Pathways to Sustainable Energy
Item 4: Role of Fossil Fuels in Decarbonizing Energy Systems

14th session of the Group of Experts on Coal Mine Methane
7 November 2019, Geneva
**Mission (Im)Possible?**

- It is possible to achieve sustainable energy through **collaboration**, forward looking policy measures for investors & immediate action.

- **Technology transition** is imperative to attain sustainable energy and meet 2°C target.

**Reality Check**

- In UNECE region 80% of today’s energy fossil fuel based. Even under a scenario that meets the 2°C target, fossil fuels will still account for at least 56% of the region’s energy mix by 2050.

- 200GW of relatively new coal-fired power plants are still operational in 2050.
Comparing investment requirements - UNECE REF, NDC and P2C scenarios (2020 – 2050)

+ $200 billion p.a.

Billion US$2010

REF

NDC

P2C

Key Message
“Delay is expensive!”

Energy transition cost increase to meet 2°C target is negligible compared to social and health costs. Air pollution ALONE cost $1.8 trillion in 2015 in OECD and BRIICS* combined

- T/D&S: transmission, distribution and storage of electricity and district heat
- CCS: carbon capture and storage
Address GHG Emissions throughout the whole Coal Value Chain

Integrated Coal Value Chain

Extraction & Processing

Coal Mining

End Market

Power Plants

Industry

Steel & Cement

Global Abandoned Mine Methane (AMM) and Coal Mine Methane (CMM) Emissions – Reference scenario, source: PNNL 2018

Opportunities to Address GHG Emissions during Coal Mining Life Cycle

1. Pre-mine Drainage
2. Methane Capture and Use during Coal Extraction
3. Abandoned Mine Methane
Environmental, Economic and Social Concerns

Environmental Concerns

- Promote carbon neutral technologies, especially in the case of most carbon intensive uses.
- Introducing water and air management in existing assets.

Economic Realities

- Manage the speed of structural changes as local and national economies need to adjust to new circumstances.
- Potential for new business opportunities, however, structural change needs to be carefully managed.
- The problem of vested interests. The expected resistance of current system beneficiaries and important stakeholders needs to be managed.

Social Concerns

- Coal-industry dependent communities face challenges, such as job losses, economic decline, disruptive cultural changes.
- A concept of “just transition” can facilitate in structural planning.
- Benefits of transition include job creation in low-carbon sectors.
Reduce the Environmental Footprint of the Energy Sector

- Position CCS/CCUS/HELE and negative carbon technologies in policy parity with other carbon neutral electricity generation technologies.
- Develop and disseminate investment guidelines for low-carbon technologies (HELE and CCUS).
- Deploy and disseminate best practice guidance on methane management (monitoring and remediation) in extractive industries.

Accelerate the Transition to a Sustainable Energy System

- Address the social and economic impacts of phasing out obsolete and aging fossil-based infrastructure.
- Address the challenge of integrating intermittent renewable energy into power and heating grids.
- Promote alternative business models that move away from energy as commodity (push model/customer communication as a one-dimensional bill) to energy as service, with new breeds of service providers.
- Facilitate policies and standards to limit emissions of methane if natural gas is to provide needed balancing support for introducing intermittent renewable energy.
Prepare the Energy System for Deep Transformation

- Discourage the use of high carbon energy sources with environmental taxes.
- Promulgate policies to commercialize renewable gases (such as hydrogen and biomethane) as essential elements for advancing decarbonization through sector coupling and sectoral integration.
- Establish regulatory frameworks for big data, smart grids and an integrated systems approach to support energy transition and create opportunities for new entrants.
- Accelerate deployment of Information & Communication Technologies (ICT) to improve demand-side participation in energy markets, improve supply and demand side efficiencies, and enable greater penetration of intermittent renewable energy.
- Implement energy market designs that promote innovative, sustainable and flexible business models.
- Set national targets and pursue sustainable energy action plans.
Thank you!

Sustainable Energy Division
UNECE
Date 07 I 11 I 2019, Geneva
More Insights
How can the UNECE Region attain Sustainable Energy (SE)?

- **Current Phase:** May 2017 – Oct 2019

- **Outputs**
  - Pathways and Scenario Development
    - Sub-regional modelling of SE scenarios to 2050
    - Policy and technology options
  - Policy dialogue
    - Adaptive policy pathways
    - Policy dialogues
    - Sub-regional workshops
  - “Early-warning system” concept
    - SE Targets
    - Key Performance Indicators (KPIs)
    - Signposts

For more information visit website: [https://www.unece.org/energy/pathwaystose.html](https://www.unece.org/energy/pathwaystose.html)
Defining Sustainable Energy
Three Pillars

“Secure the energy needed for economic development”
- Energy Efficiency (energy intensity of economy, rate of improvement of energy intensity, conversion efficiency)
- Fuel mix
- Net energy trade
- Investment requirements

“Minimize adverse energy system impacts on climate, ecosystems & human health”
- GHG emissions from the energy system
- Energy-related air pollution, water use & water stress

“Provide affordable energy that is available for all at all times”
- Access to energy services
- Energy affordability
- Food security (biomass use)
Scenario development
Illustration of scenario design

**REFERENCE SCENARIO**
Based on shared socio-economic pathway

**NDC SCENARIO**
Implements by 2030 the NDC under the Paris Agreement – NDCs forever

**P2C SCENARIO**
2-Degree target of the Paris Agreement as the key component of Sustainable Energy

**INPUT**
- Demographic
  - Population by region
- Productivity
  - GDP per capita by region
- Technology
  - Power plant conversion efficiency
  - Transport fuel economy, etc.
  - Crop yields, etc.
- Resources
  - Fossil fuel, uranium, solar, wind, geothermal, land, water and other
- Policies
  - Pollution control
  - NDCs
  - Water use

**MODEL**
- Integrated Model
  - Resource extraction, exports-imports, energy transformation and use
  - Markets
  - Capital
  - Labor
  - Agriculture
  - Land use
  - Carbon cycle
  - Atmosphere
  - Hydrology
  - Oceans

**OUTPUT**
- Energy Security
  - Price of energy
  - Energy imports/exports
  - Electricity access
  - Energy/GDP
- Quality of Life
  - GDP per capita
  - Energy services per capita
  - Share calories from non-staples
  - Water stress
- Environmental Sustainability
  - \(SO_2\), \(NO_x\), \(O_3\) concentrations
  - Deforestation/afforestation
  - Avg. Earth surface temp
  - Water withdrawals/recharge

**Metric examples**

**Targets/Goals**
- LPG/KPI
Modeling Results: UNECE
Electricity Generation

Electricity generation by technology - UNECE REF Scenario

TWh

- Other
- Wind Offshore
- Wind Onshore
- CSP
- PV
- Geothermal
- Biomass CCS
- Biomass
- Hydro
- Nuclear
- Gas CCS
- Gas
- Oil CCS
- Oil
- Coal CCS
- Coal
Modeling Results: UNECE
Electricity Generation

Electricity generation by technology - UNECE
NDC Scenario

- Other
- Wind Offshore
- Wind Onshore
- CSP
- PV
- Geothermal
- Biomass CCS
- Biomass
- Hydro
- Nuclear
- Gas CCS
- Gas
- Oil CCS
- Oil
- Coal CCS
- Coal
Modeling Results: UNECE

Electricity Generation

Electricity generation by technology - UNECE
P2C Scenario

![Graph showing electricity generation by technology from 2010 to 2050. The graph indicates the contribution of various technologies such as Wind Offshore, Wind Onshore, CSP, PV, Geothermal, Biomass CCS, Biomass, Hydro, Nuclear, Gas CCS, Gas, Oil CCS, Oil, Coal CCS, and Coal to the overall electricity generation.]
Modeling Results: UNECE
Share of Coal in Electricity Generation Mix

Coal in Electricity Generation Mix by Subregions
REF Scenario

TWh

2010
2030
2050

WEU w CCS
WEU
SCS w CCS
SCS
RUS w CCS
RUS
NAM w CCS
NAM
EEU w CCS
EEU
CAS w CCS
CAS
BMU w CCS
BMU

0 500 1,000 1,500 2,000 2,500 3,000 3,500