29th Session of the Committee on Sustainable Energy
Pursuing Carbon Neutrality to Advance the Energy Transition

25-27 September 2020, Geneva
4. Carbon neutrality as a pathway to sustainable energy

Jarad Daniels
Vice-Chair, Committee on Sustainable Energy
4. Carbon neutrality as a pathway to sustainable energy

- Pathways to sustainable energy
- Framework on carbon neutrality
- Recommendations for policy makers
- Next steps and future phases
Meeting the 2030 Objectives will require:

- Pursuing systemic efficiencies
- Cutting CO2 emissions significantly by 2050
- Optimising existing fossil-based infrastructure
- Accelerating deep transformation of the energy sector
- Advocating efficient integration of energy markets
- Promoting sustainable resource management
4. Carbon neutrality as a pathway to sustainable energy

Kostiantyn Gura
Chair, Group of Experts on Renewable Energy
GERE Cooperation with other Expert Groups across Key Areas of Work

Synergies between RE and Gas
Joint GERE & GEG TF on Hydrogen

Carbon Neutrality Project ->
reflecting role of RE in
attaining carbon neutrality in
UNECE, feeding in findings
from GERE activity on tracking
progress in the uptake of
renewable energy sources
Long-term -> digitalization and
decentralization -> focus on
smart grids and technology

Long-term -> energy
efficiency and
digitalization;
sustainable cities,
smart buildings,
energy as a service,
prosumers etc.

Water – Energy Nexus ->
sustainable resource management,
application of UNFC for various
renewable energy solutions
Long-term -> tracking resources
for batteries
HYDROGEN – an innovative solution for carbon neutrality?

Hydrogen provides multi-sector decarbonisation

- Transport
- Power Generation
- Industry
- Heat

Net-zero Blue H2

Green H2
Vladimir Budinsky
Acting-Chair, Group of Experts on Cleaner Electricity Systems

4. Carbon neutrality as a pathway to sustainable energy
Carbon Neutrality across Power & Energy Intensive Industries

Cut 90Gt of CO₂ emissions by 2050 & meet quality of life aspirations

Develop & deploy zero and negative carbon technologies

What is the available carbon budget? (% total GHG target by 2050)
ECE countries must cut/capture at least 90Gt of CO$_2$ by 2050 to meet 2°C.
Attain carbon neutrality by balancing carbon emissions with carbon removal through natural systems, sector coupling and an integrated approach.
**Carbon Neutrality Framework**

**Attaining carbon neutrality in the UNECE region by 2050!**

### Targets for power sector and energy intensive industries to cut carbon emissions

<table>
<thead>
<tr>
<th>Energy Supply</th>
<th>Energy Infrastructure</th>
<th>Energy Demand</th>
<th>Carbon sinks</th>
</tr>
</thead>
</table>
| Policy measures and tools:  
- Available resources  
- New technology deployment  
- Energy self-sufficiency  
- Diversity of energy supply  
- Free trade of energy resources  
- Availability of capital  
- Standardization  
- Regulatory systems  
- … | Policy measures and tools:  
- Interconnecting infrastructure (pipelines, LNG terminals, HV lines)  
- Energy storage  
- State of existing energy infrastructure; 3rd party access  
- New and planned energy infrastructure projects  
- Availability of capital  
- Standardization  
- … | Policy measures and tools:  
- Energy access  
- Energy affordability  
- Monetizing emissions & incentivizing emissions cuts  
- Efficiency improvements  
- Post-Covid-19 behavioral changes  
- … | Policy measures and tools:  
- reforestation  
- Use of land  
- Oceans  
- Sustainable use of biomass  
- … |

### Scenarios to attain carbon neutrality based on different technology options and across all UNECE subregions

<table>
<thead>
<tr>
<th>Technologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>renewable energy</td>
</tr>
<tr>
<td>HELE</td>
</tr>
<tr>
<td>energy storage (batteries, power-to-X, hydro)</td>
</tr>
</tbody>
</table>
“Ideal” mix does not exist

No single or simple solutions to reach sustainable energy goals

A host of policies and technologies will be needed across every sector to keep climate targets within reach, and further technology innovation will be essential to aid the pursuit of a 1.5°C stabilization.
Define Carbon Neutrality Framework

Develop technology briefs:
- Role of CCUS in attaining carbon neutrality
- Role of nuclear energy in attaining carbon neutrality
- Role of innovative solutions (e.g. hydrogen) in attaining carbon neutrality and decarbonizing energy intensive industries

Task Force Mid-term Objectives:

- Apr: Defining Framework on Carbon Neutrality Workshop I
- May: Drafting carbon neutrality framework
- Jun: Develop narratives for assumptions and key questions for model to answer
- Jul: Strengthen assumptions that feed into model
- Aug: Modelling exercise
- Sep: Present Carbon Neutrality Framework to the Group of Experts on Cleaner Electricity Systems and the Committee on Sustainable Energy
- Oct: Finalising Framework on Carbon Neutrality Workshop II
- Nov: Results and policy recommendations
Carbon Neutrality Project Status

Timeline for H1 2021:

- Finalise CCUS and Nuclear Energy Technology & Policy Brief
- Brief on decarbonisation of energy intensive industries
- Interplay of selected technology options within the carbon neutrality concept
- Dialogue on financing modernization of the power & energy intensive industries
4. Carbon neutrality as a pathway to sustainable energy

Francisco de la Flor
Chair, Group of Experts on Gas
The future decarbonized energy system will be an optimal combination of “electrons and molecules”, in which the electricity and gas sub-systems are progressively more interlinked, increasing the share of renewable energy -- either as electricity or as gas.

A successful transition to an affordable and clean energy system in the future will require that both traditional and emerging technology fulfil their decarbonisation potential.

The gas infrastructure as the backbone of a low-carbon energy system.

Low carbon, decarbonized and renewable gases: methane/biomethane and hydrogen.

LNG will have to remain a key component of the energy equations in many years to come.
Hybrid System – Sector Integration

Source: ENTSOG
Renewable and Low-Carbon Gases: backbone for the future Energy System

Legend:
MET = Methanisation; P2G = Power to Gas; SMR = Steam Methane Reforming, PYR = Pyrolysis; CCS = Carbon Capture and Storage; CCU = Carbon Capture and Utilisation
Terminology for New Gases

**Renewable gases**
- Biogas / Biomethane
- Renewable hydrogen

**Decarbonised gases**
- Synthetic gas

**Low-carbon gases**
- Hydrogen >90% decarbonisation**

**Natural gas**

**Process**
- Anaerobic digestion / Gasification
- Pyrolysis / Gasification
- Power-to-gas (P2G) / Electrolysis
- Photo catalysis

**Energy source**
- RES (Renewable feedstock incl. waste-based gases - cf. RED II)
- Electricity from RES
- Natural gas or other hydrocarbons
- Natural gas or other hydrocarbons
- Natural gas

* Disclaimer: This overview is based on existing processes and known technologies and evidently does not preclude new technological developments.

** compared to natural gas

Source: New Gases Network
Carbon neutrality through synergies between gas and renewable energy – Recommendations

- Recognise the value of the flexibility provided by gas-fired power plants
- Take into account the impact of variability from VRE on natural gas demand
- Set up a policy and regulatory framework to enable a Hybrid Energy System
- Implement an adequate regulatory framework for VRE integration
- Promote sectoral integration - couple the electricity, gas and end-use sectors
  - Foster research, development and innovation
  - Establish principles for how to transport new gases (hydrogen, biomethane and others);
  - Clarify market access and grid access rules for renewable, decarbonised and low carbon gases to the gas grid
  - Manage gas quality in a proper way
  - Implement standardised GOs/certificate frameworks across the ECE region for renewable, decarbonised and low-carbon gases.
- Widen the concept of “renewable energy”
  - Introduce a “new gases” terminology
  - Enable synthetic methane to be classified as a renewable energy. However, guidance is needed to avoid double counting of CO2 reduction between the provider and the user of CO2;
- Deploy a digitalization environment
- Share knowledge and experiences across the ECE region
Hydrogen – an innovative solution to carbon neutrality - Recommendations

- Expand collaboration on hydrogen production
- Encourage collaboration between ECE, other Regional Commissions, and other UN entities in promoting joint projects
- Consider behavioural change through hydrogen market design/market stimulation
- Be agnostic and open-minded and not prescribe upfront
- Speak the same language
- Accelerate electrolyser development and deployment.

In conclusion: hydrogen, although clean and versatile, is not an energy source but an energy vector. It must be produced, transported and stored before being converted to other forms of energy, such as electricity or heat, or to other feedstocks. Our future work in this field may help remove barriers to how we produce, transport, trade, store and use hydrogen.
4. Carbon neutrality as a pathway to sustainable energy

Stefan Büttner
Co-Chair, Task Force on Industrial Energy Efficiency, Group of Experts on Energy Efficiency
The Energy Efficiency Barometer of Industry
The #EEBarometer covers 88 countries in 10 languages.

- **United Kingdom:**
  - ECCI (Edinburgh Centre for Carbon Innovation)
  - CATAPULT (High Value Manufacturing)
  - ecci
  - ITALCOGEN

- **Italy:**
  - Assicurazione dei costruttori e distributori di impianti di cogenerazione

- **Germany:**
  - University of Stuttgart Institute for Energy Efficiency in Production EEP
  - TÜV Rheinland
  - PRECISELY RIGHT
  - KEA-BW DIE LANDESENERGIEAGENTUR
  - Rez

- **Sweden:**
  - Linköping University

- **Latvia:**
  - LMABF (Laboratoriums i Materialteknik)

- **Austria:**
  - UNECE
  - Mac Nulty Consulting
  - Fraunhofer IPA

- **Spain:**
  - Comillas University Foundation

- **Mexico:**
  - ALLIANCE TO SAVE ENERGY

- **United States:**
  - Alliance to Save Energy

- **Canada:**
  - Expense Reduction Analysts

- **Poland:**
  - Expense Reduction Analysts

- **Slovenia:**
  - Expense Reduction Analysts

- **Global:**
  - Energy Efficiency in Industrial Processes
  - UNECE
  - University of Stuttgart Institute for Energy Efficiency in Production EEP

**Country specific barometer and economic indicator**

**Country specific barometer**

**Global barometer in widely used languages**

**Global barometer in English, Spanish, French, Russian or German**
The Energy Efficiency Barometer of Industry

#EEBarometer

Open until 31 Dec: www.eep.uni-stuttgart.de/eee

- Reduces unknowns, risks and uncertainties
- Informs decision makers about the current state and needs of the economy
- Analyses the impact and effectivity of pilot and development schemes
- Informs finance sector and service providers about feasible approaches and mechanisms
- Shows were companies stand in relation to others
- Delivers evidence on where and how to act to increase energy productivity
- Allows, in the medium-term, cross-country, sector-specific analyses -> TOP-Runner

© Institut for Energy Efficiency in Production EEP / Fraunhofer IPA