



# Sustainable Energy and Human Development in Europe and the CIS



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# Foreword



*This year marks the beginning of the Sustainable Energy for All (SE4ALL) decade. The UN Secretary General's SE4ALL initiative was launched in 2011 and aims to achieve three main objectives by 2030: **ensuring universal access to modern energy services, doubling the share of renewable energy** in the global energy mix, and **doubling the rate of improvement in energy efficiency**. As a multi-stakeholder partnership the SE4ALL initiative encourages governments, the private sector, financial institutions and international organisations to work together in mobilising political will and technical and financial resources. Scaling up action on sustainable energy will generate significant development dividends such as economic growth, expanded social equity and a cleaner environment. More than 83 countries have already joined the SE4ALL initiative, six of which are from Eastern Europe and Central Asia.*

*Many of the energy challenges in Europe and the Commonwealth of Independent States (ECIS) are similar to those in other regions, yet others are specifically related to the climatic, economic, environmental and political circumstances in the region. This publication sheds light on those regional issues associated with energy efficiency, renewable energy, and energy access. It also highlights the human, economic, social and environmental dimensions of sustainable energy.*

*The ECIS region is blessed with almost universal household electrification (99.4%). However, the ageing energy supply infrastructure, a lack of supply diversification and increasing tariffs expose more and more people to power cuts and high electricity and gas bills. This situation is particularly acute during the cold winter months, and disproportionately affects poor and rural populations. Some are switching back to solid fuels for cooking and heating, and others to electricity generation via off-grid diesel generators. Access to affordable and reliable energy is a key determinant of socio-economic development in the region.*

*Although the region has tremendous untapped potential for almost all forms of sustainable energy, so far renewable energy sources (other than hydropower) account for only 1.38% of energy supply. However, the region has shown a positive trend in recent years in terms of adopting sustainable energy technologies, for example the generating capacity of solar PV and wind power plants increased by 2.5 GW from 2005 to 2012.*

*Many of the countries in the region have high carbon footprints due to a legacy of energy intensity and energy inefficiency from industries and buildings constructed during the past five decades. Investments in energy efficiency often present win-win solutions; they can save energy, thereby concurrently reducing both costs and greenhouse gas emissions. In addition, energy efficiency increases the disposable income of families, which can make a difference for poverty-affected households.*

*UNDP works with many partners in the ECIS region to promote sustainable energy solutions. Sustainable energy and human development are closely connected, and it is my hope that this report will make a significant contribution to our understanding of specific energy-related challenges, and will guide subsequent action to enhance sustainable energy deployment and improve human development in the region.*



**Cihan Sultanoğlu**

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# List of Acronyms

<b>BiH</b>	Bosnia and Herzegovina
<b>CA</b>	Central Asia
<b>CAGR</b>	Component Annual Growth Rate
<b>CAU</b>	Caucasus
<b>CHP</b>	Combined Heat and Power
<b>EEA</b>	European Environment Agency
<b>ECIS</b>	Europe and Commonwealth of Independent States
<b>EU</b>	European Union
<b>FIT</b>	Feed-in Tariff
<b>FiP</b>	Feed-in Premium
<b>FYROM</b>	Former Yugoslav Republic of Macedonia
<b>GDP</b>	Gross Domestic Product
<b>GEF</b>	Global Environment Facility
<b>GHG</b>	Greenhouse Gas
<b>GIZ</b>	Deutsche Gesellschaft für Internationale Zusammenarbeit (German Society for International Cooperation)
<b>GTF</b>	Global Tracking Framework
<b>GW</b>	Gigawatt
<b>IEA</b>	International Energy Agency
<b>IFAD</b>	International Fund for Agricultural Development
<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>IRENA</b>	International Renewable Energy Agency
<b>LAC</b>	Latin American and the Caribbean
<b>MRET</b>	Mandatory Renewable Energy Target
<b>MS</b>	Member States
<b>MTCE</b>	Million Tons of Coal Equivalent
<b>MW</b>	Megawatt
<b>MWh</b>	Megawatt hour
<b>ODA</b>	Official Development Assistance
<b>OECD</b>	Organisation for Economic Co-operation and Development
<b>OPEC</b>	Organisation of the Petroleum Exporting Countries
<b>RE</b>	Renewable Energy
<b>REEEP</b>	Renewable Energy and Energy Efficiency Partnership
<b>RES</b>	Renewable Energy Sources
<b>RF</b>	Russian Federation

<b>RoI</b>	Return on Investment
<b>SE4ALL</b>	Sustainable Energy for All
<b>SME</b>	Small and Medium Enterprises
<b>SPV</b>	Solar Photo Voltaic
<b>TFEC</b>	Total Final Energy Consumption
<b>TJ</b>	TeraJoule
<b>TPES</b>	Total Primary Energy Supply
<b>UN</b>	United Nations
<b>UNECE</b>	United Nations Economic Commission for Europe
<b>UNDP BRC</b>	United Nations Development Programme Bratislava Regional Centre
<b>UNMIK</b>	United Nations Interim Administration Mission in Kosovo
<b>WB</b>	World Bank
<b>WBs</b>	Western Balkans
<b>WBT</b>	Western Balkans and Turkey
<b>WCIS</b>	Western Commonwealth of Independent States
<b>WEC</b>	World Energy Council
<b>WHO</b>	World Health Organization
<b>WWF</b>	World Wildlife Fund

# Introduction

Energy is central to human development. It accelerates social progress and enhances productivity. Without the provision of and access to clean, reliable, and affordable energy services, other economic and social development goals cannot be achieved. Energy directly affects people, communities and countries in terms of economic growth, health, security, environment, education, and employment. Although most countries in Europe and the CIS<sup>1</sup> provide access to the electricity grid and gas distribution networks for most citizens and businesses, the challenges they face related to sustainability, efficiency and reliability of modern energy services are complex. The challenges associated with sustainable energy are not primarily about physical access to the electricity grid or gas distribution network. They are mostly related to the inefficient use of energy, frequent power cuts, increasing energy costs, sustainable and affordable heating in winter, and the slow uptake of renewable energy.

The past two decades have produced many changes in how countries in the ECIS region use energy. At present, some export large quantities of fossil fuels and boast some of the world's highest rates of energy intensity; others struggle to provide reliable and affordable energy to their own citizens. Many of the ECIS countries have a legacy of energy intensity and energy inefficiency. In some of them energy intensity is as much as three times higher than the EU average. Energy losses due to old infrastructure and dilapidated networks are significant. Numerous market barriers, often combined with subsidised energy prices, pose a real challenge for promoting renewable and

efficient energy technologies in ECIS countries. Lack of access to basic energy services and frequent disruption of power supply are of particular concern in Central Asia and the South Caucasus.

This publication provides an overview of key challenges and developments related to renewable energy, energy efficiency and energy access in the ECIS region. The analysis presented here does not attempt to be a comprehensive exploration of all energy sector issues; instead it focuses on analysing trends and exploring opportunities related to the economic, social and environmental aspects of sustainable energy. It is divided into three chapters, each discussing the status, challenges and potential for energy access, energy efficiency and renewable energy.

**Energy Access:** Although near-universal electrification exists in the ECIS region, significant challenges remain, such as intermittent power supply, energy poverty, energy security and a reversal to the use of solid fuels for cooking and heating. Whilst differences between countries necessitate country-specific approaches, several concurrent energy access themes stand out. The most pressing issue in the region is probably the need to address insufficient access and supply interruptions in order to rectify the negative socio-economic and environmental consequences, which present major obstacles to economic development and overall sustainability in some countries.

Secondly, energy sector reforms, undertaken successfully in some transition economies, are

<sup>1</sup> For the purpose of this report, the ECIS region consists of: the Russian Federation, Ukraine, Moldova, Belarus, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan, Armenia, Georgia, Azerbaijan, Turkey, Albania, Serbia, the Former Yugoslav Republic of Macedonia, Montenegro, Bosnia and Herzegovina and Croatia.

essential to reconcile decades of subsidised energy tariffs and distorted energy prices, thereby releasing money for investments in energy supply infrastructure. At the same time, as energy sector reforms have often been suggested as a solution to the economic inefficiencies of subsidised energy tariffs, a number of organisations such as the IMF and the World Bank have supported governments with the removal of energy subsidies. The issue is extremely complex and not easy to resolve. Some progress has been made, however large fossil fuel subsidies remain a significant barrier to greater investments in energy efficiency and renewable energy. Decision-makers face the dilemma of how to deal with energy subsidies and, like the politicians, are concerned that taking unpopular decisions may provoke social unrest and imposing unpopular energy price hikes may generate political discontent among the former beneficiaries of energy subsidies. Consequently, energy sector reforms in many transition economies are considerably restricted.

Thirdly, increases in energy tariffs threaten to intensify energy poverty in the region and targeted social assistance will be required to ensure that the poorest do not slip through the social safety net.

Lastly, programmes targeting rural and isolated households across the region should be considered a priority by SE4ALL development partners.

Tracking the progress made in addressing the above issues will require new methods and indicators and will necessitate the collection of reliable primary data. Furthermore, building the capacity required for tracking progress towards SE4ALL targets will strengthen the ability of governments to understand and address both energy and development issues.

The chapter on energy access examines available data on energy access in the ECIS region and provides an insight into the current challenges, their possible solutions, and methods for tracking progress towards energy access.

The three main challenges to achieving sustainable, reliable and affordable energy access in the region are also discussed: (1) remote, off-grid locations (2) on-grid access with limited or intermittent supply due to the poor condition of infrastructure or fuel supply problems; and (3) affordability issues. For certain countries these issues are closely linked to the additional challenge of energy security. The chapter closes by suggesting additional, regionally important tracking methods. It proposes the integration of tracking indicators that reflect the special conditions of the region, including power supply reliability, expanding the scope of tracking from households to social institutions and productive uses of energy in the medium term.

**Energy Efficiency:** In the ECIS region, energy efficiency is an essential component of addressing current energy challenges. Many countries use several times as much per unit of output energy as OECD countries, while the energy consumption *per capita* and quality of energy services is much lower. Long-term patterns of energy use in the built environment, transportation infrastructure, industry, and agriculture, hinder the penetration of energy efficiency technologies and practices, resulting in soaring energy demands. In most cases, the energy production and distribution infrastructure needs major investment to provide better efficiency, coverage and quality of services.

Over the last two decades, primary energy intensity per unit of GDP produced has fallen in all ECIS countries. However, in the majority of countries in Central Asia and other CIS countries, primary energy intensity is still more than double EU-27 levels. This relatively high energy intensity translates into a large potential for energy savings and associated economic, social and environmental gains.

By 2010, the building sector was the biggest consumer of final energy and electricity, with space and water heating dominating energy consumption. Unlike other regions the need for sustainable heating is a unique challenge in

ECIS countries because it concerns every country and every citizen. The demand for electrical appliances and equipment in the building sector, especially in commerce and administration, poses a rapidly growing challenge. Energy efficient construction and efficient thermal retrofitting of buildings represent the highest potential for energy savings. The most attractive options economically are technologies that use electricity efficiently, such as lights, appliances, electronics, and equipment.

By 2010, about half the countries of the ECIS region had adopted laws on energy efficiency and set national energy efficiency targets. In order to achieve their targets, many countries apply regulatory and financial incentives, in line with international practice. Although the countries have advanced in the design and adoption of energy efficiency policies, comprehensive and coherent policy packages, which address a range of complex barriers, have yet to be formulated. Available evidence suggests that the implementation and enforcement of energy efficiency policy represents a challenge for the region, which is why further capacity building remains an important task.

In spite of the recent energy tariff increases throughout the ECIS, energy prices are still lower than the cost recovery threshold. Energy subsidies misrepresent the true cost of energy for end-users and represent high fiscal and environmental burdens. Removing energy subsidies and redirecting them to energy efficiency policies and social protection programmes may not only raise energy efficiency and help cope with energy poverty, but it can also result in net gains for the public budget.

Energy efficiency attracted only 17% of all energy-related financing during 2006-2012; 83% of financing was invested in generation and production of fossil fuels and renewable energy, in spite of the fact that energy efficiency investments are much more cost effective. The low share of financing for energy efficiency is partially explained by the difficulty of providing

such financing to disaggregated small-scale energy efficiency projects. More assistance will be required to develop standardised methodologies for making energy efficiency projects identifiable, replicable, and bankable; equally monitoring, reporting, and verification procedures will need to be established in order to scale up these projects and make them commercially attractive for implementers.

Whereas sectoral energy intensity is high, *per capita* energy consumption is relatively low compared to the OECD or EU-27 countries. As economies develop and inequalities rise, reducing energy demand through energy efficiency technologies and practices becomes a cost-effective solution to securing the ability to meet growing energy demand and to addressing energy poverty.

Low efficiency in the building sector causes additional demand for heating and electrical energy. When these are constrained, households tend to switch to non-commercial, traditional fuels. Wood collection by rural communities contributes to deforestation, biodiversity loss, and soil degradation. Outdated technologies, used for the combustion of non-commercial energy carriers, lead to indoor air pollution and high greenhouse gas emissions.

Uncomfortable thermal conditions in homes, combined with low quality lighting, contribute to higher medical bills and productivity loss. Problems at health and educational facilities, due to non-existent or low quality heating and electricity supply, undermine the human potential and ultimately contribute to lower labour productivity.

Accurate tracking of energy efficiency trends at national, sector, end-use, and technology levels is essential to the design, evaluation, and optimisation of energy efficiency policies. This is why more effort is needed to track and analyse sectoral end-use statistics, to evaluate existing energy efficiency policies, and to track and analyse energy efficiency finance.

The energy efficiency chapter begins with an assessment of recent energy intensity trends in the region and goes on to describe energy efficiency issues in selected sectors. The chapter also tracks the policy environment for energy efficiency and provides a snapshot of energy efficiency finance. It examines the link between energy efficiency and social and economic development in the ECIS region and concludes by reviewing the challenges in tracking energy efficiency and identifying priority areas for attention.

**Renewable Energy:** Global investment in renewable energy suffers from severe regional imbalances. The ECIS region is no exception. It is estimated that in 2010 approximately 96.2% of total primary energy supply in the region came from fossil fuels, 16.2% higher than the global average. Despite the fact that the ECIS region exhibits excellent potential and promotional schemes for solar, wind, biomass energy, small hydropower (SHP) and geothermal plants, the vast majority of these resources remain untapped, impeded by a range of informational, technical, institutional and financial barriers.

An analysis of the renewable energy situation in the ECIS clearly shows that despite the excellent growth potential, actual deployment remains comparatively low and the energy mix is dominated by fossil fuels (coal, oil, and natural gas). Although some countries in the region have begun ambitious journeys to expand their RES in the near future, a number of existing barriers prevent investments from reaching their full potential. In particular, high initial investment costs for renewable energy projects and a lack of competitiveness when compared to fossil fuels remain major limitations to scaling up the use of RES and engaging the private sector. A number of key conclusions have emerged from this analysis.

Higher financing costs reflect a number of perceived or actual informational, technical, regulatory, financial and administrative barriers and

their associated investment risks in the region. Whilst there is evidence that favourable RES promotion schemes have led to increased deployment, the correlation is not always so clear. Experience has shown that investment barriers and risks must first be targeted with policy and financial de-risking instruments before financial incentive instrument are selected to target the remaining incremental cost necessary to make each technology price competitive.

High levels of fossil fuel subsidies (over 5% of GDP in some countries in Central Asia and as high as 11% in the Western Balkans) distort market price signals and reduce the competitiveness of RES over fossil fuels. In order to achieve the goals of SE4ALL by 2030 the competitiveness of RE technology must grow unhindered against their fossil fuel counterparts. This will require the reduction and the gradual phasing out of fossil fuel subsidies, not only in this region but globally.

The analysis revealed an absence of diversification in RES, with hydropower accounting for some 63.9% of TPES and LHP representing over 93% of electricity capacity from RES. To successfully increase RES diversification emphasis will need to be placed on promoting and supporting other forms of renewable energy (solar PV, wind, biomass, geothermal) and in helping to drive down the associated costs and risk factors of each technology. This can be reinforced through long-term commitments to specific renewable energy targets and detailed renewable energy roadmaps, and is an indication to investors that governments are committed to pursuing a strategy of increasing the share of RES.

The findings of the analysis in the renewable energy chapter reiterate the need for selected policy and financial de-risking instruments to attract private investment. Access to energy markets needs to be simple and transparent. Improvements can be made in the provision of qualified and detailed information about RES opportunities and commercial banks, in

particular, the need to be better educated about the risks and returns associated with financing renewable energy projects. The enhanced engagement of the banking sector is critical in increasing investment in RES. However, banks must first have a clear understanding of the investment risks involved in order to be in a better position to finance renewable energy projects.

Public policy instruments can play an important role in de-risking RE projects and help to encourage private sector investment in RES. Ultimately, it is the private sector that will drive new investment in renewable energy as public and international donor funding on its own is not enough to provide the level of investment that is needed. This means that RE investment de-risking must be at the core of any strategy that promotes renewable energy.

In order to understand the unique role RES can play in achieving the SE4ALL goals, the renewable energy chapter provides a concise overview of RE in the region. Beginning with the current state of deployed RES, the chapter then examines the RES market and the supporting financial, policy and institutional environment in the region. It quickly becomes clear that the majority of RES technical potential remains untapped, hindered by financial, technical and political barriers. Finally, the chapter explores some of the ways in which these barriers can be overcome and how the investment environment can be de-risked to promote investment and encourage the development of RES. The chapter closes with key findings and examines the methodological challenges that exist in tracking the progress made towards achieving the SE4ALL goals moving forward.

UNDP has been and is continuing to support comprehensive energy sector transformation programmes in the ECIS region, accelerating

the market adoption of clean technologies which includes measures such as: building capacities in local financial institutions for investing in renewable energy and energy efficiency; improving policy, legal and regulatory frameworks; raising awareness and building institutional capacities; and piloting site-specific technical solutions. In Armenia, foreign direct investment has been secured to restore a municipal district heating system; in Bulgaria, a new financial credit facility has been established offering affordable energy efficiency loans to homeowners; and in Croatia and Kazakhstan, UNDP's pilot investments have been considerably scaled up through state-funded programmes.

By addressing national and regional energy challenges in Europe and the CIS, UNDP is contributing to the UN Sustainable Energy for All (SE4ALL) initiative, and the achievement of its three sustainable energy goals by 2030: ensuring universal access to modern energy services, doubling the share of renewable energy in the global energy mix and doubling the rate of improvement in energy efficiency. UNDP supports transformational change, which lies at the heart of SE4ALL and the sustainable development agenda outlined in the outcome document<sup>2</sup> of the UN Conference on Sustainable Development (Rio+20).

Through UNDP's work over the past two decades it has become clear that energy is not merely a topic for specialised engineers; it needs to be addressed as part of national strategies on economic growth, social protection and climate risk management. Comprehensive and ambitious transformations will be required to achieve the SE4ALL targets. Countries will need to mobilise significant resources from public and private sources for a wide range of investments. The scale and complexity of the tasks ahead will require strong political commitment

<sup>2</sup> *The Future We Want: Outcome document adopted at Rio+20 available at: <http://www.un.org/en/sustainablefuture/>*

and the political and financial risks associated with transformations in the energy sector will need to be identified and addressed.

In order to attract and sustain both large- and small-scale investments and ensure a coherent overall approach to energy development, a favourable environment of policies, capacities, institutional frameworks and financing, at the national and local level, will need to be created. A promising approach, that has already yielded concrete results, is to remove barriers to facili-

tate public and private investments in clean and sustainable energy solutions. Some of these results are documented in the third volume of UNDP RBEC's success stories "Empowering Lives, Building Resilience". UNDP, together with many other partners, supports policy and regulatory reforms that level the playing field and lower the investment risks associated with clean energy. UNDP also helps build the capacity of private and public companies and institutions to implement policies and to design and scale-up their investment programmes.

# 1. Energy Access



## 1.1 Overview

The SE4ALL initiative has the ambitious target of universal access to modern energy services, which includes access to electricity and modern cooking and heating solutions for all by 2030 (Banerjee, 2013).

The ECIS region has almost universal household electrification. However, electrification does not tell the entire story. **Access to reliable and sustainable energy remains a challenge** in certain countries, areas and populations and poses challenges for food security, economic development, human health and poverty reduction, particularly in Central Asia and the far eastern parts of Russia. The three main challenges to achieving sustainable, reliable and affordable energy access in the region are: **(1)** remote, off-grid locations **(2)** on-grid access with limited or intermittent supply due to poor infrastructure or fuel supply problems and **(3)** affordability issues. These issues are closely linked to additional problems: energy security and energy poverty.

## 1.2 Defining Energy Access

Energy access is defined by the International Energy Agency (IEA) as “a household having reliable and affordable access to clean cooking facilities, a first connection to electricity (defined as a minimum level of electricity consumption) and then an increasing level of electricity consumption over time” (IEA, 2013). Although energy refers to all fuel types as well as electricity, access to electricity is defined by the World Bank as the percentage of households with an electricity connection, or the electrification rate (World Bank, 2013).<sup>3</sup> This information is usually

obtained from household and other demographic surveys. Unfortunately, these indicators often fail to capture detailed information on the quality and quantity of electricity supply. The quality of electricity supply can be defined as the fitness of electrical power supplied to consumer devices (voltage and fluctuations) as well as continuity of supply. Intermittent and insufficient access to energy is a more pressing issue in the region, more so than traditional energy poverty and has important outcomes for socio-economic development and environmental sustainability in the region.

The level of access to modern and clean cooking fuels, as defined by the 2013 Global Tracking Framework for SE4All, is determined by the primary cooking fuel used in each household.<sup>4</sup> Solid fuels that do not fall within this designation comprise wood, charcoal, agricultural residues, animal dung, and coal. Energy poverty is traditionally defined as insufficient access to electricity and/or dependency on traditional fuels, meaning insufficient access to modern energy services, which include electricity, clean cooking facilities<sup>5</sup> and affordable heating.<sup>6</sup>

## 1.3 The Benefits of Energy Access

Access to electricity and modern forms of energy have become important human development tools and enable sustainable development. The life sustaining aspects of energy access facilitate the provision of adequate food, shelter, water, sanitation, medical care, education, and access to information. Electricity supports fundamental human activities including lighting, communication, transport, commerce, manufacturing, and industry. Access to energy services such as space

<sup>3</sup> Sources for electrification rates include the World Bank Global Electrification Database and data from the International Energy Agency (IEA), International Renewable Energy Agency (IRENA) and Renewable Energy Policy Network (REN21).

<sup>4</sup> The World Health Organization's indoor air health impacts database accessed for data on cooking fuel access for this report: [http://www.who.int/indoorair/health\\_impacts/he\\_database/en/](http://www.who.int/indoorair/health_impacts/he_database/en/)

<sup>5</sup> Clean cooking facilities are defined by the IEA as fuels and stoves that do not cause indoor air pollution in houses.

<sup>6</sup> Energy poverty is also used by the SEA4ALL initiative to cover lack of access to affordable fuels. It should be noted that the European Commission uses the term “fuel poverty” in these circumstances.

heating provided by electricity and modern forms of energy are critical aspects for human development. Furthermore, the productive uses of energy for entrepreneurial activities are essential for businesses, economic development and community service provision. In contrast, insufficient access to electricity and modern forms of energy (non-solid fuels gas) are a hindrance to sustainable development and are particularly harmful to poor populations who may have limited access to affordable forms of modern energy. Insufficient access to energy has a harmful impact on women who are usually responsible for cooking and children who need adequate access for education and healthcare.

As a core deliverable of the SE4ALL initiative, universal access to electricity and gaseous fuels for cooking provides opportunities to improve livelihoods as well as providing many environmental benefits. Investing in energy access can provide improvements to public health and productivity whilst reducing harmful greenhouse gas emissions and the reliance on unsustainable energy sources. Historical rural electrification regimes across the region have brought a multitude of social and economic development benefits and have reduced the reliance on traditional fuels. **Universal access to clean energy is an important human development tool** enabling inclusive development, poverty reduction, business development, reducing the gap between the rich and the poor whilst reducing greenhouse gas (GHG) emissions that contribute to climate change.

#### 1.4 Access to modern energy services

ECIS countries have the advantage of nearly universal access to the power grid, with a rate of access to electricity (99.4%) that is unmatched by any region, other than North America (World

Bank, 2013). However, interruptions or shortages in electricity supply, insufficient access to clean and efficient cooking facilities and affordable heating restrict access to energy in particular groups, populations and countries. In addition, the 1990s war in the countries of the former Yugoslavia - Croatia, Kosovo<sup>7</sup>, Bosnia and Herzegovina (BiH), and Serbia resulted in damage to the sub-regional energy infrastructure, leaving many people who had previously been connected to the grid without access. As a result, **instances of energy poverty are present across the region**. Energy poverty severely impacts the potential for economic growth, negatively affecting people's livelihoods and the quality of social services.

The number of people without access and with intermittent supply has the potential to grow if infrastructure is not repaired or replaced and if the electricity supply is not increased (Renewable Energy and Energy Efficiency Partnership (REEEP), 2013).

#### 1.5 Availability and reliability of grid-connected electricity

Where grid access does exist, in some countries and populations, insufficient supply and deteriorating transmission infrastructure effectively break the link between grid access and reliable supply in Kosovo, Moldova, Albania and the Central Asian, Caucasus and Western CIS sub-regions. Many countries in the region fail to transmit, produce or import enough electricity to meet peak demand during winter months. Access to reliable energy services, such as an uninterrupted electricity supply and access to electricity, heat and gas networks is limited in rural and remote areas, especially in Kosovo, Moldova, Albania, Russia and across Central Asia. As a result, rural and remote populations are becoming increasingly reliant on solid fuels

<sup>7</sup> Hereinafter referred to in the context of UN Security Council Resolution 1244 (1999)

for thermal use (cooking and heating) and electricity generation (via off-grid generators).

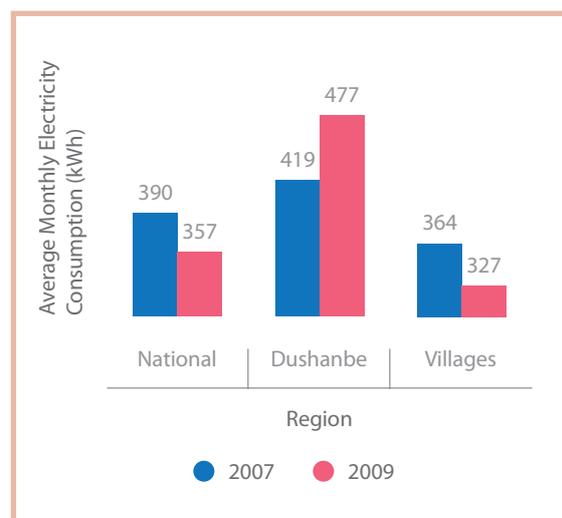
Turning to solid fuels to compensate for reduced access to electricity leads to indoor and outdoor air pollution, poor health, through respiratory illness related to smoke inhalation, and numerous negative environmental consequences such as deforestation, biodiversity loss, soil degradation and greenhouse gas emissions. In addition, relying on energy imports puts populations at the mercy of the supply and transmission capacity of other countries and of increases in energy prices.

### 1.5.1 Central Asia (Tajikistan and Kyrgyzstan)

These countries face most difficulties in terms of access to energy determined by the availability and reliability of the power supply. The unseasonably low rainfall and reduced hydroelectric supply capacity during Central Asia's winter of 2007-2008 caused severe reductions in Tajikistan's and Kyrgyzstan's energy supply, and resulted in a severe and compounding energy/water crisis. In Tajikistan, the crisis left over one million people without access to heat and electricity, as well as sanitation and pump-supplied water during severe winter conditions, the impact of which was most severe in rural areas (WHO, 2009). The electrification rate in Tajikistan is 97.3% although, alarmingly, Barqi Tojik (Tajikistan's power utility) data indicates that despite comprising nearly three quarters of the country's population, rural households during 2008-2010 accounted for only 8-11% of Tajikistan's total electricity consumption (see Figure 1.1). This discrepancy is partly due to the unreliable electricity supply, and unplanned blackouts during winter months when demand outweighs supply but may also be explained by the high cost of electricity.

Figure 1.1 illustrates the declining and disproportionate access to electricity in different areas of Tajikistan. The trend demonstrates that unplanned outages such as supply shortages and electricity rationing, which has become official

**Figure 1.1: Declining access to household electricity Tajikistan 2007-2009**



Source: UNDP, 2010

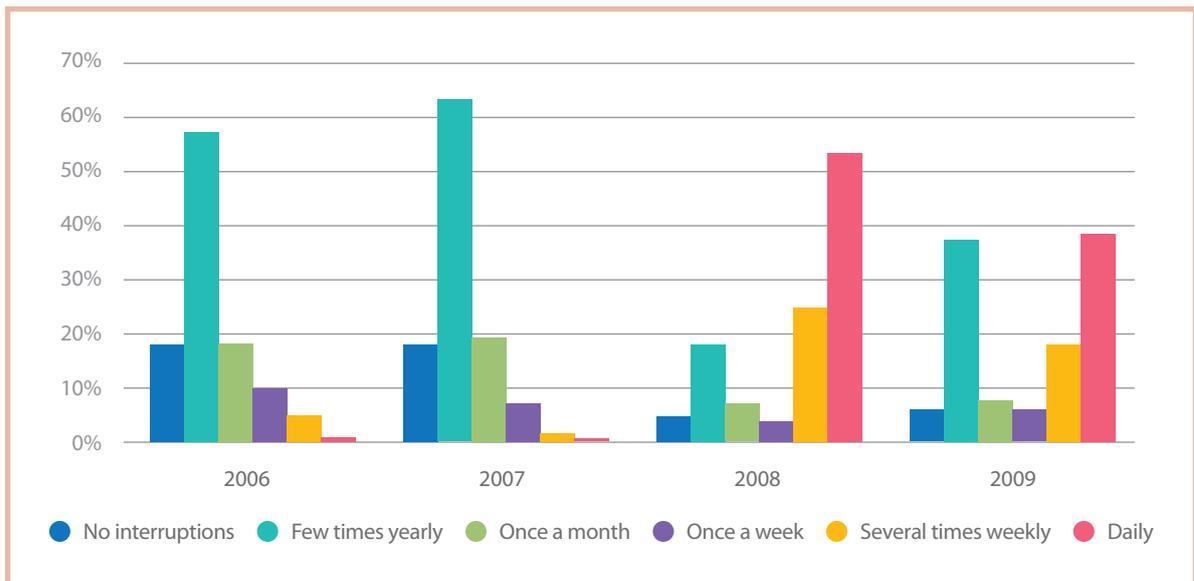
practice in winter, has a disproportionate effect especially in rural areas. Rural areas only have access to electricity for around six hours a day, whilst for other users, such as businesses, schools and hospitals who don't have their own generators, access is reduced even further. The energy and water access crisis in Tajikistan spread to neighbouring Kyrgyzstan (see Figure 1.2), with both countries suffering from planned and unplanned outages due to supply shortages. As a result, both countries had to launch humanitarian food security appeals (UNDP BRC, 2009).

The increase in frequency of power interruptions in Kyrgyzstan from 2006-2009 revealed a worrying and growing trend of unreliable electricity supply.

The effect of climate change on accelerating the melt of the glaciers that feed the reservoirs supplying hydropower plants, also poses a serious threat to the continuity of energy supply in Tajikistan and Kyrgyzstan (UNDP, 2009).

### 1.5.2 Western Balkans

*Albania:* In 2007, a lack of rainfall and low water levels for hydropower generation resulted in continuous load-shedding across the country

**Figure 1.2:** Kyrgyzstan, share of households reporting interruptions in electricity service (2006-2009)

Source: UNDP, 2010

and daily outages. Average daily electricity outages amounted to 3.7 hours in 2007 and severely affected economic development. The Ministry of Finance estimated that the 2006 power shortages cost Albania 1% of its GDP growth (Likmeta, 2011).

### 1.5.3 Western CIS

*Russia:* A number of rural and remote regions in Russia do not have access, or have inadequate access to essential energy services including electricity, heating and gas, ordinarily available to the majority of the population. Due to increasing supply capacity constraints and deteriorating power infrastructure a number of regions in the central and remote north struggle to meet electricity demand or will face difficulties in future (IFC/GEF, 2011). A joint IFC and GEF study revealed that in the absence of increased access, these supply shortages will probably affect lower income and remote populations as the issues of affordability, absent and intermittent supply, and electricity price inflation will be compounded (IFC/GEF, 2011).

*Ukraine:* In the Ukraine, the persistence of non-monetary settlements in the electricity sector

has resulted in serious cash shortages in the sector causing fuel supply shortages and 'frequent interruptions in electricity supply' with similar occurrences in the gas and district heating sectors (Dodonov, B., *et al*, 2004).

### 1.5.4 Caucasus

*Azerbaijan:* Azerbaijan has significantly enhanced its installed capacity over the last few years. However, only 75% of installed capacity is typically available during winter because of obsolete equipment and poor maintenance. The available supply capacity does not meet peak winter domestic demand and many areas have electricity for only a limited time during the day (REEEP, 2013). Furthermore, daily rationing of electricity continues to take place in some rural areas and the supply system needs further improvement to be able to deliver electricity to all those in need. The most vulnerable areas are the mountainous regions in the South-East, North-West, North-East and the non-occupied regions of Karabakh. Insufficient access and supply interruptions across the Caucasus have had numerous negative socio-economic and environmental consequences presenting major obstacles to economic development and mass

deforestation in the rural areas of the Talysh Mountains in Southern Azerbaijan (Noackl and Hidayatov, 2007). The rural mountain zone of Sheki-Zagatal and the central areas of Mugan-Salyan and Karabakh-Mil have the country's highest rates of extreme poverty and often lack basic infrastructure and power supply altogether (IFAD, 2013).

## 1.6 Consequences of Unreliable Power

The consequences of insufficient and intermittent electricity supply are well documented across the ECIS region. **Insufficient electricity poses a serious threat to the provision of public services and human development.**

*Insufficient electricity poses a serious threat to the provision of public services and human development.*

The quality of social services such as health-care and education are severely affected due to the absence of electricity and malfunctioning heating systems. Interruptions in electricity service delivery often mean reduced access to water, sanitation, irrigation, health and other social services that rely on an adequate electricity supply (UNDP BRC, 2009). In Kosovo, for example, frequent blackouts have affected children's access to higher education and have led to fatalities during medical procedures (UNDP Kosovo, 2007). Blackouts during the winter of 2007-2008 in Tajikistan resulted in a decline in the provision of basic healthcare across the country (WHO, 2009).

The socio-economic consequences of limited access to affordable and reliable electricity are often more severe in less populated rural areas. For many in rural areas, the absence of a reliable electricity supply results in loss of income and a lack of employment opportunities. For many vulnerable households in Tajikistan, migration has become the predominant coping mechanism (UNDP BRC, 2009). Unreliable and intermittent access to electricity also poses chal-

lenges for food security in rural areas in the region; this is especially true for Central Asia. Agriculture is dependent on irrigation, and as a result of intermittent and unreliable electricity supply farmers turn to highly inefficient off-grid diesel-powered generators to power irrigation pumps. In combination with fluctuations in rainfall and water shortages, insufficient access to energy threatens economic development prospects in rural areas.

Although urban areas in the ECIS region have nearly 100% connectivity to the grid, they also face challenges related to intermittent and unreliable energy supply, as well as hikes in energy tariffs and access to affordable energy. In the Ukraine, Russia and Moldova this has meant that many poor families can no longer heat their homes adequately during winter. Poor populations in the Ukraine are particularly susceptible, as no targeted social welfare approaches currently exist to protect vulnerable consumers against planned increases in electricity tariffs (Dodonov, B., *et al*, 2004).

On a regional scale, energy infrastructure and supply also have a significant and direct bearing on the potential for sustained economic growth. An insufficient and intermittent supply of electricity inhibits the productivity of households and businesses as well as the types of activities and businesses that can be sustained. The World Bank cites the unreliability of power supply as one of the biggest obstacles to private sector business and economic development in Kosovo and Uzbekistan (World Bank, 2013c). Moreover, the energy-related operating costs of social infrastructure squeeze out new investments for social and economic development. Increasing the reliability of supply opens up opportunities for enterprises, which could in turn boost employment opportunities and alleviate poverty in the region.

The environmental consequences of inadequate and unreliable electricity supply are also evident in a number of countries. Reduced access to en-

ergy for electricity and heating is most commonly offset by the use of increasingly expensive and unreliable off-grid supply, including diesel-fired generators, coal, and biomass, *i.e.*, firewood and dung (UNDP, 2011). These alternative off-grid solutions may address the inadequate supply in the short term, however, they have serious long-term environmental consequences. The environmental effects of solid fuel use include deforestation, biodiversity loss, air pollution and soil degradation. These problems are evident in Tajikistan's mountainous regions, which have lost up to 70% of their forest cover since the late 1920s<sup>8</sup> (UNDP, 2010). Wood collection by poor households in the Western Balkans has led to well-documented deforestation and biodiversity loss (EEA, 2010). In Moldova, the use of sunflower stems, maize cobs and stalks, and other agricultural waste and coal is the predominant source of heat energy in rural households (EBRD, 2008). The use of solid fuels in households also has a negative effect on health. Deaths from indoor air pollution are highest in Tajikistan and Kyrgyzstan (516 and 418 per million a year, respectively) (UNDP, 2011). This reflects a correspondingly high number of people without access to safe cooking and heating fuels.

## 1.7 Heating

Unlike many developing countries and countries with economies in transition in other regions, **heat is absolutely critical to human well-being across the ECIS region.** Due to its location and climatic conditions, access to affordable, reliable and environmentally sustainable heating is a key socio-economic development issue. The need for sustainable heating is a key challenge in the ECIS because of low temperatures in the winter months. For some, it is even a matter of life or death, as became evident after the crisis in Central Asia during the winter of 2007-2008.

Without access to reliable and affordable modern and clean energy solutions, the continued use of traditional solid fuels for cooking and heating will affect human development and environmental sustainability. Most households without access to modern forms of energy in the region cook and combust fuels directly in the home with negative impacts upon human health and the environment.

Although there has been a shift in the use of traditional solid fuels to clean energy sources, such as electricity, LPG, natural gas, biogas and kerosene, in recent years (WHO, 2013), approximately 37 million people in the ECIS still rely on traditional solid fuels for heating and cooking (see Table 1.1).

A significant percentage (>30%) of rural populations use solid fuels for cooking, heating and other energy purposes in the Western Balkans and Caucasus sub-regions (Figure 1.3). Often, populations located in remote, rural and sparsely-populated areas do not have access to gas and district heating networks, which could explain the high levels of traditional solid fuel use in Tajikistan, Kyrgyzstan, BiH, Montenegro, Serbia, FYROM, and Turkey.

An IEA report on transition economies globally found that district heating is a critical energy resource and can often meet up to 60% of heating and hot water needs (OECD/IEA, 2004). In the ECIS region this is particularly the case for urban areas where gas, heating and hot water supply networks are available, although many rural and some urban populations across the region lack access to these services (UNDP, 2010). In combination with an unreliable power supply in winter, this has led to a significant increase in alternative fuel use. For example the unreliable power supply in Kyrgyzstan has led to an increase in coal consumption, whilst official survey data indicates that nearly 50% of rural Tajik

<sup>8</sup> Saidov, M., et al. *Tajikistan Forest Genetic Resource, Committee on Environmental Protection under the Government of Tajikistan*, p 5. Dushanbe, 2013.

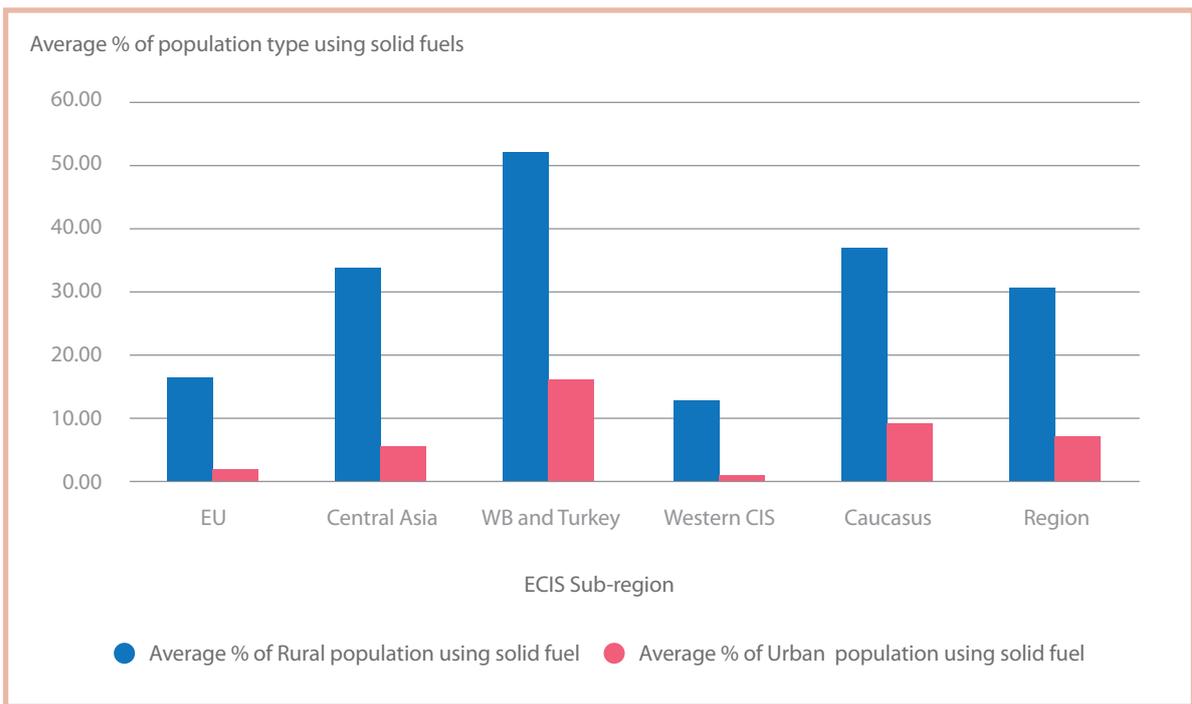
**Table 1.1:** Population using solid fuels in ECIS region

Region	Country	Use of solid fuel (% of population)	Use of Solid fuel (absolute population)
<b>CENTRAL ASIA</b>	Kazakhstan	19.0	3,228,820
	Kyrgyzstan	37.3	2,068,019
	Tajikistan	35.0	2,664,077
	Turkmenistan	0.2	10,251
	Uzbekistan	15.7	4,631,911
<b>Sub-region Average/Total</b>		<b>21.4</b>	<b>12,603,078</b>
<b>WESTERN BALKANS AND TURKEY</b>	Albania	N/A	N/A
	Croatia	12.2	523,613
	Bosnia and Herzegovina	48.7	1,869,952
	Kosovo	N/A	N/A
	Montenegro	31.9	199,210
	Serbia	33.5	2,410,474
	FYROM	36.5	751,161
	Turkey	11	8,319,012
<b>Sub-region Average/Total</b>		<b>29.0</b>	<b>14,073,422</b>
<b>WESTERN CIS</b>	Ukraine	4.2	1,865,929
	Moldova	14.7	523,958
	Russia	3.4	4,918,620
	Belarus	3.4	323,447
<b>Sub-region Average/Total</b>		<b>6.4</b>	<b>7,631,954</b>
<b>CAUCASUS</b>	Armenia	4.4	143,537
	Azerbaijan	9.8	916,001
	Georgia	42	1,875,723
<b>Sub-region Average/Total</b>		<b>18.7</b>	<b>2,935,261</b>
<b>Region Average/Total</b>		<b>18.9</b>	<b>37,243,715</b>

Source: WHO, 2013

households rely on dung and firewood for winter heating (OECD/IEA, 2004). In Azerbaijan and remote populations in Russia, Ukraine and the Western Balkans, where there is no district heating or gas supply (REEEP, 2013), the main fuel used for domestic energy needs is wood.

**Although district heating and gas supply networks are available for urban populations in a number of countries in the region, these networks are often old and deteriorating, making them inefficient, unreliable and costly to maintain.** In Russia,

**Figure 1.3: Solid fuel use, Rural vs. Urban by Sub-region**

Source: Elaborated by the Authors based on WHO, 2013

70% of the population's heating requirements are met by district and local heating (DENA, 2010). Although the network is extensive, it is very old and it is estimated that 60% of the network requires major repairs or replacement (IEA, 2009a). The resulting energy efficiency issues mean frequent service interruptions for some urban populations (DENA 2010). In Ukraine, domestic energy poverty is increasing, as evidenced by reports of low household thermal temperatures (Bouzaro. S., et al., 2011). In BiH, district heating is available

*Although district heating and gas supply networks are available for urban populations in a number of countries in the region, these networks are often old and deteriorating, making them inefficient, unreliable and costly to maintain.*

in only 40% of urban areas and gas in only 20% (World Bank, 2013b). In Kosovo, only Prishtina, Gjakova, Mitrovica and Zveçan have district heating systems, which meet only 3% of total heating demand. In Armenia the district heating system completely collapsed in 2005 and the population was forced to invest in individual heating systems fuelled by wood,

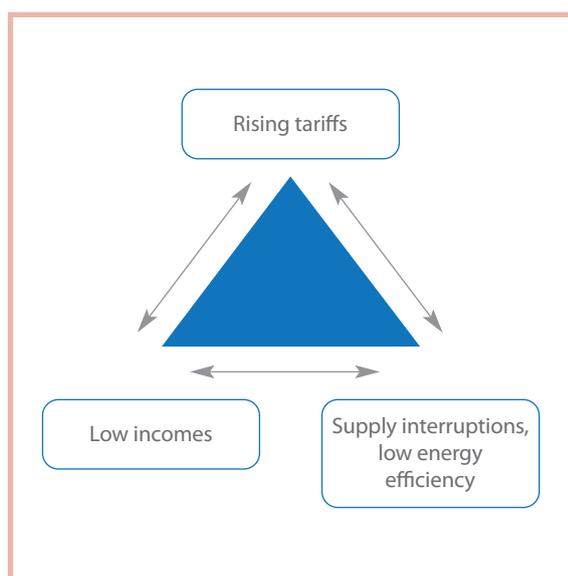
gas and electricity. Due to the high poverty rate (35%, 2010) most families in Armenia are currently live with low thermal comfort levels (UNDP, 2010).

## 1.8 Energy Poverty

Energy poverty is frequently defined by development agencies as a spending threshold of above 10% of household income on energy services (ICPS, 2013). However, the definition of energy poverty

can be even more complicated and takes into account supply and consumption levels; prices; energy efficiency of

homes; and the complex phenomena of fuel stacking. Households may find themselves below the energy poverty line when they are unable to maintain a healthy temperature level, spend a disproportionate amount of their budget on energy, live in insufficiently-heated homes or are in debt for residential utility services (ICPS, 2013).

**Figure 1.4: Factors Affecting Energy Poverty**

Source: Elaborated by the Authors, 2014

Apart from Turkmenistan, all the countries in the region have experienced a gradual increase in communal service tariffs such as electricity, gas and water. Energy price inflation exacerbates the problem of energy poverty as it becomes more difficult for low income households to pay their utility bills. A 2013 World Bank report found that household spending on energy in the Eastern Europe and Central Asia region is nearly 5%, leaving households extremely vulnerable to price increases in this sector (Laderchi, C. R., *et al.*, 2013).

The report also revealed that energy price inflation was at its highest level in 2011 at 25% or more in Moldova and around 10% or more in Albania, Kyrgyzstan, Russia, Serbia, Tajikistan, Ukraine and Uzbekistan. Central Asian countries (with the exception of Turkmenistan which has heavily subsidised primary energy) as well as Belarus, Russia, Turkey and Ukraine have all experienced a rise in tariffs as

providers struggle to extend services to new users and maintain existing services whilst compensating for decades of tariff levels set below cost recovery levels (REEEP, 2013). Increasing tariffs have led to greater incidence of energy poverty especially in Tajikistan and Kyrgyzstan and have the potential to further extenuate inequalities in Russia and Ukraine (REEEP, 2013; ICPS, 2013). The World Bank suggests that in many cases, targeted social adjustment through welfare benefits would be more cost-effective than subsidies and can offset the energy poverty associated with price increases (World Bank, 2013c).

The increase in energy tariffs has been most rapid in Tajikistan, Kyrgyzstan, Kazakhstan, Turkey, Belarus, Russia, Ukraine (see Table 1.2). In these countries some 38 million people live

**Table 1.2: Selected Vulnerability indicators in the Europe and CIS region**

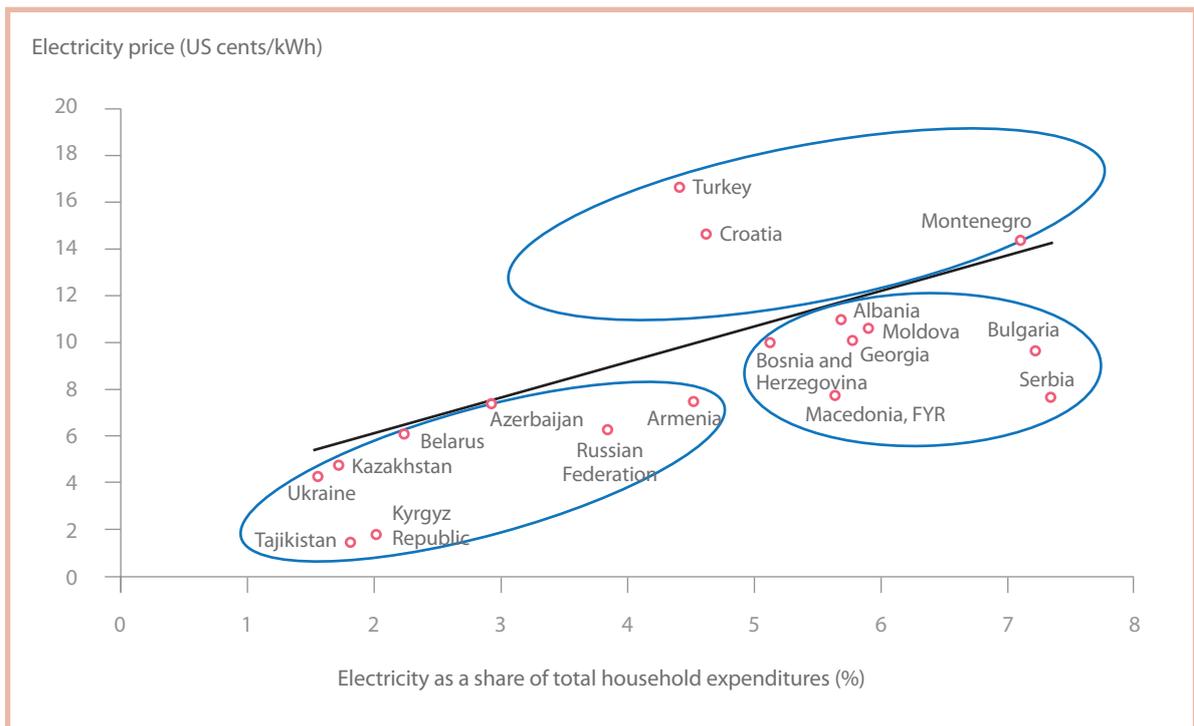
Country	Those living below national poverty line: <sup>9</sup>		Energy price inflation rate <sup>10</sup>
	Millions	Population share	
Belarus	0.5	5.4%	38%
Kazakhstan	1.2	8.2%	17%
Kyrgyzstan	1.9	33.7%	30%
Russia	15.9	11.1%	25%
Tajikistan	3.7	46.7%	58%
Turkey	13.5	18.1%	21%
Ukraine	1.3	2.9%	30%

Source: UNDP, BRC 2009<sup>11</sup>

<sup>9</sup> 2012 World Bank data.

<sup>10</sup> Alternatively electricity, gas, fuels, or other communal service tariffs. Data is for January-June 2009 compared to January-June 2008.

<sup>11</sup> All data from national statistical offices unless otherwise stated (as in UNDP BRC 2009; adjusted to include most recently available data).

**Figure 1.5: Electricity Price and Electricity Share of Total Household Expenditures**

Source: Amended from Laderchi, C. R., et al, 2013

below nationally defined poverty lines,<sup>12</sup> which affects their purchasing power and access to essential energy services. The average percentage of household income spent on energy by the lowest income decile of the population in the region is approximately 14% - about double the global average of 4-8% (Banerjee, 2013).

Higher electricity prices are associated with higher burdens of electricity spending on household budgets (see Figure 1.5); this trend suggests households find it difficult to keep their energy expenditures in check.<sup>13</sup> Indeed, the World Bank report (Laderchi, C. R., et al., 2013) reveals country evidence that energy price increases in the region have often resulted in households having to cut back on basic consumption, such as food and healthcare products.

This is especially worrying for the Central Asian region and the remote and rural areas of Russia. Official statistics (Turkmenistan and Uzbekistan excepted) indicate that 2011 household incomes in the Central Asia sub-region were either stagnant or in decline, while expenditure on food and utilities comprised up to two thirds of the consumer price index (UNDP BRC, 2009). In combination with the effect of food and energy price inflation trends, stagnant and declining household income has the real potential to further exacerbate energy poverty in the region, especially in rural and isolated areas. This is because these households generally have lower incomes and therefore spend a higher proportion of total income on energy, which is compounded by low employment and a lack of income generating activities.

<sup>12</sup> The nationally defined poverty line is a threshold minimum level of income deemed adequate in a given country as defined by that country. National estimates are based on population-weighted subgroup estimates from household surveys and therefore definitions of the poverty line may vary considerably among nations.

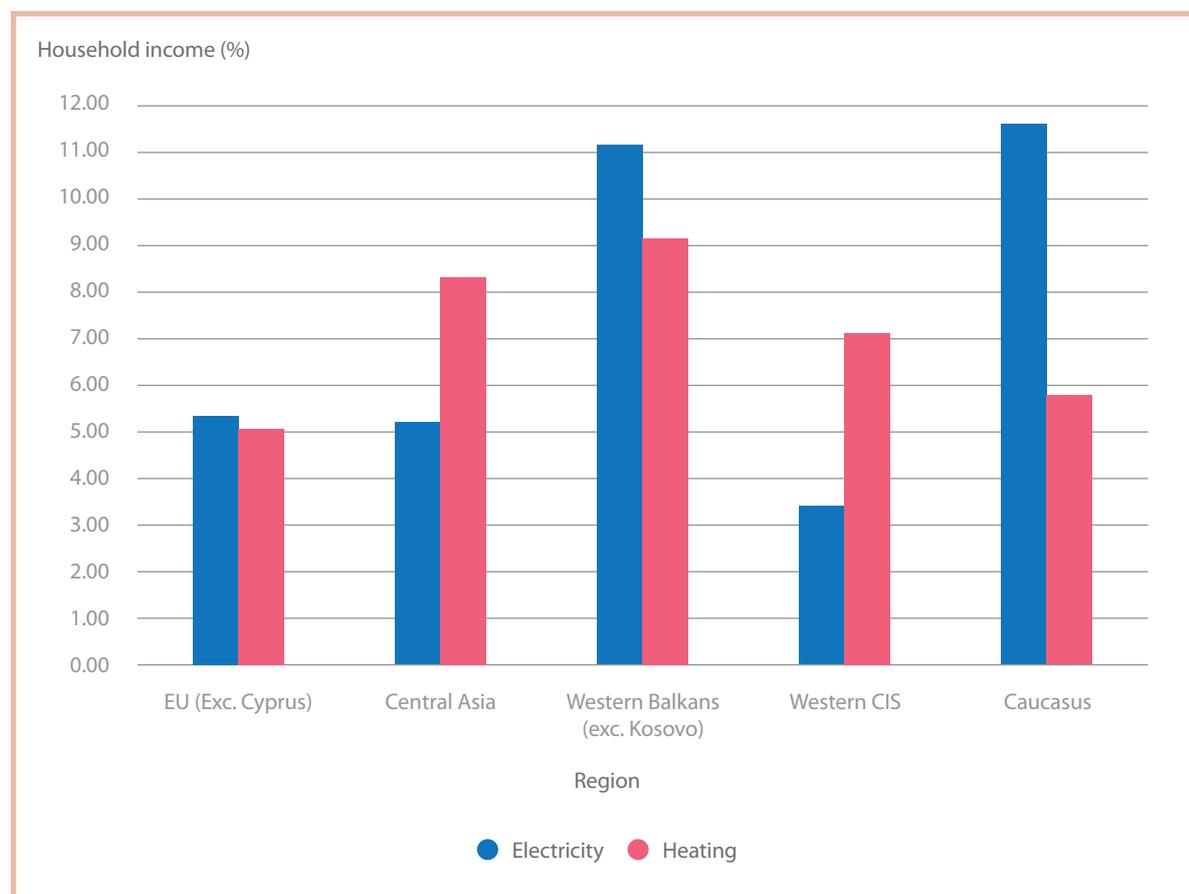
<sup>13</sup> Reliable data is not currently available for gas and district heating as a percentage of household income for all countries in the region.

More modest poverty impacts would be felt in the rural areas of the Western Balkans and Turkey (UNDP BRC, 2009). However, if targeted social welfare assistance instruments are not employed to counteract the combination of food price inflation and increases in energy tariffs, the World Bank predicts an additional 5.3 million people could become poor in the ECIS region (World Bank, 2011).

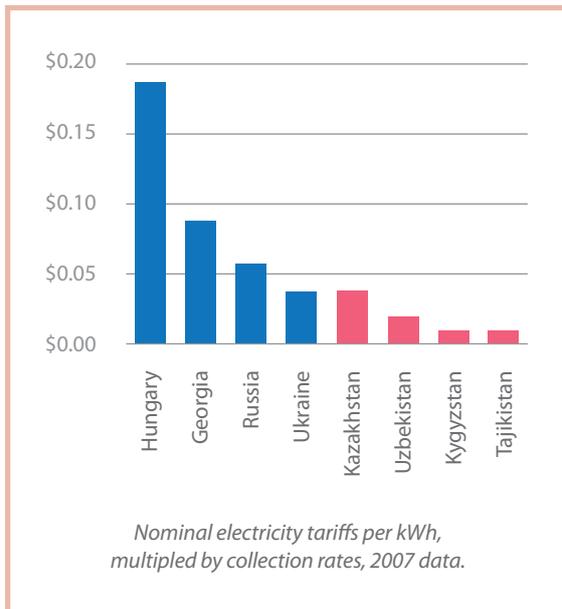
Subsidised energy tariffs for oil and gas also pose a serious threat to energy sector development and reinforce social inequalities in the region. Kazakhstan (32.6%), Azerbaijan (35.8%), Uzbekistan (60%) and Turkmenistan (61%) have the highest energy subsidies (average subsidy rate) in the region (IEA, 2013a). The effect of distorted energy prices is possibly most predominant in Kyrgyzstan, Turkmenistan, Uzbekistan,

and Ukraine where subsidies exceeded 5% of GDP in 2011 (IMF, 2013). In many countries household energy consumption is subsidised by the state budget, and the energy tariff prices are often set below cost recovery levels. As subsidies are largely untargeted and inequitable they tend to benefit the higher income population that has a higher *per capita* consumption of energy, which inadvertently reinforces social inequalities. For example, in Belarus the richest 30% of households receive 45% of total energy subsidies while the poorest 30% receive only 15% (World Bank, 2011). Many countries in the region have committed to eliminating cross subsidisation, tariff reforms, and energy price increases. In addition to appropriately-phased price increases and institutional reforms, targeted social assistance will be required to compensate the poorest households (IMF, 2013).

**Figure 1.6:** Affordability of Electricity and Heat Energy at Cost Recovery in 2010, bottom income decile, as a percentage (%) of total household income expenditure (estimated)



Source: UNDP BRC, 2009

**Figure 1.7a: Effective Electricity Tariffs in the Region**

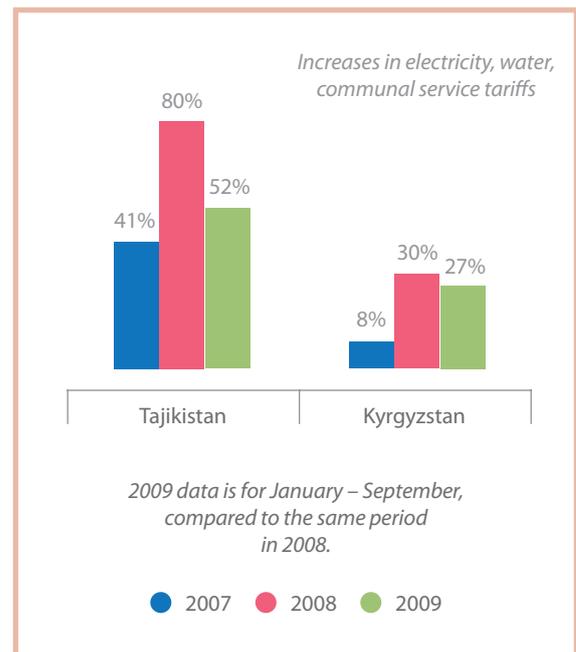
Source: UNDP BRC, 2009

Energy poverty is a significant issue in the lower decile population group when compared to EU member countries, as shown by the percentage of household income spent on electricity and heating (see Figure 1.6).

## 1.9 Energy Poverty in Tajikistan and Kyrgyzstan

The worst energy poverty in the region is found in Tajikistan, where 50% of rural Tajik households rely on dung and firewood for winter heating and households with the lowest incomes spend roughly 16% of income on household energy needs (UNDP, 2011). The lack of access to modern energy services is a serious hindrance to economic and social development, and must be overcome if the UN Millennium Development Goals are to be achieved (IEA-WEO, 2010).

The biggest impact of energy price inflation in the region will be felt in Tajikistan and Kyrgyzstan, both lower income countries and highly dependent on energy imports. Energy price inflation during 2010 for Tajikistan

**Figure 1.7b: Rising Tariffs in the Region**

Source: UNDP BRC, 2009

reached an all-time high of 42%. Despite inflation, these rates have tended to remain low, relative to other transition economies, reflecting the strong opposition to raising tariffs (UNDP Tajikistan, 2011).

Despite the increase in effective electricity tariffs in Kazakhstan, Uzbekistan, Kyrgyzstan and Tajikistan, these tariffs are still relatively low when compared to Russia, Ukraine and Georgia (Figure 1.7a). The yearly price increases in communal services tariffs in Tajikistan and Kyrgyzstan (Figure 1.7b) may be essential to meet cost recovery targets, but they have a significant impact on the vulnerability of poor households and heighten the levels of energy poverty, especially for those living below the poverty line. In 2012, 38.3% of the Tajik population, and 33.7% of the Kyrgyz were living below the nationally indicated poverty line (World Bank, 2013f). In Kyrgyzstan, living standard surveys indicate that the average household in 2009 devoted approximately 10% of its income to energy purchases. This figure is almost double for Tajikistan (World Bank, 2013f), where some 20% of household budgets in rural areas are spent

on wood for cooking and heating purposes alone (UNDP Tajikistan, 2011), which is in part due to energy price inflation.

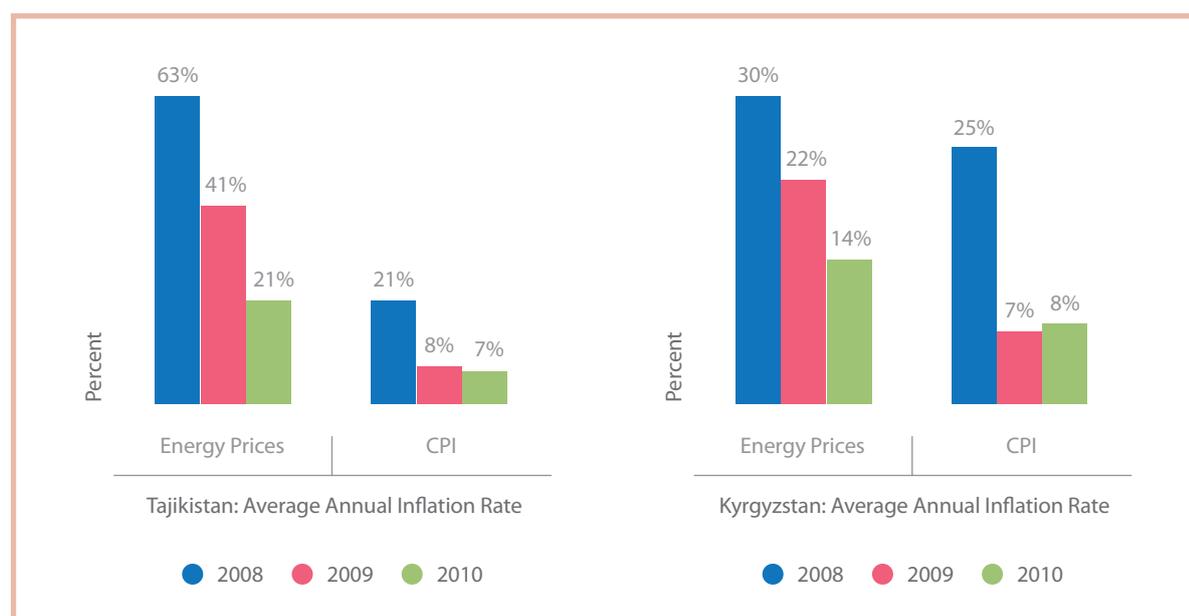
If energy prices increase every year at rates that exceed the consumer price index (CPI), the resulting energy poverty will severely affect the more vulnerable, lower-income households. As a consequence, remote and rural populations will be forced to turn to traditional solid fuels for their essential energy needs. The situation will then be exacerbated by the substandard supply of energy in these regions. Despite the clear need to address the pertinent energy crises in Tajikistan and Kyrgyzstan, neither country has pursued the types of reform, successfully introduced in other transition economies, that protect vulnerable low- and middle-income households from the impact of high tariffs (UNDP BRC, 2009). Unless measures are taken to increase the supply and improve access in rural and remote areas, reforms will merely heighten energy poverty, increase the use of traditional fuels and perpetuate the negative health and environmental impacts.

## 1.10 Energy Poverty in Russia and Ukraine

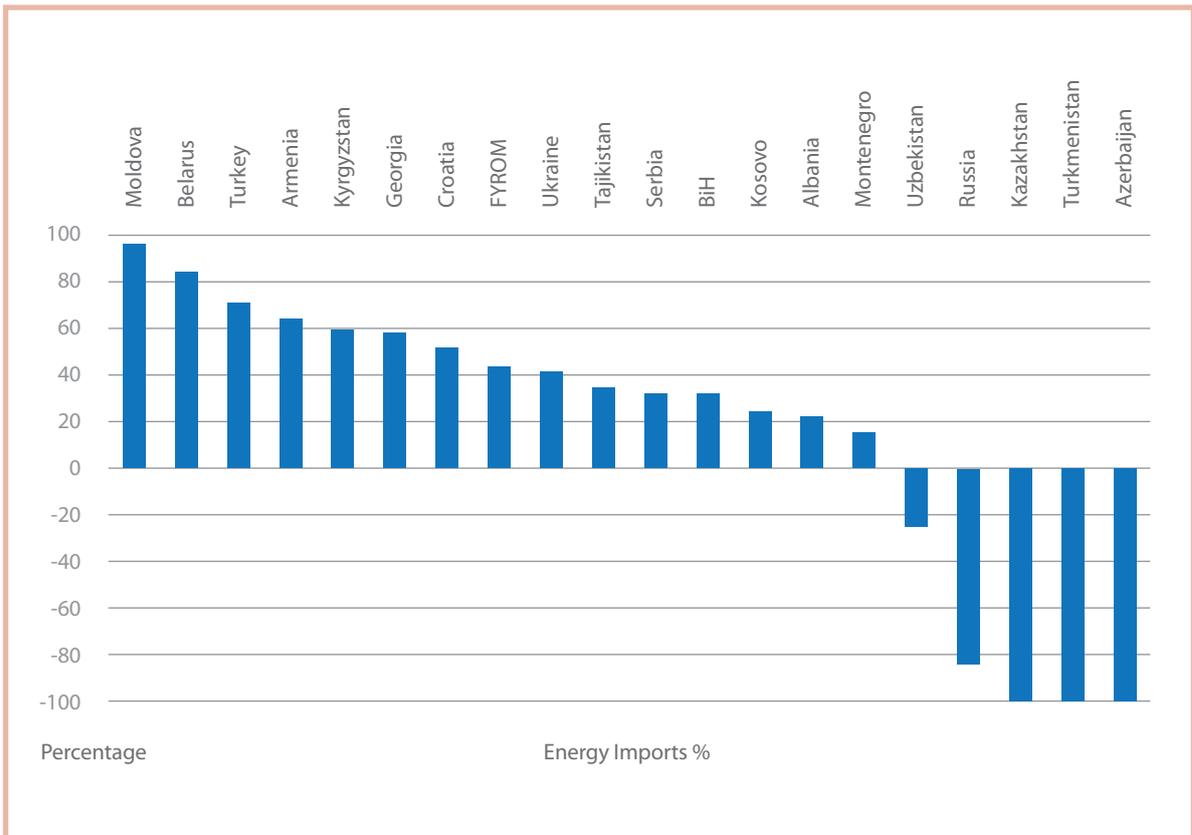
Security and affordability of supply are particularly important issues in Russia's Far East, northern regions and other isolated areas. Whilst representing a small part of Russia's electricity market they cover a large geographic area. Minimal competition exists between electricity providers in this region as a result of the large distances between towns and the lack of electricity transmission interconnections. Consequently, these areas do not benefit from the price competition of electricity market liberalisation that exists in the rest of Russia (IFC/GEF, 2011).

In Ukraine in 2011, 5.6% of households spent more than 10% of their total income on heating. If gas rates increase to predicted levels over the next 10 years, it is estimated that nearly 45% of households will have to spend more than 10% of their income on communal services. The current cessation of heavy government subsidies and subsequent hike in gas prices pose a serious threat to increasing energy poverty levels in the Ukraine (ICPS, 2013). Increases in electricity

**Figure 1.8:** Trends in Household Energy and Consumer Price Index (CPI) in Kyrgyzstan and Tajikistan (2008-2010)



Source: UNDP BRC, 2010

**Figure 1.9: Energy Imports, Net (% of Energy Use)**

Source: Elaborated by the Authors based on 2010 World Bank data (2013e).<sup>14</sup>

prices without appropriate reforms and targeted social assistance are predicted to push a significant portion of the population into “severe social problems” Dodonov, B., *et al.* (2004).

### 1.11 Energy security

**Energy security is a key political and economic concern for many countries in the ECIS region.** Political conflicts, ageing supply infrastructure, the susceptibility of each energy supply and a reliance on hydropower all pose serious threats to energy security in the region. These threats are further exacerbated by the levels of energy imports.

A number of countries in the region are heavily reliant on fossil fuel energy imports. Many former Soviet states, as well as former socialist states in Eastern Europe, have the typical characteristics of an energy supply infrastructure built during the socialist era, and are thus dependent on energy supplies, such as oil and gas, from the east, especially from Russia. These countries include Armenia, Belarus, BiH, Serbia, Belarus, Georgia, FYROM and Turkey. Many negative socio-economic and environmental effects are associated with energy insecurity in the region when populations are forced to increase their use of traditional solid fuels.

The region exhibits a high level of energy dependence with a majority of net importers

<sup>14</sup> Net energy imports are estimated as energy use minus production, both measured in oil equivalents. A negative value indicates that the country is a net exporter. Energy use refers to use of primary energy before transformation to other end-use fuels, which is equal to indigenous production plus imports and stock changes, minus exports and fuels supplied to ships and aircraft engaged in international transport.

(>51%). As the predicted demand for oil and gas may double over the next ten years, the negotiation of supply agreements and improvements in gas infrastructure is crucial (IEA, 2009b).

The energy security of a number of countries is threatened by growing trends of import dependency as domestic production struggles to meet growing demands. Turkey currently imports approximately 71% of its total primary energy supply in order to meet the demands of its rapidly growing population, which it is unable to match in its energy production. Belarus imports 85% of its total primary energy needs, the majority of which comes from Russia. Likewise, Georgia's primary energy balance, whilst diversified by source, is dependent on oil and natural gas imports, mostly supplied by increasingly unreliable sources in Ukraine and Russia and suffers from gas price inflation when supply agreements change (REEEP, 2013).

Political conflict and supply agreement disputes pose a serious threat to the security of energy supplies, especially in the transmission of electricity, gas and oil; the region has already experienced a number of resource conflicts associated with energy supply. The interdependency of the energy supply exporters (such as Russia, Azerbaijan, Turkmenistan, Uzbekistan and Kazakhstan) and the countries through which these energy supplies must pass on their way west, east or south (such as Ukraine and Uzbekistan) creates a complex geopolitical energy infrastructure that is susceptible to supply conflict and political disputes.<sup>15</sup>

Tensions between upstream and downstream countries regarding water resources, particularly when it concerns the construction of large hydropower plants in upstream countries, has intensified the energy and water crisis in Central

Asia. One such dispute is between Kyrgyzstan, Tajikistan and Uzbekistan. The majority (94%) of Kyrgyzstan's energy is generated from hydropower stations, the management of which severely affects downstream Uzbekistan, which experiences continuous water shortages. This has resulted in a trans-boundary conflict over water resources (Mosello, 2008). Likewise, the construction of hydropower stations in Tajikistan has also resulted in disputes with Uzbekistan (UNDP BRC, 2009). This led to the eventual disbandment of the Central Asian Power System (CAPS), which had a dramatic impact on Tajikistan's energy sector and population during the winter months in 2007-2008 (UNDP Tajikistan, 2011). In 2010, Uzbekistan also suspended millions of dollars' worth of electricity imports to Tajikistan, which led to the reintroduction of national electricity rationing.

Disputes over supply agreements have interrupted supply chains in the region. For example, in 2009 gas imports from Russia to Slovakia, Hungary and the Czech Republic were halted in the Ukraine for several days.<sup>16</sup> The event occurred in the middle of winter which highlights the vulnerability of heat supply security.

Major concern also exists relating to the Enguri/Vardnili hydropower cascade which is a key contributor to Georgia's electricity generation and thus a major factor in energy security in the region. Parts of the plant are in Georgia whilst the infrastructure, including the switchboard, is in territory controlled by Russia. Any political escalation with Russia could put Georgia's energy supply at risk. Similarly, in Moldova electricity generation is based almost entirely on gas. The only large power plant is located in the Transnistrian region, which has an uncertain administrative status, thus posing political risk to the security of electricity production. Energy

<sup>15</sup> In this example, energy security is a term for an association between national security and the availability of natural resources for energy consumption to meet required needs. Energy independence refers to non-reliance on imports of oil and other foreign sources of energy.

<sup>16</sup> For more details see Annex 6

production in Kosovo relies heavily on coal, thus lignite is the most important energy resource producing around 97% of total electricity generation.

### 1.12 Ageing Energy Supply Infrastructure

The Soviet legacy gas import infrastructure, the majority of which was built in the 1950s/60s, and a dependency on natural gas imports, especially in winter, are major threats to the security of energy supply for many countries. When the Soviet Union collapsed, Kyrgyzstan, Kazakhstan, Tajikistan, Uzbekistan and Turkmenistan quickly discovered that their new, disconnected grids had significant transmission infrastructure gaps and suffered from high distribution losses. Whilst Kazakhstan's northern region is mostly energy independent, its isolated, rural southern regions continue to be almost completely reliant on electricity imports from Russia, Kyrgyzstan and Uzbekistan. Moldova, which has almost no primary energy resources, is primarily dependent on the Eastern European gas supply grid, making it particularly susceptible to interruptions in that system (Baran, 2006). The ageing and ineffective energy supply infrastructure in the Western Balkans, Moldova and Belarus, compounded by low domestic primary energy resources and energy production capacity, may result in an increased dependency on imports to meet growing demands unless renewable energy alternatives are scaled up to meet this demand. This energy dependence combined with interruptions in supply and high distribution losses demonstrate vulnerability to energy insecurity.

### 1.13 Energy Supply Mix Vulnerability

The absence of supply diversification and the reliance on one energy source for electricity production makes a number of countries in the region highly vulnerable to fuel shortages and

adverse climatic conditions (affecting hydropower). Kazakhstan, Kyrgyzstan, Montenegro, Serbia, Turkey, Ukraine, FYROM, BiH, Albania, Armenia, Azerbaijan, Belarus, Moldova, Turkmenistan, and Uzbekistan each use only one specific fuel source to produce 51% of their energy. Almost all (97%) of Kosovo's electricity production is from coal.

As net importers of energy (>51%) Kyrgyzstan, Turkey, Moldova, Belarus and Armenia are particularly vulnerable to limited fuel switching options. A number of these countries have already experienced difficulties meeting peak demand with domestic and imported capacity or are expected to face this difficulty in the future. In addition, possible forced and scheduled shutdowns of power plants, such as the Metsamor nuclear plant in Armenia, which supplies 42.9% of the country's electricity, cause severe electricity shortages. These examples exemplify the vulnerability of countries to insufficient diversification in their energy supply mix.

### 1.14 Energy Insecurity and Hydropower

Insufficient rainfall and seasonal variance in river flow have led to a number of energy/water crises throughout the region with some countries being particularly vulnerable.

*Central Asia (Tajikistan and Kyrgyzstan):* The reliance of Tajikistan and Kyrgyzstan on hydropower makes these countries highly susceptible to energy insecurity. The combination of population growth, lack of investment in energy sector infrastructure, interruptions in gas imports from Uzbekistan, and the dissolution of the Central Asian Power System (CAPS) dramatically affected the energy sector and population during the 2007-2008 winter (UNDP Tajikistan, 2011). In addition, limited and increasingly expensive gas supplies from Uzbekistan and an underdeveloped coal sector have left Tajikistan almost exclusively dependent on hydropower production. Nation-

wide electricity rationing in 2011 further demonstrated that increased electricity imports were not an option, posing a real threat of further energy crises in Tajikistan and highlighting its reliance on hydropower and imports of electricity. It is estimated that improvements to national and household energy security would require billions of dollars in investment in electricity generation, including mini and micro hydropower plants, extension and connectivity to regional gas supply networks and the development of the coal sector (UNDP Tajikistan, 2011). Similarly, Kyrgyzstan's hydropower production accounts for more than 93% of the country's power production. During 2008 energy production by the Toktogul plant fell 21%, and a further 6% in 2009 when hydropower water releases were limited by the need to restore reserves (UNDP Tajikistan, 2011).

*Western Balkans (Montenegro, Albania, BiH, Croatia, FYROM, Serbia, Kosovo):* The Western Balkan sub-region is also heavily reliant on hydropower for electricity, which cannot be easily exchanged for other sources when electricity pro-

duction from hydropower is low. Recent climatic variability and low rainfall levels during winter months have lowered hydro reserves in the region. Overall hydropower production in the Balkans fell by 27% in 2011 from 2010 (ICIS, 2011), while Montenegro lost 46% of its production (ICIS, 2011). Albania, BiH, Croatia and FYROM have all seen year-to-year hydropower production fall by between 33-39%. Importing from elsewhere in the region has boosted cross-border prices (ICIS, 2011). Additionally, variable and low hydropower production in combination with an increase in electricity demand has increased electricity prices across the Western Balkans sub-region. The trend of a reduced power supply and increased electricity demand is expected to continue in the region, in particular in the Western Balkan countries of Albania, BiH, Croatia, FYROM, Montenegro and Serbia.

To compensate for the low hydropower production in recent years, a number of countries have begun expanding alternative capacities. For example, FYROM, Kosovo and Croatia are building new coal-powered thermal plants to

**Table 1.3: Barriers to Energy Access in ECIS**

Type of Barrier	Barrier to Energy Access	Possible Solutions to Barriers
Technical	<ul style="list-style-type: none"> <li>• Lack of equipment</li> <li>• Insufficient expertise and maintenance</li> <li>• Deteriorating energy infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>• Innovative financial instruments</li> <li>• Development of partnerships</li> <li>• Off-grid and renewable energy solutions</li> <li>• Energy Efficiency and consumption management</li> </ul>
Economic and Financial	<ul style="list-style-type: none"> <li>• Distorted energy tariffs below cost recovery</li> <li>• Compounding effects of poverty</li> <li>• Lack of financing</li> </ul>	<ul style="list-style-type: none"> <li>• Energy sector and welfare reform</li> <li>• Targeted social welfare benefits</li> <li>• Public-private partnerships, hybrid financing</li> </ul>
Political and Institutional	<ul style="list-style-type: none"> <li>• Constrained capacity to plan and implement projects</li> <li>• Corruption and instability</li> </ul>	<ul style="list-style-type: none"> <li>• Capacity development and partnerships</li> <li>• Legal reforms</li> </ul>
Social and Cultural	<ul style="list-style-type: none"> <li>• Community opposition</li> <li>• Lack of awareness</li> </ul>	<ul style="list-style-type: none"> <li>• Community outreach and training programmes</li> <li>• Educational reform</li> </ul>

Source: Elaborated by the Authors, 2014

meet the expected increase in electricity demand. While additional coal-fired capacity addresses power shortages in the short to medium term, negative environmental effects at the local level as well as increased greenhouse gas emissions make these investments unsustainable and unattractive in the long run.

### 1.15 The Future: Addressing Barriers to Energy Access

**Despite the potential benefits of expanded energy access, a number of technical, economic, political and social barriers still exist in the region.** These barriers suggest that energy markets and the private sector will not by themselves address energy poverty and provide high-quality, reliable and affordable access to energy. If energy access and energy poverty issues are not addressed, the poor will

continue to face numerous social and economic development issues. Where the private sector, government and financial institutions are unlikely to intervene, developmental partners will need to provide targeted intervention and development assistance to ensure progress is made towards improving access to modern forms of energy.

### 1.16 Tracking Access: Challenges in Defining and Measuring Access to Energy

Tracking access to sustainable energy in the ECIS region is challenging. As current indicators do not provide a clear picture of energy access, reflecting the special conditions in the region particularly in terms of heating and energy for community and productive uses, additional indicators should be used to capture these

**Table 1.4:** Measurement Targets and Proposed Approaches

Target for Measurement	Comments	Proposed Approach
Access to affordable and reliable heating	As case studies have shown, energy for heating is a major requirement in the ECIS region. Unfortunately the tracking framework does not identify sufficient data on energy for heating that would allow the compilation of a global database. In the medium term SE4ALL envisions the development of a tracking framework to measure access to heating (Banerjee, 2013).	Measurements of access to heating to be included in household survey data collected by government statistical agencies.
Community energy and productive uses of energy	The household-based definition of access to energy excludes access to energy for community services, such as health and education, and productive uses such as enterprises (Banerjee, 2013). Methodologies to collect this data need to be developed.	Recent frameworks to measure energy for public services and productive uses have been developed by the IEA, WHO, USAID and UNESCO which can be utilised for this purpose (UNDP, 2010).
Availability and reliability of power supply	Moving forward tracking indicators need to capture information on availability and reliability of power supply as a pertinent issue in the region. Currently there is little available reliable data on this issue, it is suggested that methodologies be developed and data collected.	Primary data can be collected from energy suppliers and distributors.

Source: Elaborated by the Authors, 2014

aspects (see Table 1.4). A detailed commentary about data issues that complicate tracking can be found in Annex 1.

## 1.17 Summary of Findings

Although near-universal electrification exists in the ECIS region, significant challenges remain, such as intermittent power supply, energy poverty, energy security and a return to solid fuels for cooking and heating. Whilst differences between countries will require country-specific approaches, several energy access themes stand out:

- The most pressing issue in the region is the need to address **insufficient access and the interruptions of supply** in order to rectify the negative socio-economic and environmental consequences that **obstruct economic development and sustainability** in some countries.
- **Energy sector reforms**, undertaken successfully in some transition economies, are essential to rectify decades of subsidised energy tariffs and distorted energy prices, thereby **releasing money for investments in energy supply infrastructure**. As energy sector reforms have often been suggested as a solution to the economic inefficiencies of subsidised energy tariffs a number of organisations, such as the IMF and the World Bank, have supported governments with the removal of energy subsidies. However, the issue remains extremely complex and diffi-

cult to resolve. Because decision-makers face the dilemma of how to deal with energy subsidies, energy sector reforms in many transition economies are considerably restricted. While some progress has been made, large fossil fuel subsidies remain a significant barrier to greater investment in energy efficiency and renewable energy (Dansie, G., *et al*, 2010).

- Politicians and decision-makers fear that taking unpopular decisions may provoke social unrest and imposing unpopular energy price hikes may generate political discontent among the former beneficiaries of energy subsidies. Furthermore, energy subsidies are sometimes used as a political inducement to win favour in elections (Dansie, G., *et al*, 2010).
- **Further increases in energy tariffs threaten to intensify energy poverty** in the region and targeted social assistance will be required to ensure that the poorest do not slip through the social safety net.
- **Programmes targeting rural and isolated households across the region should be considered a priority** by SE4ALL development partners.

New methodologies and indicators will be required to track the progress being made to address the above issues. This includes the collection of reliable primary data. However, by building the capacity required for tracking progress towards SE4ALL targets, the ability of governments to understand and address both energy and development issues will be strengthened.

## 2. Energy Efficiency



## 2.1 Overview

One of the three objectives of the SE4ALL initiative is to double the global rate of improvement in energy efficiency. In the ECIS region, energy efficiency is an essential component of addressing current energy challenges. Following a steep decline in the 1990s, countries in the ECIS region have experienced economic growth at a cumulative rate of 4.7% per year (World Bank, “World Development Indicators”).<sup>17</sup> In order to maintain such high rates of economic growth and continue their convergence with developed economies, the ECIS region needs access to a long-term, secure, affordable and sustainable energy supply. Many transition countries still use several times as much energy per unit of output as OECD countries, while energy consumption *per capita* and the quality of energy services is much lower. Long-term patterns of energy use in the built environment, transportation infrastructure, industry, and agriculture, hinder the penetration of energy efficiency technologies and practices, resulting in soaring energy demands. In most cases, the energy production and distribution infrastructure needs major investment to provide better efficiency, coverage and quality of services.

## 2.2 Defining energy efficiency

Energy efficiency is the ratio of end-use output to energy input of individual technologies and processes (World Bank, 2013a). However, assessing energy efficiency is not straightforward as it is often complicated to track and analyse the energy efficiency of numerous individual measures in order to make conclusions about sector, national, and cross-country progress. This is why energy intensity indicators, which

are the ratios of energy input to national or sector output or activity, are used as a proxy for energy efficiency at an aggregate level. In defining energy intensity indicators, this chapter relies on the SE4ALL Global Tracking Methodology (World Bank, 2013a) and uses EU-27 energy intensity indicators as a benchmark. Assessing energy-efficiency at the bottom-up, technology level requires more detailed analysis and has not been reviewed in the present assessment.

## 2.3 Recent Trends in Energy Efficiency

### 2.3.1 Country-level energy efficiency

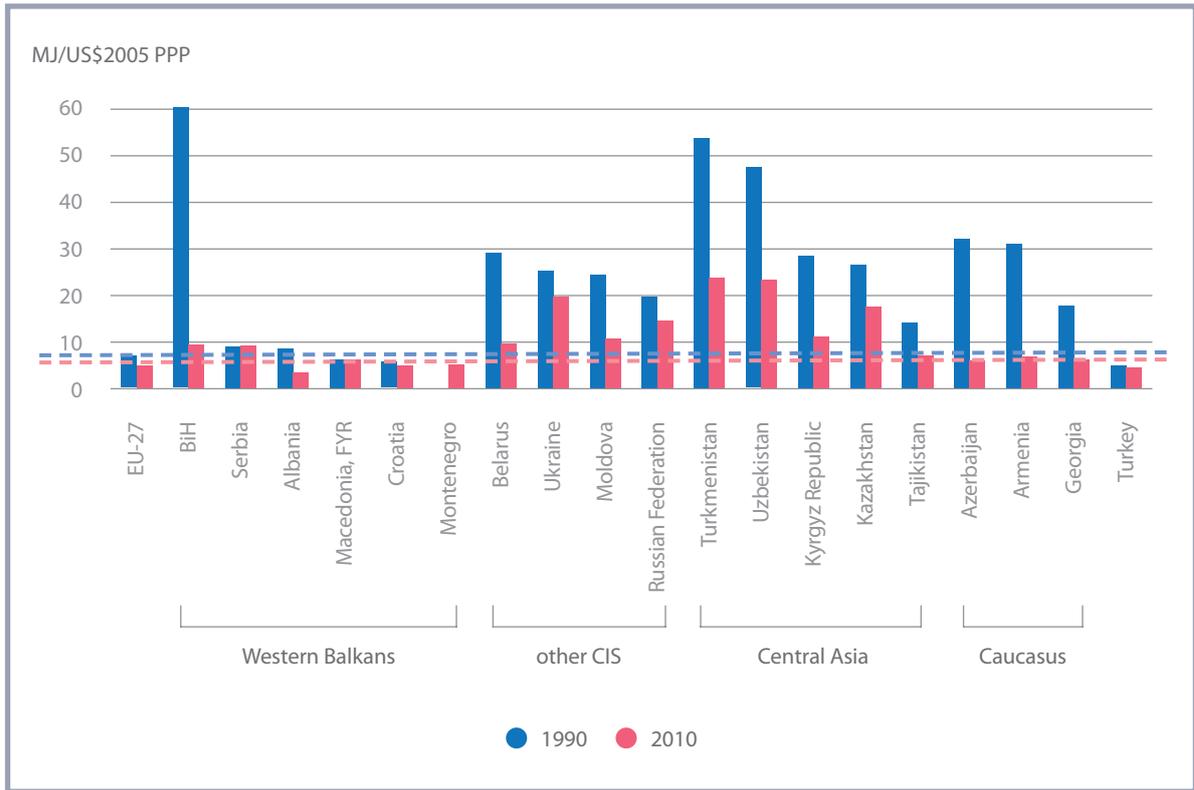
In 1990, the GDP primary energy intensities<sup>18</sup> of ECIS countries<sup>19</sup> were among the highest in the world (IEA, “World Energy Statistics Balances”). During the last two decades, these intensities have fallen considerably in absolute terms (Figure 2.1). By 2010, primary energy intensity in the Caucasus and Western Balkans had decreased to EU-27 levels. However, in the majority of other ECIS countries, primary energy intensity is still more than double EU-27 levels.

Analysing the structure of final energy consumption can provide a more accurate approximation of energy efficiency than energy intensity. The Divisia method (World Bank, 2013) divides changes in final energy consumption into: 1) changes in economic activity; 2) changes in economic structure, *e.g.* shifting away from heavy industry; and 3) actual energy intensity changes, *e.g.* technological or operational improvements. The third measure represents an approximation of energy efficiency.

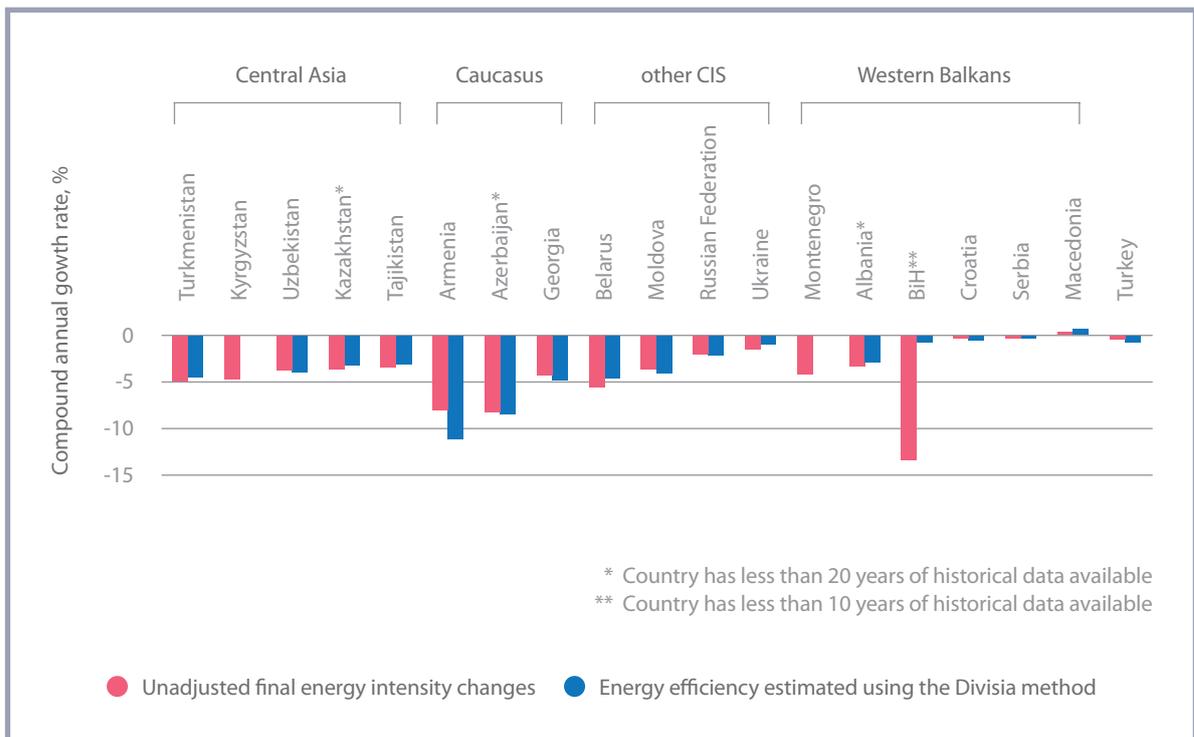
<sup>17</sup> Growth measured as an increase in Gross Domestic Product (GDP) at constant rates.

<sup>18</sup> Primary energy intensity is the ratio between the Gross Domestic Product (GDP) at purchasing power parity (PPP) exchange rates and the Total Primary Energy Supply (TPES).

<sup>19</sup> Hereinafter, countries of the ECIS region are merged and analysed as the following regions: Western Balkans, Central Asia, Caucasus, other CIS, and Turkey.

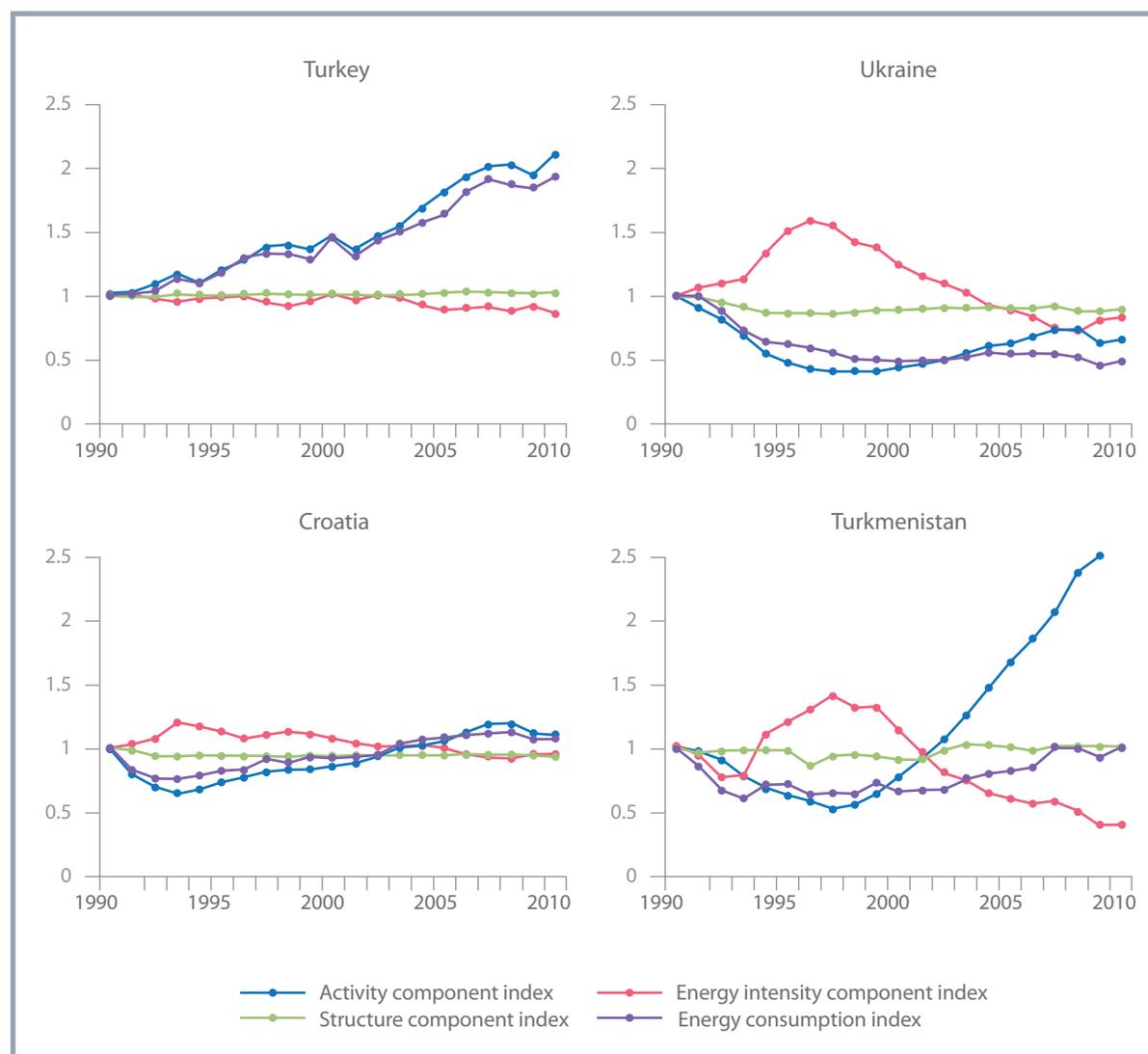
**Figure 2.1:** GDP primary energy intensity in the ECIS region in 1990 and 2010 vs. the EU-27

Source: World Bank, 2013; WEC, "Energy Efficiency Indicators Database"

**Figure 2.2:** Improvement in unadjusted final energy intensity vs. energy efficiency changes measured using the Divisia method, 1990 – 2010

Source: World Bank, 2013

**Figure 2.3:** Indices of final energy consumption and its drivers: activity, structure, and energy efficiency (energy intensity component index) in selected countries, 1990 - 2010



Source: World Bank, "Sustainable Energy for All Database"

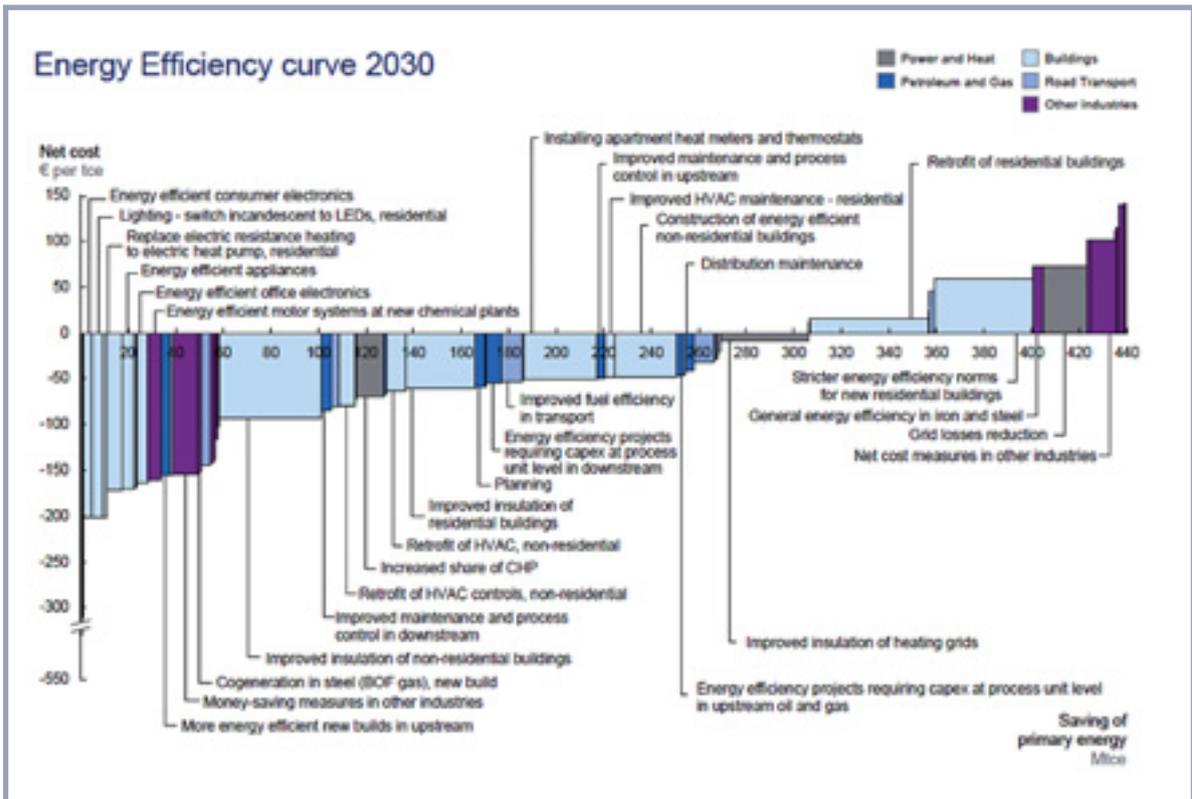
The real progress in energy efficiency of seven<sup>20</sup> ECIS countries, when estimated using the Divisia method, was found to be slower than had been suggested by unadjusted energy intensity indicators. In other countries, the energy intensity analysis underestimated energy efficiency (see Figure 2.2).

The Divisia analysis also revealed that energy efficiency plays a major role in the reduction of en-

ergy demand in all countries (see Figure 2.3). In Turkey, growing energy consumption due to the expansion of the economy was partially offset by energy efficiency improvements. In Ukraine, energy efficiency decreased until 1996, and this decline was attributed to the economic restructuring and the economic recession, which reduced energy consumption. After 1996, in spite of economic expansion, energy consumption declined further due to improvements in energy

<sup>20</sup> Ukraine, Belarus, Albania, Tajikistan, Turkmenistan, Kazakhstan, and Bosnia and Herzegovina (BiH). The difference was especially notable in BiH.

**Figure 2.4:** Supply curve of energy efficiency in Russia, 2030



Source: McKinsey & Company, 2009

efficiency. In Turkmenistan, energy consumption grew steadily from 2001 because energy efficiency improvements, though high, were not enough to offset high economic growth. In Croatia, the drop in energy consumption in the beginning of the 1990s was attributed to economic decline and decreasing energy efficiency. After 1994, energy consumption grew because energy efficiency improvements and economic restructuring could not sufficiently offset economic expansion.

### 2.3.2 Energy efficiency potential at the country level

**In spite of significant energy efficiency improvements during the last two decades in**

*In spite of significant energy efficiency improvements during the last two decades in almost all ECIS countries, further energy efficiency opportunities exist.*

**almost all ECIS countries, further energy efficiency opportunities exist.** Several studies have been undertaken to provide country-level estimates of the technical and economic energy efficiency potential. In 2009 McKinsey & Company evaluated Russia's potential for energy efficiency improvement by generating a supply curve for energy efficiency (see Figure 2.4).<sup>21</sup> The measures identified could reduce Russia's energy consumption in 2030 by 23%, compared to baseline energy consumption. While the investments required are estimated to be EUR 150 billion over 20 years, they would generate EUR 345 billion in cost savings. The

<sup>21</sup> Supply curve of energy efficiency characterises the potential for energy efficiency from a sequence of technological options as a function of marginal costs per unit of energy conserved.

figure indicates that the building sector possesses the highest share of total potential, including negative cost potential. Technologies related to improving the thermal envelope in buildings were found to yield the highest savings. The most attractive options economically are technologies that use electricity, such as lights, appliances, electronics, and equipment.

## 2.4 Energy Efficiency at the Sector Level: Buildings

From 1990 to 2010, the relative importance of energy-using sectors in the structure of energy demand<sup>22</sup> in the ECIS region (except Turkey) has changed (see Annex 7 for details). In 1990, industrial energy consumption was the highest, but had shrunk in the beginning of the 1990s, reflecting sectoral restructuring and partial collapse (IEA, "World Energy Statistics Balances"). Although by 2010, the industrial sector had recovered, its consumption did not return to 1990 levels.

In contrast, the final energy consumption of the building sector increased in both absolute and relative terms compared to 1990. In 2010, it reached 34-46% of total final energy consumption (IEA, *ibid*). In addition, 2010 figures show that 22-66% of total electricity production in the ECIS region was used in buildings (IEA, *ibid*). While primary energy consumption associated with electricity and district heat generation is accounted for in energy balances, the demand for electricity and heat comes from buildings, thus many energy saving opportunities can be found in the building sector. In Turkey, total energy demand grew steadily in

both the industrial and building sectors from 1990 to 2010, with the building sector predominating (IEA, *ibid*).

While the following section focuses on final energy consumption and energy intensity in the building sector due to its importance in the ECIS region, an overview of energy intensity in other sectors is provided in Annex 8.

### 2.4.1 Residential buildings

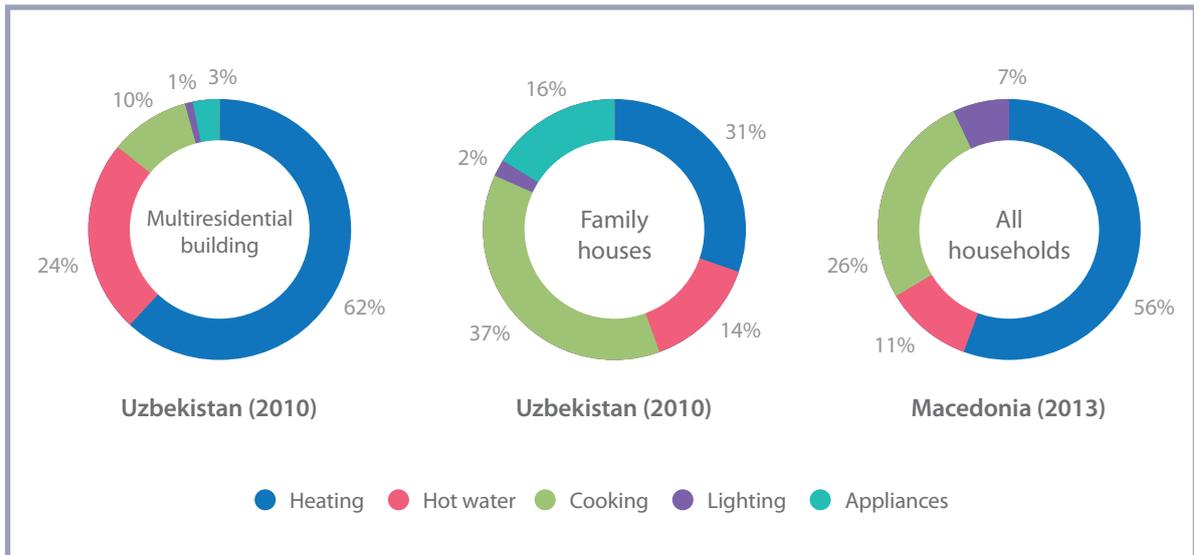
For the majority of countries in the ECIS region, energy intensities in the residential sector per household and *per capita* have been on the rise since the end of the 1990s (IEA, *ibid*; UNECE, "Statistical Database"). In spite of this increase, residential sector energy intensity did not exceed that of the EU-27 (IEA, *ibid*; World Bank, "World Development Indicators"; UNECE, *ibid*; EUROSTAT, "Population and Social Statistics" - all accessed 2013).<sup>23</sup> ECIS countries generally have lower levels of energy efficiency compared to the EU-27, but they also have lower living standards, such as smaller living (and thus heating) area per person and fewer electrical amenities, which reduces energy intensity (see Annex 9 for details).

At present, ECIS households primarily consume energy for heating and hot water. For example, in 2010 Uzbekistan's and FYROM's heating and hot water totalled 45%-85% of energy use (see Figure 2.5).

However, available data reveals that space heating intensity declined between 1990 and 2010. In Russia, for instance, space heating intensity per household in 2010 was 65% of its 1993 level,

22 The total (primary) energy demand reflects the demand for energy in the economy. One part of primary energy is directly consumed by energy-using sectors in the form of fuel, e.g. natural gas. Another part of it is converted to secondary forms of energy, e.g. electricity and heat, within the so-called transformation sector (often also referred to as the energy supply sector) and then transported and distributed to consumers in energy-using sectors. The main energy-using sectors are industry, residential, commercial and public buildings, transport, and agriculture.

23 The exceptions were Belarus, and Azerbaijan (per household); Belarus (per capita); and Russia (per household and per capita).

**Figure 2.5:** Breakdown of residential final energy consumption in selected countries

Source: Center of Economic Research, 2011; Ivanov, 2013

and the space heating intensity per square metre in 2010 was 50% of its 1993 level (the difference between these two intensity trends is explained by the increase in living area per household) (IEA, World Energy Statistics Balances; UNECE, "Statistical Database"; WEC, "Energy Efficiency Indicators Database"; EUROSTAT, "Population and Social Statistics").

The potential exists to further reduce the energy demand for residential space heating. This is especially true for the multi-residential buildings constructed using mass-produced, pre-fabricated materials ('panel' buildings) in the 1960s-1980s, which are heated by off-site district heating systems. This type of building features predominantly in the housing stock of the Western Balkans, Caucasus, Central Asia and other CIS countries which tend to have poor thermal qualities, if not retrofitted. Many district heating installations and distribution systems are now more than 50 years old and, without renovation, may lose more than half the heat they produce.

#### **Case study: Retrofit of residential buildings in Montenegro**

Between 2010-2013, the UNDP Country Office in Montenegro implemented two projects: "Beautiful Cetinje" and "Energy effi-

ciency base formation of informal settlements". Energy audits were conducted for 34 municipal houses and identified the average final energy consumption per household as 636 KWh/m<sup>2</sup>-yr. (all electricity). The audits indicated that measures such as insulation and replacement of building components could save up to 63% of household energy consumption. The average investment required was estimated at EUR 5,850 for a 100m<sup>2</sup> household, however the anticipated saved energy costs would pay back EUR 830/yr.

#### **Case study: Construction of residential buildings in Kazakhstan**

In 2013 the UNDP Country Office in Kazakhstan implemented a pilot project promoting the use of energy-efficient design and construction in the country. A prototype building was constructed under a joint project between the national Government of Kazakhstan, the Karaganda city authorities and the Global Environment Facility, as a model for energy efficient communal housing in Kazakhstan. The incremental construction costs were 10% higher than standard construction costs, however the savings in energy costs are expected to be 30%.

More specific data will be available once emissions monitoring has been carried out on the house.

Electrical appliances and equipment, both classic (refrigerating, washing, cooking appliances, and lighting) and modern (cooling, entertainment, communication and information technologies) contribute to a high and growing share of energy consumption in ECIS households. In Uzbekistan and FYROM this share ranged from 4-33%, depending on building type.

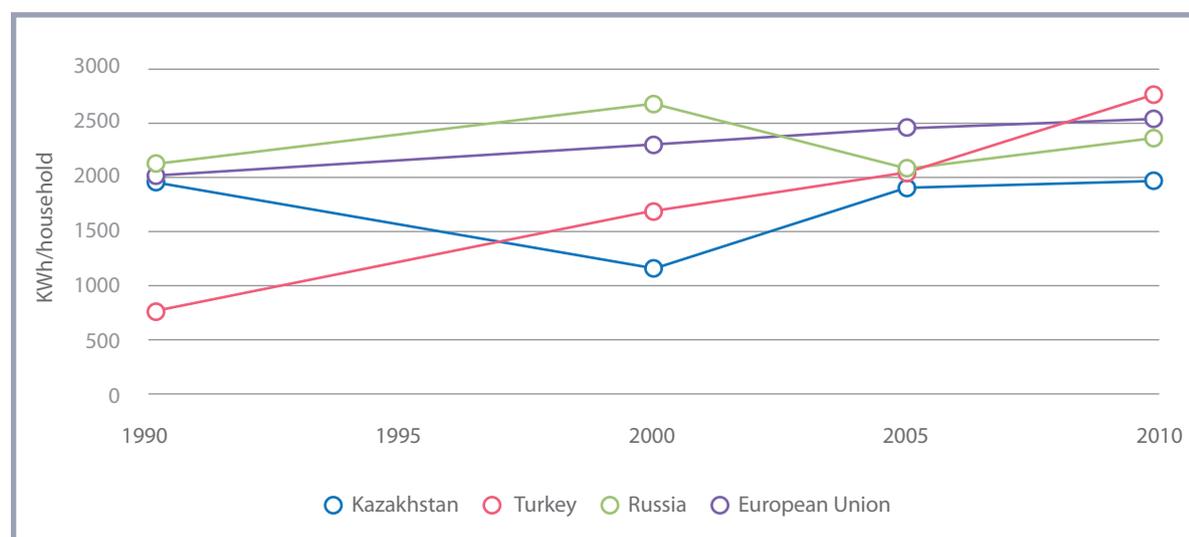
In those countries for which information was available, an increase in electrical intensity per household was observed during 1990–2010 (see Figure 2.6), as the growing number of electrical appliances and equipment outweighed the electrical efficiency gains in the building sector. For example, in 2011 Gesellschaft für Konsumforschung (GfK Group) reported increases of 35% in Russia and 8% in Ukraine in the number of major domestic appliances sold in 2011 versus 2010. This increase indicates that not only were the old appliances exchanged but also new appliances were added to the household inventory. As a result of the growing amount of electrical appliances and equipment over the last two decades, electricity consump-

tion in the residential buildings of the ECIS region has grown 1.3-4.6 times (IEA, “World Energy Statistics Balances”).

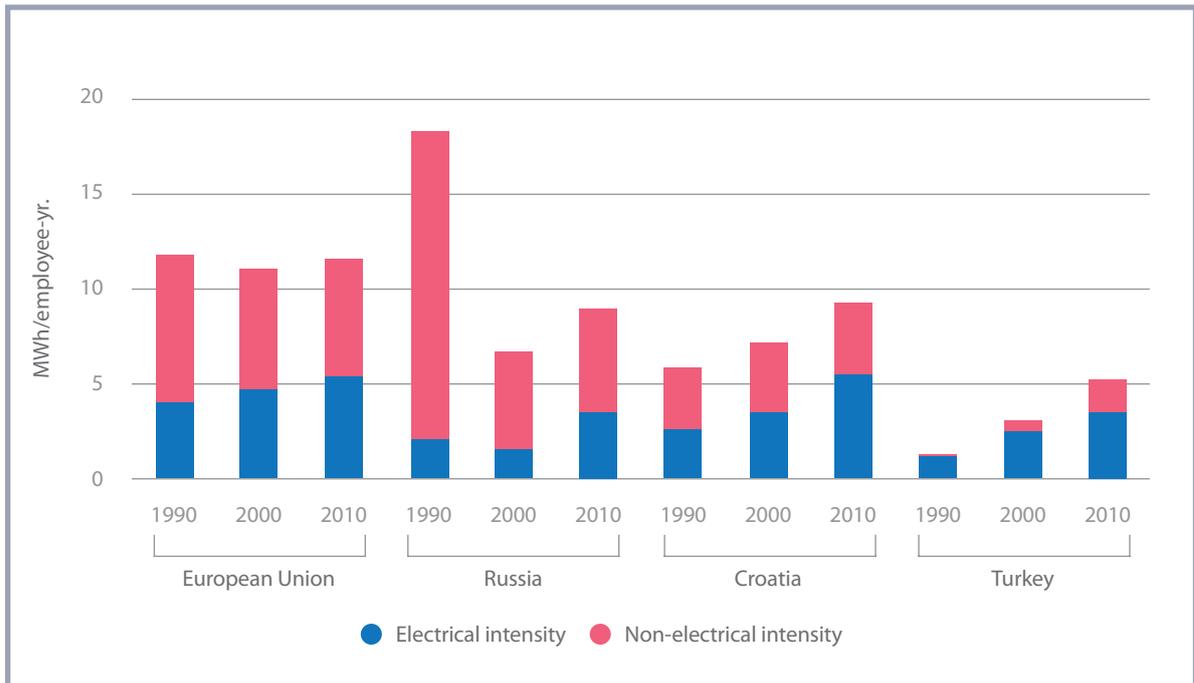
Although the efficiency of appliances has also increased during the last two decades, the usage rate of these more technologically advanced appliances was still slower than in the EU-27. For instance, in Russia, the share of A+ class refrigerators increased from 2% to 21% between 2004 and 2011, while in Western Europe and Eastern Europe A+ class refrigerators were already dominating the market by 2011 (46% and 65%, respectively) (GfK, 2011; UNDP, 2010). This slower penetration of high efficiency appliances is probably due to their cost. For instance, in 2011 the average refrigerator of A+ class cost EUR 650 in Russia as opposed to EUR 361 in Eastern Europe (GfK, 2011).

The highest and also cheapest potential for savings in single use electricity lies in lighting. The country lighting assessment of the Russian Federation conducted by UNEP (UNEP, 2012) concluded that exchanging the bulb type throughout the country (see Annex 9 for details) would reduce electricity consumption for lighting by 46.3% (5.8% of total national electricity consumption). This would result in USD 5.6 million in net benefits with an eight-month payback period.

**Figure 2.6:** Electrical intensity of households, 1990 - 2010



Source: WEC, “Energy Efficiency Indicators Database”

**Figure 2.7:** Intensity of electricity and non-electrical energy carriers of services per employee

Source: WEC, "Energy Efficiency Indicators Database"

## 2.4.2 Commercial and public buildings

A significant reduction has been made in end-use energy intensity per value added in commercial and public buildings in many ECIS countries (with the exception of Turkey and the Western Balkans) (IEA, "World Energy Statistics Balances"; World Bank, "World Development Indicators"). However, available data shows an increase in the energy intensity of the commercial and public services sector when measured per employee (Figure 2.7). This increase in energy intensity is predominantly caused by growing electricity consumption, while the relative share of non-electrical energy (mostly used for space and water heating) has declined. This trend is in line with growing energy intensities in the commercial and public sectors, common in the EU-27. These trends are a result of the switch from other fuels to electricity and the growing use of telecommunications equipment, information technology and other workplace

technologies. In 2010, the overall electricity demand by commercial and public buildings in the ECIS region had grown by 2.4-6.1 times that of the 1990 demand (IEA, *ibid*).

Over the past few years, several studies and pilot projects have been undertaken which demonstrate that a significant potential for energy efficiency improvement exists in the public sector.

### **Case study: educational and healthcare facilities in Uzbekistan<sup>24</sup>**

The UNDP Country Office in Uzbekistan is currently implementing a GEF-funded project which promotes energy efficiency in public buildings. Most of these buildings were constructed 30-60 years ago with no consideration for energy efficiency and consume 320-690 kWh/m<sup>2</sup> per year, and by 2008 it was estimated that 66% of healthcare facilities required their heating and hot water systems

<sup>24</sup> Information was also obtained via local questionnaires, copies of which are held by the UNDP RBEC Regional Centre

to be retrofitted. Energy audits conducted within the project demonstrated that insulating and exchanging the building components and installing efficient heating and ventilation equipment could result in a 50-60% reduction in space heating demand (Usmanov, 2013) (see Figure 2.8).

### Case study: municipalities in Moldova, Macedonia and Kosovo.

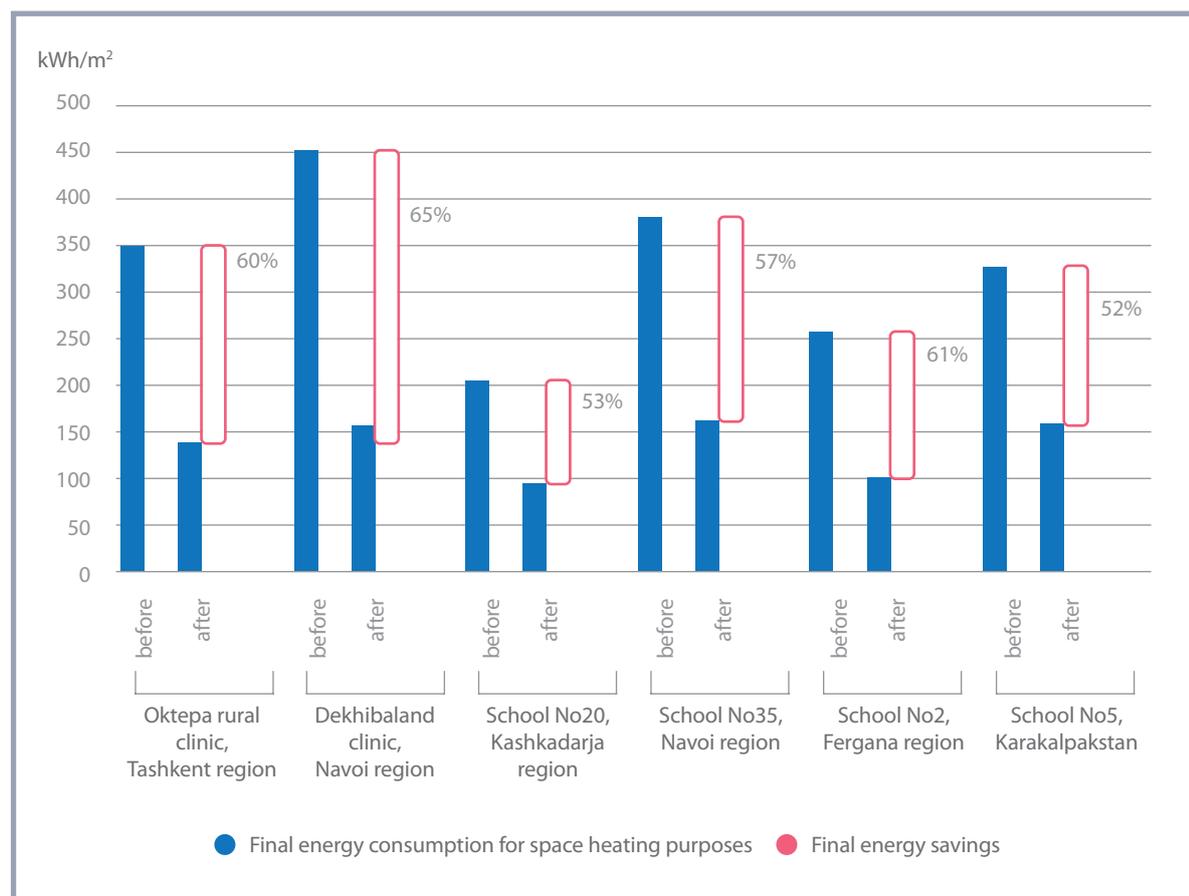
As part of a Czech-UNDP Trust Fund<sup>25</sup> project focussed on transferring Czech knowledge to support local government associations, an evaluation of the overall potential for heating energy savings in 39 schools in Moldova,

FYROM, and Kosovo was undertaken (Zahradník, P., *et al*, 2013). The average heating costs in 2011 ranged from 10-12 EUR/m<sup>2</sup> or 35-105 EUR/student and the evaluation revealed that up to 50% of the energy used for space heating could be saved. Depending on the country, this translates into approximately 70-85 kWh/m<sup>2</sup> or 5-6 EUR/m<sup>2</sup> (Figure 2.9).

## 2.5 Policy Environment for Promoting Energy Efficiency

**The progress in energy efficiency from 1990 to 2010 in ECIS countries was partially triggered by the enabling policy environment.**

**Figure 2.8:** Ex ante evaluation of thermal efficiency retrofits of public buildings in Uzbekistan

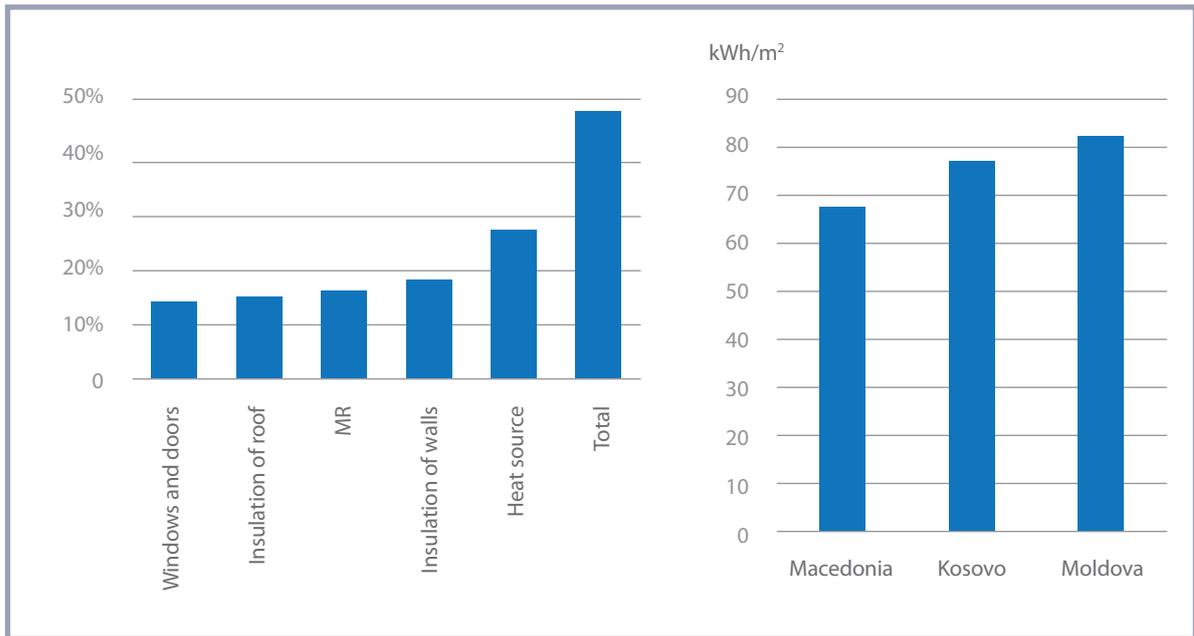


Source: : Elaborated by the Authors based on Usmanov, 2013

25 The Czech-UNDP Trust Fund

[http://www.euroresources.org/fileadmin/user\\_upload/PDF\\_country\\_and\\_Programme\\_profiles/czech\\_rep4.pdf](http://www.euroresources.org/fileadmin/user_upload/PDF_country_and_Programme_profiles/czech_rep4.pdf)

**Figure 2.9:** The average potential for savings of energy used for the space heating purposes at the surveyed schools in Macedonia, Moldova, and Kosovo



Source: Zahradnik, P., et al, 2013

**Although significant steps towards the adoption of energy efficiency policy frameworks have been made, room remains for further improvement.**

### 2.5.1 Policy framework

By 2010, about half the countries of the ECIS region had adopted laws on energy efficiency or energy conservation (WEC, “Energy Efficiency Policies and Measures Database”; REEGLE, “Country Energy Profiles”; Kogalniceanu and Raicevic, 2013).<sup>26</sup> In contrast, only Albania, Russia, Uzbekistan and Belarus had adopted this type of law in the 1990s. However, since 2000, the driving force behind the adoption of energy efficiency laws, for many ECIS countries, has been European Union accession. The Energy

Community Treaty<sup>27</sup> extends the core energy legislation of the EU *acquis communautaire* to South East Europe and the Black Sea region as a legally binding framework. As such, the Contracting Parties to the Treaty (the Western Balkans, Ukraine and Moldova) are obliged to adopt and implement selected EU energy efficiency legislation within a particular timeframe. These ECIS countries have therefore had to adopt an energy saving target of a 9% reduction in total energy sales by 2018, from 2010 levels (Directive 2006/32/EC).

Overall, more than half the ECIS countries had set targets for energy efficiency improvements by 2010. (WEC *ibid*; REEGLE *ibid*; Kogalniceanu and Raicevic, 2013)<sup>28</sup>. The most ambitious target, adopted by Belarus in its National Energy Saving Programme, requires the country to

<sup>26</sup> Information was also obtained via local questionnaires, copies of which are held by the UNDP RBEC Regional Centre

<sup>27</sup> The Energy Community Treaty entered into force in July 2006. The Parties to the Treaty are the European Union and eight Contracting Parties from the South East Europe and Black Sea region ([www.energy-community.org/portal/page/portal/ENC\\_HOME](http://www.energy-community.org/portal/page/portal/ENC_HOME))

<sup>28</sup> Information was also obtained via local questionnaires, copies of which are held by the UNDP RBEC Regional Centre

reduce GDP energy intensity by approximately 6% annually from 2011-2015. Ukraine, Russia, Kazakhstan, Serbia, and Turkey have aimed for an annual reduction of 1.5-3.3% in GDP intensity, according to country-specific timeframes.<sup>29</sup>

## 2.5.2 Policy landscape

The design and adoption of energy efficiency policies has advanced in the ECIS region during the last two decades. The energy efficiency policies of Ukraine, Russia, Albania, Croatia, Serbia and Turkey, target the energy-using sectors, and can be found in the World Energy Council policy database (WEC, *ibid*). An analysis of these policies (see Annex 10) shows that regulatory and financial incentive policies are frequently used, which is in line with international practice. However, the analysis also revealed that these policies are not compiled as a comprehensive and coherent package, but are designed in a more fragmented manner and therefore do not address the wide range of barriers that exist in the region.

The most commonly introduced and updated policy tools were the introduction of minimum energy performance standards and labelling. These were applied to buildings, transport, industrial facilities, appliances and equipment, to effect the phasing out of inefficient stock and the further promotion of energy efficient technological options. Some countries adopted the provision of financial incentives and fiscal support for energy efficiency technologies and practices, as well as for energy audits. In several countries, voluntary agreements on energy efficiency have also been initiated between government and industry and other businesses, including the provision of support for energy performance contracting. Of the six countries reviewed, Turkey and Croatia currently have the most comprehensive energy efficiency policies.

## 2.5.3 Policy implementation and enforcement

As few *ex post* evaluations of ECIS energy efficiency policies have been undertaken, it is difficult to provide concrete numbers on their effectiveness. However, the available evidence suggests that the implementation and enforcement of energy efficiency policies is a challenge for the region.

The European Bank for Reconstruction and Development (EBRD, 2008) attempted to monitor the relationship between the institutional framework and sustainable energy outcomes in Eastern Europe, the Baltics and the Western Balkans. The methodology used quantitatively measured the development of key institutions and market incentives (including energy pricing) and then compared this measurement with how the countries ranked in terms of energy intensity (see Figure 2.10).

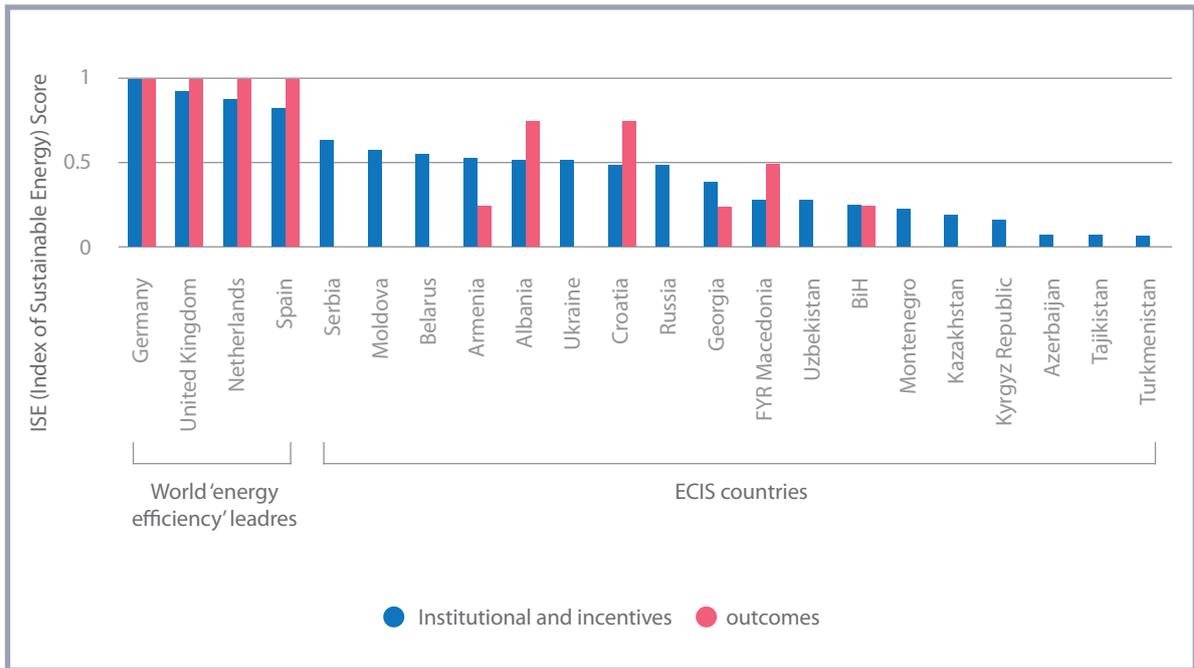
While the results of the study are subject to many caveats, they revealed that some countries in the reviewed regions, such as Serbia, Moldova, Belarus, Armenia, Albania, Ukraine, Croatia, Russia, and Georgia, had made progress in establishing institutions and market incentives for energy efficiency. However, in spite of the built capacity in these countries, only Croatia could record energy efficiency outcomes similar to those of countries already advanced in energy efficiency. The positive results in other countries were explained by their extensive use of hydropower (Albania and Georgia) and nuclear power (Armenia), their economic structure and the limited existence of energy-intensive industries.

## 2.5.4 Tariff reform

Another energy efficiency policy frequently used in the ECIS region is incentivised energy

<sup>29</sup> An overview of energy efficiency legislation and targets in the ECIS region can be found in Annex 10.

**Figure 2.10:** Institutional framework (institutions and market incentives) vs. energy efficiency outcomes

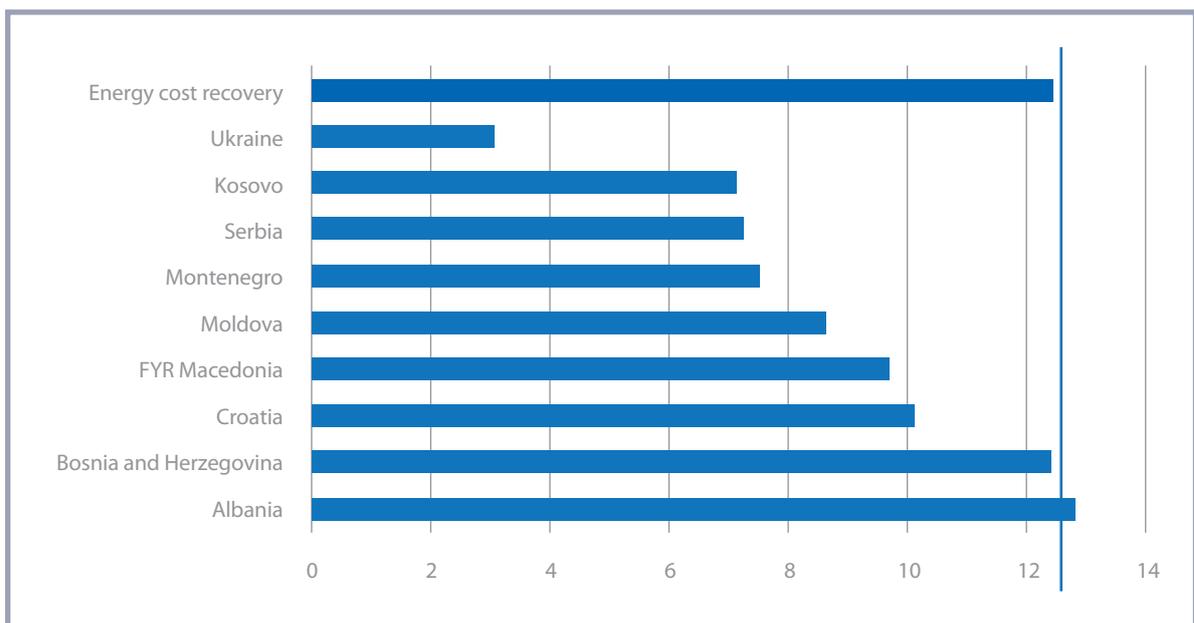


Source: EBRD, 2008

pricing. Energy subsidies are given to energy suppliers in order to lower energy tariffs for end-users and thus address the energy poverty challenge. The subsidised energy

tariffs for end-users are often lower than the levels of energy cost recovery and the difference must be shouldered by the public budget (Figure 2.11).

**Figure 2.11:** The electricity prices for households in the 4th quarter 2011 vs. energy recovery cost



Source: Electricity prices – Energy Regulators Regional Association (ERRA) cited in Kogalniceanu and Raicevic (2013). The electricity cost recovery is estimated for the whole region (World Bank, 2012).

Energy subsidies misrepresent the true cost of energy for end-users. This is especially the case when universal energy tariffs are used, as high-income groups enjoy low prices for energy, and therefore have no incentive to limit their demand for energy or to invest in energy efficiency measures. A vicious circle results as energy consumption, created by a growing demand for amenities that do not meet modern efficiency standards, will increase, and more subsidies will be required to meet the cost.

## 2.6 Financing Energy Efficiency

Estimates for the total amount of public and private investment in energy efficiency made in ECIS countries have yet to be made. The Review of the Financial Support Facilities Available for Energy Efficiency and Renewable Energy (Western Balkans Investment Framework, 2011) identified 25 individual funds that provide financial and technical assistance for the improvement of energy efficiency in the Western Balkans. The total available funding was estimated at approximately EUR 830 million, 98% of which was loan financing, including associated technical assistance and grants (see Annex 11 for details).

The Central and Eastern European network for monitoring the activities of international financial institutions (CEE Bankwatch, 2013), conducted an evaluation of the finances provided by international financial institutions (IFIs)<sup>30</sup> for the energy infrastructure of South Eastern Europe, including the Western Balkans. The evaluation revealed that only EUR 289 million (17% of all energy-related financing between 2006-2012) was allocated to energy efficiency; the balance went to fossil-fuel energy and renewable energy investments, despite the fact that energy efficiency investments are known to be

1,000-10,000 times more cost-effective than investments in new energy generation capacity.

One of the reasons for this dichotomy is that providing financing for energy efficiency is difficult. Energy efficiency in the residential and commercial/public sectors is spread among households, commerce and administration, as well as among different technological solutions. In January 2013, experts from the European banking sector, commercial financiers, analysts and policy makers, attended a workshop organised by the German Institute for Economic Research<sup>31</sup> to address the issue of financing energy efficiency and to discuss the use of criteria for energy efficiency financing by European public and private banks. The experts identified the need to have standardised methodologies for designing and monitoring energy efficiency projects in order to scale them up and make them commercially attractive for banks. The normal practice of IFIs, in the field of small-scale energy efficiency, is to provide technology-based credit lines to local banks, which then disburse finance to recipients in energy-using sectors through preferential (low-interest) loans. However, often the market is still immature, recipients are unfamiliar with the benefits of energy efficiency and/or the marketing of the available financial products is not well developed and recipients are therefore reluctant to apply for loans. Furthermore, local banks have limited capacity and experience regarding new energy efficiency products, which creates a challenging environment in which to work.

## 2.7 Energy Efficiency and Human Development

The Global Energy Assessment (Gomez-Echeverri, L., *et al*, 2012) notes that energy efficiency improvement brings numerous cost-effective and

<sup>30</sup> EBRD, EIB, WB, EU-IPA

<sup>31</sup> German Institute for Economic Research, Expert Workshop on Energy Efficiency Investment by Public Banks, [diw.de/en/diw\\_01.c.407156.en/research\\_advice/sustainability/climate\\_policy/events/events.html](http://diw.de/en/diw_01.c.407156.en/research_advice/sustainability/climate_policy/events/events.html)

near-term benefits. Energy efficiency should therefore be considered an important decision-making element of ECIS policies, because it is closely linked to economic and human development.

### 2.7.1 Energy efficiency as a factor of economic growth

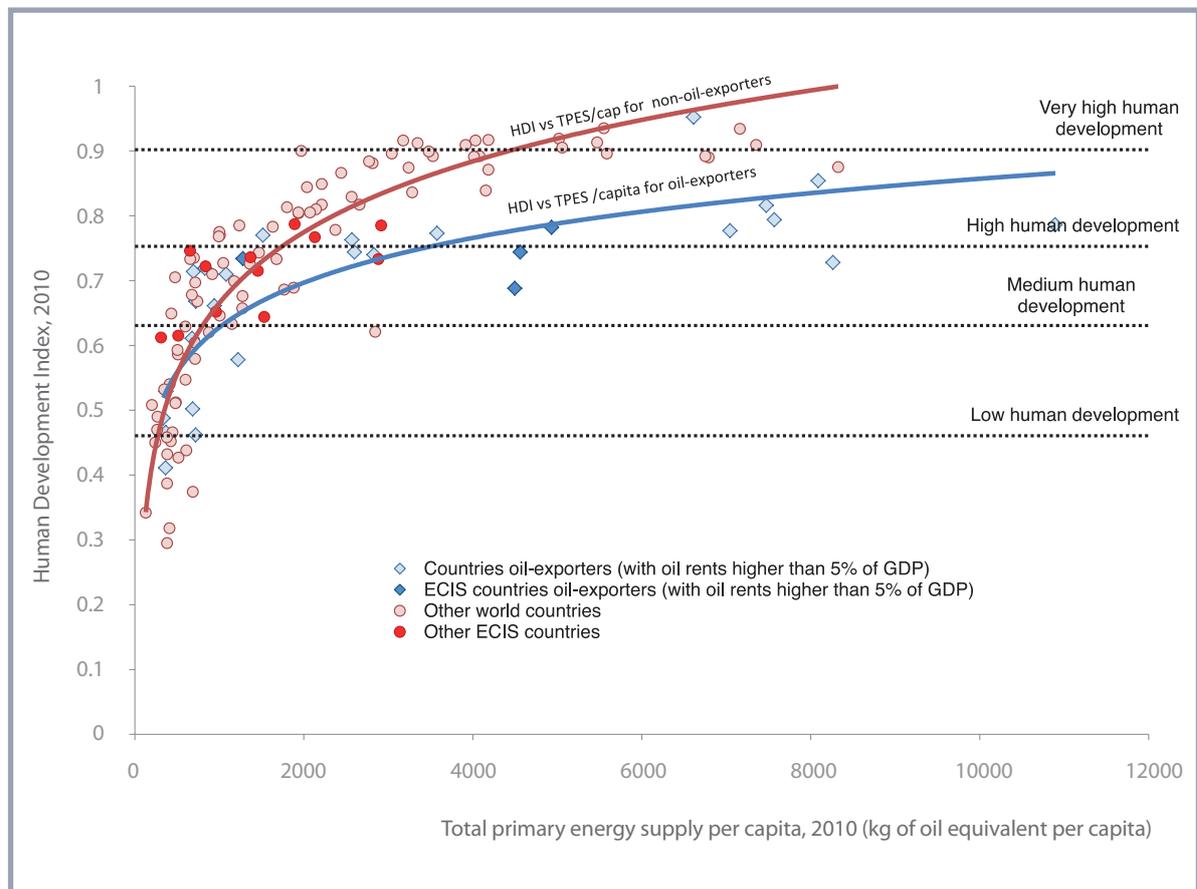
In spite of the low levels of energy efficiency, *per capita* energy consumption in the ECIS region is relatively low, compared to OECD or EU-27 countries. It is widely believed that there is a relationship between the UN Human Development Index and the *per capita* energy consumption of a nation (see Figure 2.12), which falls into three categories: (i) a steep rise in human development relative to energy consumption for energy-poor nations; (ii) a mod-

erate rise for transitioning nations; and (iii) essentially no rise in human development for energy-advantaged nations, consuming large amounts of modern energy.

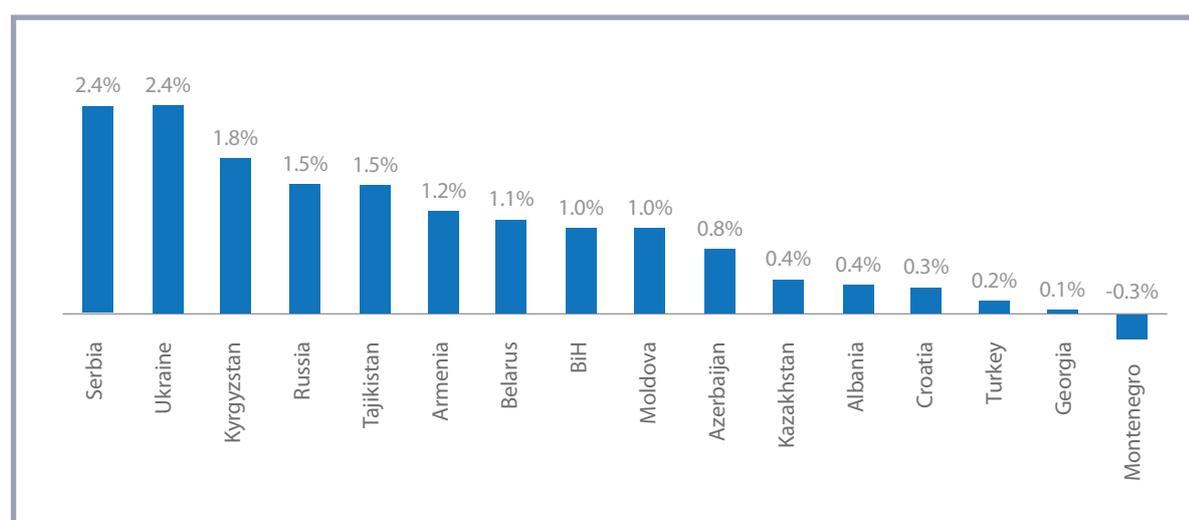
A second trend, can also be seen, which represents heavy energy exporters such as the Organization of the Petroleum Exporting Countries (OPEC) and some former Soviet Union nations, among others.

This would seem to suggest that in order to move up on the Human Development Index, ECIS countries will probably increase their energy consumption. However, as economies grow, providing more fuels to satisfy the growing demand for amenities will not be a simple solution and thus reducing energy demand using energy efficiency technologies in order not to compromise economic growth is important.

**Figure 2.12.** Human development index vs total final consumption / capita, 2010



Source: based on World Bank, "World Development Indicator Database" and UNDP, 2013

**Figure 2.13:** Net gains from removing subsidies for electricity and gas, as % GDP

Source: World Bank, 2012

### 2.7.2 Energy efficiency and fiscal gains of from removing energy subsidies

As discussed earlier, many ECIS countries provide subsidies to energy providers in order to lower energy tariffs for end-users. A recent report (World Bank, 2012) found that in 2010 electricity and gas subsidies constituted 0-5% of GDP depending on the country, despite the significant progress made during the last few years to reduce these subsidies. The report, which estimated the fiscal benefits of mitigating electricity and gas subsidies in the region, indicated that the finances regained from subsidy removal could be invested into energy efficiency policies and social protection programmes to compensate poor households. The report also inferred that all the ECIS countries, except Montenegro, could achieve net gains in the range of 0.1-2.4% of their GDP by removing electricity and gas subsidies (see Figure 2.13).

#### Case study: Kazakhstan

A recent OECD study (2013) evaluated the impact of removing indirect subsidies for district heating tariffs in Kazakhstan. The subsidies are directed mostly at oil con-

sumption (55%), electricity (30%), and coal (10%), but these fuels are used to produce district heating, so their subsidy indirectly lowers the district heating tariff. According to the IEA estimates cited in the report, the subsidy value in the country amounted to USD 5.85 billion in 2011, absorbing 3.3% of the country's GDP in that year. The study evaluated savings in public expenditure both where subsidies were reduced to the acceptable affordability threshold and also where only basic heating comfort was assured. The study concluded that if the heating tariff was increased but remained below an acceptable affordability threshold, the burden of the subsidy on the public budget would decrease to USD 1.4 billion/yr. If the heating tariff was raised further, assuring only basic heating comfort, the burden of the subsidy on the public budget would drop to USD 520.3 million/yr.

### 2.7.3 Energy efficiency and energy supply security

The UNDP Country Office in Kazakhstan identified several issues related to energy supply problems that are connected to low energy efficiency. The pilot audits undertaken in Karaganda re-

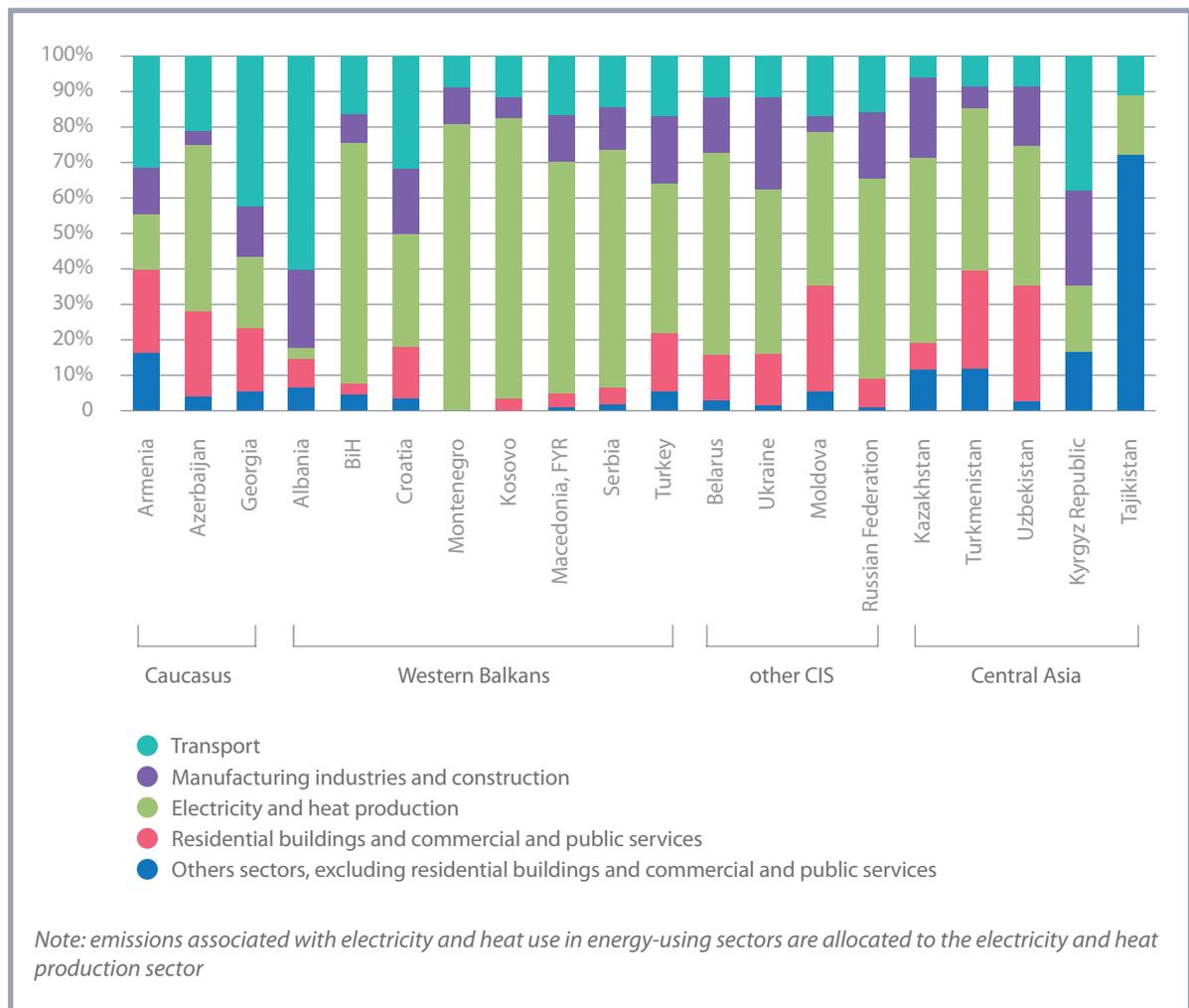
vealed that due to high heat losses in district heat networks, households and commercial and public buildings do not receive enough heat and thus switch on additional electrical heaters. These heat losses also resulted in low temperatures in sanitary hot water supplies, and households had to install additional individual electric water heaters, resulting in additional electricity demand and a greater burden on the electricity infrastructure. In Almaty, the district heat water circulation is so low during summer that households have to let the water run while waiting for the hot water supply (55-60°C).

In Tajikistan and Kyrgyzstan some households cannot afford to pay the high energy bills caused by the low efficiency of thermal building en-

velopes and heating systems and consequently begin using firewood, coal and dung (UNDP Kyrgyzstan, 2011; UNDP Tajikistan, 2010). Traditional, and often non-energy efficient technologies, are frequently used to burn solid fuels resulting in very low combustion efficiency, high greenhouse gas emissions, and indoor and outdoor air pollution.

The survey of the rural population in Kyrgyzstan in 2010 (UNDP Kyrgyzstan, 2011) found that 12.5% of respondents had 1-2 power interruptions per week and 2% experienced interruptions of half an hour or more on a daily basis. The interruptions were caused by the physical deterioration of the electrical systems, the need to replace transformers and power transmission lines, and to install new and automatically

**Figure 2.14:** CO<sub>2</sub> emissions from fuel combustion in the ECIS region by sector, 2010



Source: World Bank, "World Development Indicators"

switching transformers, and the low technical knowledge of the electricians.

### 2.7.4 Energy efficiency and the environment

Among the main causes of indoor and outdoor air pollution in the Western Balkans, Kyrgyzstan, and Tajikistan is the continued use of out-dated technologies for combustion of solid fuels.

Wood collection by rural communities leads to deforestation, biodiversity loss, and soil degradation. In Montenegro (UNDP, 2011)<sup>32</sup> 70% of households still use firewood for their energy requirements, which is predominantly purchased from traders, while the balance is collected in forests and parks.

The high losses that occur during the process of fossil fuel energy transformation, transportation and distribution, as well as the use of non-sustainable harvesting of biomass result in high greenhouse gas emissions (see Figure 2.14). Emissions from electricity and heat production are also high, reflecting both the low efficiency of these sectors and the high demand for electricity and heat (mostly from buildings and industry).

### 2.7.5 Energy efficiency and health

Populations suffering from energy poverty have to tolerate below-standard temperatures in their homes, administration buildings, and offices. A survey of the rural population in Kyrgyzstan undertaken in 2011 (UNDP Kyrgyzstan, 2011), concluded that cold temperatures experienced by clinics and first aid posts are detrimental to the work and well-being of the medical staff and also deter people from visiting healthcare services. Power blackouts and worn equipment lead

to failures in the operation of refrigerators and medical equipment, which results in an overall reduction of the quality of medical assistance. The substandard conditions make it difficult to provide adequate care for women during childbirth, newborn babies and the seriously ill.

Uncomfortable thermal conditions at home, combined with low lighting result in higher medical bills for those affected and productivity loss as a result of employee sick days. In rural areas, where households have lower incomes and often have no access to effective and efficient energy services, fuel poverty tends to be high (Macours, K., and Swinnen, J., 2008). The 2011 survey revealed that more than half the respondents heat only one room in winter. In some provinces, this indicator was very high, particularly in Jalal-Abad (94%), Batken (82%) and Naryn (72%). The prevalence of unheated, outside toilets and the lack of heated bathrooms or bathhouses further contributes to the various cold-related diseases.

### 2.7.6 Energy efficiency and education

Education facilities are also affected by low thermal comfort and low lighting and the consequent reduction in school attendance undermines the human potential of the country and ultimately contributes to lower labour productivity. Numerous examples of substandard conditions in education facilities have been reported through UNDP-supported projects. An energy audit of Kazakh schools revealed that the lighting level did not comply with the country's building codes.<sup>33</sup> Field visits conducted in November-January in Kyrgyzstan, recorded below-standard temperatures in rural schools, forcing teachers and pupils to wear coats in the classrooms. Additionally, more than half the schools were found to have no in-house sanitation facilities.

<sup>32</sup> Information was obtained via local questionnaires, copies of which are held by the UNDP RBEC Regional Centre  
<sup>33</sup> *ibid*

## 2.8 Tracking Energy Efficiency

Accurate tracking of energy efficiency trends at the national, sector, end-use, and technology levels is essential for the design, evaluation, and optimisation of energy efficiency policies. Even though the background data for the analysis of energy efficiency in the ECIS region has improved over the last twenty years, it lags behind that of OECD or EU-27 countries. Observing these trends in the ECIS region is therefore challenging.

While energy macro-statistics are now publicly available in the International Energy Agency and World Bank websites,<sup>34</sup> sector end-use statistics are either unavailable, fragmented or of such poor quality that they are difficult to analyse. If sectoral energy efficiency indicators from national energy agencies and local experts were compiled in a database similar to the ODYSSEE database<sup>35</sup> for the EU-27, this would facilitate the analysis of energy efficiency trends and the potential for energy efficiency savings could be estimated.

Significant progress has been achieved in gathering and cataloguing the information on energy efficiency policies in databases such as the IEA Energy Policy Database, the World Energy Council Database, and the REEGLE energy profiles.<sup>36</sup> However, few *ex post* evaluations of these policies have been undertaken in order to understand how well these policies perform, what their success and limitation factors are, how they should be revised, and what other countries can learn from them.

Major investment mobilisation will be required to realise available energy efficiency potential. In order to understand how to leverage and scale up private and public investment, it is nec-

essary to ascertain who invests in energy efficiency and the investment size, how effectively this finance is spent, where it is spent and what triggered the investment (Buchner, B., *et al*, 2012). Information on financing provided by international financial institutions and international non-governmental organisations can be tracked on their websites and in evaluation reports. However, as the individual expenditures are not clearly delineated, the specific allocation of funds is difficult to assess. Further efforts must be made to track and analyse public and private energy investments, as this is essential for understanding how to generate additional investments.

## 2.9 Summary of Findings

Over the last two decades, the primary energy intensity per unit of GDP produced has fallen throughout the ECIS. However, in the majority of countries, primary energy intensity is still more than double that of EU-27 levels. This relatively high energy intensity translates into a large potential for energy savings and associated economic, social and environmental gains.

By 2010, the building sector was the biggest consumer of final energy and electricity, with space heat and hot water preparation dominating energy consumption. The need for sustainable heating is a unique challenge in the ECIS region because it concerns each country and every citizen. The demand for electrical appliances and equipment in the building sector, especially in commerce and administration, poses a rapidly growing challenge. Energy efficient construction and efficient thermal retrofitting of buildings represent the highest potential for energy savings. The most attractive options economically are technologies that use

<sup>34</sup> <http://www.iea.org/statistics/>, <http://databank.worldbank.org/>

<sup>35</sup> <http://www.odyssee-indicators.org/database/database.php>

<sup>36</sup> <http://www.iea.org/policiesandmeasures/energyefficiency/>, <http://www.wec-policies.enerdata.eu/>, <http://www.reegle.info/>

electricity efficiently, such as lights, appliances, electronics, and equipment.

By 2010, about half the ECIS countries had adopted laws on energy efficiency and set national energy efficiency targets. In order to achieve these targets, many countries have applied regulatory and financial incentives, as is the practice internationally. Even though ECIS countries have made progress in the design and adoption of energy efficiency policies, comprehensive and coherent policy packages, which address a range of complex barriers, have yet to be developed. The available evidence suggests that energy efficiency policy implementation and enforcement is a challenge for the region, which is why further capacity building remains an important task.

Despite the recent energy tariff increases throughout the ECIS, energy prices are still lower than the cost recovery threshold. Energy subsidies misrepresent the true cost of energy for end-users and place a high burden on public budgets. Removing energy subsidies and re-channelling them to energy efficiency policies and social protection programmes may not only result in improved energy efficiency and the alleviation of energy poverty, but may also result in net gains for the public budget.

Energy efficiency attracted only 17% of all energy-related financing during 2006-2012; 83% of financing was invested in the generation and production of fossil fuels and renewable energy, even though energy efficiency investments are much more cost effective. The low share of financing for energy efficiency is partially explained by the difficulty in providing such financing to disaggregated small-scale energy efficiency projects. More assistance is required to develop standardised methodologies for making energy efficiency projects identi-

able, replicable, and bankable. Monitoring, reporting, and verification procedures must also be improved in order to scale up these projects, making them commercially attractive for implementers.

Although sectoral energy intensity is high, *per capita* energy consumption is relatively low, compared to OECD or EU-27 countries. Reducing energy demand through energy efficiency technologies and practices is a cost-effective solution to managing the growing energy demand and to addressing energy poverty as economies develop and inequalities rise.

Low efficiency in the building sector causes additional demand for heating and electrical energy. When these are constrained, households tend to switch to non-commercial, traditional fuels. Wood collection by rural communities contributes to deforestation, biodiversity loss, and soil degradation and the use of obsolete technologies for the combustion of non-commercial energy carriers leads to indoor air pollution and high greenhouse gas emissions.

Uncomfortable thermal conditions in homes combined with poor lighting contribute to higher medical bills and productivity loss. Problems at health and educational facilities due to the lack of or low quality heat and electricity supply undermine human potential and ultimately contribute to lower labour productivity.

Accurate tracking of energy efficiency trends at national, sector, end-use, and technology levels is essential for the design, evaluation, and optimisation of energy efficiency policies. This is why more efforts are needed to track and analyse sectoral end-use statistics, to evaluate existing energy efficiency policies, and to track and analyse energy efficiency financing.

# 3. Renewable Energy



### 3.1 Overview

One of the three objectives of the SE4ALL initiative is to double the share of renewable energy in the global energy mix by 2030. In line with the SE4ALL goals and pertinent regional issues, the benefits of renewable energy (RE) include enhanced energy security, reduced dependency on fossil fuels and energy imports, improved local environment and health, reduced levels of greenhouse gas emissions and improved access to energy. While non-OECD countries increasingly account for overall growth in renewable energy, OECD countries remain the leaders, contributing to 53% of global investment in renewable energy sources (RES) in 2012 (IEA, 2013).

Despite impressive growth in renewable energy in some countries, fossil fuels (coal, natural gas, and oil) continue to predominate and were predicted to meet 80% of global energy demand in 2013 (IEA, 2012). In 2011 fossil fuels were supported by an estimated USD 523 billion in subsidies, an almost 30% increase from 2010 and six times more than the subsidies allocated to renewables (IEA, 2012). While renewable energy offers excellent potential and benefits in many countries, there is still a long way to go to successfully scale-up its deployment and achieve the goals of SE4ALL.

Global investment in renewable energy suffers from severe regional imbalances (Frankfurt School-UNEP, 2013). The ECIS region is no exception. It is estimated that approximately 96.2% of the total primary energy supply (TPES) in the region came from fossil fuels in 2010, 16.2% higher than the global average (IEA, 2010). Despite the fact that the ECIS region has

excellent potential and employs numerous promotional schemes for solar, wind, and biomass energy, and small hydropower (SHP)<sup>37</sup> and geothermal plants, the vast majority of these resources remain untapped and are hindered by a range of informational, technical, institutional and financial barriers.

In order to understand the unique role RES can play in achieving the SE4ALL goals, the current state of deployed RES, the RES market and the supporting financial, policy and institutional environment in the ECIS region must be examined.<sup>38</sup> Equally, the ways in which these barriers can be overcome and how the investment environment can be de-risked to promote investment and encourage the development of RES need to be explored.<sup>39</sup>

### 3.2 Defining Renewable Energy Sources

RES are essential providers to energy supply portfolios. RES contribute to global energy supply security, reduce dependency on fossil fuel resources, and provide opportunities for mitigating greenhouse gases (IEA, 2007). According to the current definition by the IEA, "Renewable energy is energy that is derived from natural processes (such as sunlight and wind) that are replenished at a higher rate than they are consumed. Solar, wind, geothermal, hydropower, and biomass are common sources of renewable energy."<sup>40</sup>

For the purposes of this report, which adheres to the definitions used in the SE4ALL Global Tracking Framework,<sup>41</sup> biomass is considered an RES even though no regional-level data

37 For the purposes of this report small hydro power plants are defined as plants with a capacity of <10MW

38 Due to the availability of region-wide data, the analysis has used the base year of 2010 unless otherwise stated.

39 It is beyond the scope of this chapter to propose solutions at the country level.

40 Definition of renewable energy sources can be found at: <http://www.iea.org/aboutus/faqs/renewableenergy/>

41 The SE4ALL Global Tracking Framework document specifically recommends that "until adequate data becomes available" RES shall be "defined and tracked without the application of specific sustainability criteria".

exists to indicate whether it is produced in a sustainable manner. Furthermore, where data is available to allow analysis, energy production from large hydropower plants (LHPP) (larger than 10MW),<sup>42</sup> is treated separately. This is useful in order to focus on data regarding other RES, to exemplify the importance of diversification in the energy supply mix and is also due to the contentious nature of the sustainability of LHP.

### 3.3 Benefits of RES

Renewable energy plays an important role in addressing the simultaneous challenges of climate change and energy security. Investing in renewable energy helps countries to reduce greenhouse gas emissions while promoting sustainable development.

With the exception of LHP and biomass, where negative environmental and social impacts can be significant and should be carefully assessed through environmental impact assessments, RES have distinct advantages over other energy sources (SE4ALL, 2013; Armstrong, A. J., *et al*, 1999).

- They are environmentally friendly, as they have **negligible discharges and emissions**;
- They are **sustainable**, as they run on a virtually infinite supply of locally-available resources;
- They promote energy diversification, which enhances **energy security** by **reducing a country's dependence on imports of fossil fuels** and can reduce **exposure to price variability and supply fluctuations**;
- They develop domestic, specialised manufacturing capacities and **green jobs** and **foster economic growth**;

- They increase the share of energy from renewable sources, which can **reduce a country's reliance on (often imported) fossil fuels**;
- They **reduce dependence on traditional fossil fuel-fired energy generation** consequently **lowering greenhouse gas emissions** and can reduce **local pollution**; and
- They provide protection **from fuel supply and price volatility** and can improve a country's balance of payments.

It is important to note that each type of renewable energy technology has its own key advantages that make it particularly attractive in specific environments. There is no 'one size fits all' approach to RE solutions.

### 3.4 Renewable Energy in the ECIS

Distinctive geo-political features make energy a key determinant of development across the ECIS region. Very cold winters, inadequate and out-dated energy transmission infrastructure, a reliance on fossil fuels and energy imports, energy supply shortages and rising concerns regarding energy security, all provide specific incentives for diversifying energy portfolios and investing in RES.

**The region has a significant amount of diverse renewable energy potential.** In order to increase the competitiveness of RES compared to traditional fuel technologies for energy production, governments have implemented and are continuing to implement a variety of RES promotional schemes. Countries in the region have substantially increased the supply of energy from RES. However, in 2010 the major source of this energy (63.9%) (in Terra Joules (TJ) of Total Primary Energy Supply (TPES)) is

42 As there is no worldwide consensus on size categories of "small hydro" and "large hydro", the author chose to use The IEA Implementing Agreement for Hydropower Technologies and Programmes conservative definition of small-scale hydropower as 10 MW or less in size. Available at: ([http://www.ieahydro.org/What\\_is\\_the\\_difference\\_between\\_small\\_scale\\_and\\_large\\_scale\\_hydropower\\_projects.html](http://www.ieahydro.org/What_is_the_difference_between_small_scale_and_large_scale_hydropower_projects.html))

*The region has a significant amount of diverse renewable energy potential.*

from hydropower (both LHP and SHP), whilst over 93% of installed RES electrical capacity (Mega Watts) is from LHP. This reflects a history of significant state-owned utility investment in LHP infrastructure, especially in Russia and former soviet states.

Whilst past investment in RE was driven almost exclusively by state actors, private sector investment in RE in the ECIS region is growing. Driven by both private and public equity,

countries have witnessed a growth in energy from RES. The highest increases in TPES from RES between 2000-2010 were in Azerbaijan (125%), Ukraine (112%), Armenia<sup>43</sup> (105%), Uzbekistan (84%) and Belarus (80%) (IEA, 2010; Danish Energy Management, 2011). Despite current growth statistics, the penetration of RE in TPES, with the exception of hydropower (both LHP and SHP), remains low. This trend may be explained by a number of distinctive barriers and related risks that continue to hinder investment and deployment in the region.

### **Box 3.1 Key Energy Issues in the ECIS region**

**Three key energy issues** related to RE in the ECIS region require further attention, these include; **the prevalence of fossil fuels and fossil fuel subsidies; energy security; and decentralised RE solutions.**

#### **Prevalence of Fossil Fuels and subsidies**

**Despite efforts to promote renewable energy, fossil fuels remain dominant in the ECIS region.** Fossil fuels represented an estimated 96.2% of TPES in 2010 (IEA, 2010) due, in most part, to large reserves of oil and gas and the prevalence of government subsidies for fossil fuels in some countries. Indeed, a number of countries have increased the supply of fossil fuels over the last 10 years. Countries with the most noteworthy increase are: Kazakhstan (112%), Kyrgyzstan (66%), Turkmenistan (50%), Turkey (41%) and Bosnia and Herzegovina (48%) (IEA, 2010).<sup>44</sup>

The use of fossil fuel subsidies contributes to this high dependence on fossil fuels. In 2013, subsidies in the ECIS region accounted for around 15% of global energy subsidies, including the highest share (36%) of global natural gas subsidies, and represented 4.5% of total government spending that year (IMF, 2013). Kazakhstan (32.6%), Azerbaijan (35.8%), Uzbekistan (60%) and Turkmenistan (61%) have the highest energy subsidies (average subsidy rate) in the region (IEA, 2013).

<sup>43</sup> Danish Energy Management A/S (2011) (<http://reweek.am/UserFiles/45567aaef3822f38dfd12365719112eeRenewable%20Energy%20Roadmap%20for%20Armenia.pdf>)

<sup>44</sup> At the same time (2000-2010) some countries also increased their total renewable energy supply Turkey: 15% (mainly wind, solar and geothermal energy) and Bosnia and Herzegovina: 41% (IEA, 2010)

Energy subsidies have wide-ranging economic consequences and yet they are notoriously difficult to reform (IMF, 2013) and continue to distort the competitiveness of renewable energy in the region. The effects of distorted energy prices are possibly most predominant in Kyrgyzstan, Turkmenistan, Uzbekistan, and Ukraine where subsidies exceeded 5% of GDP in 2011 (IMF, 2013).

### **Energy Security and RES**

The socio-economic and environmental benefits of RES are widely recognised, but the contribution they can make to energy security is less well known (IEA, 2007). The potential contribution of RES to energy security in the ECIS warrants special attention. RES deployment can achieve energy security by diversifying energy portfolios, reducing the risk of energy supply disruptions and price fluctuations and reducing the reliance of many countries in the region on imported fuels (IEA, 2013).

As discussed in Chapter 1, the region's high dependence on imported fossil fuels and heavy reliance on hydropower, its ageing energy supply infrastructure and the absence of diversification in the energy supply mix, mean ECIS countries are especially vulnerable to a number of energy security risks. Pertinent energy security risks in the region include, but are not limited to, severe supply disruptions and resulting price shocks, political insecurity affecting energy supply and seasonal variance affecting LHP energy supply.

Countries most at risk are those that exhibit a high level of energy dependence as net energy importers (>51%) and those exposed to threats of limited fuel switch options as they rely on one fuel source (such as coal, oil, gas, nuclear or hydropower) for the majority (>51%) of their energy needs.<sup>45</sup>

### **Decentralised RES**

The deteriorating condition of energy supply infrastructure and insufficient energy access issues, especially in Central Asia, makes a strong case for investment in decentralised, off-grid RES even more attractive in the region. Decentralised renewable energy solutions can provide environmental, economic and social benefits by delivering the energy needed for households, hospitals, schools and production during energy or fuel supply shortages. In addition, as identified in Chapter 1, the deployment of modern forms of energy utilising RES instead of solid fuel for cooking can improve indoor air quality, especially in rural and remote populations in the Central Asia and Western Balkans regions.

<sup>45</sup> Please refer to Chapter 1 for a detailed account of these countries

### 3.5. Deployed RES

#### 3.5.1 RE as a component of Total Primary Energy Supply

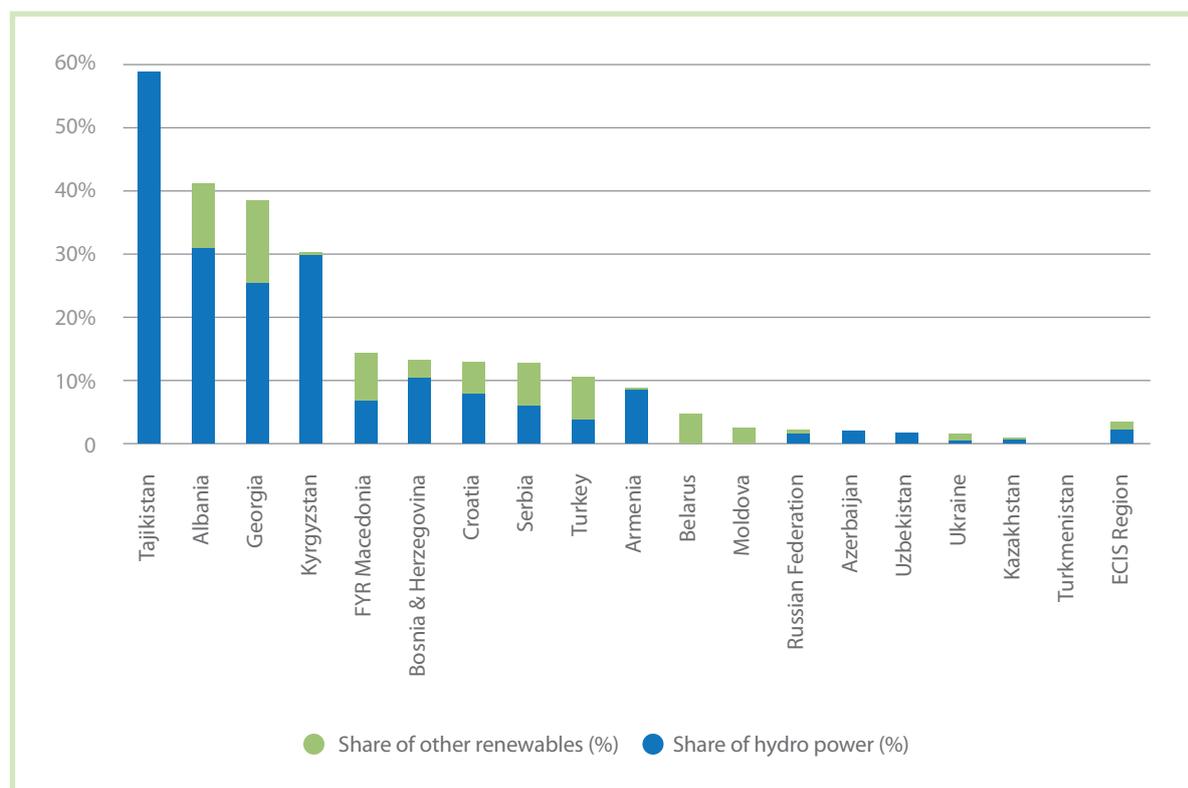
**With the exclusion of hydropower, renewable energy constitutes only a relatively small part of total primary energy supply (TPES) in the ECIS region.**<sup>46</sup> During 2010 RE accounted for only 3.8% or 1.8 million TJ out of a total of 49 million TJ of TPES.<sup>47</sup> The majority of the RE supply was from hydropower.

As can be seen, hydropower (including SHP and LHP) dominates the RE component of TPES, accounting for 63.9%. This leaves only a 36.1% share of RE contribution to TPES from biomass, geothermal, wind and solar together.

The large share of hydropower in TPES in the ECIS (2.3%) compared to the global average (2%) and

*With the exclusion of hydropower, renewable energy constitutes only a relatively small part of total primary energy supply (TPES) in the ECIS region.*

**Figure 3.1:** Share of total primary energy supply ECIS 2010

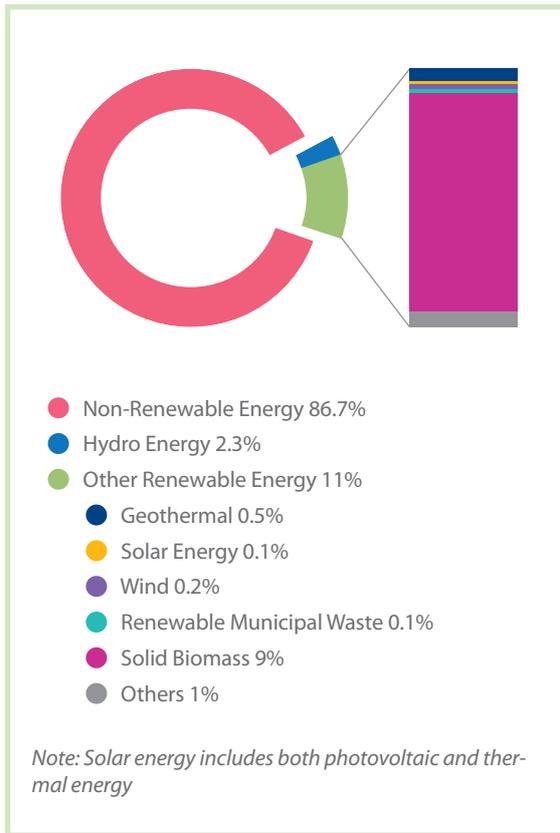


Source: Authors calculations based on country-specific data (see Annex 12 for complete source list).

<sup>46</sup> The indicator used to capture RES potential in the region is 'Total Primary Energy Supply' (TPES). According to the IEA, TPES is equivalent to total primary energy demand only and excludes international marine and aviation bunkers. TPES has advantages and disadvantages. According to the IEA (2012) a disadvantage of using TPES is that the calculations used to determine the TPES of low emission sources are obscured by assumptions about efficiencies. The resulting figures tend to under-represent the share of electricity-producing RES (SE4ALL – Global Tracking Framework Report, 2013). As such, the following sections will also explore the electricity-producing component of RES in the region.

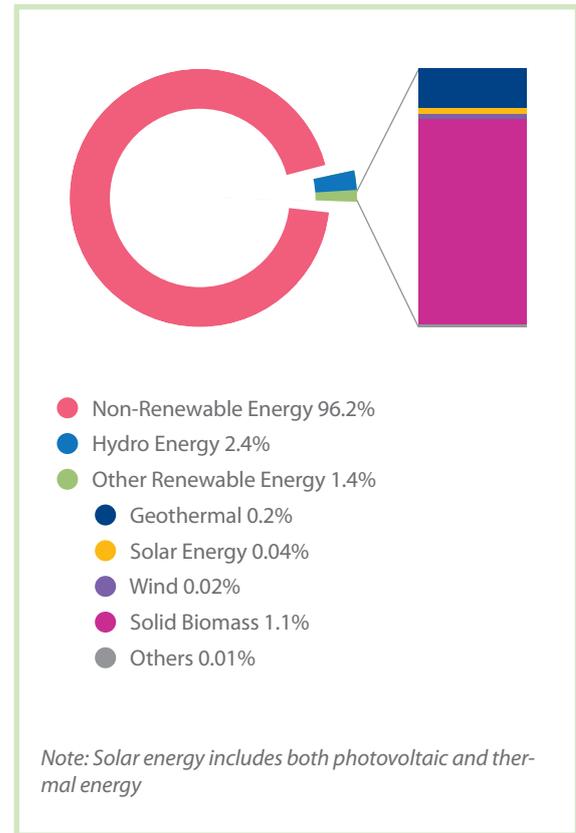
<sup>47</sup> For a more detailed breakdown by country of RES see Annex 12.

**Figure 3.2:** World share of renewable energy sources in total primary energy supply, 2010



Source: Author's calculations based on IEA, 2010.

**Figure 3.3:** ECIS share of renewable energy sources in total primary energy supply, 2010



Source: Author's calculations based on IEA, 2010.

that of OECD countries (2.1%) (IEA, 2010), demonstrates the limited diversification in renewable energy supply. Excluding hydropower, the region has one of the lowest utilisation rates of RE in TPES in the world (1.38%); only Africa has a lower prevalence of RE (excluding hydropower) at 0.3% (IEA, 2010). This reflects the trend in the ECIS of massive investment in LHP in the 1990s, especially in Central Asia and Russia (Peyrouse, S., 2007), and SHP in the Caucasus, Western Balkans, and Turkey. However, the use of RES is growing in the ECIS region and will be explored in more detail in later sections.

### 3.5.2 Sub-Regional use of RES

In terms of the share of RE as a percentage of TPES by sub-region, in 2010 the Western Balkans and Turkey led with 12%, followed by the Caucasus sub-region (10%). For hydropower, the Caucasus

sub-region ranked first (7.6% of TPES, or 76.5% of TPES from RE), followed by the Western Balkans and Turkey (5.5% of TPES, or 45.6% of all RE). However, nearly all-renewable energy (98%) in Central Asia was from hydropower.

The Caucasus, Central Asia and Russia utilise both LHP and SHP as their main source of renewable energy (76.5%, 98.6%, 80.9% respectively), while the Western CIS predominantly uses solid biomass (71.6%) (see Figures 3.4 and 3.5).

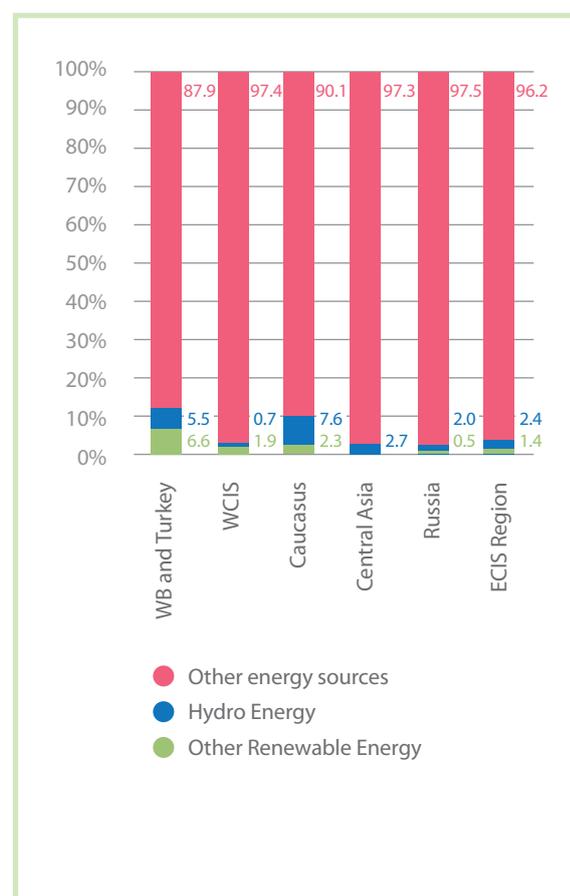
### 3.5.3 Renewable energy as a share of installed electricity output and capacity

Renewable energy features more prominently in electricity output contributing nearly 19% or 335,276 Gigawatt hours (GWh) in 2010 (see Table 3.2).

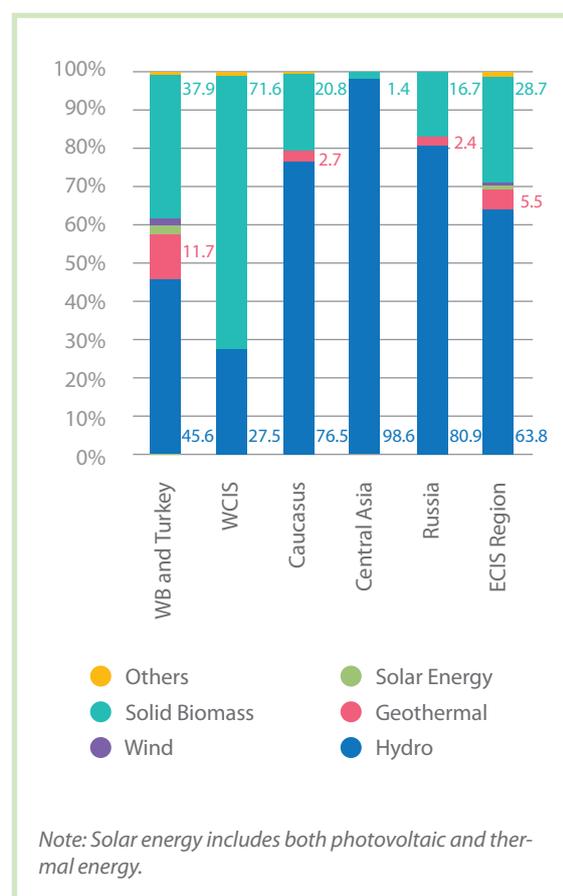
**Table 3.1:** ECIS Sub-region share of renewable energy in total primary energy supply (TPES), 2010

	Total of All Energy Sources (TJ)	Total of Renewable Energy Sources (TJ)	Total of Renewable Energy excluding hydropower (TJ)	Share of RE including hydro-power (%)	Share of hydropower (%)	Share of RE excluding hydro-power (%)
Western Balkans and Turkey	5,888,778.92	710,675.43	386,437.08	<b>12.07%</b>	<b>5.51%</b>	<b>6.56%</b>
Western CIS	6,734,465.16	174,073.24	126,271.04	<b>2.58%</b>	<b>0.71%</b>	<b>1.87%</b>
Caucasus	728,578.48	72,359.92	17,021.56	<b>9.94%</b>	<b>7.60%</b>	<b>2.34%</b>
Central Asia	6,084,596.81	164,442.77	2,269.58	<b>2.71%</b>	<b>2.67%</b>	<b>0.04%</b>
Russian Federation	29,371,365.68	740,871.89	141,425.21	<b>2.52%</b>	<b>2.04%</b>	<b>0.48%</b>
<b>ECIS Region</b>	<b>48,807,785.04</b>	<b>1,862,423.25</b>	<b>673,424.47</b>	<b>3.82%</b>	<b>2.44%</b>	<b>1.38%</b>

Source: Author's calculations based on IEA, 2010.

**Figure 3.4:** Share of RE by sub-region in TPES, 2010 (in %)

Source: IEA, 2010.

**Figure 3.5:** Share of types of RE by sub-region in TPES, 2010 (in %)

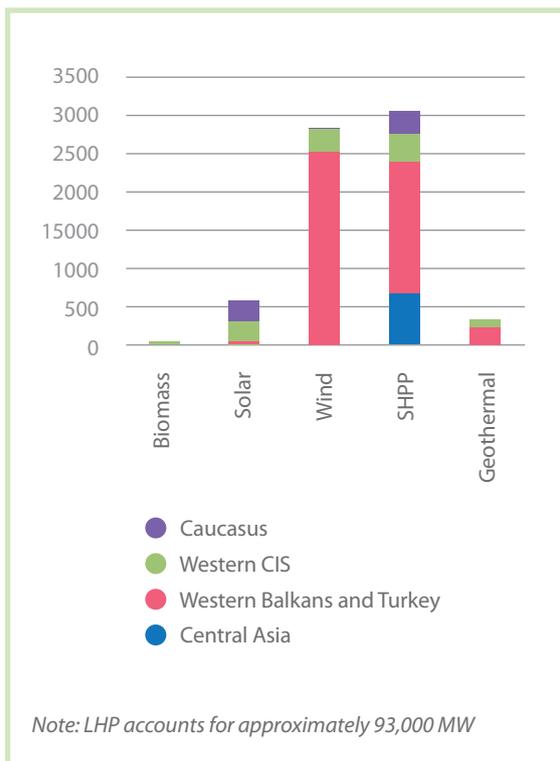
Note: Solar energy includes both photovoltaic and thermal energy.

Source: IEA, 2010.

**Table 3.2:** Total energy and share of renewable energy in electricity output by sub-region, 2010

	Electricity output: All Energy Sources (GWh)	Electricity output: all RES (GWh)	Electricity output: Hydroelectric power (GWh)	(%) RES in total electricity output	(%) Hydroelectric electricity output	(%) RES excluding hydroelectric electricity output
WB and Turkey	294,592	94,138	90,050	31.96%	30.57%	1.39%
WCIS	227,032	13,693	13,276	6.03%	5.85%	0.18%
Caucasus	35,325	15,377	15,369	43.53%	43.51%	0.02%
Central Asia	178,776	45,040	45,040	25.19%	25.19%	0.00%
Russian Federation	1,036,116	167,028	166,483	16.12%	16.07%	0.05%
<b>ECIS Region</b>	<b>1,771,841</b>	<b>335,276</b>	<b>330,218</b>	<b>18.92%</b>	<b>18.64%</b>	<b>0.29%</b>

Source: Author's calculations based on IEA, 2010.

**Figure 3.6:** Total RES electric installed capacity by technology (MW)

Source: Authors calculations based on country-specific data (see Annex 13 for complete source list).

Once again, the dominant RES is hydropower, which accounted for 98% of total GWh output from RES in 2010. Without hydropower this figure only amounts to 5,058 GWh or 2% of total electricity output, which was supplied by a combination of solar, wind, biomass and geothermal sources. Thus, the utilisation of other RES resources for electricity production in the region is very low.

At the regional level, LHP dominates the electricity supply mix, as demonstrated by indicators of installed Megawatts (MW) of RE electricity capacity. The vast majority of installed MW capacity in the region comes from LHP (93.5%). However, at the country level,<sup>48</sup> some countries have a greater share of installed capacity of biomass, solar, wind, SHP and geothermal than others. In terms of total MW installed capacity, those with the greatest share (excluding LHP) include Turkey (6.7%) predominantly from wind and SHP, Armenia (5.4%) mainly from SHP, and Croatia (5.3%), mostly from wind. The share of biomass, solar, wind,

48 For country level information please see Annex 13

SHP and geothermal capacity in the sub-regions of Central Asia, Caucasus, and the Russian Federation are comparatively small.

### 3.5.4 RES as a share of heat production

Of particular concern is the low share of RE in heat output (TJ) in the ECIS region. This is particularly the case in the Caucasus and Central Asia (Table 3.3).

**Table 3.3** Heat Output in TJ, 2010

	Heat output: All energy sources (TJ)	Heat output: RE (TJ)	Share of RE in total heat output (%)
WB and Turkey	114,228	319	0.3
WCIS	912,569	24,087	2.6
Caucasus	18,761	0	0
Central Asia	517,861	0	0
Russian Federation	6,015,631	35,734	0.6
<b>ECIS Region</b>	<b>7,579,050</b>	<b>60,140</b>	<b>0.8</b>

Source: Author's calculations based on IEA, 2010.

Heat from solar, geothermal sources, solid biomass, municipal waste and heat pumps is becoming more economically efficient, but is often overlooked in government renewable energy and energy efficiency promotional programmes, which generally focus on electricity generation and not heat supply. The IEA (2007) suggests that the direct contribution that renewable energy can make to domestic or commercial space

heating and industrial process heat should be examined more closely. RES for space heating is especially relevant for the ECIS region given its extreme winter temperatures.

### 3.5.5 Absence of RES diversification

The absence of RES diversification in the ECIS may be the result of several factors: the abundance of fossil fuels (mainly oil and gas), state-controlled energy sectors with subsidised prices in many countries, the high initial cost of investments in solar, wind, and geothermal energy technologies and shorter-term energy policy focus.

The region also has the lowest rate of biomass utilisation globally, at 1.1% (World: 9%, OECD countries: 3.1%) (IEA, 2010). This figure is partly influenced by the relatively high level of access to modern (non-solid) heating and cooking fuels in most parts of the ECIS region relative to other world regions.

## 3.6 Potential for RES

**Whilst deployment may be low the region exhibits vast potential for RES expansion.** According to the International Renewable Energy Agency (IRENA, 2012) one of the key strategic elements to successfully increasing the deployment of technologies for RE is to accurately estimate the potential of RES. These estimates provide an indication of how much RE could contribute to the energy mix and also help to determine appropriate policy instruments. There are multiple ways to estimate the potential of RES,<sup>49</sup> which include: (a) the technical potential, representing how much energy can be generated from a particular renewable technology, given system performance, topographic limitations, land-use and other environmental

49 The different types are: market, economic, technical and resource. (NREL, 2012)

**Table 3.4:** Technical potential for generating energy from RES (SHP, Solar, Wind, Biomass) in the ECIS with a ranking weight from 1-5.<sup>50</sup>

	CENTRAL ASIA					WESTERN BALKANS AND TURKEY								WESTERN CIS			CAUCASUS			
	Kazakhstan	Kyrgyzstan	Tajikistan	Turkmenistan	Uzbekistan	Albania	Bosnia and Herzegovina	Croatia	Kosovo	Montenegro	Serbia	YR Macedonia	Turkey	Belarus <sup>51</sup>	Ukraine	Moldova	Russian Federation	Armenia	Azerbaijan	Georgia
Biomass	1	1	1	n/a	1	1	1	1	n/a	1	2	1	2	1	2	1	5	n/a	1	1
Solar	5	5	5	5	5	3	5	5	2	2	5	3	5	5	5	5	5	4	5	5
Wind	5	1	1	2	1	1	1	1	n/a	1	1	1	5	5	3	1	4	1	1	1
SHP	1	1	2	1	1	1	1	1	n/a	1	1	1	1	1	1	1	4	1	1	1
Average	3	2	2	2	1.8	2	2	2	0.5	1	2	2	3	3	3	2	5	1.5	2	2
<b>Legend</b>																				
<b>1</b> Below 10,000 MW																				
<b>2</b> 10,000 to 20,000 MW																				
<b>3</b> 20,000 to 35,000 MW																				
<b>4</b> 30,000 to 40,000 MW																				
<b>5</b> Above 40,000 MW																				

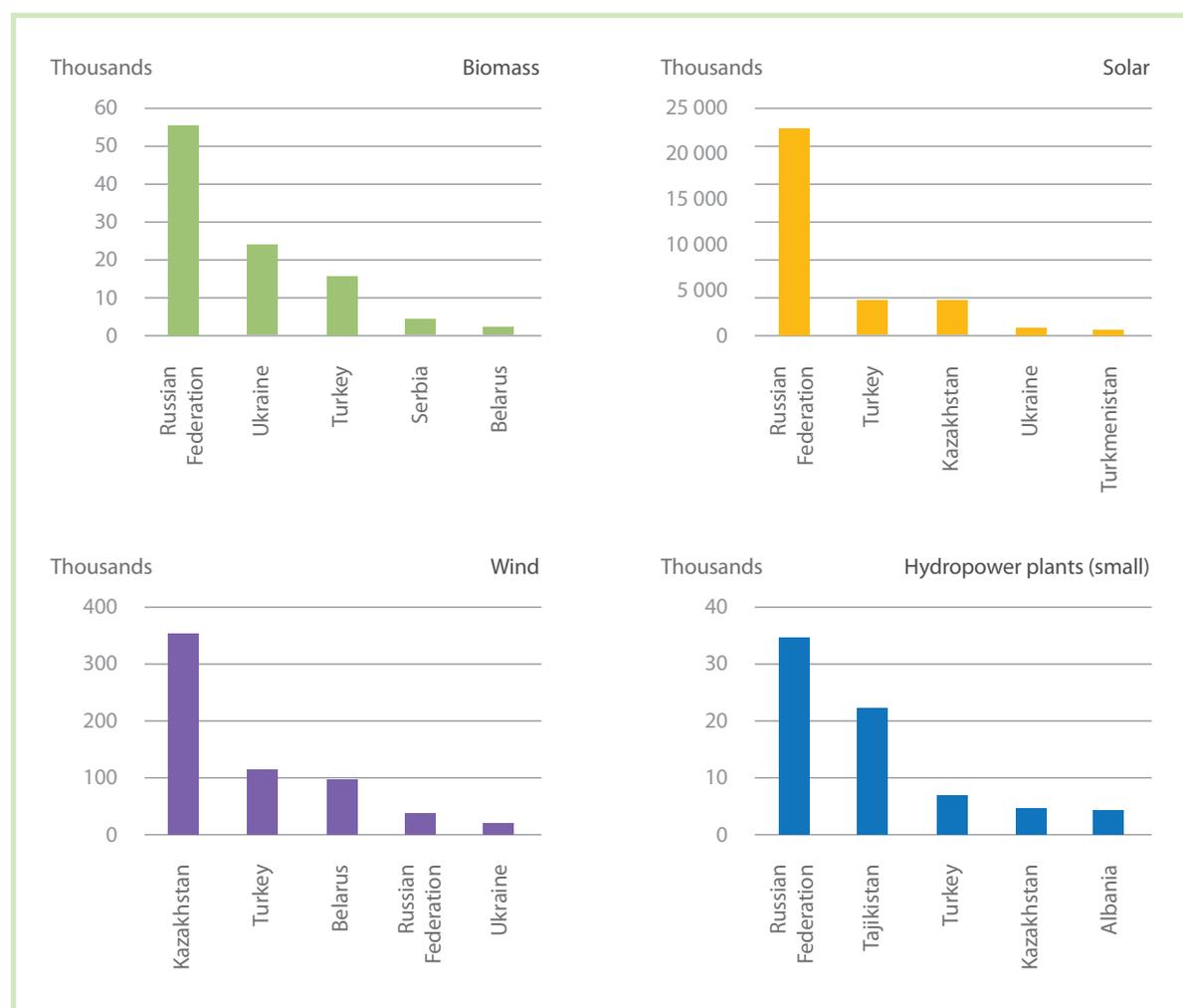
Source: Author's calculations based on country-specific data (see Annex 14 for complete source list)

Note: The datasets concerning geothermal energy potential are not available for all countries. From various sources we can only highlight a few cases where the potential for geothermal energy is significantly high - Turkey: 1500MW (Baris, K., et al, 2012); Ukraine: 14,855MW (Institute for Renewable Energy at NAS of Ukraine, 2013); Azerbaijan: 800MW (UNDP, 2013b); Turkmenistan: 6,600MW (GTZ, 2009)

<sup>50</sup> For a more comprehensive set of values per type of RES potential in ECIS countries please see Annex 14

<sup>51</sup> The total installed capacity of the entire energy mix in Belarus is around 9 GW. The Energy Potential Development Strategy of the Republic of Belarus (enacted in 2010) assumes that the realistically feasible potential is 1.6 GW. The National Programme for Development of Local and Renewable Energy Sources in 2011–2015 (enacted in 2011) assumes that the economically feasible potential is 0.6-0.7 GW.

**Figure 3.7:** Potential for renewable energy in thousands of MW by type of technology - top five countries



Source: Authors calculations based on country-specific data (see Annex 14 for complete source list)

constraints; and (b) the economic potential, which mainly deals with the cost of selected technologies and fuel and narrows down the technical potential by considering factors such as profitability and risk (NREL, 2012).

Due to its sheer size, the Russian Federation, which also has immense fossil fuel production capacity, has the highest technical potential for solar PV, Biomass and SHP (Figure 3.7). Turkmenistan also has huge potential for solar PV (665,000 out of 666,400 MW of total technical potential), but this has not yet been realised.

Due to the high wind speeds found in Kazakhstan, the technical potential from this RE source is approximately 360,000 MW.

Overall, Kazakhstan has the highest *per capita* potential for RES in the ECIS region (0.25 MW/capita)<sup>52</sup>, however its abundant resources have yet to be realised.

The overall technical potential for RES in the region should remain relatively stable, with the exception of climatic variability and change factors affecting the fuel supply of some RE tech-

52 Based on calculation: Potential of renewable energy (MW) / population (World Bank, 2011)

nologies. The economic potential of RES, however, will fluctuate, as it is contingent upon the financial, legal, policy and institutional landscapes for renewable energy.

Technology costs for RE have fallen rapidly over the last two decades. It is believed that by 2020 the technology costs of RES will reduce to the point where they become cost competitive with fossil fuels (Waissbein, O., *et al.*, 2013). Whilst the economic potential is constantly growing, financing costs, as a result of existing or perceived investment risk, continue to restrict economic potential in the ECIS region. An exploration of the financial, legal, policy and institutional landscape will shed further light on this issue.

### 3.7 Policy, Financial and Institutional Landscape for RES

**The costs involved in rapidly scaling-up RES to achieve the goals of the SE4ALL initiative are enormous.** According to the Global Energy Assessment (GEA, 2012) global investment in energy efficiency and low-carbon energy generation will need to be increased from the current USD 1.3 trillion to between USD 1.7 and 2.2 trillion per year over the next twenty years to meet the combined challenges of energy access, energy security and climate change.

Although state-owned RES are significant in the ECIS region, if economies are to successfully scale-up the use of RE, the involvement of the private sector is undeniably essential. This is where public policy landscapes can be most conducive to lowering risk and thus lowering the high, upfront financing costs of RES.

#### 3.7.1 High financing costs for RE

The large initial investment costs of RE and the longer payback periods compared to fossil fuels remain a major limitation to increasing the use of RES. Compared to traditional energy sources, RE power plants require a relatively high initial

investment although their operating costs are considerably lower (Waissbein, O., *et al.*, 2013). The higher cost of RES generally reflects the investment-related risks associated with RE technology as well as country-specific risk factors. This significantly affects the competitiveness of RE projects versus their fossil fuel counterparts (Frankfurt School-UNEP, 2013). In order to accelerate the growth of RE investment and attract large-scale capital, investment environments will need to be created using policy and financial de-risking instruments, and direct financial incentives that increase competitiveness introduced, thus encouraging investment and the greater use of RES (Waissbein, O., *et al.*, 2013).

#### 3.7.2 The role of public instruments in reducing financing costs

One of the key challenges of scaling up RE investment are the high financing costs which reflect a number of perceived or actual risks to investment (Glemarec, Y., *et al.*, 2012). Risk increases the weighted average cost of capital for RES projects; however, a broad spectrum of public instruments can be utilised by policymakers to create the conditions for attractive investment and risk/reward profiles and thereby promote the use of RE technologies. Waissbein, O., *et al.*, (2013) explain that risks and investment barriers can be tackled via three different public instruments:

- By reducing the risk category itself via **policy de-risking**. Policy de-risking instruments attempt to address and remove the underlying country specific barriers that are the root causes of risks to RE investments.
- By transferring the risk from an investor to a third party via **financial de-risking**. These instruments lower the weighted average cost of capital demand for RE investments.
- By increasing the rewards via **direct financial incentives**. These instruments compensate for residual risks and costs by increasing rewards through, for example, premium prices or tax incentives for RES.

**Table 3.5: RES Policy instruments in the ECIS Region**

SUB-REGION	Country	POLICY DEVELOPMENT							
		Financial Incentives			Public Financing	Regulatory Policies			
		Capital subsidy, grant, or rebate	Tax incentives for renewable energies	Public competitive bidding	Public investment, loans or financing	Feed-in-tariff	Electric utility quota obligation/ RPS	Tradable renewable	Law in renewable energy <sup>53</sup>
<b>WESTERN BALKANS AND TURKEY</b>	Albania		•			•			•
	Bosnia and Herzegovina	•		•		•			•
	Croatia	•	•		•	•			•
	Kosovo								
	Montenegro					•			
	Serbia	•	•			•			
	FYROM		•		•	•			•
	Turkey	•	•		•	•			•
<b>WESTERN CIS</b>	Belarus		•			•			•
	Ukraine		•			•			•
	Moldova		•		•	•			•
<b>CAUCASUS</b>	Armenia					•			•
	Azerbaijan	•	•		•	•			•
	Georgia					•			•
<b>RF</b>	Russian Federation	•		•			•		•
<b>CENTRAL ASIA</b>	Kazakhstan	•	•			•		•	•
	Kyrgyzstan	•	•			•			•
	Tajikistan		•			•			•
	Turkmenistan								
	Uzbekistan		•			•			•

Source: Author's calculations based on country-specific data (see Annex 15 for complete source list; see Annex 16 for definitions of indicators used).

Note: Data was not available for Kosovo.

<sup>53</sup> The "Law on renewable energy" is considered a specific legislation such as legally binding targets for RE, defined feed-in-tariffs for RES, preferential grid-access for RES or as part of other legislation on energy.

Usually governments choose a cornerstone instrument in the form of direct financial incentives, which are then supplemented by a number of policy and financial de-risking instruments.

With the exception of Turkmenistan, all the ECIS countries have adopted RES promotional policies. Amongst the most popular policies are subsidies, grants, tax incentives, feed in tariffs (FiTs) and RES targets. Importantly, experience from OECD countries has shown that although favourable RE legislation and enabling policy environments may be a necessary precondition for RE investment and deployment, this does not necessarily provide a rationale for differences in RES utilisation (Frankfurt School-UNEP, 2013). In the ECIS, three types of public instruments are commonly used to promote RES:

### 3.7.3 Financial Mechanisms

Given the relatively high instalment costs for RE projects and the longer payback periods compared to fossil fuel investments governments and banks in the region have employed financial de-risking instruments and direct financial incentives, often in combination, to lower the minimum return on investment (ROI) of a project required to attract investors.

#### *Direct Financial Incentives:*

**Grants** for RES are direct financial incentives that are non-repayable funds most often disbursed by development banks and governments at the beginning of the project. The European Bank for Reconstruction and Development (EBRD), the Global Environment Facility (GEF), the Asian Development Bank (ADB), the Islamic Development Bank (IDB) and bilateral organisations such as Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH and other international financial institutions offer grants as part of their financial assistance to RE projects (mostly in combination with loans).

**Tax Incentives**, such as tax exemption and tax rebates are common in the region and provide a direct financial incentive by reducing the tax liabilities and overall project costs for RES developers. For example in Tajikistan and Albania there are customs tax exemptions for imported RES technology, machinery and equipment. Additionally, Tajikistan's "Custom and Tax Codex" provides a number of exemptions from profit tax, land tax, capital facility tax as well as social tax for employees during construction (UNDP, 2014).

#### **Feed-in Tariffs (FiT) and Feed-in Premiums (FiP)**

for RE are the most common forms of market mechanism for RES promotion in the region. FiTs offer long-term contracts to RE producers paid on a cost-based price for the energy they supply to the grid. A FiP is different in that the price is variable, and is usually based on the electricity price. FiTs and FiPs only function as a direct financial incentive if they offer a higher tariff than would ordinarily be obtainable on the market or from a regulator. Fixed FiTs also function as a financial de-risking instrument as they increase an investor's planning security. All the ECIS countries have adopted FiT or FiP legislation with the exception of Kosovo, Russia and Turkmenistan. Differences in conceptual design for FiTs vary greatly between countries, as does their effectiveness in boosting RES investment. For example, in the Central Asia countries a project specific FiT is negotiated for each project, which increases transaction costs and insecurity. Belarus offers the highest FiT for wind in the region and yet has very little wind capacity. On the other hand, Turkey has a relatively low FiT for wind and has deployed more than 2GW of wind energy. One drawback of FiTs is that they represent costly long-term commitments by the state, as the high deployment rates of RES encouraged by FiTs may require increased investment in the grid (UNDP, 2014).

In **Tender and Auction Systems** governments allow producers to competitively bid for the right to produce and sell electricity at a defined price over a specified period of time in order to

solicit the lowest price. This can be used to control the quantity of installed capacity. In 2013, Russia began a MWh output-based tender scheme which allows RE project developers to benefit from regulated capacity prices for a period of 15 years (IFC, 2013).

### 3.7.4 Financial De-risking Instruments

The high cost of debt for RES projects can be addressed through financial de-risking through zero- and low-interest loans and loan guarantees from development banks.

**Low interest loans** offered by some governments and development banks increase the attractiveness of investments by decreasing the cost of capital of RES projects where investment would not otherwise take place. EBRD's Sustainable Energy Facility provides financing to RES investors in many countries in the region. In Turkey, the General Directorate of Forestry (ORKOY) of the Ministry of Environment and Forestry is working with UNDP and plans to offer zero-interest solar loans for small-scale, on-grid solar PV systems.

**Loan guarantees**, offered by development banks, work by transferring the financial risk of default from a local bank to the development bank. Loan guarantees are offered in all ECIS countries, with the exception of Turkmenistan. The significantly reduced default risk means local banks can offer lower interest rate loans to project developers, which in turn decreases financing costs.

Prioritised or complimentary **grid access** or exemption from obtaining energy generation licences provides a direct financial incentive, by

lowering instalment costs, and also decreases policy-related risk (UNDP, 2014). In Kazakhstan, Tajikistan, Uzbekistan, Albania, Serbia, BiH, Turkey, Belarus, Moldova and Armenia, RE developers are given priority when applying for access to the grid. In some countries only small RE developers are given priority for grid access, as in BiH (up to 150 KW) or Montenegro (up to 30KW). Kazakhstan, Tajikistan, Moldova, Belarus, Georgia all offer complimentary grid access for RE projects.

### 3.7.5 Policy De-risking Instruments

**Government renewable energy targets and strategies** represent an effective policy de-risking instrument that increases the planning security of investors. This can take the form of commitments to fixed RES targets, such as minimum percentage or deployment rates of overall RES within TPES, or targets for specific technologies. In contrast, the absence of long-term, legally binding RE targets, apparent in some Central Asia countries, may signal to potential investors a degree of uncertainty in future commitments to RE (Waissbein, O., *et al.*, 2013).

Most ECIS countries have adopted one or more policy targets directed at the share of renewable energy in their energy mix (see Figure 3.8). These targets vary among production, supply, consumption, and timeframes, and concurrently support a broad range of national goals.

In most cases, targets take the form of a national or international legally binding share of RE in final energy consumption, with the exception of Turkey,<sup>54</sup> Kazakhstan, and Russia, who have non-legally binding targets for electricity production and/or consumption. Arme-

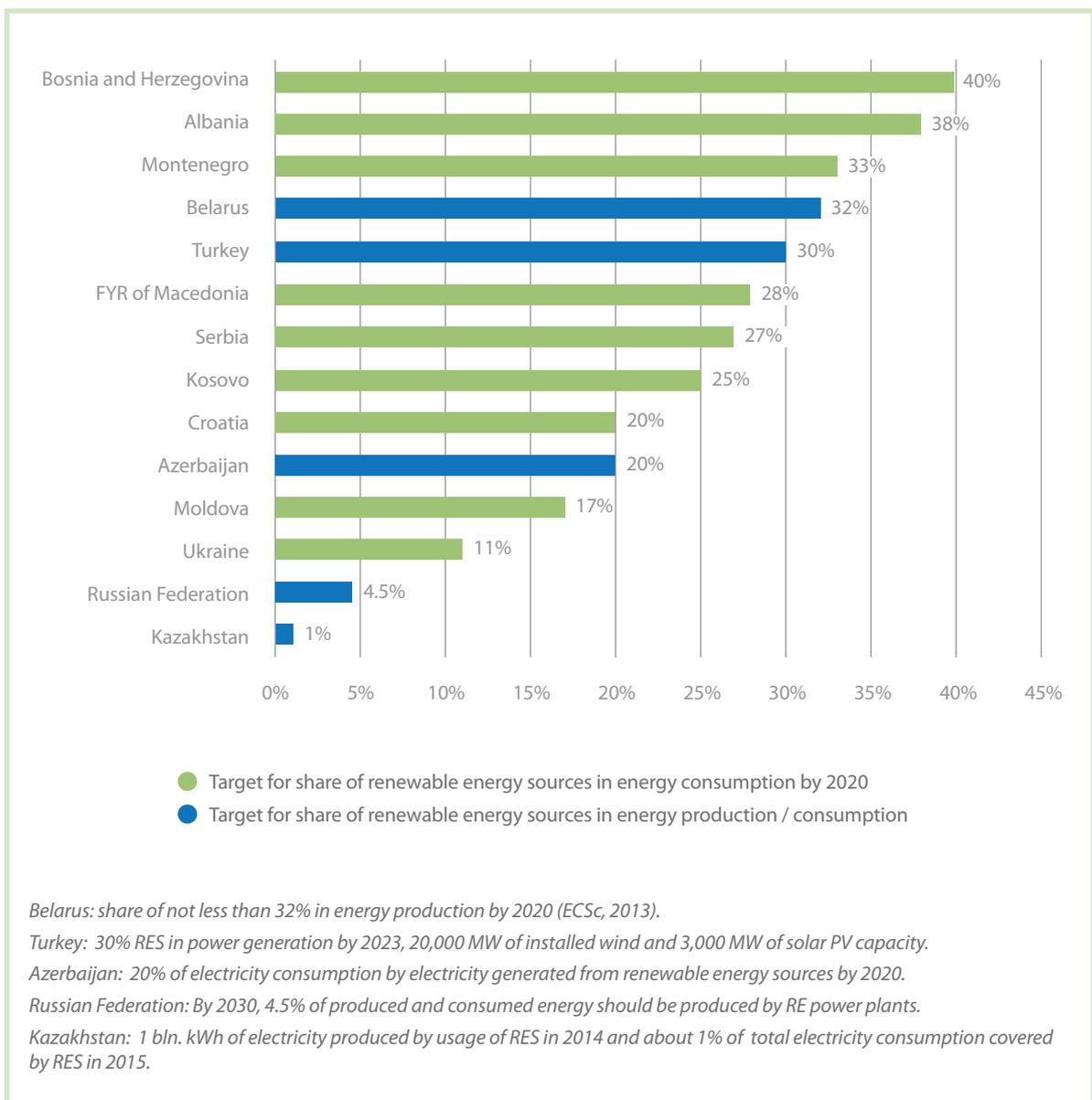
<sup>54</sup> According to the *Electric Energy Market and Supply Security Strategy Paper*, adopted by the Higher Board of Planning, the long term primary target is determined as "to ensure that the share of renewable resources in electricity generation is increased up to at least 30% by 2023" (MENR, 2010).

nia, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan and Georgia have not yet developed specific RE targets.

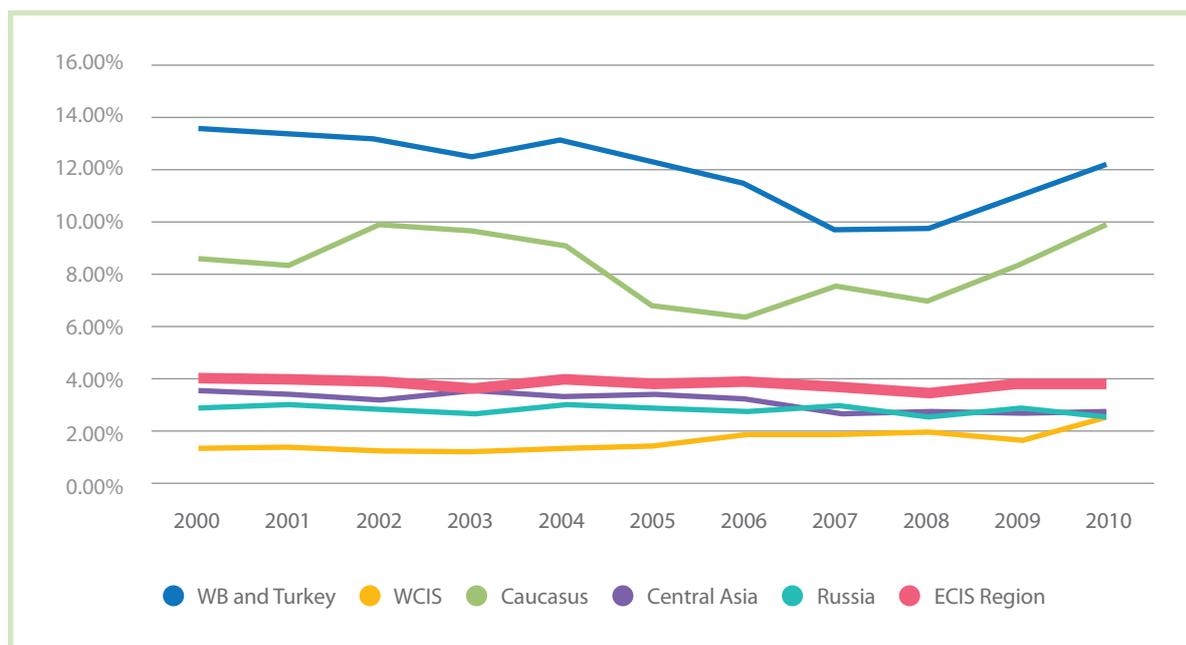
The most comprehensive commitment to RES in the region is the agreement by Albania, Croatia, FYROM, BiH, Kosovo, Moldova, Montenegro, Serbia and Ukraine to implement EU Directive 2009/28/EC, which commits these countries to binding shares of RES in gross energy consumption by 2020 (EC, 2012).

The ECIS region has a combination of excellent RES potential and numerous RES promotional schemes. Whilst the promotional policies explored are often seen as necessary for making investment in RE attractive, and as a precondition for RES deployment, RES deployment is not only tied to the selection of policy instruments and potential. In order to understand the differences in RE deployment, a closer look at the underlying investment barriers and their resulting risks for investors is essential.

**Figure 3.8:** Ranking of Energy Targets: Share of RE by 2020 in various energy contexts (including large hydropower)



Source: Author's calculations based on country-specific data (see Annex 17 for complete source list)

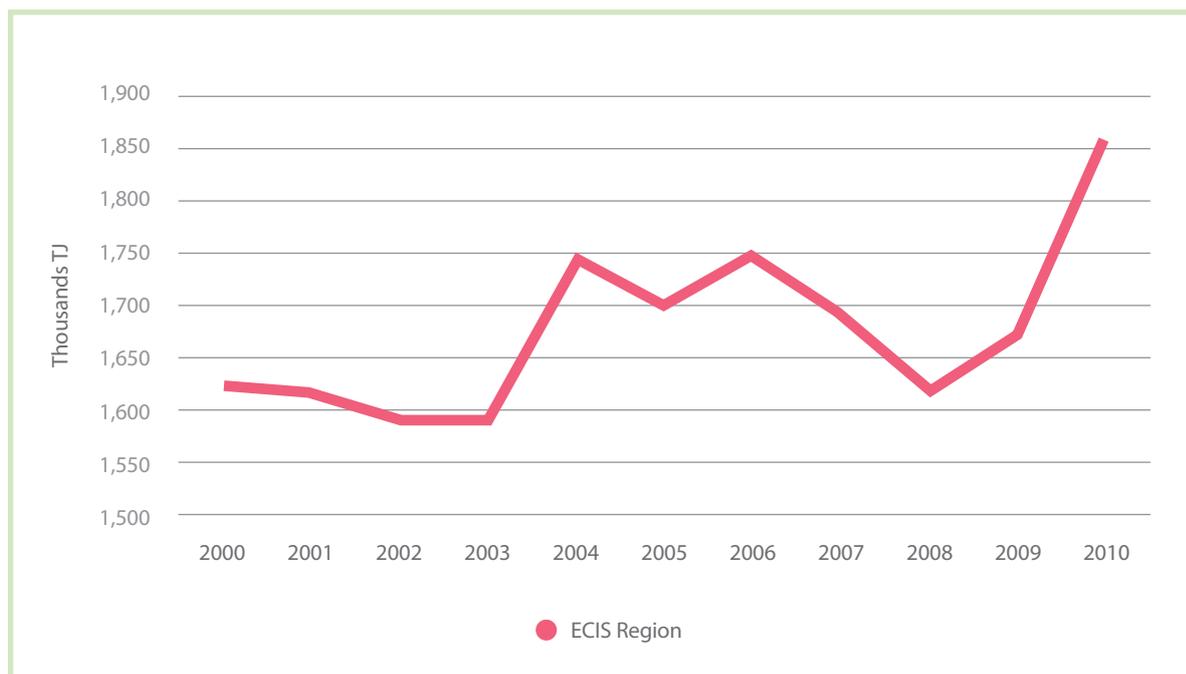
**Figure 3.9:** Evolution of RE in share of TPES (TJ) by sub-region, 2000-2010

Source: Authors calculations based on IEA, 2010

### 3.8 RES Deployment and Growth

The ECIS region has excellent potential for RES deployment. It is therefore important to explore whether cohesion exists between this po-

tential, the promotion of RES, and investment. An analysis of the evolution of RES deployment over time provides important insight into the effectiveness of promotional instruments. The absolute value of RES development can be

**Figure 3.10:** Evolution of RE energy supply (TJ) region, 2000-2010

Source: Author's calculations based on IEA, 2010

**Table 3.6:** Evolution of renewable energy supply by sub-region, 2000–2010

Sub-region	Total RES (TJ)			RES excluding hydroelectric power (TJ)		
	2000	2010	CAGR <sup>56</sup> n=10	2000	2010	CAGR <sup>10</sup> n=10
WB and Turkey	603,512	710,675	1.6%	388,874	386,437	-0.1%
WCIS	88,472	174,073	7.0%	47,572	126,271	10.3%
Caucasus	58,464	72,360	2.2%	27,301	17,022	-4.6%
Central Asia	151,298	164,443	0.8%	3,228	2,270	-3.5%
Russian Federation	755,960	740,872	-0.2%	165,176	141,425	-1.5%
<b>ECIS Region</b>	<b>1,657,707</b>	<b>1,862,423</b>	<b>1.2%</b>	<b>632,152</b>	<b>673,424</b>	<b>0.6%</b>

Source: Author's calculations based on IEA, 2010

measured in Terajoules (TJ), or as the share (%) of RE in the total primary energy supply (TPES). Although RES use has been increasing in absolute terms in the region overall, its share in TPES has remained more or less stable, with minor fluctuations of +/- 2% between 2000-2010.

In the period 2000-2010 the Western Balkans and Turkey experienced the most growth in RE deployment (38%, of which two-thirds is attributable to Turkey's massive deployment of wind power). The fluctuations witnessed in the supply of RE at the regional level (Figure 3.10) are probably due to a decrease in the use of biomass (-1% across the region except the Western CIS)<sup>55</sup> as a consequence of country commitments to reduce GHGs.

### 3.8.1 Compound annual growth rates

The Compound Annual Growth Rate (CAGR) paints a different picture of RES expansion, indicating only marginal annual growth of RE sup-

ply between 2000-2010. The CAGR for all RES for the ECIS for 2000-2010 was 1.2%. The Western CIS experienced the most significant increase (7%) in overall supply, whilst the Caucasus had the greatest decline (-4.6%). The majority of this supply increase in the ECIS region can be attributed to increased hydropower capacity between 2008-2010. Alarmingly, the total RES CAGR in TJ supplied for the entire ECIS region (excluding hydropower) has only grown by 0.6% annually between 2000-2010 (see Table 3.6).

Breaking down CAGR into type of RES (see Annex 18) reveals that wind power has experienced the greatest growth in the period 2000-2010 (54.2%), followed by geothermal and solar energy at (13.4% and 5.4%, respectively). Despite the fact that the supply of some RES has increased in the region, the overall share is still very small and in some regions has even declined.

Despite countries employing a variety of promotional schemes, only Ukraine and Turkey have noticeably increased RE capacity over the past several years.

<sup>55</sup> Namely Georgia, Russian Federation, Turkey, Kazakhstan, and Albania decreased use of biomass by 20-45% during 2000-2010.

<sup>56</sup> CAGRs were calculated using the values for total primary renewable energy supply for 2000 and 2010.  $CAGR = (2000 \text{ value}/2010 \text{ value})^{1/n} - 1$

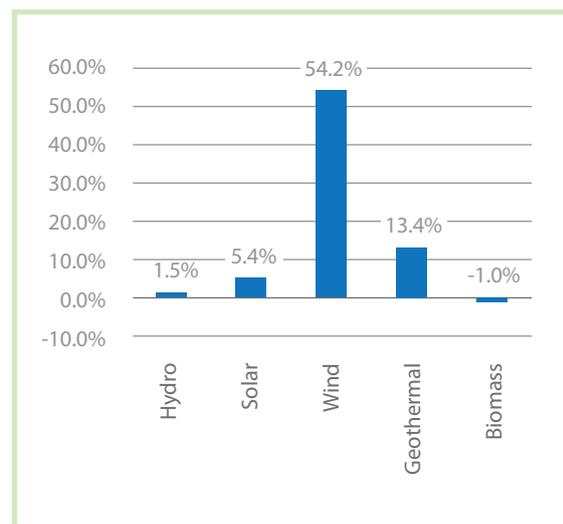
In terms of RES technology deployment, although hydropower is the largest RES contributor to TPES, it has not increased significantly over the period as many of the LHP plants were established in the 1990s. Some increase in hydropower can be, however, attributed to small hydroelectric power plants in the Western Balkans (IEA, 2007).

The greatest growth in renewable energy deployment during 2000-2010 has come in the form of wind energy (54.2%) (Figure 3.11). This is probably a consequence of RES promotional schemes and reduced capital costs for wind energy projects. Since adopting RES promotional schemes in 2008, Turkey has seen a remarkable increase in wind capacity, by around 1500 MW (UNDP, 2014).

Investment in solar power plants remained marginal (5.4%) across the region during 2000-2010, compared with global growth over the same period (around 40%) (IEA, 2010).<sup>57</sup> This may well be due to the significantly higher costs of solar installations compared to fossil fuel technology. In countries where solar power almost doubled, such as Albania, Croatia, Turkey, and Ukraine, this was largely due to promotional schemes and possibly decreasing technology costs. For example, Ukraine adopted its FiT in 2009, and over the past four years has experienced the deployment of 400 MW in installed solar PV capacity. As Ukraine's FiT for solar declines over time, the race has been on to build as much solar PV as possible.

Whilst there seems to be some indication that favourable RES promotional schemes have led to increased deployment, the correlation is not always so clear. For example, although Bosnia and Herzegovina had the highest FiT in the region for small-scale solar PV installations and one of the highest solar radiation potentials, there has been

**Figure 3.11: Compound Annual Growth Rates (CAGRs) of RES as a percentage of TPES, 2000–2010**



Source: Author's calculations based on IEA, 2010

no significant solar PV deployment so far. Similarly, Belarus (with less than 5MW of installed capacity of wind energy) stagnated in terms of wind power plant deployment despite having one of the highest FiTs for wind energy in the region (UNDP, 2014). These findings lead to the conclusion that a number of country or region-specific barriers to RE investment exist.

### 3.9 Barriers and Risks to RES Investment and Deployment

In order to reconcile the differences in RES promotion and deployment, a closer look at the underlying investment barriers and their resulting risks for investors is necessary. Deployment rates in the region tend to suggest that whilst payment obtained through a direct financial incentive may be enough to satisfy the minimum required ROI in one country, it may fail to do so in another due to specific risks and other factors. This means that not only the level of the FiT, but

<sup>57</sup> This growth has mainly been concentrated in a few countries, namely, Germany, Italy, Czech Republic, France, the USA and Japan, all of which have favourable promotional schemes and public support policies.

**Table 3.7: Barrier and Risk classifications**

Risk Category	Barrier	Description	Example
<b>Technical and Informational</b>	<b>Limited experience and cost of information</b>	Few countries have local specialists with the technical skills and capacity required to implement RE projects. Also financial advisors and project developers face high costs of information or lack of quality information in RES technology. This hampers investment and ultimately the deployment of RES in the region	Project feasibility studies such as measuring sunlight hours and river flow are costly and time intensive which may lead to investor hesitation. Likewise lack of financial information about the riskiness of a project and uncertainty results in a higher relative cost of borrowing for developers.
	<b>Lack of grid access and inadequate transmission and distribution infrastructure</b>	Uncertainties about connection, the condition of the electricity grid and energy transmission infrastructure increase the risk and financing costs of RE projects and thus affect investment attractiveness. The nature of electricity supply for example is restricted by the absence of transmission lines from the RES to load centres and by high distribution losses across the region.	Many countries in the region suffer from out-dated and deteriorating transmission infrastructure that is highly susceptible to distribution losses. Soviet era transmission infrastructure in Uzbekistan is highly susceptible to shortages and distribution losses. During the Balkans war of the 1990s significant transmission infrastructure was lost in Croatia; indeed some villages remain disconnected from the electricity grid.
	<b>Logistical challenges and supply chain issues</b>	An incomplete or poorly developed supply chain including access to RE technology hardware, qualified technicians and ease of access for maintenance are all factors considered by investors. Barriers may also be created by RE technology local content requirements (e.g. requiring a certain % of locally sourced parts) in some countries affecting supply chain options.	Across the region poor local infrastructure, such as roads in remote areas may hamper transportation of hardware to locations. Proposed local content requirements for RE technology in Russia may discourage investment where technology may be unsuitable to local conditions or spare parts are limited.
<b>Economic and Financial</b>	<b>Difficulty doing business</b>	Public sector regulation and legislation can create barriers in the laws that govern RES. Risks arise from the public sector's inability to effectively administer the licence and permit processes for RES which can increase transaction costs, delay returns and discourage investment.	On the World Bank "Dealing with Construction Permits" indicator, ECIS countries ranked poorly; Kazakhstan (145th), Tajikistan (184th), Uzbekistan (159th), Albania (189nd), Serbia (182nd), Croatia (152nd), Bosnia (175th), Turkey (148th), Moldova (174th), Russia (178th), and Azerbaijan (180th) (IFC and World Bank, 2013). Transparency issues are especially prevalent in Central Asia and the Western Balkans regions (SEECN, 2013).
	<b>Capital Scarcity</b>	Countries in the ECIS usually face a shortfall of available equity when compared to OECD countries. The region exhibits high finance costs making many RES projects uneconomical without financial incentives such as FiTs and de-risking instruments, such as preferential grid access.	Higher lending rates and therefore higher required minimum ROI for RE projects may be to blame for the observed absence of RE deployment across the region. High average lending rates are prevalent in Ukraine (18.4%), Tajikistan (25.2%), Georgia (22.1%) and Belarus (19.5%) (World Bank, 2013).

Risk Category	Barrier	Description	Example
	<b>Access to energy market</b>	Conditions relating to energy market impact investment decisions. Investors may be reluctant to invest in countries where there are uncertainties related to energy market liberalisation including, access, the competitive landscape and price outlook for renewable energy.	The vertically integrated, state-owned energy production and distribution infrastructure in Turkmenistan, Azerbaijan and Uzbekistan makes it more difficult for potential RE projects to access the electricity market and obtain long term competitive prices. <sup>58</sup>
	<b>Market distortions</b>	Market distortions caused by fossil fuel subsidies are prominent in the region, especially in ex-soviet countries with large non-renewable energy resources such as oil and gas. In these countries retail tariffs are not cost-reflective and in some cases are set below cost recovery levels. Fossil fuel subsidies may render RE investment uncompetitive.	Subsidies exist in a number of countries, especially the Caucasus, Central Asia and Western Balkans. The effect of market distortions may be reflected in the region's general overall low share of RES in TPES. Whilst Turkey has set a target to increase RES by 30% by 2023, fossil fuel subsidies may conversely be a disincentive to RES investment. In the Western Balkans, similar subsidies account for 5-11% of GDP (Kovacevic, 2011).
<b>Political and Institutional</b>	<b>Transparency</b>	Transparency is vital to attract private sector engagement. A lack of competition in vertically-integrated, state-owned or energy sector monopolies and their proximity to government decision-makers has decreased the transparency in the energy sectors of many countries. In countries where government or energy sector decisions lack transparency investors face increased risk and additional exposure to planning insecurity.	Non-transparent permit and licencing processes as well as corruption are an issue in the region. According to SEECN (2013) a lack of transparency and corruption are prevalent in the national energy sectors of the Western Balkans region (SEECN, 2013).
	<b>Government commitment</b>	The absence of a reliable RES deployment strategy or long term targets reflect a weak commitment to ensuring a reliable RE market and provide little planning security for investors.	The absence of market driven RE investment in some countries may be explained by the absence of commitment and long-term targets.
	<b>Retroactive policy changes</b>	Legislative security is also crucial. The main barrier to RE investment could be the retroactive changes to already existing promotional schemes, as they damage the sustainability of the investment climate (IEA, 2013).	Although not included in this analysis, the Government of the Czech Republic revised its RE law in 2012 affecting the profitability of solar installations which were commissioned between January 2009 and December 2010. This undoubtedly damaged the country's investment environment.

58 *Uzbekistan and Tajikistan are currently liberalising their energy market*

Risk Category	Barrier	Description	Example
	<b>Political insecurity, country risk and poor rule of law</b>	Political insecurity, country risk and legal factors include the risk of capital transfer and risk of force majeure such as wars, expropriations, revolutions and natural disasters. Investors perceive these risks and price them in their minimum ROI (OECD, 2013). A fully functioning independent and impartial judicial system, the rule of law, redress and independence of the courts are also indispensable to attracting private investors.	Uncertainties or impediments may be due to war, terrorism and/or civil disturbance, high political instability; poor governance; poor rule of law and institutions; government policy (currency restrictions, corporate taxes).  According to OECD (2013) indicators, all countries in the ECIS region are exposed to high political risks. From a ranking of 0-7, Belarus, Ukraine and Moldova all rank 7, while the average ranking in Central Asia is 6.2, the Western Balkans 5.8 and the Caucasus 5.7.
<b>Social and cultural</b>	<b>Opposition</b>	Although not as common as other barriers, local and institutional opposition to RE projects in the region hinder project approvals and expansion. Social and political resistance related to NIMBY (not in my backyard) concerns, arise from a lack of awareness and resistance, predominantly to wind power.	Tensions between upstream and downstream countries based on the use of water resources, particularly for the construction of large hydropower plants in upstream countries, has compounded the energy and water crises in Central Asia. One such ongoing dispute in the region is between Uzbekistan which opposes Kyrgyzstan, Tajikistan and Uzbekistan.

Source: Elaborated by the Authors based on Waissbein, O., et al, 2013; UNDP, 2014.

also specific risks influence project economics and clearly demonstrate that investment decisions are based upon an assessment of risks and returns and not only on projected returns.

Barriers and risks that impact investment decisions fall roughly into the following categories: technical and informational; economic and financial; legal, political and institutional; and social/cultural. It is important to note that these barriers are multifaceted and in many cases they (a) can be particular to a technology, place or region and (b) often overlap and intersect. At least 12 key types of barriers impede progress in the region (Table 3.7).<sup>59</sup>

### 3.10 Overcoming Barriers, De-risking Policies and Scaling up RE

A key finding of this report and a UNDP report (Waissbein, O., et al, 2013) on de-risking RE investment, is that rather than a problem of capital generation, the key challenge of RES investment and deployment is to address existing investor risks that affect financing costs and the competitiveness of RES. Investment decisions are made on the basis of an assessment of both risk and projected return and in many cases the risks are assessed as high, making investment prohibitive.

<sup>59</sup> This does not represent a comprehensive list of barriers. A country level assessment should be undertaken on a country-by-country basis. For a comprehensive list of risk barriers and de-risking instruments please refer to: Waissbein, O., et al., (2013) [http://www.undp.org/content/dam/undp/library/Environment%20and%20Energy/Climate%20Strategies/UNDP%20Derisking%20Renewable%20Energy%20Investment%20-%20Full%20Report%20\(April%202013\).pdf](http://www.undp.org/content/dam/undp/library/Environment%20and%20Energy/Climate%20Strategies/UNDP%20Derisking%20Renewable%20Energy%20Investment%20-%20Full%20Report%20(April%202013).pdf)

**Table 3.8: Possible Policy and Financial De-risking Options**

Risk Category -Barrier Example	Policy de-risking Instrument	Financial de-risking instrument	Example	
Technical and informational	Limited experience and cost of information	<ul style="list-style-type: none"> <li>- Capacity development and local training programmes</li> <li>- Improve stakeholder information</li> </ul>	<ul style="list-style-type: none"> <li>- Develop investor guides, technical pre-feasibility and feasibility studies for investors</li> </ul>	<ul style="list-style-type: none"> <li>- The UNDP-GEF project “Removing Barriers to Wind Power Development” provides assistance to remove technical and information barriers by supporting institutional capacity building, technical wind resource assessments, and training for local operation and maintenance responsibilities.</li> <li>- To decrease the cost of information and simplify complicated licencing processes for potential investors, UNDP and the Serbian Ministry of Energy have published an investor guide explaining licences and permit processes for small hydro, wind, solar, geothermal, and biomass power plants (UNDP, 2013a).</li> </ul>
	Lack of grid access and inadequate transmission infrastructure	<ul style="list-style-type: none"> <li>- Strengthen the operational performance of transmission companies</li> <li>- Develop grid code for RE technologies and assure grid access</li> <li>- Provide prioritised, guaranteed or complimentary access to the grid</li> </ul>	Assist transmission companies in accessing capital funding via e.g. public loans, or loan guarantees	<ul style="list-style-type: none"> <li>- In Kazakhstan a UNDP GEF project supporting the launch of a wind atlas providing pre-feasibility studies is available and provides interested investors with detailed data about wind resources in the country, thus reducing the costs of such studies for potential investors (UNDP, 2014).</li> <li>- Kazakhstan, Tajikistan, Uzbekistan, Albania, Serbia, BiH, Turkey, Belarus, Moldova and Armenia give RE developers priority when applying for access to the grid.</li> <li>- Kazakhstan, Tajikistan, Moldova, Belarus, Georgia offer complimentary grid access for RE.</li> </ul>
	Logistical challenges and supply chain issues	<ul style="list-style-type: none"> <li>- Provide training for local O&amp;M responsibilities</li> <li>- Conduct feasibility assessments</li> </ul>		<ul style="list-style-type: none"> <li>- Providing potential investors with project feasibility studies which explore possible logistical challenges or supply chain issues.</li> </ul>
Governance and increased transparency	<ul style="list-style-type: none"> <li>- Increased transparency legislation and reforms</li> </ul>		<p>The majority of countries in the region<sup>60</sup> have improved their transparency through an OECD initiative, the “Anti Corruption Network for Eastern Europe and Central Asia (ACN)” supports countries in implementing anti-corruption polices, by criminalising corruption and preventing corruption through improved transparency (UNDP, 2014). Over time this will benefit RE investment and reduce underlying governance risk.</p>	

60 Albania, Armenia, Azerbaijan, Belarus, BiH, Bulgaria, Croatia, Georgia, Kazakhstan, Kyrgyzstan, FYROM, Moldova, Montenegro, Russia, Serbia, Tajikistan, Turkmenistan, Ukraine and Uzbekistan.

Risk Category -Barrier Example	Policy de-risking Instrument	Financial de-risking instrument	Example	
Political and institutional	Government commitment	<ul style="list-style-type: none"> <li>- Commitment to targets and RES promotional schemes</li> <li>- Legislative guarantees</li> </ul>	Governments can commit to clear RES targets. For example in order to show clear legislative security for RES, Uzbekistan commits to legislation for foreign investors for 10 years.	
	Retroactive policy changes	<ul style="list-style-type: none"> <li>- Deployment caps</li> </ul>	In order to avoid retroactive policy changes governments have implemented deployment caps in line with RES promotion programmes to slow down or limit deployment to a sustainable level. Caps are currently implemented in Croatia, Turkey and FYROM in order to limit the output of a particular RES to an installed MW output capacity.	
	Political instability, country risk and legal factors	<ul style="list-style-type: none"> <li>- Risk sharing products by development banks such as political risk insurance covering expropriation, political violence.</li> </ul>	A number of development banks and international financial institutions offer loans, guarantees and grant programmes which can partially de-risk investments in RES	
Economic and financial	Difficulty doing business	<ul style="list-style-type: none"> <li>- Financial sector policy reforms favourable to long-term infrastructure.</li> <li>- Removal of barriers to market entry e.g. exemptions from electricity production licences</li> <li>- Strengthen investors knowledge</li> <li>- Private public partnerships</li> </ul>	<ul style="list-style-type: none"> <li>- Financial products by development banks to assist project developers to gain access to capital/funding e.g. public finance loan guarantees and public equity</li> </ul>	<ul style="list-style-type: none"> <li>- Countries can improve the ease of doing business for RES developers by streamlining application processes. Georgia, Serbia, Kazakhstan and FYROM offer developer manuals and pre-feasibility studies to decrease information-related costs. Georgia streamlined its permission and tender processes by providing a clear set of procedures to obtain land use, water use and construction permits for potential SHP developers. Other countries have chosen to exempt small RES power plants from the otherwise obligatory licence for electricity generation. SHPP less than 13MW in Georgia and RES power plants less than 1MW in Serbia are exempt from electricity production licences. Such exemptions can benefit small RES developers with low capital resources and relatively high costs.</li> </ul>
	Capital scarcity	Strengthen investors' (debt and equity) capacity and familiarity with regard to renewable energy projects through industry-finance dialogues, workshops and public-private partnership building	<ul style="list-style-type: none"> <li>-Financial products by development banks to assist project developers to gain access to capital/funding. These can include public loans; public loan guarantees; public equity</li> </ul>	A number of development banks and international financial institutions offer loans, guarantees and grant programmes - The UNDP-GEF project "Removing Barriers to Wind Power Development" will focus on a combination of financial de-risking instruments for wind energy investments. Instruments such as grant funding to cover the initial high risk, early development stage costs of wind energy projects, and negotiating FITs for wind power developers, will significantly increase the possibility of attracting investment for large-scale wind investment.

Risk Category -Barrier Example	Policy de-risking Instrument	Financial de-risking instrument	Example
Market distortions	- Reform fossil fuel subsidies - Establish a harmonised, well-regulated and unbundled energy market <sup>61</sup>		Many countries in the region have committed to tariff reforms, elimination of cross subsidies and to energy price increases. Countries have begun to undertake assessments of fuel subsidies; to phase-out/down subsidies; to introduce awareness campaigns; to design transfer programmes that provide subsidies to vulnerable social groups.
Access to energy market	- Establish a harmonised, well-regulated and unbundled energy market - Reform Fossil Fuel Subsidies		Uzbekistan and Tajikistan have both started to liberalise and unbundle their energy markets (generation, transmission, distribution networks).
<b>Social</b> Opposition	Awareness-raising campaigns and community involvement with project end-users		In 2007 Turkey introduced the Renewable Energy Law which develops the principles and procedures applicable to increasing and supporting energy developing public awareness about energy and to the use of renewable energy resources in energy generation, transmission, distribution and consumption. <sup>62</sup>

Countries still suffering from investment barriers should not simply copy existing promotional schemes in order to scale up commercially-driven RES. Instead, a number of complementary incentives and de-risking instruments should be introduced to target the residual risks that single instruments alone cannot address (Waissbein, O., *et al.*, 2013). Several possible policy and financial de-risking options exist (Table 3.8).<sup>63</sup>

Although a FiT or other instrument may have been in place for several years, this may not di-

rectly translate to investment and deployment of RE. This demonstrates that market transformation takes time and other barriers to investment may remain as pertinent risks to address. Many of these barriers are deeply embedded, such as fossil fuel subsidies, country specific political risks and high financing costs from commercial banks. These non-price barriers require additional de-risking efforts. Policy de-risking, rather than working to transfer risk like a financial instrument, aims to systematically remove the underlying barriers to investor risk (Waissbein, O., *et al.*, 2013).

61 „Unbundling of vertically integrated energy markets refers to the process by which energy companies' generation and sale operations are separated from their transmission networks via legislation. This is often done to break up monopolies and achieve more competitive markets“.

62 Government of Turkey, 2007 Law No.5346 on Utilisation of Renewable Energy Resources for the Purpose of Generating Electrical Energy

63 This does not represent a comprehensive list of de-risking instruments. A country level assessment should be undertaken on a country-by-country basis. For a comprehensive list of risk barriers and de-risking instruments please refer to: Waissbein, O., *et al.* (2013) [http://www.undp.org/content/dam/undp/library/Environment%20and%20Energy/Climate%20Strategies/UNDP%20Derisking%20Renewable%20Energy%20Investment%20-%20Full%20Report%20\(April%202013\).pdf](http://www.undp.org/content/dam/undp/library/Environment%20and%20Energy/Climate%20Strategies/UNDP%20Derisking%20Renewable%20Energy%20Investment%20-%20Full%20Report%20(April%202013).pdf)

Countries should identify critical barriers and address them with tailored and country specific public de-risking instruments where possible. Only where risks and incremental costs remain, should public de-risking instruments be combined with direct financial incentives.

### 3.11 Tracking Renewable Energy

The SE4ALL Global Tracking Framework has been exploring energy issues that should be addressed and knowledge that has to be generated in order to monitor the progress of the SE4ALL initiative. However, the lack of available data and the limited access to information on RES for the ECIS region as a whole, as seen from the findings in this report, are issues that require further investigation. Some countries lack the capacity to produce high-quality data and analysis, and only a few countries have the ability to track private sector investments and energy budgets. This lack of capacity poses an impediment to the effective monitoring and tracking of the RE market. Furthermore, there is the issue of access to existing information and data, as many ECIS administrations choose not to share environmental and energy information.

The identification of suitable data for the indicators required in the Global Tracking Framework (GTF) can pose significant methodological challenges. However, the analysis in this chapter has attempted to address most of them.<sup>64</sup>

### 3.12 Summary of Findings

An analysis of the renewable energy situation in the ECIS clearly shows that despite excellent growth potential, actual deployment remains comparatively low and the energy mix is dom-

inated by fossil fuels (coal, oil, and natural gas). Although some countries in the region have begun ambitious journeys to expand their RES in the near future, a number of existing barriers prevent investments from reaching their full potential. In particular, high initial investment costs for renewable energy projects and a lack of competitiveness when compared to fossil fuels remain major limitations to scaling up the use of RES and engaging the private sector. A number of key conclusions emerge from this analysis:

**Higher financing costs reflect a number of perceived or actual informational, technical, regulatory, financial and administrative barriers and their associated investment risks in the region.** Whilst countries employ a number of promotional schemes for RE in the region, analysis reveals important barriers to investment remain.

Whilst there is evidence that favourable RES promotional schemes have led to increased deployment, the correlation between promotion and deployment is not always so clear. Experience has shown that **investment barriers and risks should be targeted with policy and financial de-risking instruments first**, before selecting a **financial incentive instrument to target the remaining incremental cost** necessary to make each technology price competitive.

The high level of fossil fuel subsidies distorts market price signals and reduces the competitiveness of RES over fossil fuels. To achieve the goals of SE4ALL by 2030 **the competitiveness of RE technologies must grow unhindered against their fossil fuel counterparts.** This requires the reduction and gradual phasing out of fossil fuel subsidies, not only in the ECIS region but globally.

<sup>64</sup> For more information about the indicators suggested from the Global Tracking Framework and the indicators used for the chapter on renewable energy in the ECIS, please see Annex 20

There is a noticeable absence of diversification in RES in the region, with hydropower accounting for some 63.9% of TPES and LHP representing over 93% of the electricity capacity from RES. **In order to increase RES diversification, emphasis must be placed on promoting and supporting other forms of renewable energy (solar PV, wind, biomass, geothermal)** and on helping to drive down the associated costs and risk factors of each technology. This can be reinforced through long-term commitments to specific renewable energy targets and detailed renewable energy roadmaps. **Targets are an indication to investors that governments are committed to pursuing a strategy of increasing the share of RES.**

The findings reiterate the **need for selected policy and financial de-risking instruments to attract private investment.** Access to energy markets needs to be simple and transparent. Improvements can be made in the provi-

sion of qualified and detailed information about RES opportunities and, in particular, commercial banks need to be better educated about the risks and returns associated with financing renewable energy projects. The enhanced engagement of the banking sector is critical in increasing investment in RES. However, banks must first have a clear understanding of the investment risks involved in order to be in a better position to finance renewable energy projects.

Public policy instruments can play an important role in de-risking RE projects and help to drive and encourage private sector investment in RES. **Ultimately, it is the private sector that will drive new investment in renewable energy,** as public and international donor funding on its own is not enough to drive the level of investment needed to develop RES. Thus, RE investment de-risking must be at the core of any strategy that promotes renewable energy.

# ANNEXES

In the interests of the environment, the Annexes to this Report have not been printed. They are instead available on the UNDP RBEC Regional Centre website and can be accessed via the following link: <http://www.scribd.com/collections/4298634/Environment-Energy>

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