



# EXECUTIVE SUMMARY

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The United Nations Economic Commission for Europe (UNECE) covers a large and diverse region comprising 56 member states. These countries have different energy situations and vary in their potential for and progress in renewable energy and energy efficiency. The present report covers 17 UNECE countries, with the aim of establishing a data baseline and providing a general overview of their renewable energy situations.

Over the past decade, the national governments of the selected countries have been working actively to leverage this renewable energy potential. Energy security and access to reliable, affordable, sustainable and modern energy are the key concerns driving renewable energy deployment. These countries require more substantial investment to fully realise its renewable potential and to bring innovative solutions to tackle their energy challenges, such as heating in urban and rural areas. A reliable data baseline is a pre-requisite and an enabler for more investment activity.

The UNECE has contributed actively to fulfilling the 17 countries' aspirations in renewable energy by providing them with a platform for collaboration among UNECE member states. In 2014, a UNECE Group of Experts on Renewable Energy was established to step up these efforts. Its mandate is to carry out action-oriented, practical activities to significantly increase the uptake of renewable energy, in line with the United Nations Secretary-General's Sustainable Energy for All (SE4ALL) initiative. This *UNECE Renewable Energy Status Report* strives to present analysis of up-to-date data and information on the status of renewable energy and energy efficiency in the selected countries of the UNECE region.

## OVERVIEW

South East and Eastern Europe, the Caucasus, Central Asia and the Russian Federation are very diverse in terms of their population size and their economic, social and political characteristics. However, their energy systems were developed in a similar manner and still face some common challenges as they advance in deploying renewable energy and improving energy efficiency. Several countries covered by this report are rich in fossil energy resources, such as oil, gas and coal, and five countries (Azerbaijan, Kazakhstan, the Russian Federation, Turkmenistan and Uzbekistan) are net exporters of oil and gas. Most of the countries have sizable potential for hydropower and other renewable energy resources – including solar, wind and bioenergy – yet they are all at the early stages of deployment of non-hydro renewable energy and energy efficiency.

The 17 countries face several challenges that could become drivers for renewable energy and energy efficiency deployment. Energy security challenges are key, especially in countries that are net energy importers. Some countries face power outages on a seasonal basis. Electricity generation, transmission and distribution infrastructure is ageing, as is district heating infrastructure, resulting in great inefficiencies. Energy subsidies, prevalent in oil and gas exporting countries but also still present in importing countries, are detrimental to renewable energy and energy efficiency deployment, as energy commodities are not priced at market prices, making renewables and efficiency comparatively very expensive.

Energy intensity remains high despite notable improvements over the past two decades related to structural changes in economies and to energy efficiency efforts, and further potential for energy efficiency remains to be exploited. The energy market structure is an issue in certain countries. Lack of liberalisation makes market entry for new players (in renewable energy or other areas) extremely difficult. Administrative red tape is also slowing project implementation across the selected countries.

Regional co-operation is driven through several initiatives, but co-ordination on renewable energy is limited to the Energy Community, with its legal obligations to implement the European Union (EU) Renewable Energy Directive and binding renewable energy targets in 2020. The South East European countries of Moldova and Ukraine are members of the Energy Community, while Georgia is a candidate and Armenia is an observer. Some countries in South East Europe have EU candidate status (Albania, The former Yugoslav Republic of Macedonia and Serbia) or have opened negotiations (Montenegro), advancing the pace of renewable policies. All countries have different levels of commitment to the Energy Charter. Countries in Eastern Europe, the Caucasus and Central Asia are co-operating with the EU through the INOGATE programme.

Regional co-operation also is driven through cross-regional power trade. Transmission investment is supportive and is a pre-requisite for increased integration of renewable power in the networks. The Central Asia South Asia Electricity Transmission and Trade project (CASA-1000) is a flagship project implemented jointly by Kyrgyzstan, Tajikistan, Afghanistan and Pakistan and co-financed by the World Bank and the European Bank for Reconstruction and Development (EBRD). Other frameworks of co-operation with the EU include the Association Agreement signed by the governments of Georgia, Moldova and Ukraine in June 2014. Armenia, Georgia, Moldova and Ukraine are members of the Eastern Europe Energy

Efficiency and Environment Partnership (E5P), supported by the European Commission and other bilateral donors.

All of the 17 countries – with the exception of the Russian Federation, Turkmenistan and Uzbekistan – have at least one city or town participating as a signatory to the EU Covenant of Mayors. This reflects a city's commitment to meet and exceed the EU's objective of a 20% reduction in carbon dioxide (CO<sub>2</sub>) emissions. Overall, although several initiatives have one or more regional dimensions, common objectives or regional targets for renewables and energy efficiency have not yet been formulated at the regional level.

## RENEWABLE MARKET AND INDUSTRY OVERVIEW

The 17 countries in the region differ widely in their share of renewable energy in total final energy consumption. In some countries, these shares are driven by the persisting traditional use of biomass heating, while other countries have high proportions of hydropower in their power sectors. Countries with high shares of renewable energy in total final energy consumption include Tajikistan (58%, hydropower), Montenegro (46%, traditional biomass uses and hydropower), Albania (38%, mostly hydropower but also some traditional biomass uses), Georgia (28%, mostly hydropower but also some traditional biomass uses) and Kyrgyzstan (22%, hydropower).

The share of renewable energy use in power generation differs widely among the 17 countries. Albania, Kyrgyzstan and Tajikistan run their power systems almost exclusively on hydropower, whereas in Georgia and Montenegro, hydro represents more than half of electricity produced in the country. Although the Russian Federation has the largest total hydropower production of the selected countries, hydro's share of total power generation in Russia is lower, due to the size of the country's power system.

Other renewable power technologies are nascent in the 17 countries, with significant deployment only in Ukraine (mostly solar photovoltaics (PV) and onshore wind). Smaller developments exist in Azerbaijan, Kazakhstan, The former Yugoslav Republic of Macedonia, Montenegro and Serbia (mostly onshore wind, solar PV and biogas/biomass installations). Although rural electrification is not a central issue for the countries, distributed renewable energy solutions such as solar PV, small-scale wind, biomass and micro-hydro can be practical solutions for remote electricity generation and in places with power outages or unstable power.

The 17 countries have potential to further develop their renewable energy sources beyond hydropower. Sizable solar PV potential exists in all countries, and insolation is particularly strong in South East Europe, the Caucasus, Central Asia and southern regions of the Russian Federation, improving the economics of potential solar PV generation in these countries. Onshore wind resources are present in all of the countries, with particularly large resources in Kazakhstan, the Russian Federation and Ukraine. South East Europe, Eastern Europe and the Russian Federation have large biomass resources, which are only partially exploited. Concentrating solar power (CSP) potential exists in the Central Asia region and in parts of the Russian Federation, and confirmed

high-temperature geothermal resources suitable for power generation are present in a few sites in the Russian Federation. Other countries may have modest geothermal resources, but their suitability for power generation needs to be confirmed.

The penetration of modern renewable energy technologies for heating and cooling in the 17 countries is modest. Solar water heating installations exist in a few countries (Albania, Armenia, The former Yugoslav Republic of Macedonia, the Russian Federation and Ukraine) and could be economically developed in all of the countries. The potential for bioenergy-based renewable heat is great. In selected places with district heating networks, these could be converted to be fuelled by solid biomass or biogas (for example, the World Bank-financed Biomass District Heating Project for Belarus aims to scale up the efficient use of renewable biomass in heat and electricity generation in selected towns in Belarus).

Despite biofuels targets in several countries and ample bioenergy potential, capacities for production of liquid biofuels can be found only in Belarus (biodiesel), The former Yugoslav Republic of Macedonia (biodiesel) and Ukraine (ethanol).

## DISTRIBUTED RENEWABLE ENERGY AND ENERGY ACCESS

Access to affordable, reliable and sustainable energy is a challenge for low-income and rural populations in the region, despite its endowment in energy sources. Some children still study in under-heated classrooms. Households burn low-quality fuel wood for heating and cooking in stoves that have conversion efficiencies of 20% or less. A few rural settlements in remote areas lack electricity access. Although electrification rates are very high in the global context, several countries in the region report high use of polluting and health-damaging solid fuels for heating and cooking. To improve the quality of energy access, national governments and international donors are promoting emerging renewable energy solutions.

From a global perspective, the region has high electricity access. Although 1.2 billion people worldwide lack access to electricity networks, 15 out of 17 countries in the region had electrification rates of 100% of their population in 2010 (the exceptions being The former Yugoslav Republic of Macedonia and Moldova). In 2012, all 17 countries reported 100% electrification rates. Still, a discrepancy remains between reported rates and the situation on the ground, where a small number of remote settlements and rural communities continues to lack access to electricity. The reasons vary by country and include a history of conflict or changes in the sources of electricity supply.

Beyond electricity, the region faces a variety of energy access challenges. In some countries, populations that rely largely on solid fuels for heating and cooking still face issues related to low reliability (power outages), affordability (high rates of energy poverty), supply quality and health. Power outages continue to occur in several countries, especially in areas of the Caucasus and Central Asia that have poorly maintained and ageing energy infrastructure. Access to non-solid fuels is the greatest factor affecting energy access in the region. Almost 13 million people

across the 17 countries still rely on polluting and health-damaging solid fuels to meet their cooking and heating needs.

A mix of ad hoc projects financed by international donors and government programmes has been adopted in the region to promote renewable energy solutions that improve the quality of the energy supply. Most of the projects documented in this report address heating for residential use using solar thermal systems. Only Montenegro has a government programme providing support for the conversion to modern biomass, which can be accessed by low-income households in remote areas as well. Uzbekistan has a national standard for biogas-based systems. Another potential solution in households with a more reliable electricity supply is geothermal heat pumps, provided that local economics allow it.

Financing the switch to renewable energy solutions is an issue for local populations. So far, such efforts have been covered through grants from international donors or contributions from government budgets. Innovative business solutions have yet to emerge to cover project roll-out at a large scale as well as investments in the renewable fuel supply chain (e.g., wood pellets). Electricity access is being addressed through fewer initiatives, given the limited scale of the issue. Only Tajikistan has a renewable energy target specifically for enabling electricity access in remote communities that are not connected to the national grid. In terms of non-hydro renewable options, solar PV is being used in several countries.

## ENERGY EFFICIENCY

The selected UNECE countries have made significant progress in reducing their energy intensities since 1990, but energy intensity (which is not a substitute for energy efficiency indicators) is no longer decreasing. Most of the countries still face high losses in their electricity, natural gas or district heating transmission and distribution networks. Barriers to more-systematic market development for energy efficiency include the lack of (or inadequate) institutional frameworks. Another barrier to deployment of energy efficiency projects is the availability of sizable public or private funding. This is more relevant in Eastern Europe, the Caucasus and Central Asia than in South East Europe, where funding is available from international donors, although the absorption capacity at a local level is weak.

Countries of South East and Eastern Europe, the Caucasus and Central Asia continue to face challenges in improving the efficiency of their electricity supply, despite ongoing modernisation of their electricity infrastructure. Most countries in Eastern Europe, the Caucasus and Central Asia still had high electricity transmission and distribution losses in 2011 (the most recent year for which regional data are available), and some of them had losses more than three times the EU average of 6.2% of electricity output.

The building sector has considerable potential in the selected countries. In South East Europe, buildings represent around 50% of final energy consumption and a significant opportunity to achieve energy savings, ranging from 20–40%. Armenia's National Program on Energy Saving and Renewable Energy estimates an energy savings potential of 40% in the country's building

sector, and in the Russian Federation, deep retrofits in residential buildings could result in 50% savings. International donors are actively supporting energy efficiency projects in buildings through adequate policies, reinforcing of institutional capacity and financing of retrofits. Given the importance of thermal use in buildings and the widespread use of poorly maintained and inefficient district heating systems in these countries, this area holds high energy-savings potential.

Efficient lighting, appliances and cooking could further contribute to improving energy efficiency in buildings, but their deployment in the market is a complex process driven by regulatory policies. For example, Ukraine provides partial reimbursement of loans for residential energy efficiency equipment under the State Target Economic Program on energy efficiency. Kyrgyzstan, meanwhile, has identified energy efficiency labelling as a priority, but no action has been carried out. Outside South East Europe, only Kazakhstan, the Russian Federation and Tajikistan have phased out inefficient incandescent light bulbs from their markets.

Initiatives to improve energy efficiency in the region's industry and transport sectors are less common, due in part to less-developed policy and regulatory instruments. Achieving better efficiency in industry faces multiple challenges, including high upfront costs, concerns about competitiveness and the existence of energy subsidies. Most of the countries host projects financed by international donors and development banks, which target improving energy efficiency in industry and include voluntary or mandatory energy audits and the introduction of energy management.

## POLICY AND TARGET LANDSCAPE

Policies and targets are essential drivers for the deployment of secondary regulations and for attracting investment in renewable energy and energy efficiency projects. Some positive progress has been made in South East and Eastern Europe, the Caucasus and Central Asia, as well as in the Russian Federation. Yet there remains significant room for improvement of policies and regulations in these countries in order to fully unleash the available potential of renewable energy and energy efficiency.

All 17 countries, with the exception of Turkmenistan, have strategic documents outlining their priorities in at least one renewable energy technology. Part of this effort is the adoption of targets and regulatory policies for renewables deployment. All countries except for Georgia and Turkmenistan have renewable energy targets. Two countries – Turkmenistan and Uzbekistan – have no regulatory policies for renewable energy.

The most common support for renewable power generation is feed-in tariffs, which are used in 12 of the 17 countries (the exceptions are Moldova, the Russian Federation, Tajikistan, Turkmenistan and Uzbekistan). Tendering is used in Albania, Bosnia and Herzegovina, Montenegro and the Russian Federation. Tradable renewable energy certificates are used in Belarus and the Russian Federation. Electric utility quotas and obligations have been adopted in four countries (Albania, Belarus, Montenegro and

the Russian Federation), and net metering also has been adopted in four countries (Armenia, Belarus, Montenegro and Ukraine).

The Russian Federation is using a mix of policies, including capacity-based support, which is unique in the global context. Renewable heating and cooling is supported through mandates only in Montenegro. Several countries have renewable energy targets for the transport sector, including Albania, The former Yugoslav Republic of Macedonia, Moldova, Montenegro, Serbia and Ukraine.

Various types of fiscal incentives and public financing are present in the selected countries, with the exception of three countries (The former Yugoslav Republic of Macedonia, Turkmenistan, and Uzbekistan). Several countries have approved city and local government policies promoting renewable energy.

With regard to energy efficiency targets and policies, all 17 countries are pursuing regulatory policies with the exception of Turkmenistan. All countries except for Armenia, Azerbaijan, Georgia, Kyrgyzstan and Turkmenistan have established targets. Four countries do not have any national energy efficiency awareness campaigns. Regulatory policies are most common in the building sector, followed by lighting and appliances, transport and industry. Building standards reflecting varying levels of energy performance requirements exist in all countries except Albania, Georgia and Turkmenistan. Mandatory labelling for buildings exists only in South East Europe, although not in Albania and Uzbekistan. Lighting standards exist in nine countries, and mandatory labelling for lighting exists in six countries. Mandatory labelling for appliances exists in nine countries. In the transport sector, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Montenegro and Ukraine have vehicle fuel economy and emission standards.

Albania, Belarus, Bosnia and Herzegovina, The former Yugoslav Republic of Macedonia, Montenegro and Serbia use energy efficiency targets for industry. Other instruments used in the 17 countries for industry are auditing and monitoring regulations. Energy efficiency in power generation is addressed in policies in 12 countries.

## INVESTMENT

The 17 countries represented just 0.5% – or USD 0.9 billion – of the world's total investment in new renewable energy in 2014. Renewable energy investment in the region (outside large hydropower) developed erratically over the period 2004–2014, showing some positive signs during 2008–2011 (driven by growth in Eastern Europe) but then declining in 2013 and 2014. Based on selected countries where data are available, private sector investment is concentrated in large hydropower projects. The public sector plays a role in renewable energy investment in the region, with sources originating in national governments, international donors and multilateral development banks. Most of the governments provide fiscal incentives and public financing for renewables. Lending for renewable energy projects is available through national and international banks with the support of several international donors. Some investment is channelled through climate finance such as the Climate Investment Funds and the Global Environment Facility.

## CONCLUSION

Over the past two decades, South East and Eastern Europe, the Caucasus, Central Asia and the Russian Federation have made strides in renewable energy and energy efficiency. Governments have developed various types of targets and policies to promote renewable energy sources across the region. From a global perspective, however, these developments remain marginal. Further project deployment and investment flows are needed to enable the region to catch up with global renewable energy market development.

In the near future, expected renewable energy developments differ by sub-region:

- Southern Europe is expected to be the most active in renewables, benefiting from its proximity to the EU and from the convergence of its industry, installers, and developers with the EU energy market. Developments are expected in solar PV, solar water heating, onshore wind and bioenergy technologies in particular. The gradual switch from traditional to modern uses of biomass would be beneficial for the region's environment and the health of its inhabitants.
- In Eastern Europe, the most active player to-date, Ukraine, is facing a complex geopolitical situation and a severe devaluation of its currency, posing major obstacles to further development of renewable energy, in particular solar PV and wind.
- In Central Asia, Kazakhstan is expected to be the biggest renewable energy player and has taken the first steps towards deployment of its substantial wind energy potential. Uzbekistan is expanding its solar capacity with support from the Asian Development Bank.
- In the Caucasus, renewable energy deployment could be driven by energy security concerns in Armenia and Georgia. Armenia is more advanced in renewables deployment but remains only in the preparatory stages, although the government recently developed a Renewable Energy Program Investment Plan.
- In the Russian Federation, due to its large size, some renewable energy development can be expected, but it will be far below the country's potential. Most of the power sector is still in the hands of the state, making entry for renewable energy actors difficult. The only pressure for new development could come from concerns about system adequacy over time, due to the ageing power infrastructure and the need to decommission significant capacity over the next decade. However, competition with new natural gas power plants will be fierce.
- In the near future, further development of energy efficiency, despite its large potential in the 17 countries, is expected to be hampered by slow policy development as well as enforcement complexities. The lack of detailed sectoral data is detrimental to the implementation of proper monitoring. In South East Europe, countries such as Albania, The former Yugoslav Republic of Macedonia and Montenegro have in place relatively more developed policy frameworks, which should enable increases in energy efficiency in the near future. The size of the energy efficiency market in South East Europe will be determined by

the ability of market players to implement projects driven by newly introduced policy frameworks and to leverage available financing facilities.

- In Eastern Europe, the Caucasus and Central Asia, countries such as Belarus, Kazakhstan, Moldova, Tajikistan and Uzbekistan have in place the main pillars of an energy efficiency framework, which could yield benefits in the medium term provided that enforcement is adequately supported. Countries with above-average energy intensity for the region and with no or limited policies in place risk falling behind, as the competitiveness of their economies could be hampered by low energy efficiency. In Ukraine, in particular, the lack of efficiency measures in the industry sector could be of concern, combined with the challenging economic and geopolitical situation. Phasing out energy subsidies and introducing metering for district heating at the end-user level will be essential for future growth in energy efficiency markets in these countries.

- In the Russian Federation, a wide-ranging framework is being created to promote energy efficiency across several sectors. However, adequate regulatory conditions for investment projects to take place at the desired scale are not met, delaying further

improvements in the efficiency of buildings and industries.

In conclusion, although governments are making initial efforts to build a basis or to advance policy and regulatory frameworks for renewable energy and energy efficiency, the unfavourable economics of energy supply and use, due to subsidies and the abundance of fossil fuels in some countries, continue to hamper the economics of projects. Market structure plays an important role in the deployment of renewable energy and energy efficiency, and market entry for new players remains challenging in countries that have not fully liberalised their energy markets. Upgrades of ageing energy infrastructure could be an opportunity to better integrate renewable energy and improve energy efficiency. Common regional objectives for renewable energy and energy efficiency could help to advance this agenda and to pull the 17 countries more intensively into ongoing international co-ordination.



**OVER THE PAST TWO DECADES, SOUTH EAST AND EASTERN EUROPE, THE CAUCASUS, CENTRAL ASIA AND THE RUSSIAN FEDERATION HAVE MADE STRIDES IN RENEWABLE ENERGY AND ENERGY EFFICIENCY. GOVERNMENTS HAVE DEVELOPED VARIOUS TYPES OF TARGETS AND POLICIES TO PROMOTE RENEWABLE ENERGY SOURCES ACROSS THE REGION. FROM A GLOBAL PERSPECTIVE, HOWEVER, THESE DEVELOPMENTS REMAIN MARGINAL.**