

UNECE Progress in Sustainable Energy: Beyond Headline Indicators

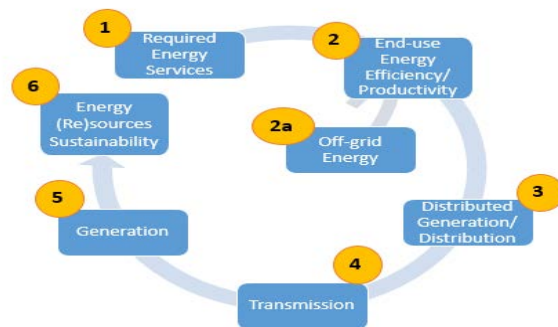
This paper summarizes key observations that emerge from a review of progress in the ECE region to the sustainable energy objectives. The review complements the ECE regional profile that was included in the 2017 SE4All Global Tracking Framework report. Sustainable Development Goal #7 of the 2030 Agenda (SDG7) sets forth key objectives¹ in the energy sector that support sustainable development. Tracking mechanisms like the SE4All Global Tracking Framework (GTF) were instituted to indicate progress towards achieving the targets. However, the agreed targets and indicators do not provide a complete picture of sustainable energy issues, challenges and prospects. This summary explores a fuller view of energy for sustainable development in the ECE region. It herewith provides the basis for a discussion on an extended indicator framework to track energy for sustainable development.

Understanding Sustainable Energy

Elements of a Sustainable Energy System

Figure 1 highlights that consumer energy service needs drive energy demand. Demand for energy commodities are a consequence of society's demand for services – indoor air quality, cooked food, industrial production, mobility, and the like – that enable quality of life and wellbeing for citizens. Demand for energy in turn drives investments in energy distribution, transmission/transport, transformation, and production. Inefficiencies at each stage in the energy value chain increase the primary energy supply needed satisfy the energy services demanded by consumers. Importantly, improving efficiencies throughout the chain reduces costs and hence prices for customers.

Figure 1: A system perspective on sustainability



Demand for energy services is moderated by price, which in turn is set by costs of energy technology, infrastructure, and fuel and tariff-setting mechanisms. Improvements in energy efficiency are made for improved or increased service and to manage energy costs.

1. Energy Services

GTF Indicators in ECE region

- 100% access to electricity.
- 98% access to clean cooking fuels.

Universal electrification: Physical electricity access

The electrification rate in the ECE region reached 100% in 2010, with 6.5 million people gaining electricity access each year from 1990 to 2010. In urban areas full electrification was reached in 2009 followed by rural areas in 2010.

¹ SDG7 has five targets: 7.1 By 2030, ensure universal access to affordable, reliable and modern energy services; 7.2 By 2030, increase substantially the share of renewable energy in the global energy mix; 7.3 By 2030, double the global rate of improvement in energy efficiency; 7.a By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology; 7.b By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small-island developing States, and land-locked developing countries, in accordance with their respective programmes of support.

Clean Fuels and Technologies for cooking

The ECE region achieved 98% access to clean fuels and technologies for cooking in 2014. Nonetheless, 23.3 million people were still reliant on traditional fuels for cooking in 2014. They live mostly in remote regions, and rely on locally gathered fuel wood burned in a wood stove or a traditional combined space heater and/or cooking oven. Traditional stoves offer users reliable heating from low or no-cost local resources at reasonable efficiencies and are a preferred option if access to commercial energy sources is impractical or expensive.

Issue 1.1 Heating – a critical service with substantial quality and sustainability challenges. The ECE region's countries circle the arctic, and cold continental climates across most of the region create the highest demand for heating services in the world. Heating services in buildings and industry make up over 40% of final energy use in the ECE region. Generally gas and electricity are used for cooking. Exceptions occur in remote areas where controlled combustion wood stoves provide heating and cooking services. 13 million people in 17 countries still rely on solid fuels for cooking.

Affordability and quality of heating services are a particular challenge with lock-in of older fossil based heating infrastructure and poor insulation remaining important issues in all countries. The historical dependence on fossil fuels for centralized heating services has created a locked-in dependence on fossil fuels, poor efficiencies and a perception of heating security based on indigenous fossil resources.

Issue 1.2: Quality of supply challenges remain, despite universal electricity access. Despite 100% physical access to electricity, several countries in the region face challenges of quality of service. Part of the post-World War II industrialization legacy is that many energy infrastructure assets are old and substantial investment for renewal and redevelopment is required to improve reliability and quality of supply.

Issue 1.3: Affordability. Affordability of heating services is a growing challenge. In all countries, low-income households make tradeoffs among heat, food, or other needs. All countries have at least part of their household population living in energy poverty, where more than 10% of household income is spent on energy. Energy poverty is a significant challenge to upgrading or renewing older un-insulated housing stock with locked-in fossil fuel dependence. Incurring higher costs when addressing greenhouse gas emissions without improving energy efficiency would worsen energy poverty.

2. ENERGY INTENSITY

GTF Indicators:

- **ECE Regional energy intensity improved from 8MJ/USD_{2011ppp} in 1990 to 5.1MJ/USD_{2011ppp} in 2014 (a -1.9% CAGR reduction in energy intensity).**

Energy intensity is often a proxy for energy efficiency. The two are not equivalent, and energy intensity does not reflect differing economic structures, resource bases, activity levels or climatic drivers for energy use. High energy intensity may result from a country extracting and exporting energy intensive mineral products in a cold climate, e.g., Canada, Sweden, or Russia, and low intensity can result from high economic contribution from service industries, e.g. Switzerland. In neither case does energy intensity provide insight into the underlying energy efficiency of an economy, the historical development paths undertaken, or the improvements in achieved energy efficiency.

Demand Side Energy Efficiency

All countries have plans to improve energy efficiency or energy productivity or to conserve energy. Diverse objectives and metrics prevent an easy evaluation of the plans. Outside of the EU and North America there is limited published progress and compliance tracking.

Issue 2.1: Pollution and energy waste from low efficiency heating systems and poor insulation. While many countries are transitioning to clean heating options with corresponding health

and environmental improvements, others remain locked into patterns of poor efficiency and high emission from coal-fired heating appliances and power plants.

Issue 2.2: A lack of progress on energy efficiency building codes and slow retrofitting. Improving energy efficiency in buildings remains a priority best practice. Without codes there is little basis to develop energy efficiency design and construction capabilities. Even with codes governments need to ensure compliance and efficacy.

Issue 2.3: Improving appliance and equipment end-use efficiency. The economic benefits of appliance and equipment standards and labelling programmes are well proven. Many countries have not yet fully implemented such programmes.

Issue 2.4: Improving Transport sustainability and service quality. Outside the EU, vehicle fuel economy progress has been weak. A full range of usage, modal choice and vehicle fuel economy standards options is needed.

Issue 2.5: Improving Industrial Productivity with Energy Efficiency. The ECE region is characterized by older industries and hence in a position to implement widespread industry energy management programmes as a means to improve overall energy productivity.

Supply Side Energy Efficiency

Average fossil fuel (coal, gas and oil) power plant efficiencies improved from 36% in 1990 to 41% in 2014. Gas fired generators improved their efficiencies from 37% in 1990 to 49% in 2014. Electricity transmission and distribution losses declined from 8.2% in 1990 to 7.2% in 2014, while natural gas transmission and distribution losses fell by half from 1.2 to 0.6%. There exists a significant scope for further improvements motivated by governments deploying effective policy and institutional processes in energy markets both to reflect prices through the energy system and to enable distributed generation options.

3. Integrating Renewable Energy

GTF: Renewable energy share grew from 5.9% TFC in 1990 to 11.5% TFC in 2014

The ECE region increased production of renewable energy consumption over the tracking period. Coupled with flat growth in total final consumption (TFC) over the period 1990-2014, the share of renewable energy in TFC increased from 6% in 1990 to 11% in 2014, growing fastest in South Eastern Europe.

Among renewable energy sources, the share of modern solid biofuels consumption was the highest in 2014 at 38%, followed by hydropower at 28%, and modern liquid biofuels at 14%. In 2012-2014, the fastest growth was reported for wind and solar power production, reaching a share of 9.5% and 4.3% respectively.

All sub-regions showed an increasing share of renewable energy over the tracking period, albeit from a very low base. There are real limits to renewables and the rate at which they can displace fossil fuels. Northern countries have limited solar insolation which limits both biomass and photovoltaic options.

Issue 3.1: Distributed Off-grid Renewable Energy for Remote Communities. In many communities, traditional wood stoves offer efficient low-cost renewable heating energy. Modern low emission woodstoves are an important choice for sub-urban as well as rural households offering substantial heating services from locally harvested renewables.

Issue 3.2: Integration of Variable Renewable Energy: Policies to Support Renewable Energy Uptake. With 100% access, the role of utilities is critical. Consumers rely on cost-reflective capacity and energy prices from utilities to motivate economic renewable energy and energy efficiency investments. Some countries are implementing policies to advance beyond naive feed-in-tariffs or

quotas to enable smarter price motivations for renewable energy, addressing the need to integrate variable renewable energy with markets for flexible supply and demand markets, to manage power system capacity peaks, and to ensure clear accountabilities for back-up supply.

4. Improved Supply-Side Sustainability

Issue 4.1: A high reliance on fossil fuels. Coal is the dominant fuel (30%) for power production in the ECE region, followed by gas (25%), nuclear (21%), and hydro-power (15%). The share of fossil fuels in the ECE region's power generation sectors varies from 2% to 100%. 6 countries have less than 3% fossil fuel shares in their power systems (Albania, Norway, Switzerland, Tajikistan, with large hydro resources, Iceland geothermal, and France nuclear). Denmark and Germany have achieved fossil shares of 40% and 57% respectively.

Issue 4.2: Many countries focus on indigenous energy resources to assure security. Economic trade in sustainable resources, increasing demand-side focus, and innovations in technologies and skills, shape sustainable outcomes and a more dynamic and resilient energy system than traditional supply security paradigms have offered to date.

Issue 4.3: Inadequate progress in supply sector efficiency. The efficiency of conversion and transformation from primary to final energy is an important aspect of all three SE4All goals. The ratio of final to primary energy ratio reflects overall energy efficiency in the supply sector obtained by dividing end-use final energy over primary energy. The global primary to final energy transformation efficiency improved from 72% in 1990 to 68% in 2010. In the ECE region the indicator dipped by around 1.4% during the same time period, but it stayed higher at 71% than the world's average 68% in 2010.

Issue 4.4: The difficulty to achieve an energy paradigm shift. Traditional social paradigms tend to prioritise centrally managed prices and technical allocation in a belief that they offer consumers better access and service, adhering to traditional energy options and infrastructure choices.

5. Increasing Energy Resource Sustainability

Issue 5.1: Greenhouse Gas Emissions of the Energy Sector. Nationally Determined Commitments (NDCs) reflect local conditions and capabilities to mitigate GHG emissions. They are diverse in scope, pledged pathway, conditionality, and additionality. They currently are insufficient. Much greater emission reduction efforts than those associated with the NDCs will be required in the period after 2025 and 2030 to hold global temperature rise below 2 °C above pre-industrial levels. Current policies for sustainable energy tend to work in a disaggregated way; separate energy efficiency, renewable energy and climate policies are led by different operational agencies. There is a need to integrate GHG mitigation potentials with the potentials for energy efficiency and renewable energy to develop a clearer understanding of the trade-offs and economically optimal investment paths available to countries in the ECE region.

Issue 5.2: Methane management. Anthropogenic methane emissions made up 21% of global GHG emissions in 2010: 6% are from coal mining, 16% from oil and gas production activities. There is a need to mitigate methane emissions, including identifying appropriate mechanisms for mobilizing needed resources, and to fund a detailed study on a common basis across the entire UNECE region.

Issue 5.3: The Energy - Water - Agriculture - Trade Resource Nexus. Countries and regional communities can extract more value from a wider and more sustainable range of resource options, and increase economic trade in resources, to improve system sustainability and resilience.