

UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE

SUSTAINABLE ENERGY
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SECURING AFFORDABLE AND
SUSTAINABLE ENERGY
SUPPLY



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Sustainable energy is the linchpin of the Global Goals

UNECE's work in energy falls into three broad categories: reconciling the reality of fossil fuels' enduring share of the energy mix with the need to address climate change, enhancing integration of energy markets in the region, and facilitating the transition to a sustainable energy system.

On 25 September 2015 the United Nations General Assembly adopted a set of Global Goals for sustainable development. The Global Goals aim to end poverty, protect the planet, and ensure prosperity for all as part of a new sustainable development agenda. Goal 7, "Ensure access to affordable, reliable, sustainable and modern energy for all", is the principal framework for UNECE's action in sustainable energy:

- By 2030, ensure universal access to affordable, reliable and modern energy services
- By 2030, increase substantially the share of renewable energy in the global energy mix
- By 2030, double the global rate of improvement in energy efficiency
- 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
- 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

Without sustainable energy, virtually none of the 17 Global Goals would be achievable – it is the golden thread that runs through them.

The Committee on Sustainable Energy's activities are conceived with a view to ensuring access to affordable and clean energy to all and to help reduce greenhouse gas emissions and the carbon footprint of the energy sector. Under its current programme, UNECE has begun developing normative instruments, including its work on standards and best practice guidance in energy efficiency, renewable energy, natural gas (reducing leaks, supporting renewables, penetrating transport, and facilitating LNG trade), clean electricity, and coal mine methane. In addition, UNECE is exploring proper management of methane from source to use in extractive industries as an effective means of reducing emissions of an intensive greenhouse gas. UNECE is helping countries improve management of their natural endowments through the United Nations Framework Classification and has recently published recommendations to policy makers on carbon capture and storage.

Ensuring sufficient, reliable and environmentally responsible supplies of energy for sustainable development remains a key challenge for the countries of the UNECE region. Inasmuch as the global population will rise to 9 billion by 2050, it will be necessary to reduce greenhouse gas emissions by 50% to avert a climate change disaster while supporting economic development and energy access.

The UNECE region is of critical importance as it produces 40% of the world's energy while consuming 45%, is home to important energy industries, produces nearly 50% of global economic

output, and is dominant in the world's financial infrastructure. Fossil fuels comprise 60% of primary fuel in the UNECE region, making the UNECE region one of the largest emitters of greenhouse gases, accounting for about half of global emissions, and there is no plausible scenario in which that share drops below 50% by 2050. The region is very diverse, comprising high and low income countries, countries that are energy rich and energy poor, and countries that are in the midst of economic transition. All of these features contribute to the growing international dialogue on developing efficient pathways to an energy system that can support sustainable development.

The persistent critical challenge is to ensure improving quality of life and economic growth while reducing the environmental footprint of the energy sector. The transition to a sustainable energy system is an opportunity to improve energy efficiency from source to use, minimize environmental impacts, reduce energy and carbon intensities, and correct energy market failures. Seizing the opportunity will require coordinated policy review and reform across many sectors. The region has the potential for economic competitive advantage given the relatively modest distances between energy supply sources and energy demand centres. Full integration of the region's energy markets under an efficient framework would significantly improve the technical, social, economic, and environmental contribution that energy could make.

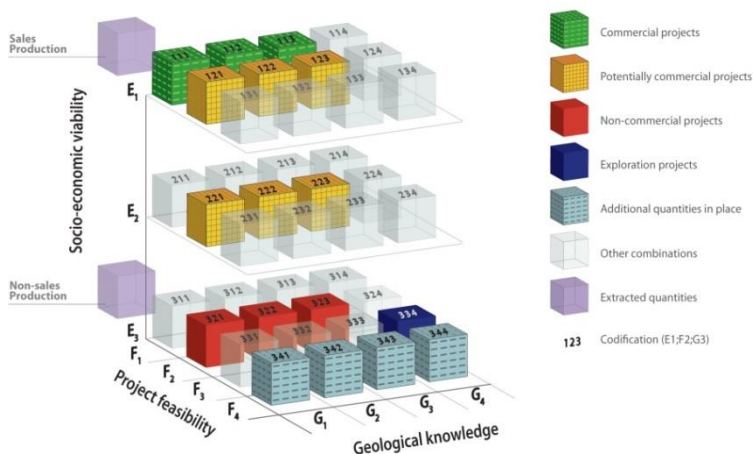
Building a sustainable energy system for the future in the UNECE region will involve a substantial transition from what is in place today. Improving efficiency relates not only to consumer-level energy efficiency issues such as energy efficient housing, vehicles and appliances, but also to upstream energy efficiency in production/generation, transmission and distribution. It is an opportunity to accelerate the change from the traditional model of

selling energy commodities to one of providing energy services based on innovation. Growth in distributed generation, shaping energy demand through IT, separating time of production from time of consumption through energy storage and improving energy network management are all indicators of an energy revolution that is underway. Central to this agenda is a sustainable electricity system. The development of smart energy networks with common rules of operation is an important opportunity to enhance the collaboration among technologies, thereby enhancing the cost-effective penetration of lower-carbon technologies and improving the overall resilience of the energy system.

Each technology and innovation has a role to play since there is no single solution to all problems. The world is changing rapidly in terms of population dynamics, wealth and resource needs, environmental quality, technological progress, and economic globalization. Because the world is changing rapidly, governments cannot afford to gamble on specific technologies. The focus should rather be on the holistic, complementary and sustainable energy system of the future and efficient pathways to get there. Governments and industry must complement one another, with governments using their instruments to secure a functional legal, regulatory, fiscal and infrastructural framework within which industry interests align with those of government and that allows it to deploy its technology, management and finance to the full capacity. Under the right framework conditions, industry and investors will be in a position to produce the services needed by government and society both effectively and efficiently.

Reducing the ecological footprint of fossil fuels

United Nations Framework Classification – sustainable management of national endowments



Ensuring reliable and affordable supplies of energy to support sustainable development is a challenge. Achieving this goal in an environmentally responsible manner is an even greater challenge. Strong, reliable and lasting international standards such as the United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 (UNFC) are a key part of the process. UNFC is unique among the major international resource classification schemes in that it is the only system that includes consideration of commercial, social and environmental impacts as well as project feasibility and technical uncertainty. It allows a direct comparison of projects that extract

primary energy fuels, such as oil, gas, coal and uranium, with renewable energy projects. UNFC serves the needs of:

- Governments when managing their natural resources;
- industry for information while deploying technology, management and finance to secure energy supplies and capture value efficiently within the established frameworks to serve their host countries, shareholders and other stakeholders;
- international organizations developing energy and mineral studies for reliable and coherent data to formulate robust and long-sighted policies; and
- The financial community for information to allocate capital appropriately, providing the required capital efficiency.

UNFC builds the foundation for fact based energy and mineral strategies and their industrial execution. The system now applies to traditional solid minerals (coal), oil, gas, uranium, thorium and other solid minerals. Comparable work is underway for renewable energy projects, as well as for geological storage of CO₂ for carbon capture and storage projects. A standardized system of classifying and comparing energy production from all types of projects allows investors to rank diverse portfolios of both alternative and conventional forms of energy. Such a system will facilitate efficient allocation of investment capital among competing energy projects and accelerate the transformation of the global energy system.

Work is progressing on the application of UNFC to bioenergy and geothermal energy in particular, with application to hydro, solar and wind to follow. The development of an international system and a standardized terminology for reporting geothermal resources based on UNFC is being undertaken by UNECE in cooperation with the International Geothermal Association (IGA).

Adoption of a global standard such as UNFC for assessing and financing projects can help accelerate geothermal projects in East Africa, Europe and elsewhere. Better yield forecasting, especially for wind, would improve investment conditions and attract private sources. An identifiable global standard based on UNFC methodology can help increase predictability and drive forward the investments needed for a low-carbon future.

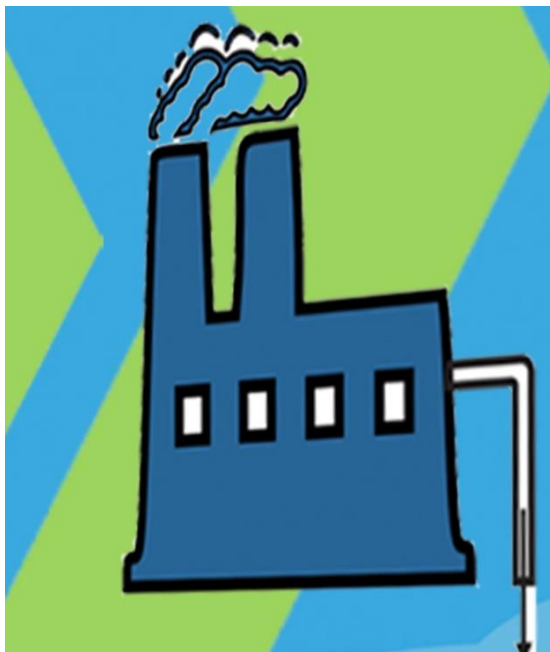
Adopting a common assessment methodology for renewable resources will greatly benefit investors, regulators, governments and consumers. Energy companies will be able to report their renewable energy resources on a consistent basis, possibly alongside their reporting of mineral and hydrocarbon reserves. This outcome would provide further insight for investors and great benefits with regard to accounting and valuation of the total renewable asset base of those companies.

The work on UNFC is carried out by the UNECE Expert Group on Resource Classification. The Expert Group is open to all stakeholders worldwide, including representatives from government institutions from both UNECE and non-UNECE member countries, industry, international organizations, the financial reporting sector, professional associations and companies dealing with regulations, evaluation, classification, exploration, exploitation and investment in energy and mineral resources. More than 250 global experts ensure the continued development and promotion of UNFC. Many countries around the world, including in Europe, Central Asia, Africa, East and South-east Asia and Latin American and the Caribbean, are looking to apply the system nationally. They acknowledge the benefits and efficiencies that UNFC brings under the global mandate given to UNECE by ECOSOC.

For more information visit:

<http://www.unece.org/energy/se/reserves.html>

Carbon capture and storage – a key to climate change mitigation



If the world is to succeed in constraining CO₂ emissions to levels consistent with a less than 2°C rise in global temperatures, then carbon capture and storage (CCS) will need to contribute about one-sixth of needed CO₂ emission reductions in 2050, and 14 per cent of the cumulative emissions reductions between 2015 and 2050 (compared to a business-as-usual approach). It is the only technology option other than energy efficiency and shifting the primary energy mix to lower carbon fuels that can deliver net emissions reductions at the required scale.

Given the rapid growth in energy demand in developing countries over this period, the largest deployment of CCS will need to occur in non-OECD countries. By 2050, non-OECD countries are expected to account for 70 per cent of the total cumulative mass

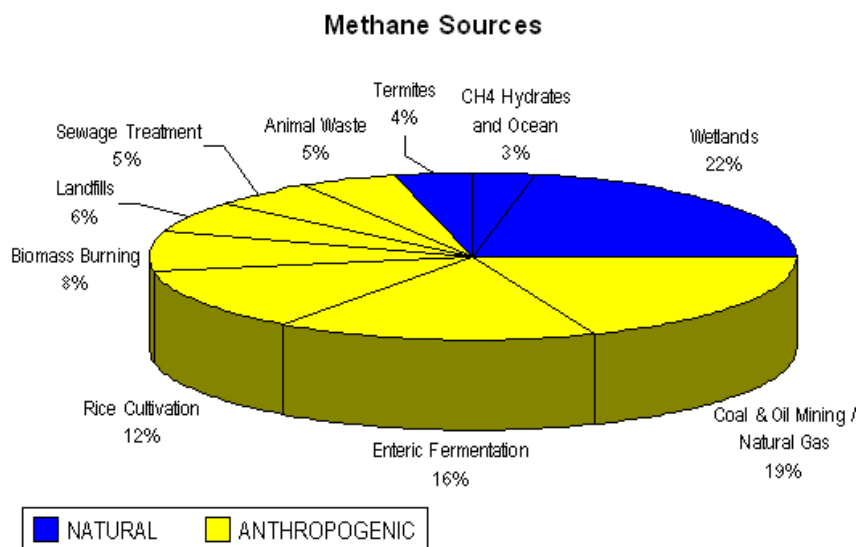
of captured CO₂. On the other hand, the OECD countries will need to show leadership in validating the technologies with both research and development and commercial-scale demonstration and assisting in deploying them at scale. Given the magnitude of CO₂ emissions from coal and natural gas-fired electricity generation, the greatest potential for CCS is in the power sector. However, CCS is not only about electricity generation. Around 45 per cent of the CO₂ captured between 2015 and 2050 in the 2°C scenario is from industrial applications that cannot be replaced by renewable technology. In this scenario, between 25 per cent and 40 per cent of the global production of steel, cement and chemicals would have to be equipped with CCS by 2050.

Making CCS technology available as a viable de-carbonisation policy option will require further fully-integrated, large demonstration projects representing the range of technologies. Global CO₂ storage levels of at least one billion tonnes per year by 2030 need to be in place, and more thereafter. Delivering such an outcome will require collective commitment by governments and industry alike to fund CCS demonstration projects and development efforts in power and industrial applications at levels commensurate with the required abatement outcomes. This commitment will require that a significant share of global funds allocated to clean energy be targeted towards CCS. Such outcomes also depend on careful alignment of public funding commitments and enduring economic incentives that can stimulate commercially attractive industry investment. Ensuring the availability of CCS will require regulatory and legislative support at all levels of government and international cooperation at project level. Particular attention should be given to permitting environmentally-sound technical solutions and safe geological storage siting that creates conditions for public acceptance.

Drawing on the analyses and assessment of its Group of Experts on Cleaner Electricity Production from Fossil Fuels, UNECE has made a number of recommendations to the UNFCCC regarding carbon capture and storage: 1) it is critical that policies on CCS/CCUS have parity with other no carbon/low carbon technologies regarding their climate mitigation potential, commensurate with the state of technological and infrastructure development; 2) governments should consider a broad array of fiscal instruments to encourage CCS/CCUS until carbon is properly and adequately priced; 3) capturing and storing CO₂ from all industrial sectors will be essential to reach climate goals; 4) CCS/CCUS deployment will accelerate if governments work together to financially sponsor demonstration projects; 5) developed countries should be encouraged to invest in CCS/CCUS in developing countries; and 6) CCS developments need to be monitored and tracked globally – best practice guidance on CCS should be developed and disseminated.

The full [set of recommendations](#) is available on the UNECE website.

Methane Management – an economic opportunity for mitigation



Proper management of methane from source to use in extractive industries will be an effective means of reducing emissions of an intensive greenhouse gas and short lived climate pollutant. Methane is the second most important greenhouse gas. In terms of the radiative forcing, it is around 30 times more potent than CO₂. While account must be taken of the respective residence times of CO₂ and methane in determining the actual contributions to the greenhouse effect, it is generally recognised that using methane instead of emitting it into the atmosphere accrues a net actual benefit from a climate change mitigation perspective. About 60% of global methane emissions are due to human activities. The main sources of anthropogenic methane emissions are the oil and gas industries, agriculture (including fermentation, manure management, and rice cultivation),

landfills, wastewater treatment, and emissions from coal mines. Fossil fuel production, distribution and use are estimated to emit 110 million tonnes of methane annually.

Reducing leaks and emissions from the gas value chain is important from both economic and environmental perspectives. In many UNECE member States there is an opportunity to improve efficiency in the gas supply chain from source to use. The differences between the volumes of gas produced at the source and the volumes delivered to end users show significant variances across UNECE member States. Reducing the differences by improving the performance among laggards will improve the overall energy efficiency, gas affordability and producers' competitiveness. It will also reduce methane emissions from leaks in the gas value chain. Since methane is a potent greenhouse gas, reducing emissions will have a significant positive impact on the environment. The UNECE Group of Experts on Gas has established a task force to explore best practices to reduce leaks in the natural gas system from source to use.

Extraction, processing and transportation of coal releases methane. This makes the coal industry one of the largest sources of anthropogenic methane emissions. These emissions can be substantially reduced through implementation of best practices in methane management. Greater focus on best practices is needed to minimize the carbon footprint along the coal industry value chain. One of the more effective near-term options is the capture and use of methane from coal mines. This not only mitigates climate change, but delivers other important co-benefits including improvement of mine safety and productivity, localized energy production, and improvement in local/regional air quality. In addition, such projects can result in

positive cash flows to the mine and serve as catalyst for investment.

Because the experiences in different countries are quite diverse, an exchange of good practices and case studies is critically important to avoid excessive methane emissions from coal mines. In 2011 the Economic and Social Council of the United Nations invited the United Nations Member States, international organizations and the regional commissions to take appropriate measures to ensure the application of the Best Practice Guidance in countries worldwide.

The UNECE Group of Experts on Coal Mine Methane (CMM) promotes the reduction of greenhouse gas emissions from coal mines. In addition to reducing the carbon footprint of an otherwise extremely carbon-intensive industry, the activities of the Group of Experts on CMM on the recovery and use of methane reduce the risks of explosions in coal mines, thus helping save lives and avoid large-scale economic losses. The principal activity of the Group of Experts on CMM is development and dissemination of the *Best Practice Guidance for Effective Methane Drainage and Recovery in Coal Mines*. In addition, the Group of Experts on CMM prepares proposals for case studies on the application of best practice guidance in specific coal mines in different regions of the world. The Group of Experts on CMM also facilitates the establishment and work of an International Centre of Excellence in CMM that will in near future deal with practical aspects of coal mine methane abatement and utilisation and provide practical training to coal mine methane professionals.

Cleaner electricity production from fossil fuels



Electricity generation through the use of fossil fuels has been a foundational pillar for modern society. Over two thirds of the world's electricity is generated using fossil fuels. The power sector was designed around fossil fuels with power plants constructed in locations with efficient access to fossil fuels and cooling water. The continued use of these fuels in the future is expected in part because global supplies of abundant and inexpensive fossil fuels are estimated to last well into the future. A number of UNECE member States, such as Azerbaijan, Bosnia & Herzegovina, Estonia, Israel, Kazakhstan, Poland, Russia, Serbia, Turkmenistan, Ukraine, USA and Uzbekistan rely to a large extent on fossil fuels. Even countries like Kyrgyzstan and Tajikistan, where electricity is generated mainly by hydro power plants, have begun to develop their coal deposits and construct thermal power plants to ensure energy security.

Both existing and new coal power generation will play an important role in global electricity systems in the short and medium term. Unfortunately, the combustion of fossil fuels

releases carbon dioxide (CO₂) into the atmosphere and thus contributes to climate change. The most effective means to benefit from continued use of fossil fuel plants while reducing GHG emissions lies in improving their generating efficiency. For each 1 per cent increase in efficiency of a coal burning power plant there is a 2-3% reduction of CO₂ emissions and other air pollutants. There has been steady technological innovation to improve generating efficiency and reduce emissions, most notably from coal.

The UNECE Group of Experts on Cleaner Electricity Production from Fossil Fuels carries out activities to reduce greenhouse gas emissions from electricity production from fossil fuels. One of the activities of the Group of Experts is an assessment of the current efficiency of the fleet of conventional power plants. This analysis serves as a basis for developing best practices on the implementation of modernization measures from an economic and environmental perspective. Also a survey of High Efficiency – Low Emissions (HELE) technology best practices across the UNECE region and globally is being prepared. Introduction of HELE technologies that enhance efficiency, environmental performance, and reliability is critical for countries in which electricity generation is based on coal.

Activities under this topic will be developed with a view to developing best practice guidance in the deployment of HELE technologies across the UNECE region and globally. It will provide member States the opportunity to adjust policy and regulation in a way that could find the right answer to ongoing coal utilisation and a pathway towards CCS retrofits.

Enhancing interconnectivity

Evolving electricity systems – getting ready for the future

Electricity demand is growing at a faster rate than other energy vectors (such as the direct use of oil, gas and coal) which makes reducing the carbon intensity of power production an urgent imperative. It is expected that fossil fuels will remain an important and cost effective fuel for electricity production on a global and regional basis, especially in the medium term. However, the changing dynamics of power systems (such as the introduction of intermittent energy sources and the deployment of energy storage and smart grid technologies) highlight a rapidly evolving electricity system. These dynamics are reflected in a broad range of initiatives of UNECE's Committee on Sustainable Energy.

Electricity generation currently contributes to 40% of annual global energy related CO₂ emissions since nearly 70% of all electricity is produced using fossil fuels. Alternatively, in 2012 for the first time, the growth of renewables in new generation outpaced fossil fuels, avoiding additional CO₂ emissions, but increasing variability in electricity systems. In the UNECE region, 60% of electricity is produced from fossil fuels, but national shares vary from 0% to 100% as a consequence of the different energy mixes (coal, natural gas, oil, hydro, nuclear, and renewables). Large shares of natural resources of coal and natural gas in the region are a resource for electricity production, but there is also growth in the deployment of renewable generation and other distributed generation sources in many countries. This trend is expected to persist as technology costs decrease.

Today's electricity system is largely defined by large scale generation that produces power which flows to end users. The electricity system of the future will be defined as a system of services, with bi-directional flow of power and information. This (r)evolution will enable generation, distribution and end-users to produce or use power in a highly price-responsive system while providing services needed to support grid operations. The integrated electricity system of the future will provide electricity more sustainably by allowing all sources and uses of energy to interact efficiently and will realize net savings through better asset utilisation of the grid, generation and end-user resources.

Well-established, reliable grids can improve operations and maintenance incrementally. Conversely, many existing grids in both developing and developed countries have not been well maintained or upgraded and significant investments are needed. Well planned approaches that consider long term investment horizons and best in class technologies can ensure that investments today do not become burdens tomorrow. Building new infrastructure to provide electricity service to new consumers can offer different challenges, but in some ways can be easier. In provided access to electricity, designs are not encumbered by existing infrastructure and therefore can build systems tailored to meet short term and anticipated long term needs. These evolving electricity system aspects will continue to be considered in current and future UNECE work plans.

The role of gas in sustainable energy



Liquefied natural gas (LNG) – towards global gas markets

Recent market developments point to a fundamental change in the role of Liquefied Natural Gas (LNG) in the global energy landscape. The use of LNG to transport natural gas is poised to grow dramatically in the foreseeable future. Growing international concern over energy and environmental security has led to policies in both gas importing and exporting nations that will likely increase LNG trade in coming years. While significant growth of LNG trade has been anticipated for decades, developments in liquefaction, shipping, and gasification technology and costs, gas market supply and demand dynamics, economic accessibility of previously uneconomic resources, and geopolitics have created

a new dynamic that is accelerating development of an LNG market that will progressively connect a global gas market.

Natural gas is a major energy source for power generation, residential heating and feedstock for industrial production. LNG offers a flexible means of transporting this energy source without the need for inter-regional pipeline infrastructure. While excess LNG import capacity and higher costs compared with pipeline transport have dampened enthusiasm for LNG in recent years, current trends point to increased reliance on LNG to supply the world's energy needs. Growing demand for gas, diversification of suppliers, new pricing mechanisms and the development of disruptive technologies have opened the potential for regionally isolated LNG trading to grow into a robust, more transparent global market.

The UNECE Group of Experts on Gas is working to develop Best Practice Guidance for Liquefied Natural Gas based on the key trends in global LNG trade. The primary goal of this effort is to provide a data-driven assessment of evolving trends in order to facilitate informed policy discussion at the national and international level. This activity engages in a dialogue and analysis of the costs and cost trends through the whole gas and LNG value chains, and discussion of possible best practice guidance. The impact of LNG on security and diversification of supply, flexibility, liquidity, prices, and competition and market integration can be significant. There are opportunities for improvement in LNG specifications, liquefaction plants, receiving facilities, local operating procedures, LNG tankers designs, and so forth. Some harmonization of LNG quality specifications is needed to ensure it is acceptable at all LNG terminals and to a majority of end users. Players throughout the LNG chain, including regulators, will be encouraged to standardize and

exchange information. Such efforts would improve compatibility and efficiencies and maintain safety levels throughout the industry. Attention should be paid as well to the development of small-scale LNG that is flexible, has lower capital costs, and can service smaller markets.

Building upon the findings and recommendations of the recently published UNECE study on LNG and taking into account recent data and trends, this task force will assess the potential for LNG in the UNECE region under an optimal policy framework. The work will be undertaken in collaboration with other relevant organizations such as the IGU, the IEA, and associations of system operators.

Removing barriers to using natural gas in transportation

Natural gas and bio-methane can be used to reduce pollution coming from transportation. Substituting natural gas for conventional fuels provides tangible environmental benefits: cars driven on natural gas emit significantly less carbon-dioxide (CO₂), sulphur (SO_x) and nitrogen oxides (NO_x) per kilometre travelled than those using diesel or petrol. Emissions of CO₂ are reduced even more when renewable bio-methane is blended in (40% CO₂ savings with a 20% share of bio-methane). Natural gas vehicles also have reduced noise profiles, which is beneficial for vehicles operating in an urban environment.

Natural gas can be used as a fuel for any mode of transportation: on-road vehicles, scooters, heavy duty vehicles, ships, locomotives, even aircrafts. Natural gas vehicles (NGVs) are not zero-emission vehicles, but their environmental, economic and availability advantages make them an important alternative to vehicles running on conventional fuels. Further, deployment of

NGVs will also support the infrastructure needed for the electric or hydrogen-fuelled vehicles of the future.

The UNECE Group of Experts on Gas is exploring how to remove barriers to the use of natural gas as a transportation fuel. Using natural gas as a transportation fuel is a critical area for natural gas demand growth, while reducing environmental impacts. The principal activity of the Group of Experts is development and dissemination of the specific recommendations on a range of topics from distribution to vehicles, including standards and technology as well as customer interaction. Limited infrastructure for fuelling NGV's is a significant barrier to deployment and the range of choice of NGV's is modest. Expanding both of these aspects would provide customers with an increased range of choice and ease of use. Understanding the details of the barriers will enable their removal and accelerate the use of natural gas in the transport sector

The use of NGV's varies widely across geographic regions, along with existing market and infrastructure. An exchange of good practices and lessons learned across the value chain is essential to support continued growth. Task force members reach across the UNECE region and are playing an essential role and serving as a catalyst for ongoing investment.

Natural gas and renewable energy – allies or competitors?

In the future energy system natural gas and renewable energy will both play a determining role as each contributes to energy security, economic growth, enhanced energy access and quality of service and climate change. Despite this reality, the specific roles, values, and merits of natural gas and renewable energy in relation to the long-term energy transition are debated. The rapid deployment of renewable energy in some parts of the world

coupled with the use of shale gas in the United States has contributed to significant departures from historical trends, prompting new dynamics in energy markets. The current nexus of these dynamics can be found in the power sector, but other trends likely will emerge in industry, buildings, cities, transport, agriculture, and end uses.

Mostly policy makers and industries have approached the issues facing natural gas and renewables separately or have concentrated on the competitive impacts of one on the other. UNECE's Groups of Expert on Gas and Renewable Energy founded a joint Task Force to address how more compelling business models could be developed so that these energy resources can be better aligned within a future energy system. The objective of the Task Force is to "Demonstrate the essential synergies between gas and renewables in achieving a sustainable future energy system by developing best practices and policy guidelines for gas to be an enabler of renewable energy and a part of a sustainable energy future".

Work has only just started and will focus at the outset on analysing how key countries approach the two energy sources in their respective national or regional energy policies, and subsequently will assess the economic and technical feasibility of alternative approaches including the benefits of properly structure regional balancing markets. The Task Force will conduct an analysis of the economics of gas-fired power in the context of green policies on renewables and gas, including an assessment of the impacts of support schemes on the gas sector and on both gas and power system management. Finally, best-practice guidelines will be prepared on the role of natural gas in a sustainable energy system.

Preparing the future energy system

Exploring Alternative Pathways - How can UNECE attain its sustainable energy objectives?

The Committee of Sustainable Energy provides the UNECE member States with a platform to explore various pathways for development of a future sustainable energy system. Diverging economic development, resource availability and energy mixes are being reflected in national energy strategies and thus express different priorities on how to achieve the overarching goals. There are shared commitments among UNECE member States regarding the sustainable energy goals, including recognizing that access to affordable energy is a critical foundation for development. Stable and predictable framework conditions can ensure that investments are taken in a timely manner.

The pathways project provides an opportunity to understand more fully the different approaches taken by countries in response to international, regional and national factors and to explore the challenges and consequences that the approaches present. The uncertainty in the evolution of energy systems derives from a wide range of trends and forces and can be redirected either by new technology or measures of key players. The exploration of alternative energy futures is the basis for a UNECE-wide policy dialogue to further a more profound understanding of the interconnectivity of processes and systems. In the long run, the proposed dialogue is intended to support governments, energy industries and other private sector, non-governmental and international organizations to identify activities necessary to achieve the goals.

Renewable Energy - A Crucial Role in the Future Energy Mix



Renewable energy resources are one means to reduce the carbon intensity of the energy sector, improve energy security and encourage sustainable development. Investing in renewable energy resources can also be a cost-effective way to provide access to energy to those without it.

The UNECE region accounts for nearly half of global renewable energy capacity. The potential for developing renewable energy technology is growing and renewable energy is integrating progressively into the energy mix. Nevertheless, in many UNECE member States renewable energy policies do not work well and more can be done to develop suitable frameworks on how to “do renewable energy right” from a systems perspective.

The UNECE’s Group of Experts on Renewable Energy is exploring ways to enhance the uptake of renewable energy. An area of focus is the development of best practice guidance for renewables. The Group has begun its work by filling information gaps to establish a baseline for future activities. It is expected that the development of the best practice guidance will help

guide investments in the future. In particular, the Group is examining the interaction of intermittent renewables with fossil fuels, particularly natural gas, to ensure quality of service. A system perspective will focus less on the comparison of the cost of specific intermittent renewables (including the costs of network reinforcements and back-up power) with dispatchable fossil and more on system-wide valuation of energy (kWh), capacity (MW), balancing services, storage, demand-side management and the like that enables every technology to play its role fully.

Investments in renewable energy will be a key factor in reducing the carbon intensity of the energy sector in the ECE region. To undertake the right path, it is essential to understand the starting point and the challenges by improving the quality of data, by identifying the right indicators, and by preparing tracking systems to tackle the required changes. The UNECE Renewable Energy Status Report was launched during COP21 Climate Conference in Paris, the Conference of the Parties of the UN Framework on Climate Change, to contribute to this understanding.

This report represents a comprehensive overview of the renewable energy infrastructure, industry, policy, regulations, market development and potential growth rates in 17 selected countries of the UNECE region. It is a very timely report, coming few months after the adoption of the 2030 Agenda for Sustainable Development with its Goal 7 on ensuring access to affordable, reliable, sustainable, and modern energy for all. UNECE - through its Committee on Sustainable Energy and the Group of Experts on Renewable Energy - will continue to assist member States with specific activities to achieve the objectives of the 2030 Agenda and of the Sustainable Energy for All (SE4All) initiative of the UN Secretary-General, and of the landmark agreement adopted at COP21.

Energy Efficiency – Getting more from less



Improving energy efficiency contributes to energy security, better environment, quality of life, and economic well-being for all. Energy efficiency is called “the first fuel” as it is the best way of getting more out of existing resources, supporting economic growth, and reducing energy costs. Significant potential for improving energy efficiency exists worldwide but attempts to improve it often fall short because of inadequate national policy frameworks or lack of enforcement of appropriate legislation.

Despite the multiple benefits, improving energy efficiency remains elusive. The state of the global economy and the economics of energy markets have prioritized short-term economic considerations, and geopolitics has moved energy security to the forefront of policy considerations. Consequently,

even though most of the countries have started to implement energy efficiency policies, the scope and the degree of maturity of these policies vary considerably. Many barriers to improving energy efficiency impede the collective ambition of attaining sustainable energy.

The UNECE Group of Experts on Energy Efficiency encourages the exchange of know-how and best practices between experts and policy makers, governments, business community, academia, civil society, and international actors on how to significantly improve energy efficiency in the region. This work is undertaken collaboratively with the United Nations Regional Commissions, other international organizations and other stakeholders. The Group of Experts conducts analyses and identifies the state of development of energy efficiency in the UNECE region, based on existing data and benchmarking indicators. It highlights success stories that can be scaled up, in line with the energy efficiency objective of the sustainable energy goal and the energy efficiency aspects of the Hammamet Declaration.

The Group of Experts has developed a menu of economically viable and efficient policies, including high-impact policy measures, that could help the countries of the UNECE region (at the national and local levels) to significantly improve energy efficiency. The publication *Best Policy Practices for Promoting Energy Efficiency* presents a structured framework of best practices in policies to promote energy efficiency that have been proven as effective and viable under certain conditions.

Identification of UNECE member States that have implemented energy efficiency measures, conducting national case studies and development of a benchmark that should serve as a reference point for policy makers and energy experts working in

the field of energy efficiency, allows both tracking and reporting of progress and providing platforms for experience sharing.

More extensive work and greater focus on best practices is required in order to improve, complete, maintain and update the menu of these high-impact policy measures, followed by the development of implementation mechanisms, that will ensure successful energy efficiency policy outcomes, thus contributing to climate change mitigation efforts and strengthening regional cooperation in energy efficiency, with a view to reducing greenhouse gas emissions.

United Nations Economic Commission for Europe

Sustainable Energy Division




UNECE's work on sustainable energy is designed to improve access to affordable and clean energy for all and help reduce greenhouse gas emissions and the carbon footprint of the energy sector in the region. It promotes international policy dialogue and cooperation among governments, energy industries and other stakeholders.

The Committee on Sustainable Energy and its six subsidiary bodies carry out concrete and results-oriented activities with the aim to achieve the specific objectives identified for each priority area:

Areas of work

- Cleaner Electricity Production
- Coal Mine Methane
- Energy Efficiency
- Natural Gas
- Renewable Energy
- Resource Classification
- Energy Security

For more information

-  <http://www.unece.org/energy.html>
-  https://twitter.com/UN_ECE
-  <https://www.facebook.com/UNECEpage>
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Securing Affordable and Sustainable Energy Supply

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