed here: https://unece.org/sites/default/files/2021-04/Geologic CO_2 storage report_final_EN.pdf
8. The Carbon Neutrality in the UNECE Region: Integrated Life-cycle Assessment of Electricity Sources report can be accessed here: https://unece.org/sites/default/files/2022- 07/LCA_0708_correction.pdf
9. The Carbon Neutrality in the UNECE Region: Technology Interplay under the Carbon Neutrality Concept can be accessed here: https://unece.org/sustainable-energy/cleaner-electricity- systems/technology-interplay-under-carbon-neutrality-concept