UNECE

ENERGY

Pathways to Sustainable Energy

Presentations by Expert Groups

15 May 2019, Geneva

Presentations by Expert Groups

- Group of Experts on Energy Efficiency (GEEE) – Aleksandar Dukovski, Chair
- Group of Experts on Renewable Energy (GERE) – Nazir Ramazanov, Chair
- Group of Experts on Cleaner Electricity Systems (CES) – Igor Litvinyuk for Barry Worthington, Chair
- Group of Experts on Coal Mine Methane (CMM) – Michal Drabik, secretary, for Raymond Pilcher, Chair
- Group of Experts on Gas (GEG) – Rafael Guerra for Francisco de la Flor Garcia, Chair
- Expert Group on Resource Management (EGRM) – Sigurd Heiberg for David MacDonald, Chair and Gioia Falcone, Focal Point and Vice-Chair

Group of Experts on Energy Efficiency (GEEE)

Aleksandar Dukovski, Chair

Key Insights from the Perspective of GEEE:

- Water-Energy-Food Nexus is possible only by efficiency:
  - **Energy efficiency as the first fuel** – Before investing in new production and supply infrastructure, the countries should look in to improving energy efficiency as much as they can.
  - Energy efficiency improvements should to be both **cost-effective** (in comparison with new infrastructure) and **widely available** (technology exchange)
  - **Business models** that prioritize energy efficiency: investments that can deliver **more services** for the **same amount** of energy input, or the **same services** for even **less** energy input. **Pricing of negawatt**.
  - EE policy action in Industry Sector : Lower energy intensity, increased efficiency and **rethink** technologies that are energy intensive.
  - EE policy action in Transport Sector : **Rethink** large freight transport, electricity commuting, **reorganize** cities.
  - EE policy action in Buildings Sector : Building codes, **NZEB** promotion, appliance standards and integrating **flexible business models** for residential sector.
  - **Energy efficiency potential remains untapped**. It should be in **every** scenario.

Policy Recommendations:

- Energy efficiency as the first fuel:
  - Governments need to commit to look at investing in EE before any investments in production and supply infrastructure.
  - Set clear targets for each country to reduce energy consumption according to established action plans (ex. 15% in 2050 compared to 2020)
  - Develop business models with focus on increased energy efficiency and savings. Negawatt pricing. Carbon saving pricing.
  - Industry sector: Set targets for energy intensity, phase-off inefficient technologies, obligatory EMS and increase R&D for energy intensive technologies.
  - Transport sector: Phase-off all oil vehicles according to action plans (ex. 80% by 2050, 100% by 2060), phase-off all urban public transportation on oil according to action plans (ex. 80% by 2030, 100% by 2040), increase R&D for large freight transport and rural area transportation. Develop progressive vehicle standards.
  - Buildings sector: Mandatory new buildings to be 40kWh/m^2/year by 2035 and NZEB by 2050, all public buildings to be NZEB by 2035. All energy intensive appliances to be programable based on open standards framework.

Group of Experts on Renewable Energy (GERE)

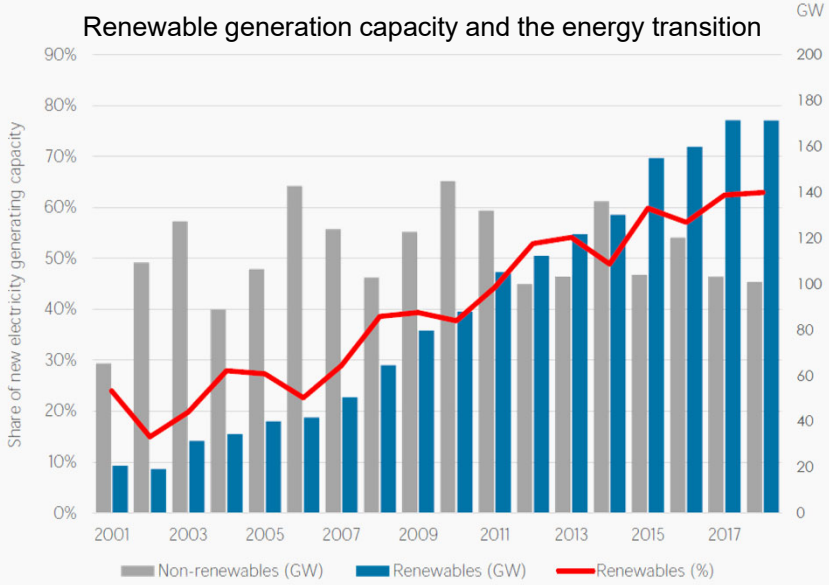
Nazir Ramazanov, Chair

Key Insights:

Opportunities to scale up renewable energy in UNECE region

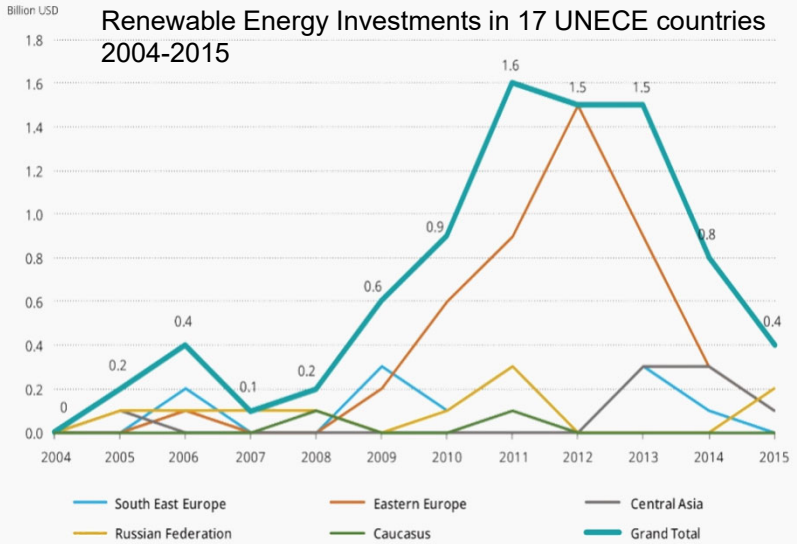
- At the end of 2018, global renewable generation capacity amounted to 2 351 GW
- 7.9% Growth in renewable capacity, 171 GW Increase in global renewable generation capacity
- 84% Wind and solar share of new capacity in 2018
- UNECE 17 Countries: Decline of investments despite high potential

Renewable generation capacity and the energy transition



IRENA Capacity Statistics 2019

Renewable Energy Investments in 17 UNECE countries 2004-2015



REN21 UNECE Renewable Energy Status Report 2017

Policy Recommendations:

Create a suitable environment for renewable energy investments through:

- Energy reforms to remove barriers;
- Improve normative, regulatory and financial framework on holistic and integrated approach, also to address environmental and nexus related issues;
- Establishment of renewable energy funds;
- Innovative mechanisms to develop cost-effective renewable energy on a sustainable, reliable and affordable manner;
- Future energy system based on country-specific conditions;
- Strengthening technological and regional/cross-border cooperation: exchange of country experiences, trade and effective use of infrastructure, joint/ regional investments
- Increased cross-sectoral cooperation within a future energy system: trade-offs and synergies between renewable energy and gas for multiple objectives

Next Steps and Priorities in the UNECE Region

- UNECE has a significant untapped renewable energy potential
- Tracking of RE development: UNECE REN21 RE Status Report 2020
- Exchange of experiences & practices for common and faster action
- A holistic and integrated approach for inter-sectoral and cross-sectoral cooperation taking into account nexus criteria and added societal benefit, e.g. trade-off and synergies between RE & Gas; RE & Water management.
- Support member States in finding solutions to overcome existing barriers in the RE sector through multi-stakeholder dialogue – since 2016, UNECE RE Hard Talks in Georgia, Ukraine, Azerbaijan, Kazakhstan, Bosnia and Herzegovina, Serbia. Next Renewable Energy Hard Talk in the Russian Federation, 18-19 June 2019.

Group of Experts on Cleaner Electricity Systems (CES)

Igor Litvinyuk for Barry Worthington, Chair

Key Insights:

- Many **UNECE** Member States **will continue to use fossil fuels for power generation** for decades (i.e., coal; natural gas; petroleum derivatives up to 2050 and beyond)
- An **opportunity exists** to assure that this **utilization** occurs with the **highest possible efficiency and lowest possible emissions.**
- **Deployment of digital technology** can improve operational efficiencies that must be considered in integrated system planning, engineering and construction.
- **Smart buildings; smart cities and smart grids** will deploy technologies that are not currently contemplated by today's legal and regulatory frameworks.
- **Cleaner Electricity Systems will be the centerpiece** of achieving nearly all of the UN SDG's. Consequently, it will be a pivotal factor in the work of the UNECE CSE. All groups of experts; and a key building block on the Pathway to Sustainable Energy.

Policy Recommendations:

- UNECE Member States should **adopt fiscal policies that provide CCS/CCUS/HELE technologies** with parity with other low carbon/no carbon electricity generation technologies.
- UNECE Member States should **support development/adoption of recommendations leading to standards for efficiency of power generation**, initially coal; then other fossil fuels; eventually renewables and other alternatives as new, advanced technologies enter the marketplace. Recommendations should be targeted at International Financial Institutions as well as commercial lenders.
- UNECE Members States should **support R&D into innovative technologies while adjusting policy frameworks to accommodate "disruptive" technologies**, some of which are today unknowable.
- UNECE members should **strive for deeper bi-national and regional energy market integration.** In doing so, they must be mindful of the need to harmonize conflicting real-world realities, such as environment, economic and social concerns.

Next Steps and Priorities

- **International collaboration is the key to sustainable energy** – both within the UNECE regions and with other regions.
- **Keeping all energy options open** – for existing and emerging technologies is crucial.
- Energy access, affordability, safety, security, reliability, and environmental responsibility are essential to reaching UN SDG
- Future activities should include:
  - **Defining and quantifying energy subsidies**;
  - **Identification of barriers to energy efficiency** – in some countries energy went from an era of scarcity to an era of abundance – and in some examples prices have moderated. We could reinforce the value of EE.
- Further work on integrated traditional systems with alternatives is warranted.

Group of Experts on Coal Mine Methane (CMM)

Michal Drabik, secretary, for Raymond Pilcher, Chair

Key Insights from the Perspective of CMM:

- Coal Mining Lifecycle
  - Coal will be a prime energy fuel for decades to come, and **global emissions of methane will continue to increase** as mining continues to access deeper resources.
  - Coal and methane are co-located resources in many parts of the world and key coal producing nations often mine coal in gassy regions emitting greater than 750 million tonnes of CO_2e or 52.5 billion cubic meters of methane per year. Much of this is emitted as a low concentration methane in air mixture.
  - **Methane emissions do not cease at the time of mine closure**. Methane escapes through abandoned mine openings (perfect seals are not possible), through natural and mining related fractures and other conduits. **Surface mines** also emit methane, additional study is needed to verify estimates of emissions.
- Mitigation of emissions
  - **Mitigation is possible** and some projects are operating to reduce methane emissions at active and abandoned mines.
  - Annual emissions from one large underground coal mine in the USA can emit 2 million tCO_2e per year, or more, a mitigation project at similar size mine rivals CCS projects at power plants

Policy Recommendations:

- Encourage member States to **pass legislation that clarifies ownership** and **promotes global recognition** that coal associated methane is an important energy resource and a powerful greenhouse gas. This will enable beneficial use and mitigate emissions.
- Encourage preferential **access to pipelines and power grids** for gas and electricity produced from methane sourced at active and abandoned coal mines.
- Natural gas and electricity **pricing should be preferential** for energy produced from, CMM e.g. feed in tariffs and preferential dispatch.
- Introduce **tax incentives** to support CMM projects or pass legislation to **tax carbon** emissions.
- **Emissions trading** groups should be formed between coal mines and consumers to promote methane emissions reductions at coal mines through projects financed by coal consuming industry, i.e, power, cement and steel producers and **emissions credits** used as offsets for the industrial consumer's emissions.
- Establish government backed loans to **finance** development of coal mine methane emissions reductions projects. Encourage the development of a revolving fund to finance a broader array of projects

Next Steps and Priorities

- Greenhouse gases emitted during the coal mining lifecycle can be reduced if confronted
  - The **barriers** to reducing GHG emissions throughout the coal mining life are **not technological** but are caused by **gaps in policy and lack of financial support**
  - **Methane** emitted during coal mining can be used to **produce heat and electricity**, **chemical feedstocks** and **motor fuel**
    - It can be **employed to supply energy** for water purification at coal mining sites and local communities (SDG8)
    - Rather than become a fugitive and powerful GHG emission, it should be recognized as a **valuable resource** that can be **captured and used responsibly**(SDG12)
    - As coal mines inevitably close, coal associated gas may continue to be **produced and used to fuel for alternative industry development** if the value is recognized and innovation is supported by appropriate and targeted policy and infrastructure (SDG8) and (SDG9)
    - Coal mining world wide is inextricably linked with the surrounding cities and communities. Mine closures stress the fabric of the community but though **innovative business model development, community leadership, and innovative finance**, these disruptions can become **opportunities for rebuilding and growth** (SDG11)
    - The **CMM GoE** has a strong relationship with the **Global Methane Initiative**, it must forge other **partnerships to disseminate and promote** the capture and use of this gas (SDG17)
  - Coal is likely to be a part of the world energy mix for decades to come but its role in a sustainable energy future of coal is a matter of expert dispute
    - The coal mining industry needs to adopt low emissions mining operations that emphasize higher safety standards and zero fatalities
    - I**ndustrial coal consumers** must assume some responsibility for environmental degradation that occurs throughout the coal mining life cycle and work toward **energy efficient—low emission consumption**
    - Countries and communities must prepare for the **end of life phase of coal mining** as **resources are depleted** and **usage patterns and markets change**
  - CSE Expert Groups should work together to develop a *Best Practice Guidance to a Sustainable Energy Future*
  - Additional **scenarios** should be tested in Phase 2 of the Pathways Project to **test various options for energy infrastructure transformation**; the results should be used to help **guide the future work programmes** of the Expert Groups

Group of Experts on Gas (GEG)

Rafael Guerra for Francisco de la Flor Garcia, Chair

Key Insights from the Perspective of GEG:

- Natural gas (NG) as a key tool to advance in the decarbonization of the UNECE. NG is particularly relevant for the **SDG 7** to increase access to affordable, reliable and sustainable energy, to accelerate the uptake of renewable energy and to improve energy efficiency.
- Sustainable pathways cannot be achieved without the right level of **energy infrastructure**. The **gas infrastructure can deliver high storage and transmission capacity** in a very efficient and cost-effective way.
- **Decarbonization projects (Power to Gas & Energy Storage) and renewable and Low Carbon Gases implementation** (Green/blue hydrogen and biomethane) decrease environmental impact and carbon footprint of the energy sector
- Conducting **methane emissions mapping** exercises help to understand the real impact of methane on climate change and to close the knowledge gap in terms of detection, quantification and mitigation of methane emissions along the gas value chain.
- Replacing more polluting fuels with gas, especially in sectors such as in electricity generation, heating and, as much as possible transportation, is an effective way of addressing the issue of **air pollution**

Policy Recommendations

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Policy Recommendations:

- **The pathways should be technology-neutral** and always the **most cost-efficient**, bearing in mind that the energy future under COP21 agreement will be a combination of renewable/low carbon electrons and renewable/low carbon molecules.
- Promote the **necessary energy (gas and electricity) infrastructure and energy interconnectivity** among markets to enabling energy supply competition, liquidity, price convergence, diversification of energy supplies, renewable integration, etc., resulting in more competitive and **affordable prices** for consumers
- Ensure a **cost-efficient energy storage system** for the short, medium and long-term is therefore essential. In this regard, the role of gas system should be acknowledged. Via Power-to-gas technologies electricity can be stored in the form of gas within the gas system at minimum costs. . The gas system can deliver high storage and transmission capacities in a very efficient and cost-effective way. **Gas infrastructure is well positioned to help overcome the challenges of decarbonization**
    - Ejemplos: https://www.entsog.eu/index.php/innovation-transition
    - Include in the power and gas grids development plan the effects of integrating growing shares of variable renewable (wind and solar). Wind and Solar will impose high requirements in terms of flexibility and peak demand from conventional generation technologies (i.e. gas)

Policy Recommendations

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Policy Recommendations:

- Recognise the importance of **renewable gases** (such as hydrogen and biomethane). **Sector coupling and sectoral integration** are essential elements for advancing in the **decarbonisation**. This framework should recognize the positive externalities of renewable and low carbon gases:
  - For instance in biomethane, from an ecological perspective, using the digestate, which is a biomethane production by-product, instead of chemical fertilisers, reduces pollution of ground water. Fast growing energy crops, planted and harvested between two main crops and then used to produce biogas, contribute to carbon storage and do not compete with land for food usage. Economically, biomethane production creates local jobs and provides an income supplement for farmers that are involved in the process. From a security of supply point of view, large quantities of biomethane can be produced within Europe reducing the import dependency of the European energy system.
  - Ejemplos: https://www.entsog.eu/index.php/innovation-transition
- Policies to manage **methane emissions** across the value chain should enable the role of gas in the future global energy mix by helping governments achieve their climate goals, instilling stakeholder confidence with respect to gas´ environmental value and term predictability that allow industrial planning and investment
- Implement measures to improve quality of life by enhancing **air quality** in big cities and much polluted areas. This should be done as quick as possible and on the most cost-efficient manner. Gas is well-positioned to tackle this challenge. As for example: Beijing, Shanghai, Urumqi, Santiago de Chile, New York, Istanbul, Toronto, Berlin, Dublin, Krakow and Rotterdam

Other Messages

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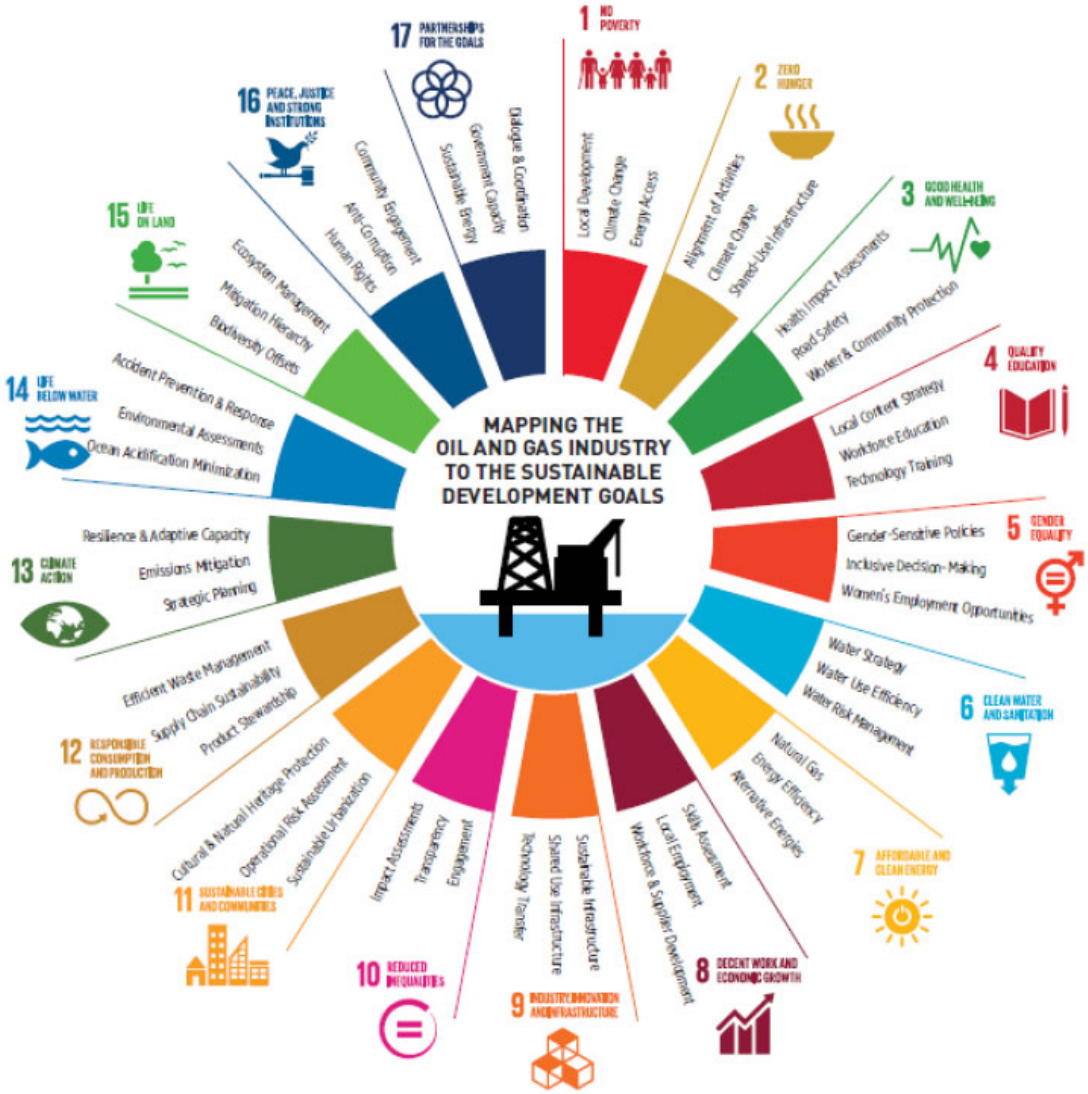
Gas supports Sustainable Development Goals



Source: Mapping the oil and gas industry to the Sustainable Development Goals: An Atlas, 2017, IPIECA, IFC, UNDP.

Expert Group on Resource Management (EGRM)

Sigurd Heiberg, for David MacDonald, Chair and Gioia Falcone Focal Point and Vice-Chair

Key Insights

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- **Oil & gas still leading the transition.** RE and nuclear will not displace them unless further financial/policy drivers exist. Oil should be replaced by gas, RE and nuclear for heating and transport, and kept for petrochemicals.
- **RE alone will not suffice** to achieve 1.5/2.0 ºC target:
  - Gradual phase out of coal and replacement by gas, cleaner coal technologies, greater focus on energy efficiency.
  - Hydrogen not an effective solution yet. Should seek a sustainable energy mix rather than focusing on fuels/technologies in an isolated manner.
- **Nuclear energy can play a key role in decarbonising the electricity sector** towards meeting the Paris Agreement targets.
- **Synergies between fossil fuels and RE**. Increasing role of natural gas as a bridging fuel leading to 2030.
- **Contrasting views on CCS**. Viable technology if costs decrease. Huge investments required, which may have a negative social impact, currently no policy incentives provided.
- **Use of natural resources has more than tripled from 1970** and continues to grow. Over 80 elements in the periodic table are required for energy production today. This high levels of resource production are responsible for:
  - 5% of total greenhouse gas emissions
  - 90% of biodiversity loss
  - 90% of water stress
- **Massive amounts of critical raw materials** required (e.g. for batteries and RE technologies, such as lithium, cobalt and nickel) **for sustainable energy**, which could be a limiting factor also due to induced import dependency bottlenecks (with large amounts of materials supplied by China, Japan, etc.). Alternative technology, acceptable international standards and adoption of circular economy can reduce material demand and increase resource security.
- **Systems-thinking approach.** Whole life-cycle of resource production and consumption should be considered both from producers and consumers' side. End-users become more aware about environmental and social issues, which can potentially lead to large shifts of behaviour.
- **Business models and disruptive technologies**: Shale oil disruptive force in recent years, better storage technologies, decentralized RE production. Growing interest for small modular reactors (SMRs) due to their lower costs, improved safety, increased flexibility and potential new applications for further decarbonisation of industry (through high grade heat for industrial processes) and transport.

Policy recommendations

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- **Governments should develop new, transformative policy instruments**. Regulation appropriately modified to foster the rapid demand and supply of low carbon technologies. System-thinking approach can induce high impact. For example, tightening the regulation of plastics could significantly reduce the rate of oil demand.
- **Role of nuclear** as a source of low carbon baseload electricity should be recognized by governments and promoted within SDGs as part of the low carbon solution. Key component of the power mix, especially if uranium and thorium resources available from the country.
- **Alternative business models** moving away from energy as commodity (push model/ customer communication as a one dimensional bill) to energy as service, where customer partners with (or even replaces) the provider.
- **Development of storage technologies** should be pushed by governments, main game changer for RE. Heat storage in molten salts and other forms of storage should also be investigated.
- **Global governance required to ensure optimal usage of scarce resources and reduction of import dependency. Promote innovation** for transition from a linear to a **circular model.**
  - Set raw materials efficiency targets (at global, national and industry level), develop national plans for sustainable use of natural resources, adoption of policy mixes (such as regulations, market-based instruments) tailored to national context;
  - Pressure on resources will continue to increase. Knowledge will be crucial for resources management and strengthening the circular economy. There is a need for a comprehensive raw materials management system, such as the United Nations Resource Management System (UNRMS) assessing resources for the circular economy. This methodology should be adopted by all UNECE member States;
  - Waste management should be part of the initial development plans. Zero waste principal should be built into incentives.
- **Resource curse** can be avoided if a dynamic systems approach and proper information architecture are used in studying the problems, proper tools could be developed. The UN Resource Management System is one such approach.

Next Steps and Priorities

- Deep dive in circular economy, resource efficiency and sustainable consumption and production and their role in energy system transformation. Rate of recycling and reuse of materials can vary from 1 to over 80%. Business opportunities and policies that can promote circular economy. Synergies with SDG12 and SDG9.

- Deep dive on battery storage as a key game changer for accelerating uptake of renewables and EVs. Impact of import dependency for access to critical raw materials used in low carbon energy technologies. Synergies with SDG9.

- Investigate impact of electrification, digitisation and decentralisation as main drivers for decarbonisation of energy system. Business opportunities, policies and access to finance.

- By 2030, global demand for water, food and energy will increase between 40% and 50%. Interdependencies among resources (food, water and energy stress nexus) and impact on sustainable energy could be investigated at regional and sub-regional level. Determine how policies should promote more balanced intersections between energy, environment, health, security, education and social justice. Synergies with SDG8, SDG12, SDG11.

- Deep dive on nuclear energy, quantification of potential impacts/benefits towards providing sustainable energy for all. Role of small modular reactors.