Modernising Infrastructure - Transition of the Energy Sector
Pathways to Sustainable Energy
13 November 2018, Kyiv
Central issues
Framework for analyzing the transition

**Resolving the legacy:**
- Infrastructure, assets = sunk capital
- Social structures: People, jobs, education, social life
- Regional, subregional
- Centers of innovation – centers of regeneration

**Technology is changing**
- Pace of technological change in energy
- Uncertainty of rate of penetration of new technologies
- Integrating resource efficiency into the planning
- Resiliency of new infrastructure over planning period

**Finance under uncertainty**
- Restricted funding for fossil technologies
- Incentivize winners and compensate losers
- How big? How long-term the planning period?

**Innovative Policies**
- Importance of innovative, flexible, holistic policy frameworks
- Sustainable approach: quality of life, energy security, impact
Pathways to Sustainable Energy
Defining “Sustainable Energy”

ENERGY SECURITY

“Secure the energy needed for economic development”

- Energy Efficiency (energy intensity of economy, rate of improvement of energy intensity, conversion efficiency)
- Resource management
- Circular economy
- Fuel mix
- Net energy trade
- Investment requirements
- Intellectual property
- SMEs, business models
- Innovation, proactive solutions

ENERGY AND ENVIRONMENT

“Minimize adverse energy system impacts on climate, ecosystems & human health”

- GHG emissions from the energy system
- Energy-related air pollution, water use & water stress
- Cities
- Energy for Sustainable Development

ENERGY FOR QUALITY OF LIFE

“Provide affordable energy that is available for all at all times”

- Access to energy services
- Energy affordability
- Work force in population centers, jobs
- Food security (biomass use, agriculture)
Pathways to Sustainable Energy
Identifying choices, tracking progress

MULTIPLE OPTIONS depend on

- Resource availability
- Development priorities
- Environmental constraints
- (Geo-) Political climate
- Industrialization
- Social aspects
- Financial constraints
- ...

Same starting point – choice of pathways via different policy options
How Pathways helps develop options for countries on how to achieve Sustainable Energy UNECE Region Project Approach

- **Country-owned scenario development**
  - Modelling of sustainable energy scenarios to 2050 for countries
  - Updated energy system data; new sub-regional analysis possible
  - Policy and updated technology options for UNECE region
  - Understand what makes economical sense to fix

- **Informed policy dialogue**
  - Adaptive policy pathways build on importance of large industrial complexes: true impact of energy transition
  - Innovation policy agenda
  - Position energy as fundamental enabler for economic development
  - Sub-regional focus via workshops

- **Planning process: Early-warning system**
  - Signposts
  - Choice of Sustainable Energy Targets & Key Performance Indicators
Some modelling examples - UNECE Region
High Fossil Fuel Dependency

Share of fossil fuels in energy mix (TPES)

Data source: IEA World Energy Balances.

How to move from a fossil fuel based to an economy fueled by clean energy is one of the major challenges for the UNECE region and most of its sub-regions?
Example Modeling Results – change versus base case scenario – Electricity Generation

Difference in electricity generation, UNECE NDC versus Reference Scenario

Source MESSAGE

Wind Offshore
Wind Onshore
CSP
PV
Geothermal
Biomass CCS
Biomass
Hydro
Nuclear
Gas CCS
Gas
Oil CCS
Oil
Coal CCS
Coal

TWh

2020 2025 2030 2035 2040 2045 2050

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

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TWh

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Energy Efficiency
UNECE Group of Experts on Energy Efficiency

- Optimization of resources (financial and natural)
- No modernization of energy systems without energy efficiency: link between supply and demand side
- Increasing energy efficiency influences renewable energy share
- Need new business models targeting energy efficiency
- “Hook” to financing
  - How to put a price on saved energy
  - Formulate value added for countries
- Task Force on Industrial Energy Efficiency
Central issues

Pathways can help countries in developing innovative policies

**Approach**

- It is coming - proactivity
- Innovative *Integrated* Planning
  - E.g. renewable energy, storage, energy efficiency in combination
- Technical solutions are not the only answer
  - *Local* ownership involving education systems
  - Enhanced understanding of technical change and innovation policy
- Issue of large complexes dependent on energy
  - Centers of “regional regeneration”
- In partnership: Lusatia, Kazakhstan, others
Thank you!

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UNECE
Date 13 I 11 I 2018, Kyiv
Example Modeling Results
Cumulative Energy Sector Investments
“Business As Usual”

UNECE Region - Reference Scenario
2020 – 2050 in billion US$ \( \text{2010} = 25,975 \text{ billion} \)

Source MESSAGE

Extraction fossil fuel  Electricity Supply (including T&D)

15,164  10,811

- Coal
- Gas
- Nuclear
- Hydro
- Wind

- Extraction fossil fuel
- Oil
- Gas CCS
- Biomass
- Solar

- Coal CCS
- Oil CCS
- Nuclear
- Biomass CCS
- Wind

794
15 (Oil)
5,274
951
1,776
5, 11, 34.5 (Biomass, Geothermal, Solar)
1,953
Example Modeling Results
Cumulative Energy Sector Investments
“NDC Scenario”

UNECE Region – NDC Scenario
2020 – 2050 in billion US$\textsubscript{2010} = $26,672 billion

Extraction fossil fuel  Electricity Supply (including T&D)

- Coal
  - 94 Coal CCS
  - 11 (oil)
- Gas
  - 5,128
- Nuclear
  - 115
  - 1,750
- Hydro
  - 1,919
  - 49, 214, 484 (Biomass, Geothermal, Solar)
- Wind
  - 2,766

- Extraction fossil fuel
- Oil
- Gas CCS
- Biomass
- Solar
- Coal
- Oil CCS
- Nuclear
- Biomass CCS
- Wind
- Coal CCS
- Gas
- Hydro
- Geothermal