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Carbon neutrality as a pathway to sustainable energy**Pathways to Sustainable Energy – Policy recommendations
from the Expert Group on Resource Management****Note by the Bureau of the Expert Group on Resource Management****I. Introduction**

1. The Expert Group on Resource Management has been active for many years in the development and implementation of the United Nations Framework Classification for Resources (UNFC) which is a global classification system that facilitates comprehensive resource management. UNFC ensures proper treatment of associated technical, social, environmental, and economic challenges and opportunities. The framework currently applies to all resources, i.e., oil and natural gas, renewable energy, nuclear fuel resources, injection projects (e.g. for carbon storage), minerals and anthropogenic resources. Application of UNFC to groundwater resources is under development.

2. Attaining Sustainable Development Goal (SDG) 7 on access to affordable, reliable, sustainable and modern energy requires a focus on all sectors as well as the necessary raw materials not only as fuels but also for structural materials and minerals for the energy systems in production, transmission, storage and distribution. Availability of similar information on renewable energy vectors (heat, electricity and hydrogen) and for the geological storage and use of carbon dioxide is also essential for attainment of SDG 7. UNFC provides a unified framework for all resources to be classified and reported consistently and coherently, which makes the short-, medium- and long-term management of these resources more integrated, efficient and less wasteful.

3. The application of UNFC supports the needs of governments, industry and financial institutions by providing the required disaggregated information on social-environmental-economic viability, technical feasibility and uncertainties involved in producing the quantities. Such information should be available in a uniform manner for all the resources that are required for sustainable energy systems. The United Nations' System of Environmental-Economic Accounting incorporates UNFC. It has received the endorsement from experts globally as a tool for redirecting investment to sustainable outcomes to accelerate attainment of the 2030 Agenda. UNFC is being implemented in many countries and regions, either directly or indirectly by bridging to national systems.

4. While UNFC assists in providing the essential data and information for attaining sustainable development, the complexities involved in the comprehensive management of

resources from a forward-looking and sustainable perspective will also require an integrated resource management system based on UNFC. Therefore, the Expert Group has initiated the development of a United Nations Resource Management System (UNRMS), which will be a tool-kit for managing resources in such a manner that will bring good social, environmental and economic gains.

5. The Expert Group has previously participated in the Pathways to Sustainable Energy project and provided inputs for the development of strategies and actions to ensure the attainment of sustainable energy in the United Nations Economic Commission for Europe (ECE) region. The Expert Group has emphasised the role of holistic and integrated management of resources, aligned to the requirements of the 2030 Agenda for Sustainable Development, as crucial to envisaging the pathways to sustainable energy. The policy recommendations of the Expert Group, summarised in this note, consider crucial aspects such as food-water-energy security, critical raw materials required for sustainable energy systems, the urgent necessity of progressing the circular economy agenda and ensuring the social license to operate.

6. The recommendations provided in this document are especially valid in this current crisis wrought by the COVID-19 pandemic. The health challenges for the ECE region and worldwide are daunting, with a severe potential loss of life, but also with significant short- and long-term impacts on socio-economic and environmental activities. Current demand and resource use trajectories are changing almost every day, and it is still too early to conclude with regards to how the future will look. It is however clear that things will change, at least in the short-term, and that these changes will have significant effects on natural resource use, globally. Some products face shortages, others failing demand leading for instance, to massive food wastage.

II. Resource Management and Pathways to Sustainable Energy

7. Defining the pathways to sustainable energy will benefit from the application of UNFC and UNRMS in ensuring integrated and systemic resource management. UNFC provides the relevant data and information on the social, environmental and economic viability, as well as technological maturity and uncertainty in produced quantities of individual resource projects. In addition, UNRMS, which is under development, will provide the proper management framework for progressing the projects towards maturation.

8. The Expert Group recommends widespread adoption of UNFC and UNRMS by ECE member States to aid policy making and governmental resource management as well as by industry for business process management and by the financial sector for capital allocation. These actions are in general essential for a rigorous and evaluated definition of pathways for sustainable energy, especially to increase resource efficiency, to decrease the carbon footprint and to move towards a more circular economy. Special mention must be made of the UNFC Specifications for Injection Projects, which are crucial for Carbon Capture, Utilisation and Storage projects and the UNFC Anthropogenic Resource Specifications, which are essential for progressing towards a circular economy.

A. Embrace Food-Water-Energy Nexus Approach

9. Since 2019, several crises in the shape of widespread forest fires and the ongoing COVID-19 pandemic have put severe pressures on the planet. Such crises have a significant and immediate bearing on how resources are produced, distributed and consumed, revealing significant stresses on supply chains and the industries they serve when the personnel that service them get sick or incapacitated. Such extreme events are difficult to predict by traditional methods, and the need is clear for a new paradigm for managing stretched human and technical resources during complex acute events. This paradigm shift should enhance efficiency in our immediate responses but should also offer the prospect of better enabling us to limit the exposure to such events in future through better planning and preparedness.

10. Apart from the human costs, all industries, including the critical FEW nexus-related resource sectors, are being impacted by the economic consequences of these most extreme of black swan events. Not only does this focus stakeholder attention on SDG 3 related to good health and wellbeing, but the need in parallel to achieve a better understanding of how sustainable resource management can offer a better basis for preventing infectious diseases from spreading in the future. Such prevention could include support to a clean and healthy environment or better managing movements of people and resources in the global economy. A new paradigm is essential for managing human and technical resources for preserving and enhancing public health, especially in its ability to respond to acute and unpredicted crises, based perhaps or redefining what public health as a term means.

11. The Expert Group recommends adoption of the Food-Water-Energy nexus as a key objective of resource management. Integrating the security, accessibility and affordability of essential resources underpins the sustainable management of resources as called for by the 2030 Agenda. This would need to be adopted with the framework of the principles of resource management¹ such as having:

- (a) responsibility to the planet;
- (b) integrated and indivisible approach to the management of resources;
- (c) a systems view;
- (d) social license to operate;
- (e) full life-cycle view;
- (f) service orientation;
- (g) comprehensive resource recovery;
- (h) circularity;
- (j) zero waste;
- (k) zero harm;
- (l) hybridisation and connectedness to other sectors;
- (m) continuous strengthening of core competencies and capabilities.

12. The Expert Group recommends the use of UNFC and UNRMS as tools that can assist in breaking the “silos” and linking policy objectives seamlessly to project implementation. Energy and water resources are integrally related and strongly interdependent. Facilitating integrated management and monitoring offers an essential foundation for sustainable development. UNFC and UNRMS can support this process by enabling harmonised data and information on energy and water resources.

B. Focus on critical raw materials required for sustainable energy

13. Meeting the needs of a sustainable energy future will have implications on countries’ resource base and the availability, costs and prices of critical raw materials, such as battery minerals and rare earths. Over 80 elements in the periodic table are required for energy production today, e.g. minerals such as lithium, cobalt, and nickel are required for batteries, and rare earths are used in permanent magnets needed by renewable energies, electric vehicles or digital technologies. Sourcing these essential critical raw materials for production purposes will be a challenge. Geopolitical relationships are already shifting since these materials are located in a limited number of countries.

¹ Expert Group on Resource Management (2020), UNRMS Concept note: Objectives, requirements, outline and way forward (ECE/ENERGY/GE.3/2029/4) https://www.unece.org/fileadmin/DAM/energy/sc/pdfs/egrm/egrm11_apr2020/ECE_ENERGY_GE.3_2020_4.pdf

14. The immediate response to the COVID-19 pandemic and the recovery from the severe economic downturn it will trigger will require a massive fiscal response. Numerous countries and multilateral financial institutions have announced many such measures. It is crucial that the related massive investments are directed towards a “green”, and not a brown recovery”, to stay on course to meet the goals of the 2030 Agenda for Sustainable Development. However, the critical raw materials required for a green energy transition are currently not sufficiently accessible.

15. The metals and minerals required for technologies such as solar photovoltaics, batteries, electric vehicle motors, wind turbines, and fuel cells already face key sustainability challenges. The pressure put on supply chains by the COVID-19 pandemic has increased the challenges. The application of UNFC and UNRMS can provide reliable and coherent data on the availability and sourcing of these critical raw materials from all sources (conventional, unconventional, recycling, waste, etc.), to support the roll-out of green technologies.

16. Batteries provide a special case to ponder in defining the pathways to sustainable energy. Batteries require several special materials and have limited life cycles, and over time their energy storage capacities reduce. Alternative technologies, innovation, acceptable international standards and adoption of circular economy practices can reduce material demand and costs as well as increase resource security. These actions are an area that would need to be further analysed as the region is moving towards widespread electrification. UNFC is being applied for the management of battery raw material resources in Europe.²

17. Regional and national tailoring to needs is a prerequisite for sustainable resource management. Several Horizon 2020 projects have work packages to test and implement UNFC as the resource management framework in Europe. EuroGeoSurveys (EGS), the Geological Surveys of Europe, is committed to the development of UNFC and UNRMS. The Mineral Resource Expert Group of EGS is mapping the interoperability between national datasets and UNFC with the development of many case studies. Nordic countries (Finland, Norway and Sweden) have developed locally moderated UNFC guidelines for mineral resources.³ The Norwegian Petroleum Directorate (NPD) has been using UNFC since 2014 for classifying about 700 individual petroleum projects and reporting in annual resource accounts.

18. UNFC is bridged to the Oil and Fuel Gas Reserves and Resources Classification 2013 of the Russian Federation, and the Russian Federation aims to do the same with its minerals system and to pilot use of UNFC in the Commonwealth of Independent States (CIS) region. Financing critical raw materials resource projects in a conventional, market-driven manner could be a challenge, as this sector is viewed as a high-risk industry, so alternative financing mechanisms are being actively sought.⁴

19. Other countries in Central Asia and South-East Europe are following similar integrated approaches. The ECE project “Integrated energy and water resource management in support of sustainable development in South-East Europe and Central Asia”,⁵ funded by the United Nations Development Account (UNDA), started in 2018 with the participation of Bosnia and Herzegovina, Kazakhstan, Kyrgyzstan and Serbia. This project is a good example

² See UN Framework Classification for Resources helps EU to manage raw materials for batteries and shift to circular economy <http://www.unece.org/info/media/news/sustainable-energy/2019/un-framework-classification-helps-eu-to-manage-raw-materials-for-batteries-and-shift-to-circular-economy/doc.html>

³ See Guidance for the application of UNFC for mineral resources in Finland, Norway and Sweden https://www.unece.org/fileadmin/DAM/energy/se/pdfs/UNFC/2018/UNFC_Nordic_guidelines/180212_A_guidance_for_the_application_of_the_UNFC.pdf

⁴ See UNFC to help drive smart investments into mineral and energy projects <https://www.unece.org/info/media/news/sustainable-energy/2018/unfc-to-help-drive-smart-investments-into-mineral-and-energy-projects/doc.html>

⁵ <https://www.unece.org/energy/welcome/areas-of-work/unfc-and-sustainable-resource-management/projects/integrated-energy-and-water-resource-management-project.html>

of regional and national approaches to sustainable resource management.⁶ This project is focusing on application of UNFC and has built-in guidance for management of social and environmental aspects throughout the cycle of natural resource development. Best practices promoted by UNFC drive approaches that can help transform challenges into opportunities, and the experience of this project is worth emulation by all member States.

20. However, the value networks of critical raw materials encompass the whole world. Resources produced in one region may be turned into usable products in another region and consumed in yet another region. Fortunately, UNFC is the common language used in many countries worldwide. Led by the Africa Mining Vision (AMV), a UNFC and UNRMS-based African Mineral and Energy Resources Classification and Management System (AMREC) is now being implemented by the African Union (AU).⁷ Similarly, UNFC is being implemented in a number of countries in Asia and Latin America either directly or indirectly.

21. The Expert Group recommends the creation and strengthening of International Centres of Excellence on Sustainable Resource Management (ICE-SRM) as vehicles to implement and build capacity on UNFC and UNRMS. The ICE-SRM are to be tailored to meet the needs of each region. ICE-SRM are currently envisaged for the European Union region and CIS, as well as in the African Union, East and southeast Asia and Latin America. The Expert Group further recommends sharing of experience and knowledge on sustainable resource management across the network of ICE-SRMs through a central platform managed under the auspices of the Expert Group.

22. Micro, Small, and Medium Enterprises (MSMEs) are the main drivers of economic development in almost all economies of the world. The COVID-19 pandemic has put the critical raw material supply chains under severe pressure but opens opportunities which could be filled by MSMEs. Many of the opportunities will also enable the MSMEs to make significant contributions in sustainable resource management, building resiliency and progress towards the circular economy in the ensuing economic recovery predicted worldwide. However, the economic disruptions have also brought new challenges, which will require innovative solutions. Application of UNFC and UNRMS in sustainable resource management could be useful for MSMEs to build innovative business models and to gain from the new avenues that are being opened. However, MSMEs lack access to information and business networks, especially on issues concerned with resource management.

23. The Expert Group recommends the urgent creation of a platform to bring together MSMEs, policymakers and financial institutions to support resource supply chains in the ECE region. Such a platform could be a starting point for MSMEs who want to develop and operate in the international market for raw materials and other goods. It could act as an interface between the individual companies and the large international institutions and help small and medium-sized entrepreneurs to obtain information and assistance more quickly and effectively. Therefore, the establishment of a raw material alliance for a circular economy is recommended.

C. Adopt Circular Economy Principles

24. The demand for and use of material resources has increased by more than ten times since 1900. The demand is set to double again by 2030. The ECE region remains resource-intensive – even if the resources originate and are processed in other regions. Thus, setting aside environmental implications, natural resource use will be characterised by increased global resource demand and increased uncertainty about resource supplies, although the potential for substitution and increased efficiency should not be underestimated. Despite

⁶ See UNECE helps improve data integration for sustainable energy and water resource management in South-East Europe and Central Asia <https://www.unece.org/info/media/news/sustainable-energy/2019/unece-helps-improve-data-integration-for-sustainable-energy-and-water-resource-management-in-south-east-europe-and-central-asia/doc.html>

⁷ See Africa: world leader in implementing a UNFC-based continental system for sustainable resource management <https://www.unece.org/info/media/news/sustainable-energy/2019/africa-world-leader-in-implementing-a-unfc-based-continental-system-for-sustainable-resource-management/doc.html>

improvements in resource efficiency, use and recycling, the ECE region may be impacted by the increased global demand and related competition for natural resources. The increased demand may have significant implications in the form of price rises and sectoral shortages.

25. Economic output is expected to triple by 2050. However, future economic growth may contribute to increased resource scarcity. Economic growth generally also implies increased resource use and environmental degradation, implying a need to decouple natural resource use and environmental impacts from economic growth. The interdependence of economic systems furthermore means that individual countries and regions, including the ECE region, are increasingly affected by global economic activity. Thus, although resource efficiency is increasing, it is expected that economic growth will drive resource use and emissions to higher absolute levels. For the ECE region, material production has increased from around 13 billion tonnes in 1970 to approximately 20 billion tonnes from 1998 and onwards. The total material footprint generated by the ECE region has been approximately 25 billion tonnes from 2010. Material use contributes significantly to climate change, while the extraction and production of materials have significant effects in terms of land use, eutrophication and acidification, as well as freshwater and terrestrial ecotoxicity.

26. In a circular economy, natural resources use based on closed-loop systems ensure resources are conserved within given product life-cycles. It is now evident that the unhindered production and consumption patterns of natural resources will not be an option for the future. Cutting down on waste and reducing carbon emissions should be the basis for resource use. If this is not achieved within a reasonable time frame, the future of the planet will be in jeopardy. However, models centred on the emerging circular economy framework are not yet mature, so solutions for making the transition from linear to circular are neither easy to conceive nor to put into practice. For this reason, the circularity “gap” remains high.

27. Energy systems are particularly problematic from a circular perspective, principally, as energy production often involves using natural resources whether they are renewable or not. The same applies to other energy sources, such as hydro, wind and solar power, which require large areas of land that may affect environmental conditions and compete with other land uses (e.g., food production). Moreover, energy systems are capital intensive and have lifetimes of forty years or more, with hydro-electric dams having more than 100 years of life. The above factors emphasise some primary challenges underlying circularity. From a resource management perspective, it further demonstrates that balancing energy demand and supply will not only require increasing resource-efficiency and improved natural resources management but also a systems approach whereby all relevant sectors are involved in the implementation of integrated solutions.

28. All current systems, models, standards and best practices were devised to support a linear economy process. It may prove that circular economy action will be difficult to achieve with a linear economy framework. Moving from the present situation to a circular economy may not be achievable if a clear path for repurposing the current system is not found. The UNFC Specifications for Injection Projects and for Anthropogenic Resources will remain essential tools for achieving circularity in resource management. Importantly these specifications can not only contribute to fostering the development of circular economy strategies but also support the long-term resilience of raw material supply-chains.

29. For the circular economy to be realised principles are not enough. The Expert Group recommends that countries share data and align industrial policies and trade in support of shared outcomes as expressed in the SDGs. A global database based on UNRMS principles needs to be set up to capture links between resource uses, and a global platform established for sharing knowledge. The Expert Group further recommends establishment of international partnerships to promote large-scale experimentation and development of UNRMS specifications for performance measurement, reporting and accounting.

D. Ensure Social License to Operate

30. Respect for human rights and the interests, cultures, customs and values of employees and communities affected by resource production is an integral part of sustainable resource management and are stressed in the United Nations Guiding Principles on Business and

Human Rights. Such an approach will need to pursue continual improvement in social performance and contribute to the social, economic and institutional development. Resource management needs to proactively engage key stakeholders on sustainable development challenges and opportunities openly and transparently, and effectively report and independently verify progress and performance.

31. Sustainable resource management can have complex social impacts related to displacement, land rights, cultural heritage, indigenous peoples, gender equality, employment, public health, safety and security, sexual exploitation and abuse, and other issues. Rights-based social safeguards, inclusive dialogue and risk management principles should be applied to resource projects to ensure that they benefit the poor, leave no one behind, and respects human rights. Chief among these is the need to engage all relevant stakeholders, including the public from the start of the project to allow for an inclusive, participatory, transparent, and ongoing consultation during all the planning processes.

32. Sustainable resource management should be based on free, prior and informed consent, in line with the UN Declaration on the Rights of Indigenous Peoples. Several SDG targets reinforce the above views, such as SDG 1.4 (by 2030 ensure that all men and women, particularly the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership, and control over land and other forms of property, inheritance, natural resources, appropriate new technology, and financial services including microfinance) and 16.7 (ensure responsive, inclusive, participatory and representative decision-making at all levels).

33. UNFC has developed Social and Environmental Guidelines which could ensure progress in increasing community acceptance. Mexico, a world leader in petroleum production, has just concluded a unique experiment to see whether improved social and environmental outcomes can be reconciled with long-term profitability, and surprising results have emerged. Mexico has assessed its petroleum resources using the integrated social, environmental and economic criteria outlined in the UNFC. By applying UNFC to nineteen hydrocarbon exploration and production blocks in a pilot project, Mexico has demonstrated that a comprehensive application of social and environmental criteria can deliver superior outcomes.⁸ Other countries can emulate this approach.

34. The Expert Group recommends adoption of social license to operate as a key principle of sustainable resource management. Adoption of social license to operate as a key principle can transform the extractive industry to be acceptable to all stakeholders. Continuous engagement with policy makers, investors, financial institutions, operators and non-governmental organizations will be required to formulate an effective social license to operate. The views of different stakeholder groups should be incorporated in the UNFC and UNRMS specifications.

III. Enabling the Integrated Management of Natural Resources – United Nations Resource Management system

35. If the objectives of the 2030 Agenda are to be achieved in time, and at a reasonable cost, then there has to be a change in the fundamental principles we use to manage resources. The core principles also need to be associative. They should connect to all sectors of development and the ecosystem by weaving a network of activities that leads to beneficial outcomes for people, planet and prosperity. The links of resource management should always be associated and interlinked with the food-water-energy nexus.

36. ECE is extending its work to develop UNRMS with sustainable management of natural resources as its focus. UNRMS will be a tool for integrated, sustainable management of the resources, including the management of contingencies such as greenhouse gas (GHG) abatement, which must involve transnational and agreed on UN-based instruments. The

⁸ See Mexico tests use of UNFC for the assessment of petroleum projects
<https://www.unece.org/info/media/news/sustainable-energy/2019/mexico-tests-use-of-unfc-for-the-assessment-of-petroleum-projects/doc.html>

consistent implementation of UNFC and UNRMS will support the sustainable management of the resource value-chain across multiple countries, which is seen as critical for redirecting investment to sustainable outcomes.

37. The Expert Group recommends future-proofing in the current context of elevated uncertainties due to climate change and exponential population growth. This means looking for interconnectedness that previously did not exist or was not apparent. The standard approach of slow incremental progress may work in future situations. For a world that requires a massive transformation, or when multiple crises such as climate change, widespread fires and the COVID-19 pandemic happen in parallel, there is an urgent need to seek innovative, comprehensive approaches in resource management supported by UNFC and UNRMS.
