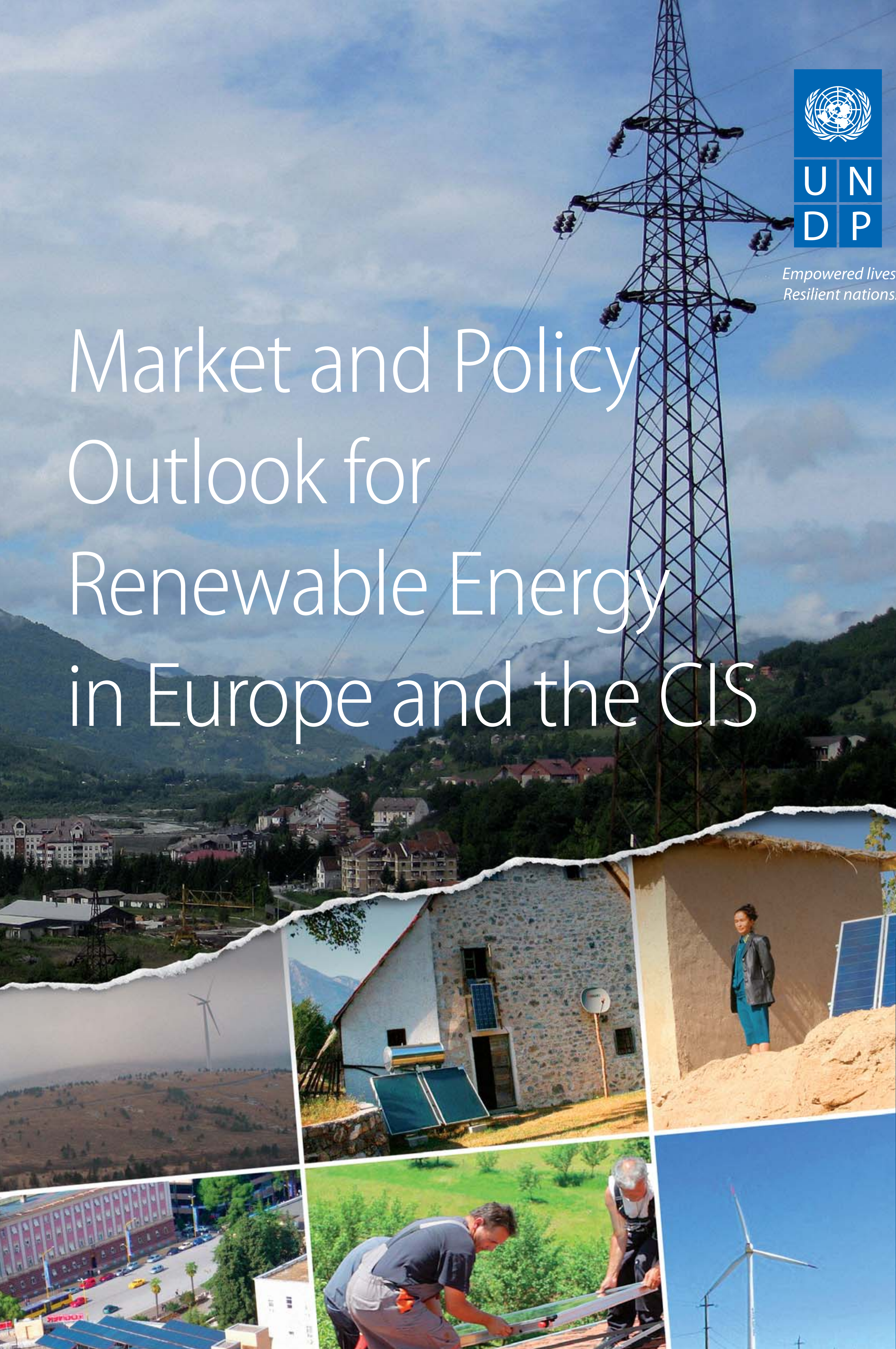
Market and Policy Outlook for Renewable Energy in Europe and the CIS



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Market and Policy Outlook for Renewable Energy in Europe and the CIS

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Foreword

Renewable energy holds tremendous potential for increased deployment in the Europe & CIS Region despite the fact that currently only a small percentage of energy is supplied by renewable sources of energy. In recent years numerous new laws, regulations, policies and incentives have been put in place to encourage increased investment in renewable energy. Key drivers behind the push for increased renewable energy in the Europe & CIS region include concerns about energy security and climate change and realization of commercial opportunities. The costs of renewable energy technologies have substantially decreased over the past few years opening up commercial opportunities for private enterprises and investors. Many countries in the region want to reduce their dependency on domestic and imported fossil fuels such as coal, gas, and oil. Renewable energy offers excellent opportunities towards supply diversification and energy independence. In addition, increased investments in renewable energy offer substantial opportunities for reducing greenhouse gas emissions.

Investments in renewable energy in the Europe & CIS region can be facilitated by de-risking the policy and regulatory environment and removing institutional, financing and informational barriers . Successful de-risking leads to increased confidence and higher internal rates of return for investors. Challenges related to scarcity of capital and the inability of project developers to obtain financing are significantly reduced once de-risking has taken place. Well designed renewable energy incentive schemes, policies and measures increase the uptake of renewable energy. A level playing field for renewable energy and increased investment in renewable energy technologies also requires reduction of subsidies on fossil fuels which have been an enormous barrier, not just in this region but globally.

This report provides a market and policy analysis and outlook for renewable energy for the Europe & CIS region. It describes and explains the linkages between policy development and renewable energy deployment and examines the barriers to and opportunities for increased investments in renewable energy. We hope that this report will contribute to a better understanding of the renewable energy market in the Europe & CIS region; ultimately leading to increased investments in the sector.

Martin Krause
UNDP, Senior Global Energy Policy Advisor &
Energy and Environment Practice Leader for Europe and CIS

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Acronyms

ADB	Asian Development Bank
ACN	Anti-Corruption Network for Eastern Europe and Central Asia
CCGT	Combined Cycle Gas Turbine
EBRD	European Bank for Reconstruction and Development
EC	Energy Community
ECIS	Europe and Commonwealth of Independent States
ECS	Energy Charter Secretariat
EDB	Eurasian Development Bank
EMRA	Turkish Energy Market Regulatory Authority
EU	European Union
FBiH	Federation of Bosnia and Herzegovina
FiT	Feed-in Tariff
FYROM	Former Yugoslav Republic of Macedonia
GEF	Global Environment Facility
GW	Gigawatt
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
KW	Kilowatt
kW-h	Kilowatt Hour
LCOE	Levelized Cost of Electricity
LCR	Local Content Requirement
MW	Megawatt
MW-h	Megawatt Hour
NPV	Net Present Value
OECD	Organisation for Economic Co-operation and Development
O&M	Operation and Maintenance
PV	Photovoltaic
RE	Renewable Energy
RES	Renewable Energy Source
ROI	Return on Investment
RS	Republic Srpska
SHPP	Small Hydropower Plants
SME	Small and Medium-sized Enterprise
TRCC	Tradable Renewable Enery Credits
WACC	Weighted Average Cost of Capital

Executive Summary

In the coming years, the worldwide deployment of renewable energy technologies will increase. The International Energy Agency (IEA) estimates that, by 2035, power from renewable energy (RE)[1] will account for almost half of the increase in the global power generation, of which almost half will be from wind and solar photovoltaic (PV) sources (IEAb, 2013). The share of RE in the global power generation reached 480 GW in 2012 and annual RE investment amounted to $214 billion in 2013 (REN 21, 2013 and FS & UNEP, 2014). This is over seven times more than in 2004, when investment amounted to $30 billion (REN 21, 2005). In 2013, renewable energy technologies represented 43.6 percent of the new installed electricity power capacity (FS & UNEP, 2014). A combination of recently implemented RE promotion schemes with increased concerns over energy security, energy demand and climate change, as well as a sharp fall in RE technology costs, has driven this development. Unique geopolitical features give countries in Europe and the Commonwealth of Independent States (ECIS)[2] specific incentives to further develop diversified energy mixes including renewable technologies. The combination of very cold winters, inadequate and outdated transmission infrastructure and numerous energy supply shortages makes energy a key determinant of socioeconomic development across the region. High dependency on imported traditional fossil fuels such as oil, coal and gas, and concerns over energy security, focuses attention on further expansion of renewable energy sources (RES) in the region. Removal of fossil fuel subsidies will help to reduce the dependency on fossil fuels. Additionally, there is tremendous potential to exploit renewable resources, such as wind, solar PV, biomass and small hydropower for electricity generation. For example, with almost 2000 kW-h/m^2, Turkmenistan, Kyrgyzstan, Tajikistan and Uzbekistan have the highest annual average horizontal solar surface radiation in the region. Despite that potential, the region's share of renewable electricity power capacity in 2012, excluding large hydro power, was only 3.7 percent. Excluding all hydro power capacity as a RES, in 2012 the region only contributed around 16 GW to the worldwide non-hydro renewable electricity power capacity. This represents a global share of 3.3 percent. The deployment of RE capacity over the last decade, particularly solar PV and wind, is unequally distributed among the countries of the region. In contrast to existing RE promotion schemes in many of the region's countries, only some countries increased their RE power capacities. This report seeks to analyse the major barriers and related risks that inhibit RE investment and deployment

In 2013, global investment in renewable energy was more than seven times higher than in 2004.

In 2012, renewable energy made up 3.7 percent of the region's power capacity.

1 *Please note that this includes large hydropower and nuclear power. In this report, both forms of energy production are not defined as renewable energy sources and are therefore excluded.*

2 *For the purpose of this report, the ECIS region consists of: Russian Federation, Ukraine, Moldova, Belarus, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan, Armenia, Georgia, Azerbaijan, Turkey, Albania, Serbia, Former Yugoslav Republic of Macedonia, Montenegro, Bosnia and Herzegovina, Croatia, Slovenia, Slovakia, Czech Republic, Poland, Hungary, Latvia, Lithuania, Estonia, Romania and Bulgaria.*

in the region. It also highlights which countries have had most success with different types of renewable energy, highlighting their policies and institutional set up as a means of creating links between policies, financing and overall renewable energy deployment.

Coherence between Renewable Energy Legislation and Deployment

Compared to traditional energy sources, RE power plants usually require a relatively high upfront investment while having significant lower operation costs during their lifetime. The levelized cost of electricity (LCOE) is a concept to compare all costs of a power plant during its economic life by including instalment, maintenance and financing costs and normalizing them over the total net electricity generated (Schwabe et al., 2011). In some countries, the LCOE for specific renewable technologies is already cost competitive compared to fossil fuel technologies (Waissbein et al., 2013). However, since RE power plants are exposed to high upfront investment the high cost of equity and debt for RE projects in general, and in developing countries in particular, impacts project profitability negatively and has a significant bearing on the competiveness of RE projects compared to fossil fuel alternatives.

To increase the competitiveness of RE, some governments have implemented or are implementing various RE promotion schemes, essentially through three different mechanisms:

- Decreasing RE technology costs to lower instalment costs;
- Decreasing financing costs of RE power plants; and
- Increasing the reward for RE generation to compensate for higher costs.

Decreasing technology costs can be achieved by investing in technological progress and releasing economies of scales due to expansion of technology deployment and increased competition. Considering that expanding uncompetitive technologies requires expensive incentives for market players in the first place, a decrease in technology costs is not a realistic alternative for countries with scarce public means. Likewise, technology advances in some developed countries have already been reducing technology costs substantially.

An alternative to reducing technology costs are policy de-risking instruments. These act to address the underlying risks, which are the root cause of the high cost of financing. Policy de-risking instruments lower risks directly and contribute to a reduction of required capital costs. Renewable energy targets and prioritized access of RE to the electricity grid are the most common policy de-risking instrument implemented in the region.

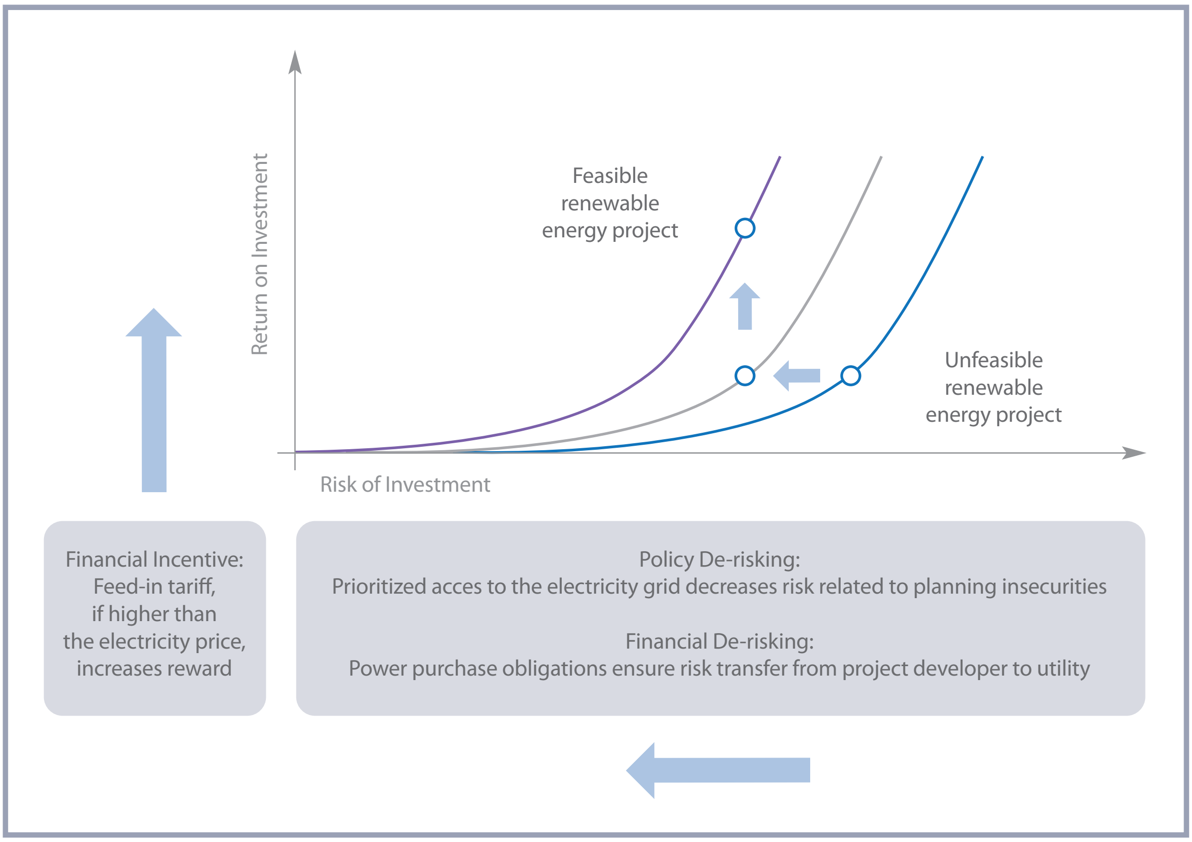
Compared to traditional energy sources, RE power plants usually require a relatively high upfront investment while having significant lower operation costs during their lifetime.

Unlike policy de-risking, financial de-risking does not tackle the risk itself, but rather transfers it to a third party, for example development banks. Low interest loans and loan guarantees are the region's most common financial de-risking instrument.

Finally, policymakers have implemented various financial invective schemes to increase the reward of produced renewable electricity in order to compensate for remaining incremental costs. Tax rebates, equity grants, quota systems, feed-in tariffs, feed-in premiums and tender and auction systems represent the most frequently adopted RE incentive schemes in the region.

Policy instruments may be combined to address various risks and barriers at the same time (Figure 1), which is referred to as cornerstone instrument (Waissbein et al., 2013).

Figure 1: Cornerstone Instruments and the Risk and Reward Structure of a Renewable Energy Project



Source: Adapted from Glemarec (2011) and Waissbein et al. (2013)

Analysing RE deployment rates in the region over the last decade reveals that countries that have recently adopted or do not have RE promotion schemes have not recorded substantial growth in RES in the last few years. With the exception of Ukraine and Turkey, only European Union member states have increased their RE capacity considerably. Whereas EU member states, Turkey and Ukraine showed an impressive growth of non-hydro RES between 2005 and 2012, amounting to almost 15 GW, less than 30 MW was deployed over the same period in the rest of the region. This implies that aggressive RE incentive schemes may have been a necessary condition for RE deployment. However, they do not automatically explain differences in RES utilization.

Renewable Energy Related and Region-Specific Investment Barriers

Instead of attributing the cause to a lack, or insufficient design, of RE incentive schemes, the analysis shows that the problem is embedded in country-specific risks and barriers, which are responsible for increasing technology and financing costs impeding private sector engagement in RE investment.

Aggressive RE incentive schemes may have been a necessary condition for RE deployment, but they do not automatically explain differences in RES utilization.

Market prospect and governments policies to simulate investment

A lack of RE targets in some Central Asian countries is a signal to potential investors of relatively low commitment to RE deployment. Some governments in Central Europe have imposed retroactive changes to existing promotion schemes. According to IEA, retroactive policy changes are considered a major barrier to RE investment, because they increase insecurity, reduce predictability for the investor and therefore damage the investment climate (IEAa, 2013).

Market distortions

Some countries in Central Asia possess large non-renewable energy resources, for example oil and gas. Cheap access to fossil fuels provides a disincentive to investing in renewable energy. Subsidized retail electricity prices are often too low to make RE competitive.

Access to the electricity market

In markets where state sector monopolies act as a single vertically integrated energy company responsible for generation, transmission and energy supply difficulties in accessing the market is impeding private sector participation.

Concessions, permits and licences

Complicated, bureaucratic and oblique licence and permit processes increase transaction costs, delay returns and discourage investment. Transparency in granting licences is essential in attracting private investors. If government decisions are unpredictable, investors face a higher exposure to additional risks related to planning insecurities.

Access to the electricity grid

As with licence granting, uncertainties and bureaucratic red tape relating to grid connection negatively influences RE financing and installations costs in some countries.

Technology and supply chain

Incomplete or poorly developed RE supply chains and local infrastructure may prevent RE deployment, particularly when RE incentives are combined with the requirement to use locally-produced equipment in RE installations.

Cost of information and limited experience with RE

Financial advisors' lack of access to quality information increases transaction costs, and feasibility studies of wind speed or water flow are cost and time intensive.

Capital scarcity

A lack of equity and debt hampers investment and entrepreneurial activities. This problem increases a project's risk. Increased risk means that debt holders usually require higher shares of equity.

Inadequate and outdated transmission infrastructure

Many countries in the region suffer from old and outdated electricity transmission infrastructure. This causes energy shortages, electricity cut-offs and high distribution losses. The vulnerability of transmission grids forces policymakers to cap additional electricity capacity, which is often required for additional RE installations.

Political instability and country risk

Risk related to political insecurities is priced in by equity and debt holders. All countries covered in the report are exposed to high political risks, according to OECD's Country Risk indicator.

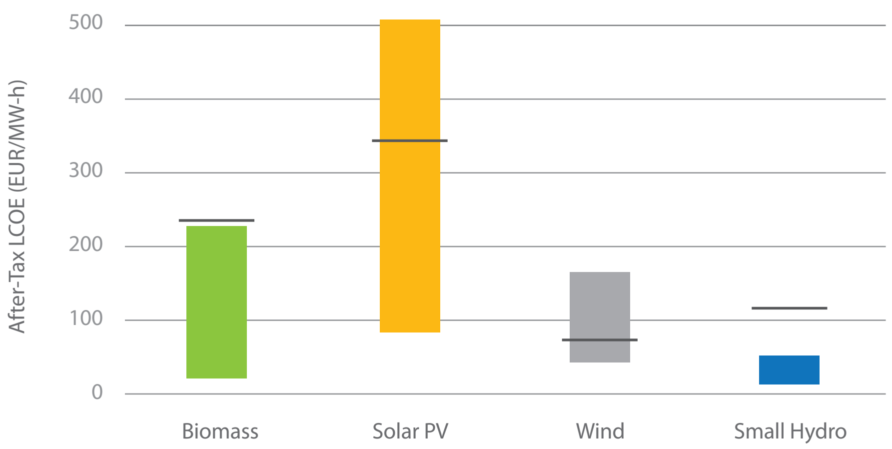
De-Risking Renewable Energy Investment

Typically, all of the risks and barriers mentioned above can be addressed by public and financial de-risking instruments. For example, effective public de-risking instruments are reliable RE deployment strategies and targets, giving investors planning security. Effective policy not public de-risking measures function alongside financial de-risking instruments as loan guarantees or soft (zero-interest) loans transferring remaining risks to development banks and providing developers with easier access to finance. Correspondingly, this can lower the LCOE significantly and either provides opportunities to lower existing incentive promotion or helps to produce satisfactory returns for investors. This has important implications for RE deployment in the region. Due to increased energy prices and significant policy reforms, energy affordability is already a major constraint in the region. During the last decade, the region has experienced a trend of raised household electricity tariffs that threatens its socioeconomic development (World Bank, 2012). Given that RE incentive schemes either burden scarce public means or are correlated with increased household electricity prices, reward schemes compensating investors for their higher risks should be introduced only after the de-risking measures. In addition, fossil fuel subsidies, which are intended to protect customers from rising energy prices, are not sustainable and threaten government budgets significantly if international energy prices rise. Fossil fuel subsidies also prevent RE from becoming a competitive and, if well-designed, a more affordable alternative. Globally, several RE projects have started in the recent past, demonstrating that under certain conditions RE power plants can already generate electricity at a lower cost than fossil fuel alternatives even without promotion subsidies (FS & UNEP, 2014).

Under certain conditions RE power plants can already generate electricity at lower costs compared to fossil fuel alternatives even without promotion subsidies.

Figure 2: Lower and Upper Bound LCOE and Feed-in Tariffs for RES in Slovenia, Ukraine and Turkey[3]

Technology	Biomass	Solar PV	Wind	Small Hydro
Country	**Slovenia**	**Ukraine**	**Turkey**	**Ukraine**
Lower Bound LCOE	32.52	90.09	51.77	13.58
Upper Bound LCOE	218.28	513.01	176.9	66.81
Feed-in Tariff	224.35	348.9	79.52	116.1



Source: Own calculations

3 *Please refer to Annex Table 12 showing the underlying assumptions of the conservative and optimistic LCOE scenario.*

Considering these risks and investment barriers, the most favourable countries for RE investment in the region are currently Slovenia, Turkey and Ukraine. Slovenia's and Ukraine's feed-in tariffs outperform the upper bound LCOE for biomass and small hydropower respectively, even when high financing and installations costs are taken into account. The upper bound LCOE for solar PV in Ukraine assumes a low capacity factor of just 10 percent. Yet plant sites located in areas yielding more than 1,300 load hours would create enough return to decrease the LCOE for solar power under the current FiT in Ukraine, even when financing and instalment costs are high. Finally, Turkey has proven in recent years that the current tariff is enough to satisfy investor requirements. In combination with a government target of deploying 20 GW wind capacity by 2023, this produces to a relatively stable and favourable investment climate.

Conclusion

Despite tremendous RE potential, increasing energy security concerns, and frequently adopted favourable RE promotion schemes, only a few countries in the ECIS region showed considerable deployment of renewable technologies in recent years. Rather than attributing this to ineffectiveness or an absence of RE incentive schemes, the analysis shows that the reasons for low RE deployment are related to multiple investment barriers and country-specific risks. The resulting high costs to finance RE projects (as bank interest rates are much higher in this region than, for example, in Europe or the United States of America) is one reason for low RE deployment rates in the region. Governments have historically focused on reward-based incentive schemes to increase the profitability of RE investment. However, RE incentive schemes either burden scarce public budgets or increase household electricity prices. In the ECIS region, affordable energy is a key determinant of socioeconomic development. Due to its location and climatic conditions, poor and rural populations are particularly susceptible to energy poverty, a major impediment to sustainable and human development. Increased energy prices are, therefore, of concern to poor and vulnerable households and businesses. Reward schemes compensating investors for their higher risks are consequently a secondary alternative for the region.

Alternatively, electricity generation costs can be addressed using public de-risking instruments by either lowering policy risks or transferring financial investment risks. Rather than increasing the financial reward, those instruments can help to reduce the substantial financing costs. This may also offer a potentially attractive alternative to fossil fuel subsidies, which are not sustainable and burden government budgets significantly if international energy prices rise. Improved efficiency and lower technology costs mean that increasing numbers of onshore wind and solar PV power plants can now financially out-compete fossil fuel alternatives even without subsidies; this is in cases where plants can be built in favourable geographical conditions for wind and sunshine load factors, as well as favourable financial conditions and low costs of capital (FS & UNEP, 2014). However depending on individual countries' energy markets, even after effective de-risking direct financial incentives to make RE investment competitive compared to other forms of energy generation may still be required. Financial instruments should directly address country-specific needs and impediments. The analysis shows that many countries experience difficulty in obtaining capital particularly equity. Hence, after effectively addressing risks and barriers, equity grant mechanisms can help to close the equity gap, establish entrepreneurial activity and rewards for potentially remaining incremental costs.

Rather than increasing the financial reward, public de-risking instruments can help to reduce the substantial financing costs of RE projects.

Financial instruments should directly address country-specific needs and impediments.

Despite the existing investment barriers, there is a rather positive trend for improved RE investment conditions in the region. The technical RE potential is substantial and the geopolitical situation in terms of energy security provides incentives for many countries to increase their own energy supply in the midterm. Some countries have adopted or revised their RE schemes and experts anticipate increased RE investment in the coming years. Other countries show low deployment rates, but some large projects are under development and specific investment barriers are starting to be addressed. The combination of favourable geographical conditions, constantly decreasing RE technology costs and increased awareness makes RE technologies ever more attractive over traditional ways of energy generation. This is likely to lead to more RE deployment in the region.

1. Current Situation and Potential of Renewable Energy in the Region

1.1 Deployed Renewable Energy Capacity

There is currently around 20,200 MW installed RE power generation capacity in Europe and the Commonwealth of Independent States (ECIS) which is the region analyzed in this report.[4] Figure 4 shows the absolute installed RE power capacity in Megawatt (MW). Turkey, which has the region's largest RE capacity, sources its RE power almost solely from wind and small hydropower plants (SHPP). After Turkey, six European Union (EU) member states have the highest absolute RE deployment. In Poland, Romania and Hungary, this is mostly from large wind and biomass installations. In the Czech Republic and Bulgaria, solar PV capacity represents the largest renewable energy source.

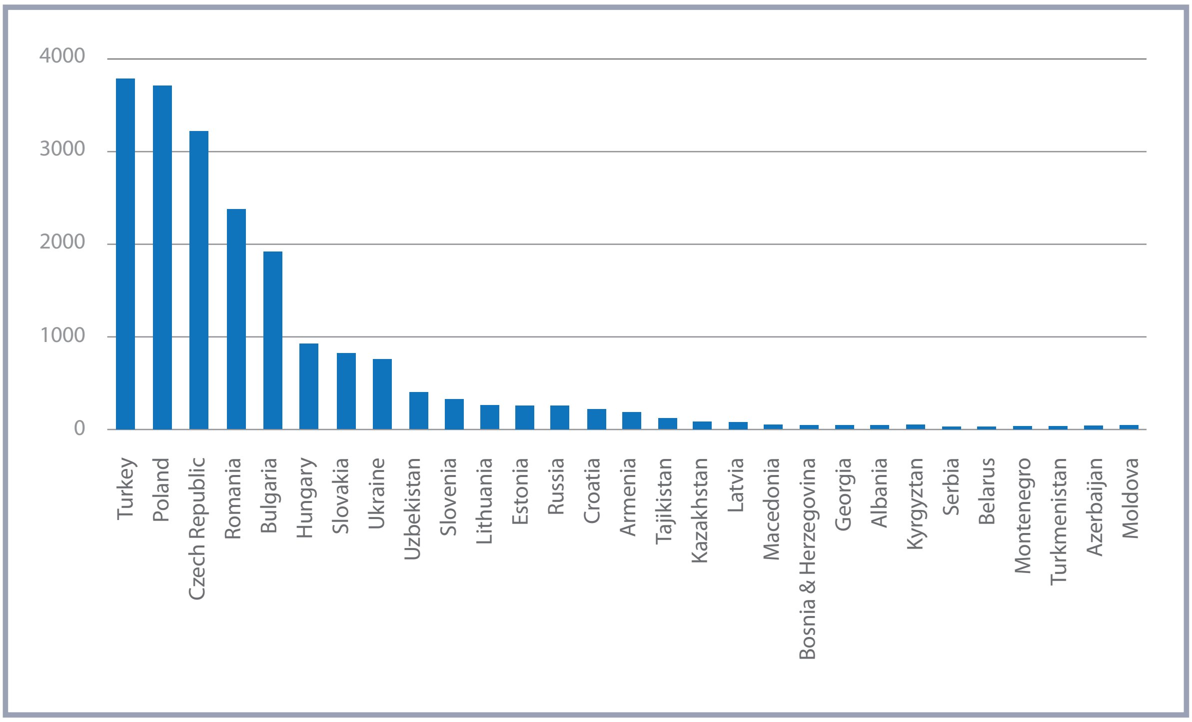
Figure 3: Europe and the Commonwealth of Independent States Region[5]

Source: Own creation

4 *This report defines RE as "electricity generation from biomass, solar PV, wind and small hydropower installations". There is no internationally agreed definition of small hydropower (IEAa, 2012). This report defines SHPPs as "power plants not exceeding an installed capacity of 10 MW". Large hydropower plants, if not particularly mentioned, were excluded as a renewable energy source due to its doubtful impact on sustainability and biodiversity. Geothermal power, commonly included as a RES, was also excluded, because of its current relatively low deployment rate in the region, the limited availability of resource assessments and relatively high installments costs. Only five countries (Russia, Estonia, Turkey, Hungary and Croatia) currently use geothermal sources for power production and installation costs amount up to $5,500 per 1 kW power capacity (Renewable Facts, 2013 and IRENA, 2013). In addition, it is environmentally critical that geothermal exploitation by drilling boreholes may release radioactive waste, primarily radium-226 and radium-228 (EPA, 2012).*

5 *The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.*

Figure 4: Absolute Installed Renewable Energy Capacity in MW per Country



Sources: Own creation

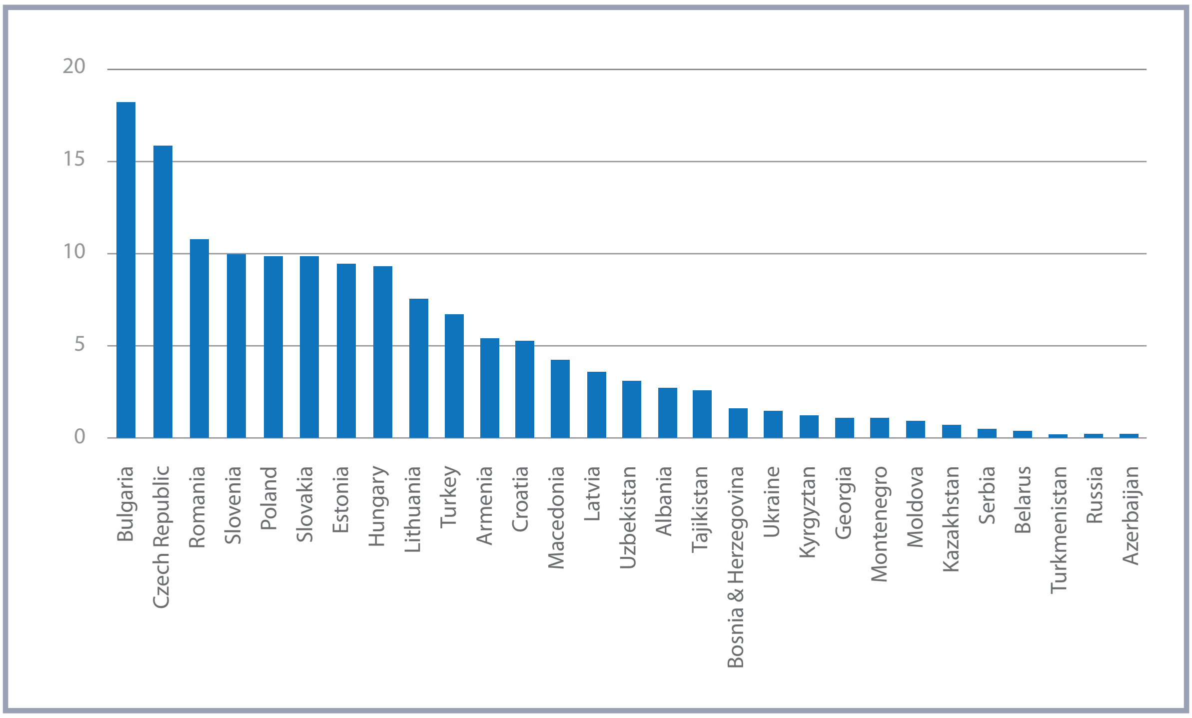
Turkey has the region's largest RE capacity and sources most of its RE power from wind and small hydropower plants.

Ukraine is the only country outside the EU apart from Turkey with a capacity of above 500 MW in RE installations, mainly due to significant investment in wind energy and solar power. In 2012, Montenegro, Turkmenistan, Azerbaijan and Moldova had less than 10 MW installed RE capacity. To increase comparability of RE instalments between countries, the relative RE share of the total installed electricity capacity should be used. Figure 5 shows that Azerbaijan and Russia have the lowest share of RE deployment compared to total installed capacity. Russia's ranking fell from a middle position in absolute RE installation to the second last rank with just 0.1 percent RE in total electricity generation capacity. Changes in ranking occur also among the top performers in RE power deployment. Bulgaria and Czech Republic show the highest relative RE share with both over 15 percent. All of the nine countries with the highest relative share of RE capacity are EU member states. Turkey, with a share of around 7 percent in renewable capacity, decreased from the first rank in terms of absolute RE capacity to the 10th rank when considering relative installed capacity.

On average, 3.7 percent of the installed electricity capacity in the region originates from RES. Figure 6 compares the region to the rest of the world. Worldwide, only 15.6 gigawatts (GW) (3.3 percent) of the non-hydro RE capacity is installed in the ECIS region. Including large hydro as a RES, the region's share increases to 8.5 percent of the world's total installed RE capacity. This is due to the significant installations of large hydropower plants in the region. For example, Albania's and Tajikistan's share of installed RE capacity increases to over 90 percent when taking large hydropower into account. And the re-

In the region some 3.7 percent, or around 20 GW installed capacity, comes from renewable energy sources.

Figure 5: Share of Renewable Energy to Total Installed Electricity Capacity (%)



Sources: Own creation

gion's overall RE share increases from 3.7 percent to 20.7 percent if large hydropower is taken into account. Nevertheless, due to a unique geopolitical context, recent decades have shown a trend of energy diversification away from large hydropower. The combination of very cold winters, inadequate and outdated transmission infrastructure and numerous en-

Figure 6: Total Installed Renewable Electricity Capacity in MW in the Region (Green) and the Rest of the World (Blue)

Sources: Ren21 (2013) and own creation

Climate, geography, outdated infrastructure and dependency on fossil fuels make a compelling case for renewable energy in the ECIS region.

ergy supply shortages, makes the provision of reliable energy a key determinant of socioeconomic development across the region. High dependency on often imported traditional fossil fuels as oil, coal and gas, and increased concerns over energy security, make a compelling case for expansion of RES. In 1980, total RE capacity amounted to over 70 GW stemming solely from large hydropower (EIAb, 2013). By 2012, the total biomass, wind and solar PV electricity capacity in the region was over 15 GW.

1.2 Renewable Energy Potential

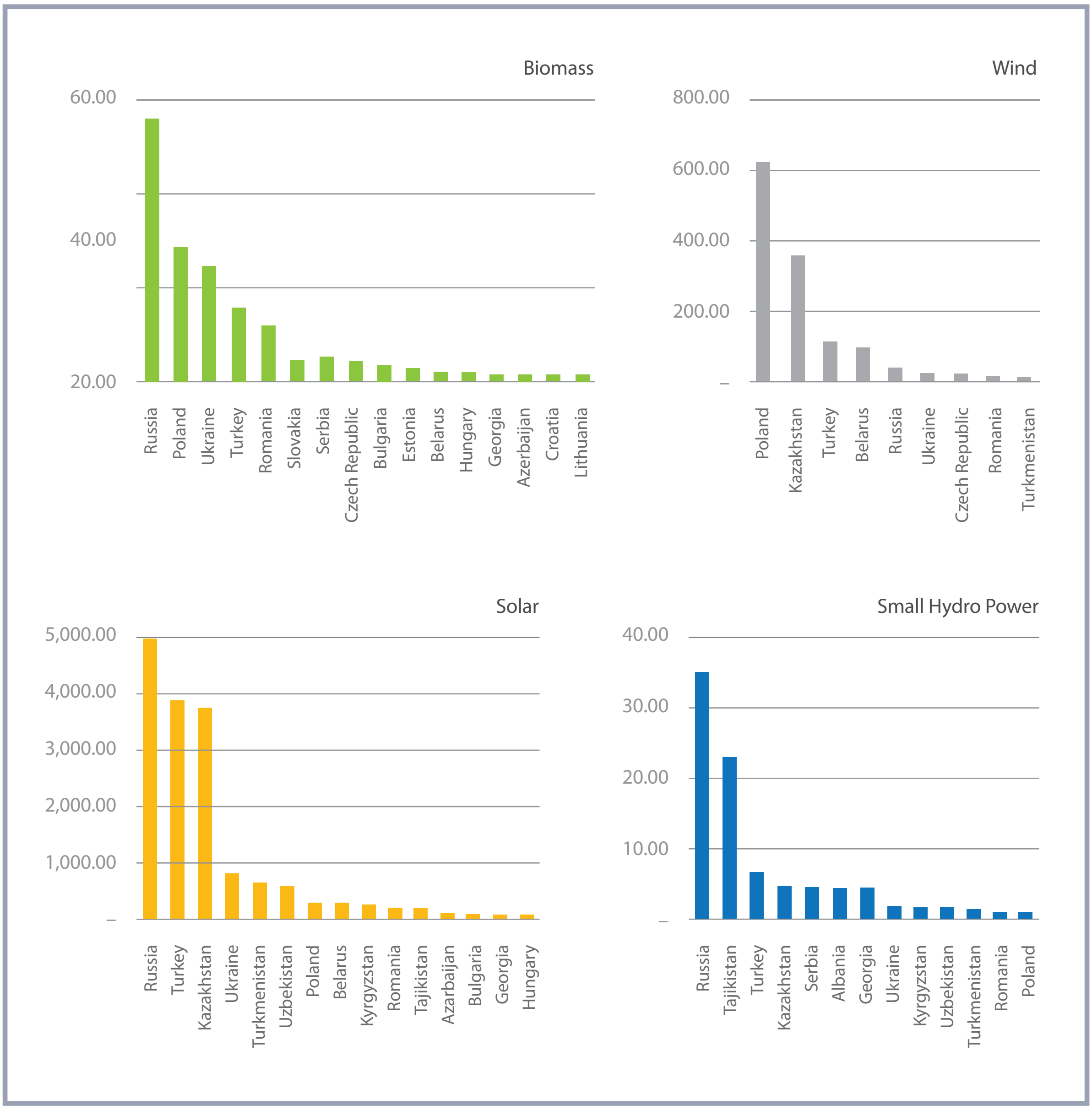
Figure 7 demonstrates the RE potential, in GW, of technical deployable RE power capacity.[6] Technical Potential is defined by the IPCC (2007) as the amount of RE that is potentially obtainable when already demonstrated technologies or practices are fully implemented. Because of its size, Russia has over 50 GW possible exploitable biomass potential. Poland and Ukraine are next, both with over 20 GW. However, except for Poland, the countries with the highest potential do not have any or very little biomass capacity installed. Poland and Kazakhstan have by far the greatest potential for wind energy. Poland, Turkey and Ukraine, three countries with high potential, have started exploiting that potential in recent years. However, Kazakhstan, Belarus and Russia have not yet unlocked their wind energy potential. When measuring the technical potential of wind energy, long-term average wind speed is the crucial factor influencing the performance of a wind power plant's electricity output. For example, the wind atlas of Kazakhstan, which was developed with support from UNDP-GEF, defines a value of long-term wind speed less than 6 metres/second as poor, and higher than 9 metres/second as exceptional (KEA, 2011).

Poland, Turkey and Ukraine, three countries with high wind power potential, have started exploiting that potential in recent years.

Russia and Tajikistan have the greatest potential for small hydropower exploitation. All countries with large SHPP potential already exploit this RES. Except for Turkey, however, none of the high potential is exploited in capacities exceeding 1 GW. Russia also exceeds other countries in technical solar PV potential.[7] Turkey and Kazakhstan follow with over 3,500 GW potential solar installations. Again, the three most promising countries for solar applications have very little or no solar technologies installed. Using power capacity as an indicator of technical solar potential might be misleading, though. The power capacity of a plant assumes perfect conditions in terms of sunshine hours, the 'fuel' of solar PV installations. Therefore, the numbers in Figure 7 differentiate only in the landmass that is technically suitable for solar power plants and do not indicate how much electricity can be produced, because solar radiation is exposed to large region specific variations. This, in turn, affects the electricity output and the return of the solar power plant. In other words, a 1 MW solar power plant will produce more electricity in Turkey than in

6 *Please note that Figure 7 includes only countries with a technical potential larger than 1 GW (for biomass and SHPP), larger than 10 GW (for wind), and the 15 countries with the highest technical potential (for solar PV).*
7 *Note due to illustrative reasons the technical solar PV potential for the Russian Federation is cut at 5,000 GW. However it is ca. 22,000 GW.*

Figure 7: Technical Renewable Energy Potential in GW Installed Power Capacity per Technology and Country



Sources: Own creation[8]

Poland, where the average radiation is lower. Figure 8 shows average yearly horizontal surface radiation per country measured in kWh/m². The figure demonstrates that solar potential is especially high in Central Asia, Caucasus and southern Europe, whereas northern Europe, for example the Baltic countries, appears to have less potential. It should be noted, though, that average values may be misleading in general, because solar resources are exposed to site-spe-

The three most promising countries for solar applications have little or no solar technologies installed.

8 The technical solar potential is estimated by using Hoogwijk & Graus (2008) and Hoogwijk (2004) average land use factors for centralized solar PV installations and JRC's (2011) assumption that 1 KW installed capacity requires a surface of 6.6 m². This equalizes an average conversion efficiency factor of ca. 16 percent.

Solar energy potential is particularly high in Central Asia, Caucasus and southern Europe.

cific factors, for example microclimates, which show a wide discrepancy in the potential capacity output (IRENA, 2013).

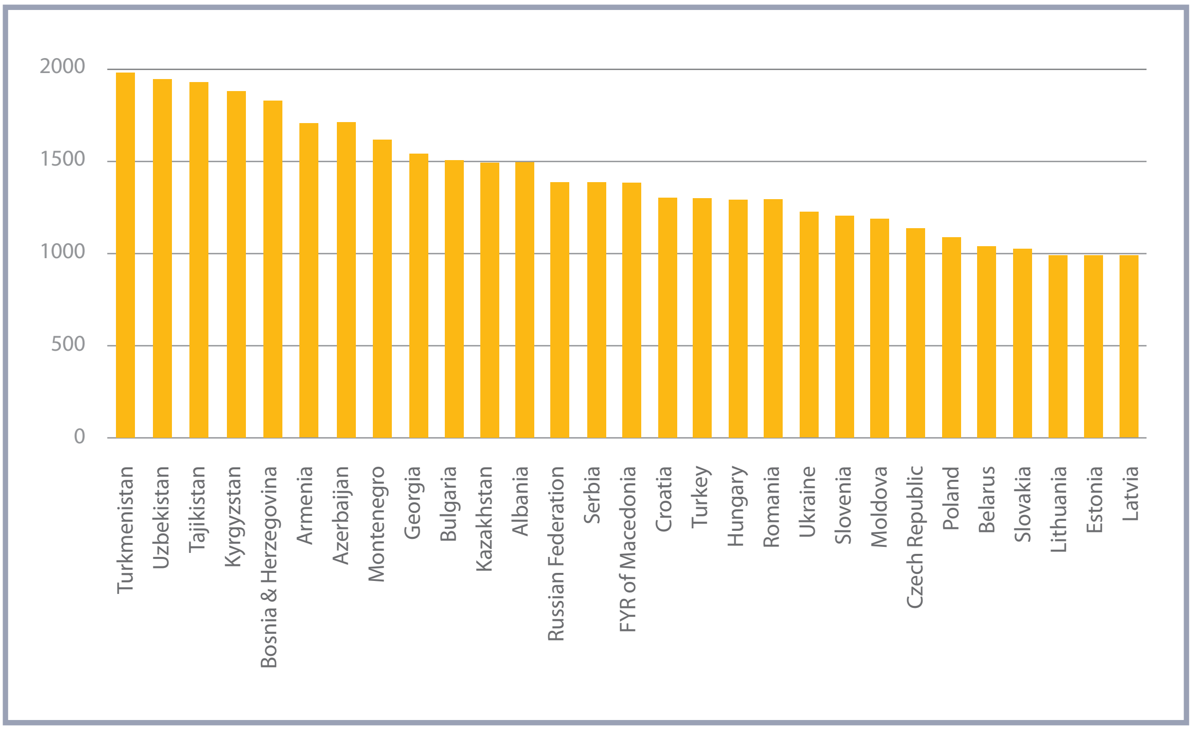
1.3 Renewable Energy Legislation and Policies

Compared to traditional energy sources, RE power plants usually require a relatively high upfront investment, but have significant lower operation costs during their lifetimes (Waissbein et al., 2013). Table 1 shows capital costs and operation and maintenance (O&M) costs for different electricity generating technologies in the United States of America.

For example, gas power plants in the United States of America can reach capital costs under $1,000 per KW installed capacity. But fixed O&M costs can amount up to $32 per KW and variable O&M costs up to $16 per kW-h (EIA, 2013b). This is significantly higher than for RE power plants, which show only marginal fixed and no variable O&M costs (EIA, 2013b). It is interesting that according to IRENA (2013), SHPPs in Europe and Central Asia have significant lower instalment costs (ca. 500 – 2,200 $/KW) compared to other regions, for example in the European Union (ca. 1,400 to 6,600 $/KW). To enable cost comparability between the different technologies, all costs of a power plant during its economic life, including instalment, maintenance and financing costs, are normalized over the total net electricity generated (Schwabe et al. 2011, Waissbein et al., 2013). This concept is called the Levelized

The LCOE compares electricity generating technologies by taking into account all costs of a power plant during its economic life and normalizing them over the total net electricity generated.

Figure 8: Yearly Average Horizontal Surface Radiation per Country in kW-h/m²



Sources: Own creation

Table 1: Capital Cost and O&M Cost Estimates by Technology in the U.S.A., 2013

Technology	Capital Cost $/KW[9]	Fixed O & M $/KW	Variable O & M $/KW-h
Coal	2,934 - 6,599	31.18 - 80.53	4.47 - 9.51
Gas	917 - 2,095	7.04 - 31.79	3.27 - 15.45
Biomass	4,114 - 8,180	105.63 -356.07	5.26 -17.49
Geothermal	4,362 - 6,243	100 -132	0
Hydro	2,936 - 5,288	14,13 - 18.00	0
Onshore Wind	2,213	39.55	0
Offshore Wind	6,230	74	0
Solar PV	3,873 - 4,183	24.69 - 24.75	0

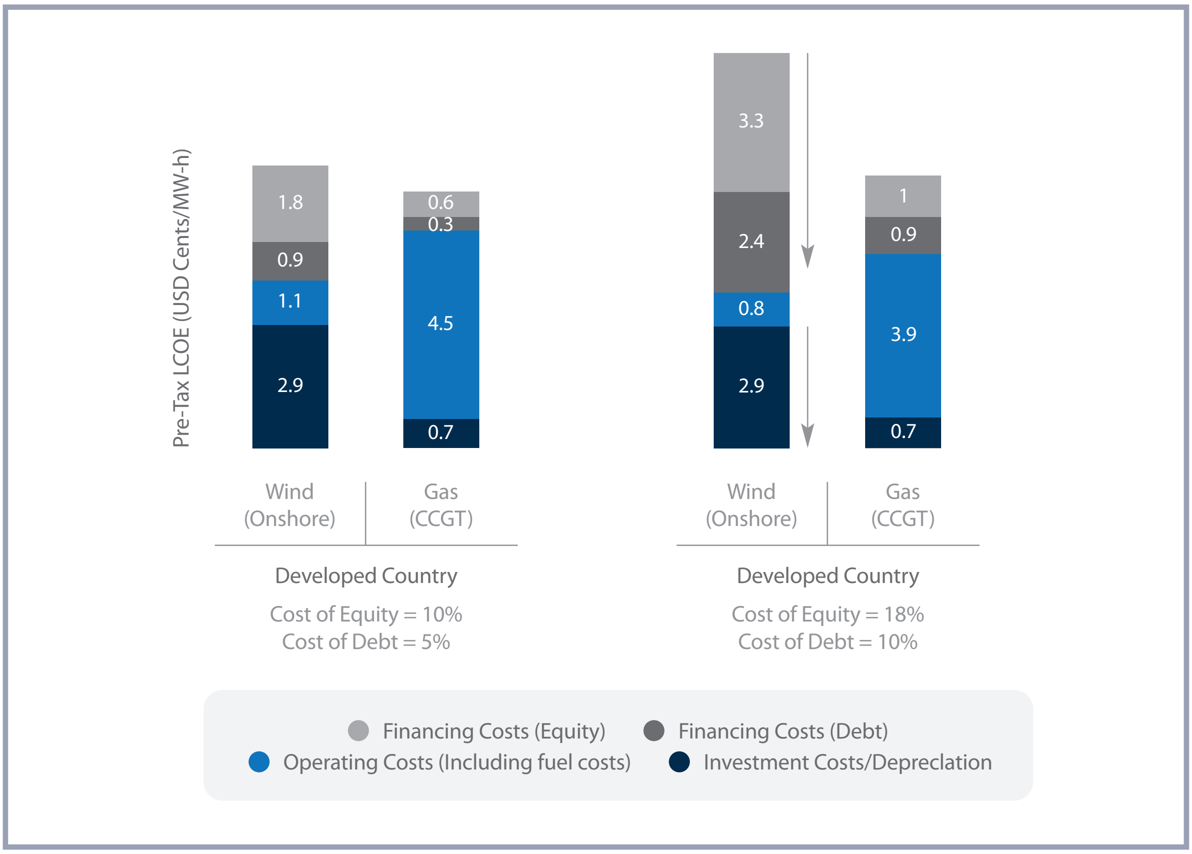
Source: Adapted from EIA (2013b)

Cost of Electricity (LCOE).[10] Figure 9 shows the LCOE for a wind and gas power plant in the developed and developing world. Considering the entire life time of a plant, the figure shows that in a developed country wind power plants are almost cost competitive compared to gas power plants. However, in developing countries the LCOE of a wind farm is significantly higher than for the gas power plant. This is due to the impact of the high upfront investment on the financing costs. In the developing country scenario, the relatively high instalment costs for RE projects impact project profitability negatively due to a higher cost of equity and debt. Generally, RE projects often have higher financing costs due to concerns on how the grid will manage intermittent RE supply (Waissbein et al., 2013). Debt holders usually require a higher share of equity the higher they perceive the risk of the underlying investment. Due to the seniority nature of debt in the case of default, the cost of equity is higher than the cost of debt, thus increasing financing costs. The problem is exacerbated in low income countries, which often have higher costs of equity and debt than developed countries. IRENA (2013) estimates the reasonable weighted average cost of capital (WACC)[11] for RE projects in Africa at between 15 percent and 20 percent. This is significantly higher than the WACC for RE projects in OECD countries, where it typically ranges between 6 percent and 12 percent. Consequently, capital-intense investment in developing countries is relatively unattractive, which – because of the long term character of RE investments – may have a significant impact on the competiveness of RE projects compared to fossil fuel technologies (Waissbein et al., 2013).

Developing countries usually have higher costs of equity and debt than developed countries.

9 Please note that financing cost, for example fees or interest during construction, are not included in the table.
10 There is no generally applicable definition for LCOE. In this paper the LCOE is calculated from the perspective of a private financial investor. Hence the LCOE is defined as "the production-dependent income required to achieve a zero net present value (NPV) of the equity share of the investment outlay, and the sum of all years' discounted after-tax cash flows" by using the nominal after-tax return on equity as a discount rate (Schwabe et al., 2011).
11 The WACC is defined as the sum of cost of equity and debt, of which each is weighted by its particular share on total capital. It therefore reflects the opportunity cost of all capital, debt and equity, which is invested in a project or enterprise.

Figure 9: The Impact of Financing Costs on Wind and Gas Power Generation Costs in Developed and Developing Countries



Source: Adapted from Waissbein et al. (2013)

As shown in Figure 9, the competitiveness of RE technologies can be increased through three mechanisms:

- Decreasing RE technology costs to lower instalment costs;
- Decreasing financing costs of RE power plants; and
- Increasing the reward for RE generation to compensate for higher costs.

1.3.1 Decreasing Technology Costs

Decreasing technology costs can be achieved by investing in technological progress and releasing economies of scale, cost decreases due to increased technology deployment and market effects, for example increased competition. Yet this approach is rather cost intense considering that expanding uncompetitive technologies requires incentives for market players in the first place. Historically, some leading developed countries with sufficient means enforced widespread incentive schemes to create a technology push, which led to a substantial fall in the technology costs of some RE technologies (Lilliestam et al., 2012). In Germany, for instance, the financial incentives for solar PV electricity during the last decade triggered massive solar PV expansion. The market for solar modules increased, which released economies of scale and investment in technological advancement. As a result, the average retail price for solar modules in Germany fell annually by 15 percent from almost €5/Watt in 2006 to below €2/Watt in 2013 (Fraunhofer ISE, 2014).

In Germany, incentive-driven technology reduced prices of solar modules by over 60 percent between 2006 and 2013.

But Germany's RE promotion was financed by higher electricity bills for retail customers. In 2012, an average German household paid almost 20 percent or €0.053/kW-h of the retail electricity price (0.29 EUR/kW-h) for RE incentives (Fraunhofer ISE, 2014). [12] In the ECIS region, affordable energy is a key determinant of socioeconomic development. Due to its location and climatic conditions, poor and rural populations are particularly susceptible to energy poverty, a major impediment to sustainable and human development. For this reason, a decrease in technology costs by widespread and cost-intensive incentive schemes is not a realistic alternative for countries in the region. Similarly, technology pushes by some developed countries decreased technology costs substantially. Between 2009 and 2014, the LCOE of onshore wind worldwide fell by some 15 percent, and by around 53 percent for crystalline silicon PV systems. Shrinking technology costs brought a fall in the total investment in solar PV worldwide in 2013. From 2012 to 2013, total investment in solar PV fell by 23 per cent to $104 billion, but more new solar PV capacity was installed worldwide in 2013 (39 GW) than in 2012 (31 GW) (FS & UNEP, 2014).

1.3.2 Public De-risking Instruments

Rather than decreasing technology costs, the LCOE of RE projects can also be addressed by reducing the financing costs. Financing costs can be decreased by

- reducing the risk category itself through policy de-risking; or
- transferring the risk from an investor to a third party, referred to as financial de-risking.

Policy De-risking Instruments serve as a tool to address the root of high financing costs, the underlying risks. Hence policy de-risking instruments lower risks directly and contribute to a reduction of required capital costs. Indeed, policy de-risking usually requires some time to reveal a positive effect. However, by directly addressing the risk, it is considered to sustainably reduce the LCOE. The two most commonly implemented policy de-risking instruments in the region are:

Policy de-risking instruments serve as a tool to address the underlying risks and causes of high financing costs.

Renewable Energy Targets

With RE policy targets, government commit to reaching a specific share of RE during a determined time-frame. If a government commits to a specific target of RE utilization, investors may interpret this as the ambition of the government to pursue an energy strategy that encourages the use of RES. This increases planning security, which usually reduces the risk of an underlying investment. Therefore, RE targets may help to reduce risks related to planning insecurity and the cost of capital. Of 29 countries in the region, 23 have pledged specific RE targets.[13]

Priority Access to the Grid

If investors perceive uncertainty regarding electricity grid connection, they have to price the probability of a failing grid connection in their cost of capital. Therefore, policymakers may prioritize RE installations in grid connection over

12 *It should be noted that the main incentive instrument for RE in Germany, a feed-in tariff, is often blamed for the increased retail electricity prices. But this is only partly correct. The RE reallocation charge for customers increased by €0.063/kW-h from 2000 until 2013, compared to the retail electricity price which increased by €0.14/kW-h in the same period. Moreover, the merit-order effect of RE squeezed wholesale electricity price traded at the stock exchange. Yet utilities have not passed price decreases on the stock exchange, induced by increased renewable electricity generation, to the end customers (Fraunhofer ISE, 2014).*

13 *For a detailed overview of RE targets in the region, please refer to chapter 2.1.or to Annex, Table 8.*

other power plants. This increases the probability of receiving a connection to the electricity grid and lowers the cost of capital. 16 countries in the region prioritize RE in access to the electricity grid.[14]

As opposed to policy de-risking, **financial de-risking** does not imply tackling the risk itself, but transfers it to a third party, for example to a development bank. Financial de-risking instruments are not considered sustainable, because the underlying risks are not actually eliminated. But they function relatively quickly and effectively. The following financial de-risking instruments are the most commonly available in the region.

Financial de-risking instruments do not tackle the risk itself, but transfer it to a third party.

Low Interest Loans

Low interest loans are loans claiming an uncommonly small amount of interest and are indicated to reduce a project's cost of debt. They serve to increase the investment attractiveness of projects or branches where investment, due to high interests, would not occur otherwise. Development banks, such as the Eurasian Development Bank (EDB) or the Croatian Bank for Reconstruction and Development, offer low interest loans for RE projects. A variety of international financial institutions offer loans to market conditions for RE investment. The European Bank for Reconstruction and Development's (EBRD) Sustainable Energy Facilities provide financing through local intermediary banks to RE developers in Belarus, Bulgaria, Armenia, Kyrgyzstan, Moldova, Poland, Romania, Russia, Slovakia, Turkey, Ukraine and the Western Balkans (EBRD, 2013). The Green Growth Fund provides direct and indirect financing through financial intermediaries for small scale RE projects usually not larger than €50 million (GGF, 2013).[15]

Loan Guarantees

With a loan guarantee, a third party assures a lender that it will cover the credit taker's debt in full, or partially in the case of default. This reduces the default risk of the credit taker and therefore the cost of capital. The advantages of loan guarantees are that they provide borrowers with easier access to finance. Similar to low interest loans, loan guarantees serve to increase investment attractiveness. However, cash payments by the warrantor only occur in the case of default. For example, EBRD offers loan guarantees in almost every country of the region.

1.3.3 Direct Financial Incentives

Even in a low risk environment, the LCOE may not be reduced sufficiently to make RE investment profitable. The LCOE reflects all costs over the economic life of a power plant from the perspective of a private investor. Put differently, it reflects the minimum electricity price that is required to be obtained, assuming several variables such as the cost of equity and debt or production estimates, to achieve a zero Net Present Value (NPV) investment. This means that, in an ideal world, with all estimated parameters being perfectly forecasted, a power plant that is eligible to obtain the LCOE per produced electricity unit over the predicted lifetime, would just create as much return on equity as required by the

Direct financial incentives increase rewards to compensate for remaining incremental costs.

14 For a detailed overview in grid access and country examples, please refer to chapter 2.4 and Annex, Table 8.
15 For a detailed overview of financing opportunities, please refer to Annex, Table 10.

equity holder to execute the investment. Due to the concept's construction, cost of equity and debt are positively related to the LCOE. A high cost of capital increases the LCOE, and vice versa. If debt and/or equity holders require very high returns, due to high perceived risks for example, policymakers may increase the reward to compensate for remaining incremental costs. The following direct financial incentives for RE projects are the most common in ECIS.

Tax Rebates

Tax rebates are direct financial incentives that reduce the tax liability that would otherwise apply to project developers. Generally, they can be based on project costs or project outputs (UNEP, 2012). For example Tajikistan's Custom and Tax Codex ensures exemption from customs' duties and VAT for imported materials and equipment as well as exemption from profit tax, land tax, capital facility tax and social tax for employees during the construction process. Moreover, independent SHPPs are exempt from the water royalty tax (Republic of Tajikistan). Some countries in the region have generally low tax regimes designed to incentivize investment. For example, Moldova charges 12 percent corporate income tax, while that figure is 10 percent in Former Yugoslav Republic of Macedonia (FYROM).

Grants

Grants are direct financial incentives usually in the form of cash payments provided to the project developer at the beginning of the project. Grants are generally available in only nine countries in the region: Kyrgyzstan, Moldova, Estonia, Romania, Bulgaria, Czech Republic, Slovakia, Hungary and Slovenia.[16] Some are available for investors in general, others are related to RE investment. For example, EBRD's Kyrgyz Sustainable Energy Financing Facility provides up to 15 percent of its loans for RE projects as a grant (KYRSEFF, 2013).[17] Grants do not only serve as a financial incentive, but also help to reduce financing costs. Grants provide project developers with 'free' equity. This lowers the cost of equity and, due to the cheap increase of the equity share, the cost of debt.

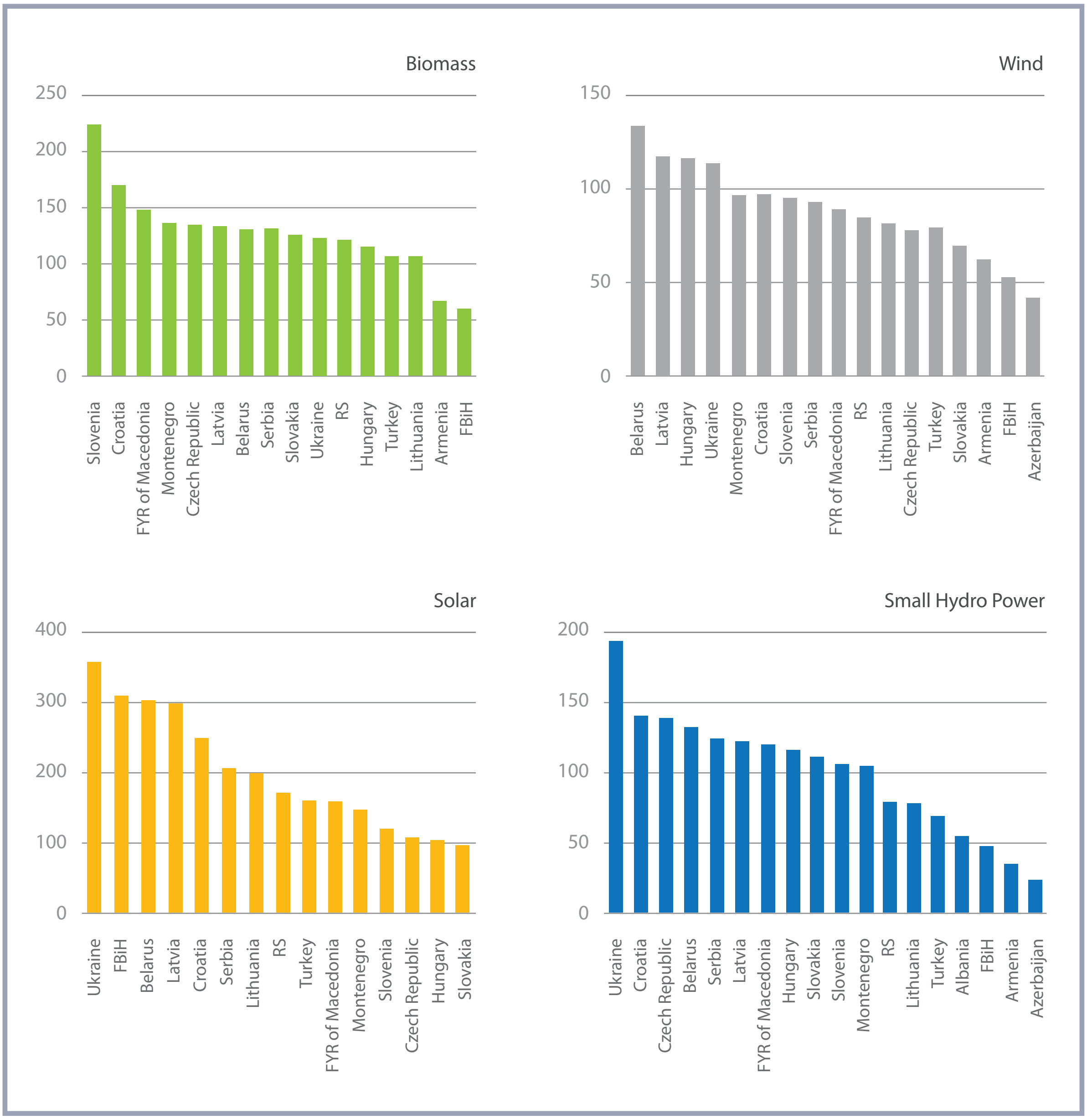
Grants not only serve as a direct financial incentive, but lower the costs of equity and debt.

Quota Systems

In quota regulations, an authoritative body obliges electricity generators to produce a fixed amount of renewable electricity annually. In order to give electricity generators the opportunity to 'outsource' their RE obligation, quota obligations are often combined with Tradable Renewable Energy Credits (TREC), usually issued in TREC/MW-h (UNEP, 2012). Consequently, electricity generators can either produce renewable electricity themselves, or buy certificates from RE power plants. One MW-h of renewable electricity generates two cash inflows for RE plant operators: the obtained price on the produced electricity and, additionally, the price for one TREC. Prices for TRECs are usually determined on a market. However, state authorities often define minimum and maximum price boundaries to limit volatility. Romania, Poland and Albania are the only countries in the region that have a quota system implemented. In Romania, the RE quota increases every year. It started at 14 percent in 2013 and will increase to 20 percent in 2020 (Republic of Romania, 2008). In Poland, the quota amounted to 12 percent in 2013 and will increase to 20 percent by 2021 (ResLegal, 2013). In Albania, the Law on Power Sector re-

16 For a detailed overview of available grants please refer to chapter 2.7 and Annex, Tables 8 and 10.
17 Annex, Table 10, provides all financing opportunities (including grants) in detail.

Figure 10: Technology Specific Feed-in Tariffs for Renewable Energy Technology per Country in € / MW-h[18]



Sources: Own creation

quires energy producers with an installed capacity higher than 50 MW to produce a quota of at least 3 percent of their annual electricity output from RES. However, since the adoption of the law no new thermal power plant has been commissioned and therefore the law has not yet been implemented in practice.

Feed-in Tariffs and Feed-in Premiums

This report defines feed-in tariffs (FiT) as fixed cash per kW-h payments determined by an administrative body and generally available for eligible energy producers. A feed-in premium (premium) is a cash payment per kW-h

18 *Please note that this figure has only limited comparability. The levels of respective FiTs reflect the highest possible amount that can be received for the specific RE technology. Each country has various differences in the conceptual design of FiTs, for example different amounts for different plant sizes.*

Feed-in tariffs are fixed cash per kW-h payments, while a feed-in premium is a cash payment per kW-h based on an underlying value.

based on an underlying value (usually the electricity price) and is subject to variations. Premiums are also determined by an administrative body and are generally available for eligible energy producers. FiTs only provide direct financial incentives if the determined electricity price exceeds the tariff for electricity obtained on the market or by the regulator. However, ignoring the tariff level, they offer a stable return of cashflow. So a FiT may also reflect a hedge against the risk of price fluctuation, which usually has a positive effect on the cost of capital. FiTs are the most commonly adopted RE policy instrument in the world, and are implemented by 99 countries (REN21, 2013). The picture in the region is similar, since almost all countries in the region have adopted a FiT legislation.[19] A premium scheme is implemented in Estonia. Some countries also offer eligible electricity producers the choice between FiTs and premiums, for example the Serbian entity in Bosnia and Herzegovina, Republic Srpska, or Slovenia and the Czech Republic.

In addition to technology-specific FiTs, project-specific FiTs see the tariff separately negotiated between the project developer and the regulating authority for each project. Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan, Moldova and Georgia (only for SHP) have project-specific FiT implemented. In Georgia, the Renewable Energy State Program offers hydropower plants of up to 100 MW power purchase obligations with the transmission operator for 10 years with a tariff negotiated with the Georgian National Energy Regulatory Commission (ECS, 2012). A drawback of FiTs is that they require steady institutions and represent a costly long-term state commitment. As a result, policymakers may not have control over RE deployment rates. In addition, high deployment may need substantial investment in the electricity grid.

Tender and Auction System

In a tender or auction system, project developers bid for the right to sell electricity at a defined price over a determined period of time (UNEP, 2012). In other words, tenders and auctions differ from FiTs and premiums in the determination of the electricity price. In a tender process, the price is defined by the lowest bidder. Instead of determining the price administratively, Lithuania requires wind, biomass, hydro and solar project developers to participate in a tender-based auction system if the plant capacity exceeds 10 KW (ResLegal, 2013). Auctions and tenders are often used to control the quantity of installed power capacity and reduce policy costs by using market-integrated incentives (FS & UNEP, 2013). In 2013, Russia approved a capacity-based tender scheme. The first capacity tender took place in September 2013 and around 100 MW of wind projects and 400 MW of solar projects were auctioned. In 2015, Poland plans to replace its current quota system with a competitive auction system.

Cornerstone Instruments

When various policy instruments are combined to address underlying risks and barriers at the same time, they are referred to as a cornerstone instrument. For example, FiTs are frequently combined with priority access to the electricity grid and power purchase agreements. The latter are requirements of energy utilities to purchase the produced electricity

19 Russian Federation, Turkmenistan, Estonia, Romania and Poland have not adopted a FiT legislation.

by eligible power producers. In this case, the risk of volatile electricity prices is transferred to the utilities, representing a financial de-risking instrument. The fixed cash payments, if they exceed the market electricity price, provide developers with direct financial incentives. Priority grid access reduces policy related risk (Waissbein et al., 2013).

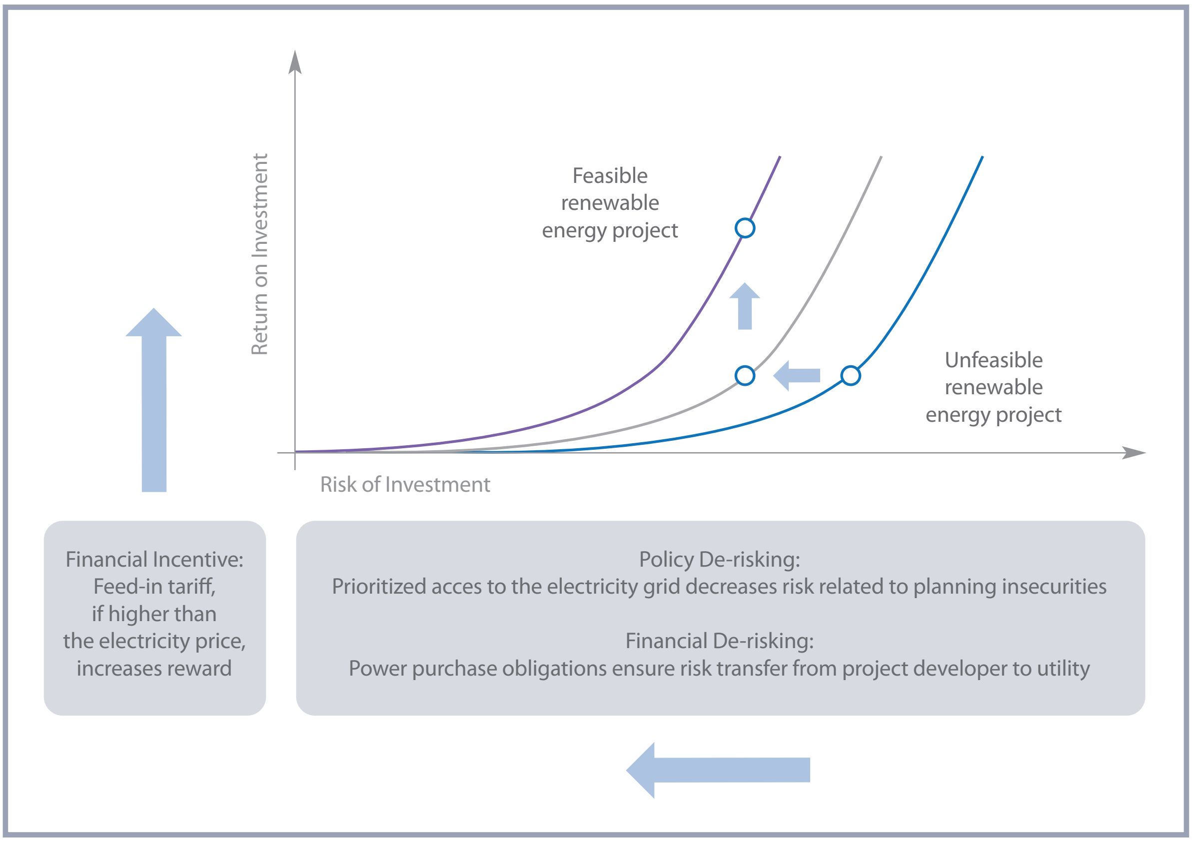
When policy instruments are combined to address underlying risks and barriers at the same time, they are known as a cornerstone instrument.

Table 2 shows countries with favourable RE promotion polices, including incentive schemes as well as policy and financial de-risking instruments. Chapter 1.4 considers whether the adoption of RE incentive schemes have led to RE deployment.

1.4 Renewable Energy Deployment and Growth

To elaborate further on the coherence between RE incentive schemes and RE deployment rates, this chapter compares RE deployment levels between 2005 and 2012, because most RE incentive schemes have been adopted since 2005. Figure 12 shows the levels of RE deployment in 2005 and 2012. In addition, a black line represents the year in which a particular RE incentive scheme was implemented. For example, between 2005 and 2008 Poland's biomass capacity grew only by around 40 MW. In 2008, Poland adopted a quota scheme promoting electricity produced from biomass installations. As a result, capacity grew in just four years to almost 1 GW in 2012. Similar trends can be seen in Czech Republic, Hungary and Slovakia. All countries showing a significant biomass deployment between 2005 and 2012 are EU member states.

Figure 11: Cornerstone Instruments and the Risk and Reward Structure of a Renewable Energy Project



Source: Adapted from Glemarec (2011) and Waissbein et al. (2013)

Table 2: Some Countries with the Most Favourable Renewable Energy Promotion Policies[20]

Country	Policy De-risking Instruments	Financial De-risking Instruments	Direct Financial Incentives
Belarus	Prioritized access to the electricity grid	Public loans and loan guarantees available	The highest FiT for wind and one of the highest FiT for solar PV and SHP power plants in the region; Tax rebates on RE investment available; Complimentary access to the electricity grid
Croatia	Committed to a binding RE share via EU Directive 2009/28/EC	Public loans, low interest loans and loan guarantees available	One of the highest FiT in the region for solar PV, SHP and biomass power plants
Bosnia and Herze-govina	Committed to a binding RE share via EU Directive 2009/28/EC; Priority grid access for RE power plants in Republic Srpska (RS) and the Federation of Bosnia and Herzegovina (FBiH)	Public loans and loan guarantees available	FiT legislation adopted in both entities: In FBiH, the FiT is the second highest for small scale solar PV installations in the region; Feed-in premium in RS; Tax rebates available
Ukraine	Committed to a binding RE share via EU Directive 2009/28/EC	Public loans and loan guarantees available	The highest FIT for solar PV and SHPP; Tax rebates on RE investment available
Turkey	Committed to a RE target; Priority grid access for RE power plants	Public loans and loan guarantees available	FiT legislation adopted
Bulgaria	Committed to a binding RE share via EU Directive 2009/28/EC	Public loans and loan guarantees available	FiT adopted; EU grants available
Serbia	Committed to a binding RE share via EU Directive 2009/28/EC; Priority grid access for RE power plants	Public loans and loan guarantees available	FiT adopted; Tax rebates available
Romania	Committed to a binding RE share via EU Directive 2009/28/EC; Priority grid access for RE power plants	Public loans, low interest loans and loan guarantees available	Quota with tradable TREC in place; EU Grants available; Tax rebates available

Source: Own creation

20 For a detailed overview of RE promotion schemes please refer to Annex, Table 8.

Figure 12: Deployed Biomass, Solar PV and Wind Power Capacity in MW 2005 and 2012[21]

Sources: Own creation

In contrast, Croatia's biomass capacity grew by only 1.76 MW since 2007, despite favourable RE incentive schemes. Due to the relatively high instalment costs, the coherence between RE incentive schemes and deployment is even stronger for solar PV power plants. For example, for a 30 KW roof top solar power plant commissioned in 2006 in Germany, an average LCOE of slightly under €0.5/kW-h was estimated (BMUB, 2007). This was significantly higher than the retail electricity price of €0.18/kW-h for an average German household (BDEW, 2013). Investment in solar PV was only profitable with a significant RE incentive scheme, for example a FiT with a re-

21 Only countries with installed biomass capacity exceeding 5 MW and with solar PV/wind capacity exceeding 200 MW respectively are presented in this figure.

muneration equalizing the LCOE. The black line which represents the year in which the incentive scheme was implemented is not visible. That is because Czech Republic, Bulgaria, Slovakia and Ukraine had no solar PV capacities in 2005 or in the respective year, when the RE incentive policy was introduced. Czech Republic adopted a FiT in 2006 resulting in over 2 GW installed solar capacity by 2012. Ukraine adopted a FiT in 2009. Almost 400 MW installed solar PV capacity has been deployed since then. In contrast, the Federation of Bosnia and Herzegovina (FBiH) has one of the highest FiT for small scale solar PV installations and shows one of the highest solar radiation potentials (Figure 8), but there has been no significant solar PV deployment to date. The findings are similar for wind capacity development between 2005 and 2012. Poland, Turkey and Romania implemented its RE incentive schemes in 2008[22] and deployed almost 2 GW of wind capacity between 2008 and 2012. Ukraine and Croatia's wind energy sectors grew by ca. 200 MW since incentives were introduced in 2009. Between 2011 and 2013, Ukraine's private sector contributed 75 percent of the installed wind capacity delivered by the state in the previous decade (ECSd, 2013). But Belarus stagnated in terms of wind power plant deployment over the same time period despite offering the highest FiTs for wind energy in the region.

It should be noted that some countries have low deployment rates to date, but some large projects are currently under development. Examples include the development of the 110 MW Pirshakul wind farm and 25 MW Absheron solar PV Park in Albania, and a pilot 50 MW wind power plant in Former Yugoslav Republic of Macedonia (ECSa, 2013 & SEECN, 2013). Others have recently adopted or revised their RE incentive schemes. For example Serbia adopted a new RE promotion in 2013. Experts estimate that the adoption of FiTs will likely lead to an increase in investment in RE in the coming years (EWEA, 2013). Similarly, the Government of Kazakhstan adopted a new RE law in 2013, replacing project-specific with technology-specific FiTs (Republic of Kazakhstan, 2013). The time-consuming characteristic of an RE project makes the comparison of RE investment with power generation deployment difficult. For example, Ukraine showed $2.8 billion RE investment in 2012, almost three times as much as in 2011. This was largely due to the financing of ca. 1 GW of SHPPs and phase one of the $126 million Botievo wind farm (FS & UNEP, 2013). This will be reflected in deployed power capacity in the coming years. Similarly, Turkey showed $1.3 million investment in RE, mostly in wind farms (FS & UNEP, 2013). In 2013, Uzbekistan ($200 million) made the fifth largest investment in RE and Kazakhstan ($100) million the eighth largest in non-OECD Asia, excluding China and India (FS & UNEP, 2014). However, investment-construction delays cannot be the only explanation for low RE utilization rates despite implemented RE incentive schemes. This chapter examines several key findings.

All countries which experienced a significant increase in RE capacity did so having recently introduced incentive schemes.

RE deployment does not inherently seem to be tied to the selection of a specific incentive scheme, and particularly not to FiTs. Poland, one of the few countries in the region that has a quota scheme implemented, showed by far the greatest absolute growth in wind and biomass capacity deployment. Albania's expiring support scheme, which is only applicable for SHPPs and has a concession-based competitive tender process, led to commissioning of 90 MW in-

22 Turkey adopted the first version of the Law on Utilization of RES for the Purpose of Generating Electrical Energy in 2005. However, only in 2008 was the law was amended by the introduction of FiTs. In 2010, Turkey revised and increased its FiT promotion scheme, which remains applicable to the present (IEA & IRENA, 2014).

stalled SHPP capacity between 2010 and 2011 (Republic of Albania et al., 2012). It is estimated that by the end of 2012, $256 million has been invested into Albanian SHPPs (IFC, 2012). However, and due largely to high technology costs, there is evidence that RE incentive schemes have been necessary to compensate for relatively high LCOEs. Russia adopted its capacity scheme in June 2013. The overall capital investment in Clean Energy between 2000 and 2011 amounted to (only) $895million. With this amount, Russia ranked second last of all 22 Clean Energy Ministerial countries (Deutsche Bank, 2012). Although incentives might have been necessary to launch RE deployment, they do not explain all differences in RES utilization. In some countries, seemingly favourable legislation did not lead to enhanced RE power capacity. A good example to illustrate, that focusing solely on incentive schemes might ignore the depth of the problem is found in a comparison of Turkey and Azerbaijan. Turkey's installed wind capacity grew by almost 2 GW between 2008 and 2012 (WWEA, 2013). But Azerbaijan's wind power capacity increased by 2 MW during the same period. Turkey's FiT for wind power installations is $73/MW-h, excluding potentially obtainable bonuses for local content inclusion. It is therefore higher than Azerbaijan's FiT, which is $57/MW-h (ECSb, 2013 & Government of Turkey, 2011). At a first glance, it seems obvious to argue that Azerbaijan's FiT provides an inadequate reward for investing in RE. But in 2013 the Turkish average market electricity price ($77/ MW-h) exceeded the FiT obtained for electricity generated by a wind power plant (Ortner, 2014). This implies that in 2013 the FiT in Turkey did not provide a direct financial incentive compared to electricity sold through the electricity market. Taking into account Turkey's significant deployment rate, it still seemed to be at least as high as the LCOE for wind power in Turkey and therefore enough to cover the required ROI of investors in the Turkish wind energy market. Azerbaijan's FiT for wind energy is just too low to cover the LCOE for wind power generation in Azerbaijan. But that does not automatically imply that it is necessary to increase Azerbaijan's tariff to the level of Turkey's. It rather suggests a focus on the cost drivers of the LCOE, in particular financing costs from higher perceived risks, to reduce Azerbaijan's LCOE towards the level of the current FiT.

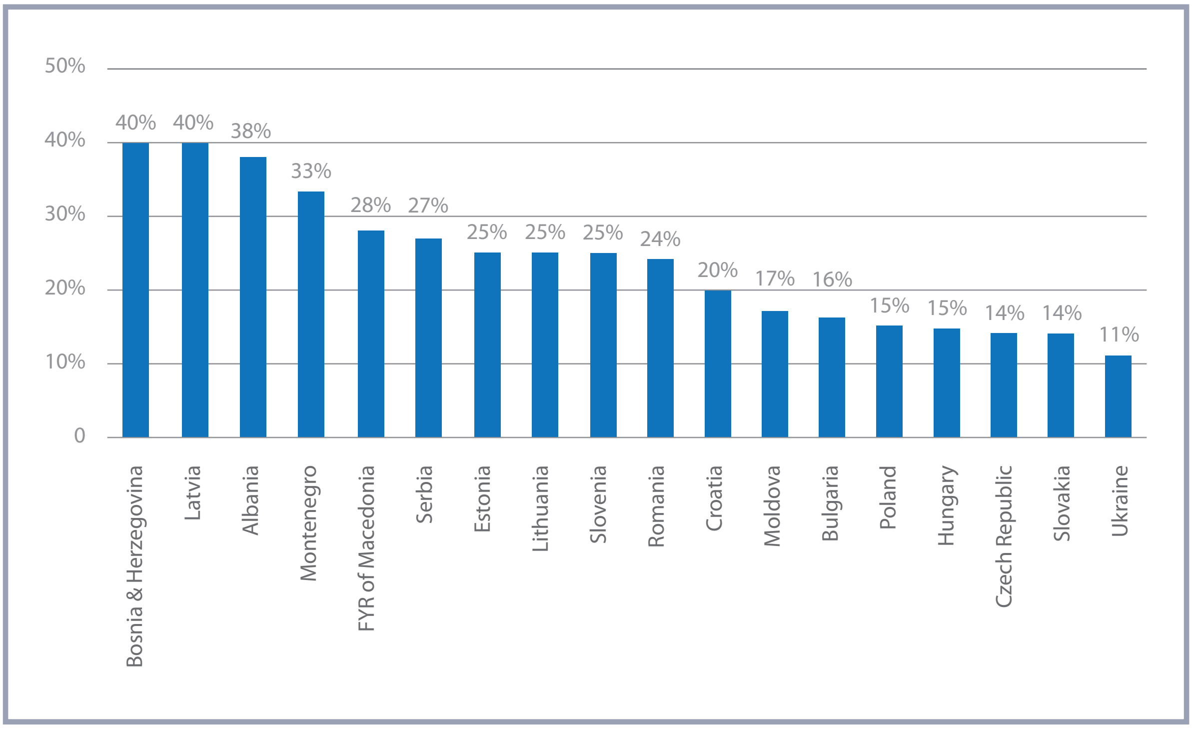
Historically, evidence suggests that RE incentive schemes have been necessary to compensate for relatively high LCOEs.

2. Barriers to Renewable Energy Investment in the Region

2.1 Market Prospects and Government Policies to Stimulate Investment

Together with the EU member states covered in this report, Energy Community (EC) member countries Albania, Bosnia and Herzegovina, Croatia, Former Yugoslav Republic of Macedonia, Moldova, Montenegro, Serbia and Ukraine agreed on the implementation of EU Directive 2009/28/EC and committed to a binding share of RES in gross energy consumption by 2020 (EC, 2012). Turkey committed to a 30 percent RES in power generation by 2023, 20,000 MW of installed wind and 3,000 MW of solar PV capacity (Melikoglu, 2013). Russia aims that 4.5 percent of produced and consumed energy should be produced by RE power plants by 2030 (Ministry of Energy of the Russian Federation, 2009). The Russian Energy Forecasting Agency estimates that reaching this target would require 14.7 GW of total new installed RE capacity (IFC, 2011). Belarus plans that local fuels and RE shall have a share of not less than 32 percent in energy production by 2020 (ECSc, 2013). However, those targets are often rather vague formulated. Also, a renunciation of the target may be easier than for countries that agreed to EU Directive 2009/28/EC.

Figure 13: Legally Binding Share of Renewable Energy Sources in Gross Final Energy Consumption by 2020



Sources: Adapted from EC (2012)

Countries with no RE targets show the weakest commitment to a reliable RE development strategy. Kyrgyzstan's National Energy Programme, for example, officially recognizes environmental protection in the energy sector and the promotion of a new tariff policy. However, no specific targets have been set by the government (Kyrgyz Republic, 2008). The government's commitment to promoting RES therefore remains unclear for investors. Commitments of governments toward RE deployment are not only communicated through RE targets. In general, legislation security is crucial, since retroactive legislation changes harm the government-investor trust relationship substantially in the long term. Uzbekistan, for example, ensures legislation security for foreign investors over 10 years (UNDP et al., 2013). Unfortunately, some countries have enforced retroactive changes in RE legislation. Due to RE promotion cost concerns, Romania's Energy Regulator ANRE suspended the issuance of two TRECs for solar power plants (until March 2017), one certificate for wind (until December 2018) and one certificate for SHP plants (until March 2017) for plants commissioned before 1 January 2014 (RWEA, 2013). The Government of Czech Republic revised its RE law in 2012. The revised law no longer offered tax incentives, but a tax for solar installations commissioned between January 2009 and December 2010 on the revenues of FiT (26 percent) and premium (28 percent) between 2011 and 2013, (Czech Republic, 2012).[23] This so-called solar tax led to the collapse of the Czech solar PV market and almost no additional solar PV deployment took place in 2011. That compares with almost 1.5 GW additional installed capacity in 2010 (EurObserv'Er, 2013). Similar to the Czech Republic, its neighbour, the unexpected boom of Slovakia's solar PV market led to an adaption of legislation by decreasing the tariff eligibility of solar installations (Dojčanová, 2011). Many RE investors are taking legal action against these retroactive changes. In Bulgaria, the Supreme Administrative Court overruled the grid usage fee, which forced solar PV power plants commissioned between 2010 and 2012 retroactively to pay back up to 39 percent of the FiT to the grid operator. Around €76 million collected by the grid and distribution operators had to be paid back to the plant operators (ResLegal, 2013).[24]

Countries with no RE targets show the weakest commitment to a reliable RE strategy.

Even if retroactive changes are overruled, the emerging planning insecurity as a result of legislation changes is expected to damage the investment climate in the long term. According to the IEA, policy uncertainties are considered to be the main barrier to RE investment (IEAa, 2013). Together with reductions in technology costs, policy support concerns represented the major reason for the 14 percent drop in 2013 from 2012 of worldwide investment in renewable

Policy uncertainty is the main barrier to investment in RE and was a major reason for the drop in worldwide investment in RE.

23 *In 2013, the tax regime was extended with a lower tax rate, 10 percent on the FiT and 11 percent on the premium. According to the last amendment by the Czech Parliament to the RE law (Regulation No. 310/2013) only plants commissioned until 31 December 2013 (except SHP) can receive the FiT. Wind, geothermal or biomass power plants with a maximum capacity of 100 kW and that hold a building permit issued before the amendment entered into force (2 October 2013), are eligible for support, but only if the plants will be commissioned before 31 December 2015.*

24 *However, in late 2013 the Bulgarian parliament adopted 20 percent fee on the revenue of wind and solar installations in 2014 following a proposal by the Budget Commission (Reuters, 2013). Bulgaria's State Energy and Water Regulatory Commission currently proves the introduction of a new fee on transmission grid access for wind and solar power plants that are eligible to receive the FiT.*

power (FS & UNEP, 2014). The long-term nature of project realization and amortization disproportionally exposes RE investors to risks related to planning insecurities. Despite a diminishing effect on RE capacity deployment rates, one approach to avoid retroactive changes is the implementation of deployment caps. Governments may have incentives to slow down or limit new RE instalments due to cost concerns or grid capacities. For example, the Government of Former Yugoslav Republic of Macedonia capped the overall installed capacity of privileged producers that are eligible to receive a FiT (Government of Macedonia, 2010). The Croatian Transmission System Operator HEP-OPS limited the installed capacity of new wind power plants at 360 MW (Krajacic et al., 2013). Estonia discontinued its premium for wind power plants when a total electricity production of 600 GW-h/ is reached. It is important to state that the existence of caps do not necessarily hinder investment. In Latvia, which also implemented output caps, the FiT caused a massive growth in commissioned wind power plants, which increased by almost 112 percent in 2012 (WWEA, 2013).[25] On the other hand, caps tend to inhibit investment and RE deployment, particularly when the investment environment is favourable. In Turkey, single solar installations are capped to a maximum of 50 MW and the total installed solar capacity in the country was limited to 600 MW until the end of 2013. According to Turkish newspapers, in the first half of 2013, 500 companies had submitted proposals of 9,000 MW solar PV capacity to the Energy Market Regulatory Authority (EMRA). This is 15 times as much as the cap of 600 MW set by EMRA for 2013. Regional top performers in terms of RE deployment rates, such as Czech Republic, Bulgaria and Romania, changed their promotion schemes retroactively after massive growth in RE generating capacity. That has caused ongoing damage to their local RE markets. Countries with previously lower deployment rates, due to inherently capped deployment rates, may be able to avoid retroactive changes. This could imply that countries with historically high RE deployment rates and retroactive legislation changes will stagnate in terms of RE deployment, whereas countries with historically lower RE installation growth rates – due to implemented caps and profound deployment plans – may expand RE capacities more sustainable over the coming years. To increase the planning security of investors, retroactive legislation changes should be avoided. RE promotion schemes can include detailed deployment plans, caps or a determined gradual decrease of promotion over a longer period of time which takes grid capacities and cost increases into account.

Retroactive changes in legislation should be avoided if investors' planning security is to be assured.

2.2 Market Distortions and Access to the Energy Market

Market distortions and access to the electricity market remain challenges in some countries. Market distortions, for example subsidies for produced electricity from technologies other than RES, are a particular problem in countries with large non-renewable energy resources, for example oil, coal and gas, and where electricity prices are traditionally cheap and not cost reflective. If the costs are directly transferred to electricity consumers, RE incentive schemes entail an unpopular increase of retail electricity prices. As a result, governments are often reluctant to promote RE. According to the IEA, global fossil fuel subsidies are five times larger than the level of worldwide RE incentives (IEAb, 2012). In 2010, Turkmenistan had the fourth largest

25 *Despite deployment caps, Latvia's FiT is on hold until 1 January 2016 for new installations and no electricity licences are granted for new installations (ResLegal, 2013).*

proven gas reserves in the world (World Bank, 2014). Natural gas is almost the only source for power generation. Retail electricity tariffs are very low, not cost reflective and subsidized. Despite enormous potential in solar PV particularly, low tariffs in combination with a missing RE strategy result in a low share of RE in the country's overall installed electricity capacity of 0.18 percent. A UNDP study for Kyrgyzstan (2011) estimated the generation costs of renewable electricity per kW-h at $0.19 for SHHP, $0.20 for wind and biomass, and $0.32 for solar power. But because of massive subsidization, the current electricity tariff of $0.1/kW-h is way below RE generation costs and not cost reflective (OJSC Elektricheskie Stantsii, 2013). Due to the abundance of natural gas and oil resources, Uzbekistan's energy sector is heavily dependent on non-renewable resources. Despite considerable technical RE potential, the dependence on non-RES in combination with very low energy tariffs prevents energy diversification (Eshchanov et al., 2013). The high upfront capital investment required for RE projects and the absence of a legislative support scheme make RE in Uzbekistan unfavourable compared to investments in oil or gas (UNDP, 2007). Countries that subsidize fossil fuels to protect consumers from rising energy prices distort RE competiveness and prevent investment in RE technologies, which could be a far more affordable alternative (Schmidt et al., 2012). Waissbein et al. (2013) showed that – contrary to the common view that RE promotion schemes increase energy bills – public de-risking measures can actually contribute to reducing energy bills. Countries with high fossil fuel subsidies implicitly burden households through tax budgets used on unnecessary high energy expenses. Removal of fossil fuel subsidies and a reallocation of the originating savings in the tax budget in combination with public de-risking measures for RE technologies can actually have a reducing – and, therefore, beneficial – effect on low income household's energy bills (Waissbein et al., 2013).

Removal of fossil fuel subsidies and public de-risking measures can help to reduce consumers' energy bills.

Investors may hesitate to invest in countries where access to the energy market is difficult. Some countries are still in the progress of liberalizing their energy market. In Former Yugoslav Republic of Macedonia, the state-owned Joint Stock Company ELM is the country's largest energy electricity generator, operating a total capacity of 800MW in thermal and seven HPPs of 530MW. In Kyrgyzstan, state-owned energy company OJSC Elektricheskie Stantsii is still the major electricity generator producing 98 percent of Kyrgyzstan's electricity (OJSC Elektricheskie Stantsii, 2013). In Turkmenistan, the electricity market is managed by vertically-integrated and state-owned Turkmenenergo, which owns and operates the grid. Turkmenenergo also generates the electricity and distributes the electricity to the end customers. In Azerbaijan, the vertically-integrated and state-owned Azerenerji owns most of the power generation capacity. In Uzbekistan, the vertically-integrated state-owned electricity company UzbekEnergo generates 97 percent of the country's electricity. The remaining 3 percent is the entire installed small hydropower capacity, which is operated by state-owned Uzsuvenergo. In Tajikistan, the state-owned electricity company, Bargi Tajik, owns most of the electricity generation capacity. However, both Uzbekistan and Tajikistan are currently liberalizing their energy markets. Tajikistan adopted a programme for the construction of SHHPs, and several mini and small hydropower plants with a total capacity of 47 MW were commissioned in 2010 and 2011. Some are privately owned and operated (UNDPc, 2012). To attract private investment, countries should continue liberalizing their energy markets and facilitate private access to historically state-owned energy markets. If incremental costs of RE production remain after the implementation of de-risking instruments, countries with monopolistic organized energy sectors could consider implementing a quota regulation scheme, requiring the state monopoly to produce a certain amount of RES. Compared to a FiT, which requires a liberalized market, this could help to effectively deploy RES by ensuring control over the deployment rate, costs and alignment with grid capacities.

2.3 Concessions, Permits and Licences

In some countries, the licence and permit processes are complicated, bureaucratic and untransparent and it can take up to several years to obtain all licences and permits to construct and operate an RE plant. In Croatia, it takes three to four years to obtain all necessary licences and permits for the construction of a wind power plant (EWEA, 2013). This is significant higher than in other EU countries, for example in Austria or Italy where 19 months of administrative procedures for a wind park is the average (EWEA, 2010). Bureaucratic permits and licensing procedures are not only time-consuming, but also cost-intensive. For example the capital cost breakdown of Amayo wind power plant shows that around 3 percent of the total installed costs or almost $3 million are borne by licence and permit related expenditures (IRENA, 2013). This can increase transaction costs, delay returns and discourage investment. In Former Yugoslav Republic of Macedonia, the bureaucratic and complex obtaining of construction, land use and electricity generation permits might be a reason for the country's relatively weak performance in terms of RE deployment in recent years (Mijakowski & Mijakowski, 2013). In Romania, around 85 permits and licences have to be obtained to construct a wind power plant (EWEA, 2013). Generally, the commission of RE power plants requires a number of licences and permits. In a first step, several licences related to the right to construct the power plant have to be obtained. These can include environmental and biodiversity impact assignments, location and land usage permits, as well as construction permits. In a second step, operational permits such as the right for electricity generation or qualifications connected to the promotion scheme (often referred as qualified producer certificates) have to be obtained.[26] Supplementary low transparency in the licence granting process impedes RE investment. Energy companies in the region have for a long time enjoyed the advantages of state-owned monopolies. The lack of competition and the closeness to decision-makers in the state promoted a lack of transparency in energy policymaking. However, transparency in licence granting is essential if private investors are to be attracted. If a government's decisions are unpredictable, investors face greater exposure to additional risk related to planning insecurities. Therefore, at the start of an RE project, investors face high uncertainty whether and under what conditions licences and permits may be obtained. The World Bank's Dealing with Con-

Complicated, bureaucratic and untransparent licence and permit processes can increase transaction costs, delay returns and discourage investment.

Transparency in licence granting is essential if private investors are to be attracted. If a government's decisions are unpredictable, investors face greater exposure to additional risk related to planning insecurities.

26 *This is just a short list of generally required licences. Countries in the region differ in the amount and type of licences required. For example, Turkish SHPP developers also need the permission of the State Hydraulic Works for the construction of a SHPP (Government of Turkey, 2002).*

struction Permits indicator quantifies the number of procedures required to build a fictive warehouse, the time required to fulfil those procedures and the costs associated with the procedures (IFC & World Bank, 2014)[27]. Countries in Central Asia particularly (regional average rank 138.5), in the Western Balkans (regional average rank 145), Russia (rank 178) and Azerbaijan (rank 180) suffer from complex, time-consuming and cost-intensive construction permit processes (IFC & World Bank, 2014).

Some countries have improved their permit processing mechanisms.

Other countries, meanwhile, have improved their indicator ranking significantly. So far and despite favourable RE legislation, investors in Ukraine have experienced difficulties in obtaining the necessary permits and licences to construct renewable energy power plants, to produce electricity and to receive the status of an eligible producer under the FiT. To obtain the necessary permits, several federal and regional authorities have to be involved. The jurisdiction of authorities often overlaps. EWEA (2013) states that after all necessary licences related to land use are obtained it takes another two years to obtain the remaining licences and permits before the construction of a wind power plant can start. Yet Ukraine climbed an impressive 145 places in 2013 to 45th position in 2014 (IFC & World Bank, 2014). Montenegro also rose by 69 places over the same period. Georgia has improved its business climate significantly over the last decade. In the World Bank's Ease of Doing Business index, the country is ranked in eighth position worldwide.[28] The number of foreign investors grew by over 400 percent between 2004 and 2010 (MESD, 2013). Together with Armenia (6) and Macedonia (7), Georgia (8) is also highly placed in the World Bank's 'Starting a Business' indicator[29], which measures how long and how cost intensive it is to get a local company established.[30] A major improvement in Georgia's business reforms has been the streamlining of its permission and tendering processes, yielding to a clear set of procedures for potential SHP developers. The commission of a SHPP requires only three licences: a land lease or purchase licences obtained from local authorities, a water usage permit issued by the Ministry of Environment Protection, and a construction permit issued by the Ministry of Economy and Sustainable Development. Georgian SHPPs of up to 13 MW installed capacity are exempt from a licence for power generation. Other countries have also simplified RE-related permission granting processes by exempting RE developers from otherwise obligatory licences. Serbia exempts power plants of less than 1 MW and Bulgaria those of less than 5 MW from the obligation to obtain an electricity generation licence. Also some countries have improved their anti-corruption legislation[31] in recent years. Others have ongoing accession negotiations with the European Union, which include membership requirements in governance and anti-corruption (European Commission, 2012).[32] The EU assimilation and accession process will likely increase transparency and governance in the future. For

Shorter – and therefore cheaper – permission processes and licence exemptions reduce not just financing costs, but the costs of RE energy instalment too.

27 Annex, Table 9 shows the 'Dealing with Construction Permits' indicator for all countries in the region. The indicators might be good proxies to display cost intensity and time-intensity of the construction of a RE power plant. However, it should be noted that IFC and the World Bank assume the construction of a warehouse for this indicator.
28 Annex, Table 9 shows World Bank's 'Ease of Doing Business' indicator for all countries in the region.
29 Annex, Table 9 shows World Bank's 'Starting a Business indicator for all countries in the region.
30 The ECIS regional average in the World Bank's 'Starting a Business' is 66.36 (IFC & World Bank, 2014).

example, in 2012 Croatia, the youngest EU member state, recorded the highest FDI inflow in the Western Balkans and the business environment is likely to further improve (UNCTAD, 2013).

Increased transparency in combination with streamlined and simplified RE permission processes are effective public de-risking measures that reduce risks related to permission granting processes. Shorter – and therefore cheaper – permission processes and licence exemptions reduce not only financing but also RE energy instalment costs. This particularly benefits small RE developers with low capital resources and relatively high information costs.

2.4 Access to the Electricity Grid

As with licence granting, uncertainties and risks regarding electricity grid access negatively influence financing costs. With a lack of transparency in the grid access process, investors face higher exposure to additional risk related to planning insecurities. For example, wind farm developers in Poland and Romania face high uncertainties regarding grid connection. Between 2009 and 2010, around 1,300 grid connection applications with a cumulative installed capacity of almost 10 GW were refused by the authorities (EWEA, 2013). In Turkey, local environmental regulations and the determination of transmission fees face challenges in terms of transparency (EWEA, 2013).

Increasing the likelihood of grid connection – and therefore reducing uncertainty – can be achieved by prioritizing RE over other forms of electricity generation when applying for grid connection. 16 countries in the region, for example Turkey, Lithuania, Serbia and Bosnia & Herzegovina, prioritize RE developers when applying for access to the grid.[33] In addition to policy de-risking measures, authorities can provide RE developers with direct incentives, for example complimentary access to the grid. In nine countries, developers enjoy complimentary grid access.[34] The combination of enhanced utilization of policy de-risking measures (prioritization in grid access and improved transparency) with direct financial incentives (complementary grid access) is likely to improve the bankability of RE projects in developing countries significantly.

In nine countries, RE developers enjoy complimentary grid access.

2.5 Technology and Supply Chain

An incomplete or poorly developed supply chain can increase financing and instalment costs, which can lead to investment reluctance. Poor local infrastructure – roads, for example – could hamper the transport of hardware to the project location. Some countries in the region require RE developers to use a certain percentage of locally produced hardware in their RE projects. In Russia's new capacity scheme, commissioned from 2014 onwards, wind projects have to contain 35 percent (65 percent from 2016), solar projects 50 percent (70 percent from 2016) and small hydropower projects 20 percent (65 percent from 2018) locally produced

31 An example is OECD's Anti-Corruption Network for Eastern Europe and Central Asia (ACN) initiative, which supports its members in efforts to fight corruption via the implementation and enforcement of anti-corruption reforms and laws. Some member states made significant progress in implementing anti-corrupting polices, by criminalizing corruption. For example, Georgia has reduced its levels of corruption significantly in recent years (OECDb, 2013). Also, Kazakhstan adopted two important anti-corruption laws changing liability provisions for corruption offences as a result of the initiative (OECD, 2011).

32 Turkey and Montenegro currently have negotiations ongoing, Serbia and Former Yugoslav Republic of Macedonia are candidate countries with no current negotiations.

33 Annex, Table 8 lists all countries with RE prioritization in grid connection.

34 Annex, Table 8 lists all countries offering complementary grid access.

equipment. After the first tender in September 2013, some critics noted that the relatively small amount of auctioned wind capacities was triggered by local content requirements (LCRs). Especially when the local RE industry is still under development and inexperienced or spare parts are rare to get, investors may react reluctantly to LCRs. However, LCRs may also create benefits. Turkey promotes the use of locally produced equipment via a higher tariff for five years, which can be received if producers install domestic equipment in their RES facilities. This can be beneficial for foreign investors, because capital investment in $/MW installed capacity for SHPPs in Turkey is significant smaller than in the rest of the world, which leads to a payback period of less than three years (Kucukali & Baris, 2009).[35] Therefore, the smart construction of LCRs is crucial to prevent investment reluctance and to successfully foster the participation of the local economy in the development of a RE market, thus benefiting from more jobs, improved infrastructure and increased human development.

Smart construction of LCRs is crucial to prevent investment reluctance and to successfully foster the participation of the local economy in the development of a RE market, so that it benefits from more jobs, improved infrastructure and increased human development.

2.6 Cost of Information and Limited Experience with Renewable Energy

High information costs are a major barrier to RE investment. A recent survey revealed that one of the major investment barriers to sustainable investment[36] is financial advisors' lack of access to quality information and research (Gateways to Impact, 2012). Project developers also face information barriers. Pre-feasibility and feasibility studies on wind speed or water flow are cost- and time-intensive. In Moldova, the absence of small and medium size private investment in renewable energies has been due largely to local banks' unfamiliarity with investment in RE (ECS, 2011).

However, some countries started to tackle information-related investment barriers.[37] To reduce information costs for potential investors, Georgia's Ministry of Energy published a manual for SHP developers and a list of possible SHPP grounds open for investment with detailed pre-feasibility studies (Norsk et al., 2012). In a joint project, the Serbian Ministry of Energy and UNDP have published investor guides explaining the licences and permits required for the investment process in small hydro, wind, solar, geothermal, or biomass power plants (UNDPa, 2013). In Kazakhstan, a wind atlas is available and provides interested investors with detailed data about wind resources in the country. In a joint project between UNDP and the Kazakh Electricity Association, pre-feasibility studies are offered for potential wind farm investment projects. In Former Yugoslav Republic of Macedonia, investors have access to detailed rulebooks describing what to consider when constructing a RE power plant and how to obtain the FiT. Instruments addressing information barriers provide several positive effects on RE investment. On the one hand, existing pre-feasibility studies save developers and investors time and money in the project development phase which re-

35 By assuming a capacity factor of 0.4, a max. available tariff of $96/MW-h and investment costs of $8,454/kW.
36 This study defines sustainable investment as "investment strategy that seeks to fulfill a positive return on investment in combination with a positive environmental and social impact including investment in companies which work with renewable energy".
37 Annex, Table 11 provides a list of countries that offer RE investment opportunities and other instruments aiming to lower information-related investment barriers.

Some countries have started to address information-related investment barriers

duces instalment costs. But on the other hand, governments that tender specific RE sites reduce policy-related risk due to an enhanced credibility in commitment to RE deployment. In combination with industry–finance conferences or training and workshops on project feasibility, this lowers financing costs (Waissbein et al., 2013).

2.7 Capital Scarcity

Many countries in the ECIS region face a lack of available equity in comparison to OECD countries. This problem increases with the risk of a project, since debt holders usually require higher shares of equity with increased project risk. The lack of equity hampers investment and entrepreneurial activities in general. However even if equity is available, it is likely that project developers need a considerable amount of debt to finance the project, due to the high upfront capital required for RE power plant investments. As well as project- and company-specific differences in obtaining credit, there are differences in local companies' ability to obtain credit in the ECIS countries. The IFC and World Bank's Getting Credit indicator is quantified by combining indicators measuring whether certain features of facilitating lending exist, and the coverage, scope and accessibility of credit information that is available.[38] The region's average ranking for this indicator is 48.4. Some countries perform better, for example Poland, Montenegro and Macedonia (all with a ranking of 3), while others are weaker, such as Tajikistan (159) and Uzbekistan (130) (IFC & World Bank, 2014). Another debt-related indicator, the lending interest rate, is the average interest rate of the private sector, which is obtained for short- and medium-term financing from banks. It is normally differentiated according to the objectives of financing and the solvency of borrowers (World Bank, 2014). A higher lending interest rate increases the cost of capital and, therefore, the financing costs. The average lending interest rate for the region is 7.2 percent, which is higher than for example in the United States of America (3.3 percent) or in the United Kingdom (0.5 percent) (World Bank, 2014)[39]. In particular, Ukraine (18.4 percent), Tajikistan (25.2 percent), Georgia (22.1 percent) and Belarus (19.5 percent) have high lending interest rates. In the World Bank Risk Premium on Lending indicator, Tajikistan (20.2 percent), Azerbaijan (15.9 percent) and Georgia (15.3 percent) have high-risk premiums on lending (World Bank, 2014)[40]. In other words, companies operating in Tajikistan or Georgia that want to obtain debt financing from local banks pay, on average, higher risk premiums and consequently interest rates than in Lithuania (3.2 percent) or Montenegro (4.8 percent) (World Bank, 2014). RE project bankability therefore suffers as a result of higher interest rates and financing costs.

High interest rates and financing costs negatively affect a project's bankability.

To address debt scarcity, the most effective solution in the short term is financial de-risking, in which development banks take over some of the additional risks. This encourages banks to provide loans and reduces the cost of capital. A number of development banks and international financial institutions in the region offer risk decreasing instruments, such as soft loans or

38 *Annex, Table 9 provides the 'Getting Credit' ranking for each country.*

39 *No data was available for Poland, Kazakhstan, Turkmenistan, Uzbekistan and Turkey; Also, according to the World Bank (2014), the calculation differs by country which limits the comparability.*

40 *The World Bank defined the risk premium on lending as "the interest rate charged by banks on loans to private sector customers minus the „risk free" treasury bill interest rate at which short-term government securities are issued or traded in the market" (World Bank, 2014).*

loan guarantees. International development banks, for example the EBRD, EBRD's Sustainable Energy Financing Facilities, the Eurasian Development Bank (EDB), the Asian Development Bank (ADB) and the International Finance Corporation offer public loans and loan guarantees.[41] In some countries, national funds have been implemented to provide RE developers with financing. Examples include the German-Armenian-Fund in Armenia and Moldova's Energy Efficiency Fund. But despite obviously beneficial impacts on project economics, the loan and guarantee programmes only address debt scarcity. Generally, debt holders require a specific amount of equity financing to provide creditors with a loan. For example, the Western Balkan Sustainable Energy Direct Financing Facility requires a sufficient amount of equity to provide RE developers with loans (WebSEDFF, 2014). Early equity grants in the project development phase are an effective instrument to tackle equity scarcity. However, only in nine countries of the region investment grants are available, of which seven are located in the EU. In Kyrgyzstan and Moldova, the only non-EU countries with RE grants available, the local EBRD Sustainable Energy Financing Facilities, KyrSEFF and MoSEFF, offer grants to RE investors. Due to equity scarcity, the absence of grant mechanisms in certain countries may have prevented investment in RE energy. FiTs or tax rebates start unfolding their beneficial effect in the ex-post construction phase. However, these instruments are rather ineffective when there is inherently no equity available. Yet closing the equity gap by providing grants does not automatically increase the amount of incentives that are already available. Instead, it means shifting some of the often available ex-post construction RE incentive schemes, such as FiTs or tax rebates, ahead of the construction phase by offering grants. In Romania, where RE developers are supported by a mix of a quota and TRECs, the energy regulator ANRE evaluates the number of certificates granted on a case-to case basis, in the event that grants or other subsidies were distributed for the construction of the RE power plant. One other advantage of grants is that they not only serve as a financial incentive before the start of the project, but also help to reduce financing costs. Grants provide project developers with 'free' (or, at least, cheaper) equity. This lowers the cost of equity. Moreover, an increase in the equity share usually lowers the cost of debt. Even if not provided as a grant, development agencies can reduce financing costs by providing equity stakes in the early project development phase. An example is IFC's InfraVentures programme, which equips private and bankable infrastructure projects with early equity and assistance to close the equity gap (IFC, 2014). Both equity stakes and grants may also have a positive effect on the historically low small-scale RE investment in the region. Although in 2013 Ukraine had the 10th highest asset financing in RE worldwide, no country in this report is represented in the top 10 for investment in RE capacity smaller than 1 MW (FS & UNEP, 2013).

Grants not only serve as a financial incentive, but reduce financing costs.

2.8 Inadequate Transmission Infrastructure

Many countries in the region suffer from old and outdated electricity transmission infrastructure, causing energy shortages, electricity cut-offs and high distribution losses. The conflict during the 1990s in the Western Balkans destroyed parts of the transmission infrastructure and cut off entire villages from the electricity grid, a situation that continues to the present day. In Uzbekistan, 50 percent of the population

41 Annex, Table 10 provides an overview of national and international financial institutions providing loans, loan guarantees and grants for RE.

Old and outdated infrastructure is a problem in the region causing energy shortages, electricity cut-offs and high distribution losses.

lives in rural areas and experience significant problems with electricity shortages and cut-offs due to high distribution losses, illegal energy tapping and the generally poor condition of infrastructure in remote areas. This may be an opportunity for off-grid RE solutions. Acceptance and interest by the rural population in RE is high, as a recent study by Eshchanov et al. (2013) demonstrates. Moreover, governments could introduce a legal basis for electricity export. If prudently designed, electricity export can provide numerous benefits to countries with scarce capital. With help from the contracting party, exporting countries are able to secure capital to deploy RE installations. Countries lacking an adequate transmission infrastructure can use the income earned on ex-

If prudently designed, electricity export can provide numerous benefits to countries with scarce capital.

ported electricity by reinvesting it in the local infrastructure. And as soon as the export agreement expires, the RE plant produces electricity at low cost. Development and infrastructure banks can assist with financial de-risking and through the provision of public loans. For example, to provide greater flexibility and reduce the costs of the 20 percent RE target in the EU, RES-Directive 2009/28/EC allows for electricity generation cooperation mechanism between EU and neighbouring countries. The €100 million Lastva-Pljevlja transmission line between Montenegro and Italy is currently under development. The transmission line aims to connect several hydropower plants and a wind farm in Montenegro to the Italian grid. EBRD assisted in this by financing of €65 million in April 2013 (SEECN, 2013). In Georgia, except for the three winter months, SHPP developers are allowed to export electricity without an export licence. In winter, the Government of Georgia offers a power purchase guarantee to ensure domestic energy supply (MESD, 2013).

2.9 Political Instability and Country Risk

According to the OECD, country risk is the risk of capital transfer and convertibility or the risk of a *force majeure*. Transfer and convertibility risk measures the likelihood of governments imposing capital or currency exchange controls. *Force majeure* includes war, expropriations, revolutions, natural disasters etc. (OECDa, 2013). Investors perceive these risks and price it in their minimum ROI.

In countries with stable institutions, a positive track record as well as lower regulatory and currency devaluation risk makes for lower cost of capital, a lower ROI and positive project economics. In countries where political uncertainty is high, higher perceived risk will be priced in by equity and debt holders, thereby increasing financing costs (IRENA, 2013). OECD quantifies country risk on an indicator from 0 to 7 (Table 3). The region does not perform well and has a regional average rating of around 5. Belarus, Ukraine and Moldova (all with a ranking of 7), Central Asia (6.2), Western Balkans (5.8) and Caucasus (5.7) all have high country risk rankings. Risks related to political and country-specific circumstance can be addressed through financial de-risking by development banks offering risk-sharing products. Examples include a political risk insurance that covers expropriation, political violence and currency restrictions (Waissbein et al., 2013).

Political risk insurances can transfer risks related to political and country-specific circumstance to development banks.

Table 3: Country Risk Indicator by Country

Country	Ranking	Country	Ranking
Kazakhstan	5	Albania	6
Kyrgyzstan	7	Bosnia and Herzegovina	7
Tajikistan	7	Croatia	5
Turkmenistan	6	Montenegro	6
Uzbekistan	6	Serbia	6
Belarus	7	Former Yugoslav Republic of Macedonia	5
Ukraine	7	Turkey	4
Moldova	7	Armenia	6
Russian Federation	3	Azerbaijan	5
Bulgaria	4	Georgia	6
Romania	4	Latvia	4
		Lithuania	3

Source: OECDa (2013)[42]

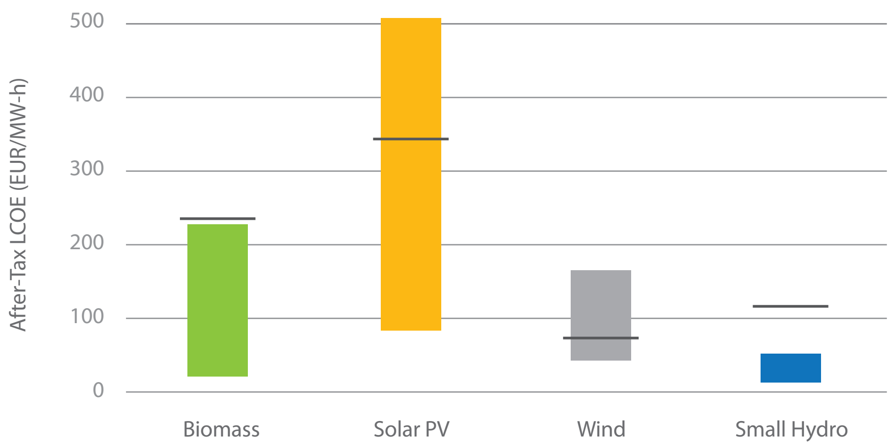
42 *Please note, for Czech Republic, Estonia, Hungary, Poland, Slovakia and Slovenia, data were not available.*

3. Best Countries for Renewable Energy Investment

Considering and evaluating the barriers and risks, Figure 14 offers an overview of the most favourable countries in the region for RE investment. When calculating the LCOE for biomass and small hydropower, the FiTs of Slovenia and Ukraine cover the generation costs in both the optimistic and in the conservative scenarios. This is a serious advantage for investors, because the calculations of the lower and upper bound LCOE assume different amounts of installation costs, O&M costs, load hours and financing costs.[43] So even when assuming a weak load factor, high installation and financing costs, biomass and small hydro investments remain

Figure 14: Lower and Upper Bound LCOE and Feed-in Tariffs for RES in Slovenia, Ukraine and Turkey

Technology	Biomass	Solar PV	Wind	Small Hydro
Country	**Slovenia**	**Ukraine**	**Turkey**	**Ukraine**
Lower Bound LCOE	32.52	90.09	51.77	13.58
Upper Bound LCOE	218.28	513.01	176.9	66.81
Feed-in Tariff	224.35	358.9	79.52	116.1



Source: Own calculations

43 Please refer to Annex, Table 12, which shows the underlying assumptions on the conservative and optimistic LCOE scenarios.

Table 4: Feed-in Tariff and Feed-in Premium for Renewable Energy Technologies in Slovenia

Eligible Technologies	Additional constraint	Installed Capacity	Tariff granted in €/MW-h
Wind		< 5 MW	95.38
Solar[44]	Building integrated/other Building integrated/other Building integrated/other	< 50 KW < 1 MW < 5 MW	122.57/115.16 112.10/106.1 93.01/85.54
Hydro		< 50 KW < 1 MW < 5 MW	105.47 92.61 82.34
Biomass	At least 90 percent of the products used must be from wood	< 50 KW < 1 MW < 5 MW	Case-by-case 224.35 167.43

Source: Government of the Republic of Slovenia (2012)

profitable in both Slovenia and Ukraine. For solar PV, the range between conservative and optimistic LCOE is wider, largely because of huge discrepancies in the assumptions of the capacity factor. The upper bound LCOE assumes a capacity factor of 10 percent, resulting in 876 load hours. Figure 8 shows that the annual average solar radiation in Ukraine amounts to around 1,300 kW-h per square metre. Yet solar PV sites with a capacity factor of 15 percent reduces the LCOE in the conservative scenario, keeping all other variables constant, to €346 per MW-h, which is lower than the current FiT in Ukraine.

Despite not having the highest FiT for wind in the region, Turkey has in recent years demonstrated that the deployment of wind power plants fulfils investor requirements. Since the Turkish government plans to massively expand its wind capacity to 20 GW by 2023, it is currently the region's most attractive country for wind energy investment.

Slovenia offers attractive RE incentives particularly for investment in biomass power plants.

Biomass – Slovenia

Slovenia promotes renewable electricity with a combination of FiT and premium. The tariff for biomass installations smaller than 1 MW installed capacity is the highest in the region. The maximum eligibility period for the FiT is 15 years and applies only to plants with an installed capacity of less than 5 MW. However, RE power plants up to 125 MW may apply for a premium. In addition to the RE promotion policy, other factors can also benefit potential RE investors. As a EU member, Slovenia has a legally-binding target of 25 percent share of RES in gross final energy consumption by 2020 (Republic of Slovenia, 2010). Since 1 July 2007, its energy market has been fully liberalized and RE developers have prioritized access to the grid. Slovenia offers possible tax exemption for foreign investment of up to 40 percent of the amount invested. The corporate tax rate is relatively low at 17 percent, and this is expected to be reduced further in 2015 to 15 percent (Invest Slovenia, 2013). Several loans and grants for RES

44 The tariffs for solar PV reflect the October 2013 tariffs. Tariffs for solar power plants are subject to monthly recalculation due to applied degression.

investment are available, for example Eko Sklad, the Environmental Fund of the Republic of Slovenia, which awards low-interest loans to renewable energy projects through tendering.

The Lending Interest Rate in 2011 was a moderate 5.5 percent and the country is a member of the Euro zone. In 33rd position, Slovenia ranks twice as high as the regional average in the World Bank's Ease of Doing Business indicator (IFC & World Bank, 2014).

Solar PV and Small Hydropower – Ukraine

The overall average solar radiation presented in Figure 8 ranks Ukraine in the bottom third of the region. However, some regions in Ukraine show excellent potential for solar PV instalments. NAS (2013) estimates that 8,600,000 Mw-h/yr electricity could be produced (technical potential) by small hydropower installations. The government promotes RE with a FiT. Ukraine offers the region's highest FiT for solar PV installations over a broad scale of installations sizes. The tariff for SHPPs is also the largest in the region. The FiT payments are defined in detail until 1 January 2030, ensuring planning security for long-term investments. Although not a member of the Euro zone and monthly FiT revisions according the current exchange rate (UAH/€), there is a guaranteed 'minimum floor', ensuring limited currency exchange risk. With the decision of the EC Ministerial Council to adopt Directive 96/92/EC, Ukraine agreed a legally binding RE target of 11 percent share of RES in gross final energy consumption by 2020 (EC, 2012). Energy generation is fully liberalized. In addition to the FiT, there are several tax incentives on projects related to RE. For instance, there is no VAT on imported equipment and materials for construction of RE plants. Taxes for land with installed renewable energy production are lowered by 25 percent of the standard rate for land.

In 2012, LCRs for RE power plants were implemented. Although there are potential negative effects, these do have future potential benefits.

Table 5: Feed-in Tariffs for Renewable Energy Technologies in Ukraine

Eligible technologies	Installed capacity	Green Tariffs in € / MW-h				
		Until 31 March 2013	1 April 2013 to 31 Dec 2014	01 Jan 2015 to 31 Dec 2019	01 Jan 2020 to 31 Dec 2024	01 Jan 2025 to 31 Dec 2029
Wind	<600 kW	64.6	**64.6**	58.2	51.7	45.2
	>600 kW <2 MW	75.4	**75.4**	67.9	60.3	52.8
	>2 MW	113.1	**113.1**	101.8	90.5	79.2
Biomass		123.9	**123.9**	111.5	99.1	86.7
Biogas		-	**123.9**	111.5	99.1	86.7
Solar (Ground Mounted)		465.3	**339.3**	305.3	271.4	237.5
Solar (on roofs or facades of buildings)	<10 kW	-	**358.6**	322.8	286.9	251
	<100 KW	426.5	**358.6**	322.8	286.9	251
	>100 kW	445.9	**348.9**	314.1	279.2	244.3
Hydro	Micro	116.3	**193.9**	174.5	155.1	135.7
	Mini	116.3	**155.1**	139.6	124.1	108.6
	Small	116.3	**116.1**	104.7	93.1	81.4

Source: Imepower (2013)

LCRs are likely to develop Ukraine's RE supply market and domestically produced equipment may be produced cheaper, which lowers instalment costs. In the World Bank's Ease of Doing Business indicator, Ukraine improved its rank by 28 places to 112th position. In the sub-indicator, Dealing with Construction Permits, it improved its ranking from 186th position in 2013 to 41st in 2014, a very impressive increase of 145 places (IFC & World Bank, 2014). It is likely that the previous untransparent and complex permission granting process for RE power plants will be improved in the coming years. The country suffers from high country risk (7), as shown in Table 3, and currently faces its most serious geopolitical challenge in recent history. The exposure to *force majeure* is relatively high and investors are currently inclined to withhold investment. External pressures aside, Ukraine now stands at a crossroads to fundamentally transform its political, economic and societal interactions. Ukraine's capacity to foster strong and responsive domestic institutions will define the country's ability to adjust to the changing environment and to reinventing its socioeconomic model.

Wind – Turkey

The Turkish Government adopted a FiT available for 10 years from the commissioning of the plant. Although not the region's highest FiT for wind power, Turkey's RE promotion scheme has been successful and satisfactory for investor requirements with more than 1 GW of deployed wind capacity between 2010 and 2012. In addition, voluntary LCRs benefit RE developers in two ways. They increase the maximum possible tariff and may decrease the instalment costs due to lower capital investment in terms of $/MW. The FiT is determined in $/MW-h, which limits currency conversion exposure. Turkey targets a share of 30 percent of RES in power generation by 2023. In particular, the government aims to reach 20,000 MW of installed wind and 3,000 MW of installed solar PV capacity by 2023 (Melikoglu, 2013). Energy generation is subject to licensing and RE power plants must obtain a RES certificate from the Energy Market Regulatory Authority (EMRA). RE power plants with an installed capacity of less than 500 kW are exempt from obtaining a RES certificate (ResLegal, 2013). The Transmission Company TEIAS is obliged to prioritize access to the grid for RE electricity generators (Government of Turkey, 2002).

Turkey has successfully promoted RE to investors and has, in recent years, demonstrated that the deployment of wind power plants fulfils investor requirements.

Table 6: Feed-in Tariffs for Renewable Energy Technologies in Turkey

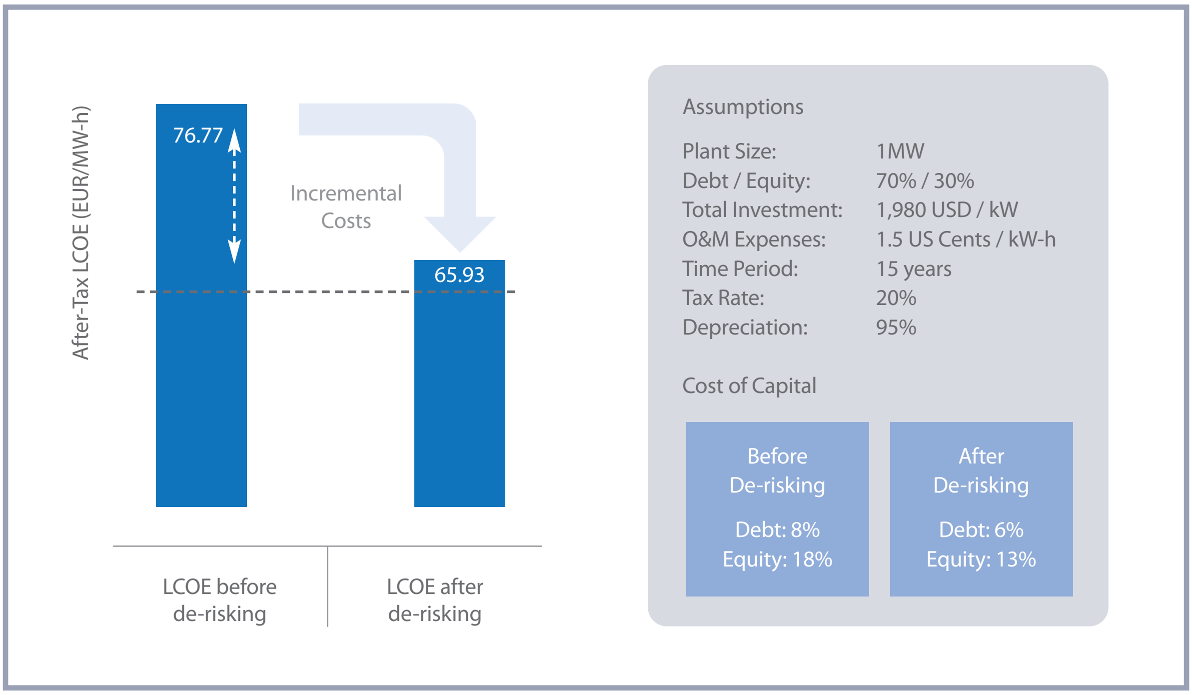
Eligible technologies	Tariff applied $/MW-h	Max. tariff possible if domestic equipment is included in $/ MW-h
Wind	73	110
Hydro	73	96
Biomass	133	151
Solar PV	133	200

Source: Government of Turkey (2011)

4. De-risking Renewable Energy Investment

Typically, all the above risks and barriers can be addressed by either policy or financial de-risking instruments. Figure 15 shows the theoretical potential to increase RE competitiveness by public de-risking instruments. If it is possible to introduce measures that de-risk the cost of debt to 6 percent and the cost of equity to 13 percent, the LCOE falls by almost €10 per MW-h to €65.93 per MW-h, assuming that all other input factors remain constant. Armenia's promotion scheme exemplifies the significance of de-risking. The FiT for wind power plants in Armenia amounts to €61.31/MW-h (R2E2, 2014).[45] This is the third lowest FiT in the region for wind power generation. Since only little wind capacity was deployed by 2012, it could be argued that this tariff is too low to incentivize investment in wind power plants.

Figure 15: LCOE for a Wind Power Project Before and After De-risking[46]



Source: Waissbein et al. (2013), IRENA (2013), PWC (2011) and own calculations

45 Based on the €/AMD exchange rate on 1 March 2014.

46 This graph is based on assumptions regarding electricity production and the cost of capital, which, if changed, do have a high impact on the outcome of the calculation. For the calculation of the pre and post de-risking LCOE, the financial tool developed by Waissbein et al. (2013) has been used. Total investment costs as well as the O&M expenses are average values for Eastern and Central Europe derived from IRENA (2013). As a tax rate, the corporate income tax for Armenia has been used (PWC, 2011). A capacity factor of 0.34 – or 3,000 load hours – has been assumed. Although this graph is based on assumptions and serves to illustrate the de-risking potential, Waissbein et al. (2013) showed that effective de-risking can actually have a positive impact on investor perception of risk leading to a fall in the cost of capital.

Assuming the costs of equity and debt for RE investment in Armenia are 18 percent and 8 percent respectively, wind electricity generation is not economically viable. The LCOE of €76.77 per MW-h is higher than the current FiT. But with the implementation of de-risking measures, the tariff would be almost sufficient for RE investment with remaining incremental costs of around €4.60. Without de-risking measures, the FiT would need to be increased to around €77/MW-h to cover the incremental costs between LCOE and FiT. This example therefore shows that even if some incremental costs do remain between FiT and LCOE, the required increase will be below the otherwise necessary increase that would be required without de-risking.

Public de-risking reduces the LCOE significantly, assuming that all other input factors remain constant.

These findings have important implications for the region's human development. Due to increased energy prices and significant reforms, energy affordability is already a major constraint. During the last decade, the region has experienced a trend of rising household electricity tariffs threatening its socioeconomic development (World Bank, 2012). Given that RE incentive schemes either burden scarce public means or are correlated with an increased household electricity price, governments are reluctant to increase electricity prices induced by RE reward schemes that compensate investors for their higher risks. Fossil fuel subsidies, which are ultimately intended to protect end customers from rising energy prices, are not sustainable and significantly threaten government budgets if international energy prices rise. As a result, they prevent RE from becoming a competitive and, if well designed, even a potentially more affordable substitution for fossil fuels. UNDP supports countries in the region in all three forms of public instruments, often with an integrated approach. In Belarus, a UNDP and GEF project, Removing Barriers to Wind Power Development, supports institutional capacity building, technical wind resource assessments, and training for local O&M responsibilities. In combination with de-risking strategies, the project aims to negotiate FiTs for wind power developers, which are lower than they would be without the de-risking elements. In Azerbaijan, UNDP and a state company, AREA, launched the Promoting the Development of Renewable Energy in Azerbaijan project. This continued until the end of 2013 and supported Azerbaijan in the construction of a pilot SHPP, by identifying the most efficient types of RES and by drafting the Law on Renewable Energy in Azerbaijan (UNDPb, 2013). A UNDP project in Croatia illustrated that countries with inadequate electricity infrastructure may want to focus on off-grid renewable energy solutions for remote areas due to cost effectiveness over expensive to grid expansion or rehabilitation (UNDPb, 2012). To address capital scarcity in Georgia, UNDP and GEF worked with German Development Bank KfW to develop and launch a RE Revolving Fund, which was capitalized with €5 million. The fund successfully invested in the first two privately owned small hydropower projects in Georgia. UNDP and GEF are currently developing a biomass financing mechanism together with investment grant mechanisms for pilot biomass projects. In addition, the project envisages raising public awareness on the production and use of biomass fuels (UNDPa, 2012). In the Reducing Barriers to Accelerate the Development of Biomass Markets in Serbia project, UNDP Serbia and EBRD developed an equity grant mechanism that helps to fill the equity gap. UNDP and GEF Albania developed a Draft Albanian Renewable Energy Plan and supported the preparation and adoption of a new law on renewable energy with the introduction of FiTs

UNDP supports countries in the region in all three forms of public instruments, often with an integrated approach.

Table 7: Risk Categories and Their Tailored Public De-risking Instruments

Investment Barrier	Description	Policy De-Risking Instruments	Financial De-Risking Instruments	Examples of Public De-risking Instruments in the Region
Market prospects and government policies to stimulate investment	Uncertainties in the energy market regarding government commitments to reliably pursue a RE deployment strategy.	• Establish long term RE targets • Establish long term deployment plans • Rather than adopting retroactive legislation changes, deployment caps should be implemented from the outset		• 18 countries adopted RE targets via EU Directive 2009/28/EC • Ukraine combined its FiT with a gradual decrease in promotion over a long period of time • Turkey signals credible RE deployment strategy by capping annual maximal installed RE capacity making it more probable that retroactive legislation changes can be avoided
Market distortions and access to the energy market	Fossil fuel subsides prevent RE to become a competitive energy substitute and traditionally monopolistic organized energy markets exacerbate private sector involvement in the energy market.	• Establish a harmonized, well regulated and unbundled energy market • Reform fossil fuel subsidies		• Uzbekistan and Tajikistan started to liberalize their energy markets
Concessions, permits and licences	Inability to efficiently and transparently facilitate RE related licences, permits and concessions increase transaction costs and reduce planning security and therefore financing costs.	• Streamline RE permission process by reducing the process steps • Establishment of an institutional body with clear accountability • Enforce transparent mechanisms and fraud avoidance mechanisms		• Georgia streamlined its permission granting process for SHPPs • Georgia and Kazakhstan implemented anti-corrupting polices following OECD's ACN initiative

Investment Barrier	Description	Policy De-Risking Instruments	Financial De-Risking Instruments	Examples of Public De-risking Instruments in the Region
Access to the electricity grid	Untransparent and bureaucratic processes for electricity grid access increases planning insecurities and therefore financing costs.	• Develop a grid code assuring grid access for RE or prioritize RE over traditional forms of power generation		• Nine Countries in the region prioritize RE in grid access
Technology and supply chain	An incomplete or poorly developed supply chain can increase financing and instalment costs, which may lead to investment reluctance especially then when countries require RE developers to use a certain percentage of locally produced hardware in their RE projects.	• Local capacity building by industry conferences or university programs • Smart construction of LCRs to participate local economy in RE expansion without preventing RE investment		• Turkey promotes the use of locally produced equipment via a higher tariff for 5 years which can be received if producers install domestic equipment in their RES facilities
Cost of information and limited experience with renewable energy	Investors, banks and developers face a lack of quality information and track record of RE in the region.	• Governments can offer specific investment suites with pre-feasibility studies to lower information costs and signal credible RE deployment potentially lowering financing costs • Provide help for foreign and local investors through investment guidelines, dialogues, conferences, workshops and trainings		• Georgia, Serbia, Kazakhstan and Macedonia offer developer manuals and pre-feasibility studies to decrease information related costs • Georgia offers specific small hydro power plants sites including pre-feasibility studies which are open to investment

Investment Barrier	Description	Policy De-Risking Instruments	Financial De-Risking Instruments	Examples of Public De-risking Instruments in the Region
Capital Scarcity	Countries in the region suffer from a general lack of local and international capital (debt and equity).	• Financial sector policy reforms for example favourable to long-term infrastructure, including project finance • Investment grants lower the cost of equity, increases probability to obtain debt financing under cheaper conditions and hence decreases financing costs	• Loan guarantees, soft (zero-interest) loans and other financial products by development banks assist project developers to gain access to capital and the risk transfer lowers financing costs	• In 9 countries there are RE related equity grants available. Romania combines grant mechanisms with reduced quota promotion
Inadequate transmission infrastructure	Many countries in the region suffer from old and outdated electricity transmission infrastructure, causing energy shortages, electricity cut-offs and high distribution losses.	• Provide legal basis for decentralized rural electrification where connection to the electricity grid is a more costly alternative • Create legal basis for electricity export	• Loan guarantees, soft (zero-interest) loans and other financial products by development banks assist transmission companies to gain access to capital and the risk transfer lowers financing costs	• Georgia offers SHP developers to export electricity; Montenegro currently builds a transmission line to Italy • EBRD assist by providing public funding for the transmission line in Montenegro
Political instability and country risk	Countries in the region suffer from country-specific risks as the risk of capital transfer and convertibility or the risk of a force majeure.		• Loan guarantees, soft (zero-interest) loans and political risk insurances by development banks assist project developers to gain access to capital and the risk transfer lowers financing costs	• A number of development banks and international financial institutions offer loans, guarantees and grant programs

Source: Own creation

and power purchase obligations of up to 15 years. The UNDP and GEF project, Promoting RES, worked with the Government of Montenegro to develop the Energy Law and other related bylaws regulating the rights and obligations of entitled RES producers, including the introduction of power purchase obligations valid for 12 years in combination with FiT (Government of Montenegro, 2011). Since 2008, 13 concessions with a total installed capacity of 97 MW for SHPP, and two wind power concessions with a total installed capacity of 96 MW, have been granted to investors (Vener, 2013). As a result of this project, in 2013 the Ministry of Economy of Montenegro opened a call for tenders for seven concessions for the exploitation of water resources (Ministry of Economy of Montenegro, 2013).[47] To address barriers arising from investor's lack of information, the Serbian Ministry of Energy, Development and Environment Protection, together with UNDP, published investor guides for RE technologies. The guides explain in detail the steps involved in the construction process for small hydro, wind, solar, geothermal, or biomass power plants (UNDPa, 2013). And UNDP and GEF's Kazakhstan – Wind Power Market Development Initiative produced a wind atlas containing detailed wind assessments.

Many countries in the region are now addressing barriers to RE investment.

Alongside UNDP efforts, many countries in the region have started tackling barriers to RE energy investment. Table 7 summarizes the investment barriers, their public de-risking instrument counterparts, plus examples from countries in the region that have started to address their risk and investment barriers.

47 More information about current SHPP tenders is available at: www.mek.gov.me/en/library/tenderi

Conclusion

Despite the region's tremendous RE potential, increasing energy security concerns and frequently adopted favourable RE promotion schemes, only a few ECIS countries have deployed renewable technologies to a significant extent in recent years. Rather than attributing this to ineffectiveness or an absence of RE incentive schemes, the analyses demonstrates that the reasons for low RE deployment are related to multiple investment barriers that often correspond with country-specific risks. The resulting high costs for financing RE projects might be the reason for low RE deployment rates in the region. Historically, governments have focused on reward-based incentive schemes to increase the profitability of RE investment. But RE incentive schemes either burden scarce public budgets or increase household electricity prices. In the ECIS region, affordable energy is a key determinant of socioeconomic development. Poor and rural populations are particularly vulnerable to energy poverty, a major impediment to sustainable and human development. Increased energy prices are, therefore, of concern to poor and vulnerable households and businesses. Reward schemes compensating investors for their higher risks are consequently a secondary alternative for the region.

Alternatively, electricity generation costs could be lowered through public de-risking instruments, by either lowering policy risks or transferring financial investment risks. Rather than increasing the financial reward, those instruments can help to reduce the financing costs related to the substantial up-front investment. This also may offer a potentially attractive alternative to fossil fuel subsidies, which are not sustainable and burden government budgets significantly if international energy prices rise. Improved efficiency and lower technology costs mean that increasing numbers of onshore wind and solar PV power plants can now financially out-compete fossil fuel alternatives even without subsidies; this is in cases where plants can be built in favourable geographical conditions for wind and sunshine load factors, as well as favourable financial conditions and low costs of capital (FS & UNEP, 2014). However depending on the energy market in each country, even after effective de-risking, direct financial incentives to make RE investment competitive compared to other forms of energy generation might still be required. Financial instruments should directly address country-specific needs and obstacles. The analysis shows that in many countries there are difficulties in obtaining capital particularly equity. Hence, after effectively addressing risks and barriers, equity grant mechanisms can help to close the equity gap, to establish entrepreneurial activity and reward for potentially remaining incremental costs.

Despite existing investment barriers, there is a positive trend for improved RE investment conditions in the region. The technical RE potential is huge and the geopolitical situation in terms of energy security concerns provides incentives for many countries to increase their own energy supply in the mid-term. Some countries have recently adopted or revised their RE schemes and experts anticipate an increase in RE investment in the coming years. Other countries show lower deployment rates, but a number of large projects are being developed and investment barriers are being addressed. The combination of favourable geographical conditions, continued reductions in RE technology costs and increased awareness make RE technologies ever more attractive in comparison to traditional ways of energy generation. This is likely to lead to more RE deployment in the region.

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Annex

Table 8: Implemented Renewable Energy Related Policies[48]

	Policy De-risking Instruments		Financial De-risking Instruments		Direct Financial Incentives							
Country	Renewable Energy Targets	Priority Grid Access	Low Interest Loans	Loan Guarantees	Tax Rebates	Grants	Quota	TREC	FiT	Premium	Tender and Auction	Complementary Grid Access
Kazakhstan	X	X	X	X	X				X			X
Kyrgyzstan			X	X	X	X			X			
Tajikistan		X	X	X					X			X
Turkmenistan												
Uzbekistan		X		X					X			
Albania	X	X		X			X		X			
Serbia	X	X		X	X				X			
Croatia	X		X	X					X			
Bosnia & Herzegovina	X	X		X					X		X	
Montenegro	X			X					X			
FYR Macedonia	X			X					X			
Turkey	X	X		X					X			
Belarus	X	X		X					X			X
Moldova	X	X		X		X			X			X
Russia	X			X							X	
Ukraine	X			X					X			
Armenia		X		X					X			

48 Please note: Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan, Georgia (only for SHP) and Moldova have project-specific FiT implemented. Azerbaijan offers FiT only for wind and SHP. The premium in Bosnia accounts only for installations in the Republic Srpska, Hungary offers the tender only for wind. In Georgia, complimentary grid access is only available for SHPPs. Lithuania offers complimentary grid access only for installations smaller than 30 KW. In Poland, Slovakia and Hungary grid access has to be paid partially by the plant operator. The FiT for Latvia is on hold until 2016 and no new electricity licenses are granted. In the Czech Republic, except for small hydropower, the FiT and the premium apply only for installations that do not exceed 100 KW and are put into operation before the end of 2015 and hold a building permit issued before 02 October 2013.

Country	Policy De-risking Instruments		Financial De-risking Instruments		Direct Financial Incentives							
	Renewable Energy Targets	Priority Grid Access	Low Interest Loans	Loan Guarantees	Tax Rebates	Grants	Quota	TREC	FiT	Premium	Tender and Auction	Complementary Grid Access
Azerbaijan	X			X					X			
Georgia				X					X			X
Estonia	X			X		X				X		
Latvia	X			X	X				X		X	
Lithuania	X	X	X	X	X				X		X	X
Romania	X	X	X	X	X	X	X	X				
Bulgaria	X		X	X		X			X			
Poland	X			X	X		X	X				X
Czech Republic	X	X	X	X		X			X	X		
Slovakia	X	X	X	X		X			X			X
Hungary	X	X	X	X		X			X		X	X
Slovenia	X	X	X	X	X	X			X	X		

Sources: Own creation

Table 9: World Bank Indicators

Country	Ease of Doing Business 2014	Ease of Doing Business 2013	Starting a Business	Dealing with Construction Permits	Getting Credit	Lending Interest Rate (%)	Risk Premium (%)
Kazakhstan	50	53	30	145	68	-	-
Kyrgyzstan	68	70	12	66	13	12.8	6.6
Tajikistan	143	141	87	184	159	25.2	20.2
Turkmenistan	-	-	-	-	-	-	-
Uzbekistan	146	156	21	159	130	-	-

Country	Ease of Doing Business 2014	Ease of Doing Business 2013	Starting a Business	Dealing with Construction Permits	Getting Credit	Lending Interest Rate (%)	Risk Premium (%)
Albania	90	82	76	189	13	10.9	5.7
Serbia	93	87	45	182	42	12.2	5.1
Croatia	89	88	80	152	42	9.5	-
Bosnia & Herzegovina	131	130	174	175	73	6.9	-
Montenegro	44	50	69	106	3	9.6	4.8
FYR of Macedonia	25	36	7	63	3	8.5	-
Turkey	69	72	93	148	86	-	-
Belarus	63	64	15	30	109	19.5	-
Moldova	78	86	81	174	13	13.4	-
Russia	92	111	88	178	109	9.1	-
Ukraine	112	140	47	41	13	18.4	-
Armenia	37	40	6	79	42	17.2	7.4
Azerbaijan	70	71	10	180	55	18.3	15.9
Georgia	8	9	8	2	3	22.1	15.3
Estonia	22	21	61	38	42	5.7	-
Latvia	24	24	57	79	3	5.5	5
Lithuania	17	25	11	39	28	6.6	3.2
Romania	73	73	60	136	13	11.3	5.1
Bulgaria	58	57	65	118	28	9.7	9.4
Poland	45	48	116	88	3	-	-
Czech Republic	75	68	146	86	55	5.4	4.8
Slovakia	49	43	108	53	42	5.8	-
Hungary	54	52	59	47	55	9	2.1
Slovenia	33	31	38	59	109	5.9	-

Source: World Bank (2014)

Table 10: Opportunities to Finance Renewable Energy Projects in the Region

Institution	Countries Available	Terms of Financing	Website
National Financing Institutions and Funds (including ERBD's Sustainable Energy Financing Facilities)			
KazREFF	Kazakhstan	EBRD prepares to launch KazREFF, which should provide development support and debt finance to renewable energy projects meeting the required commercial, technical and environmental standards.	–
KyrSEFF	Kyrgyzstan	Has means of $20 million. It provides loans up to $300,000 and grants of up to 20 percent of the loan for private companies in renewable energy.	www.kyrseff.kg/en/
WeBSEDFF	Albania, Serbia, Croatia, Bosnia and Herzegov-ina, Montene-gro, FYR of Macedonia	Locally SMEs with a sound financial and economic structure and sufficient means of equity capital can apply to Western Balkan Sustainable Energy Direct Financing facility for direct loans of between €2 million and €6 million.	www.websedff.com
WEBSEFF	Serbia, Bosnia and Herzegovina, FYR of Macedonia	Western Balkans Sustainable Energy Financing Facility provides loans of between €2 million and €5 million via local banks for private corporation's investments in energy efficiency or renewable energy projects. Loans can cover 100 percent of the investment costs.	www.webseff.com/
TurSEFF	Turkey	Credit lines are provided by EBRD over eligible commercial banks to financially viable private Turkish SMEs. A maximum loan of €5 million for renewable energy projects including technical assistance can be obtained.	www.turseff.org/
BelSEFF	Belarus	A $50 million credit line is available for private as well as public Belarusian companies investing in RE projects which have a positive NPV over a 10-year period by using an 8 percent discount rate in hard currency cash flows.	www.belseff.by/en
Energy Efficiency Fund	Moldova	The main objective of the fund is to attract and manage financial resources for funding and implementing projects in the field of energy efficiency and renewable energy by providing grants, loans and technical assistance for eligible renewable and energy efficiency projects.	www.fee.md/
MoSEFF	Moldova	Private Moldavian firms can receive €25,000 to €2,000,000 in loans for RES projects. Between 5 percent and 20 percent of the loan can be given as a grant.	www.moseff.org/ index.php?id=1&L=1
HBOR	Croatia	Croatian Development Bank offers loans for public and private entities investing in energy efficiency and renewable energy projects. A minimum loan is €13,000 and loans can cover up to 75 percent of the estimated investment value without VAT.	www.hbor.hr/ hrvatski

Institution	Countries Available	Terms of Financing	Website
Fund for Environmental Protection and Energy Efficiency	Croatia	Awards interest-free loans to all legal and natural persons in Croatia for renewable energy projects through tendering processes. The amount and specific conditions vary for each tender.	www.fzoeu.hr/hrv/index.asp
RuSEFF	Russia	Finances up to RUB 300 million (c.€7 million) from funds of the EBRD is available for privately owned, Russian companies targeting an IRR of 10 percent.	www.ruseff.com/
USELF	Ukraine	Provides loans up to $3 million from EBRD and free technical advice for privately-owned companies seeking to invest in renewable energy projects.	www.ukeep.org/
UKEEP	Ukraine	Provides loans starting from €1 million and free technical advice for small and medium projects in renewable energy.	www.uself.com.ua/
ArmSEFF	Armenia	Private Armenian companies investing in renewable energy projects which are financial viable can apply for loans.	www.armseff.org/
RoSEFF	Romania	RES projects of SMEs can receive loans of up to EUR 1 million and grants of up to 15 percent (max. €150,000) of investment costs.	www.seff.ro/
PolSEFF	Poland	Eligible for a loan of up to 100 percent of the investment costs are private Polish SMEs investing in RE projects which generate a minimum of 3kW-h per €1 invested annually.	www.polseff.org/
BEERECL	Bulgaria	Local enterprises can benefit from EBRD loans for small scale RES projects up to €2.5 million and grants (excluding PV) up to 15 percent of the received loan. Eligible are SHPPs up to 10 MW, wind power plants up to 5 MW, biomass power plants up to 10 MW and solar PV power plants up to 1MW.	http://beerecl.com
SLOVSEFF	Slovakia	Projects in the renovation or construction of SHPP (up to 10 MW), wind, solar heat systems, biomass, biogas and geothermal power plant projects with a minimum IRR of 10 percent may be eligible to receive technical advice, funds up to EUR 2.5 million and a grant (up to 15 percent of the loan) through partner intermediaries, e.g. Slovenská sporiteľňa or Tatra banka.	ww.slovseff.eu/
BEECIF	Bulgaria	SMEs can receive loans for RE projects up to 20 percent through partnerships intermediaries (e.g. Allianz Bank Bularia, DSK Bank) and grants up to 50 percent (max. 2 million BGN) of total eligible costs.	www.beeciff.org/
EERSF	Bulgaria	The Energy Efficiency and Renewable Sources Fund provides loans and guarantees for Bulgarian municipalities, private persons and corporations investing in energy efficiency, but also projects utilizing RES.	www.bgeef.com

Institution	Countries Available	Terms of Financing	Website
German-Armenian Fund (GAF)	Armenia	A €40 million loan was concluded between KfW bank and Central Bank of Armenia to promote the utilization of renewable energies and in particular SHPPs, by enhancing the access to loans for private entrepreneurs and private enterprises.	www.gaf.am
Environmental Investment Centre	Estonia	Supports investments in wind energy or CHP projects with capital from CO2 quota sales.	www.kik.ee/en
Rural Development Foundation	Estonia	Offers loans and guarantees in projects investing in the economic development in rural areas.	www.mes.ee/en
Latvian Environment Investment Fund	Latvia	Gives loans if the project provides environmental improvement and is financially sound.	www.lvif.gov.lv
European Investment Fund	Latvia	Gives loans to SMEs via CIP and JEREMIE initiative through intermediate banks.	www.eif.org/what_we_do/where/lv/
Environmental Investment Fund (LEIF)	Lithuania	Supports RE investment projects in the forms of interest subsidies and soft loans. There are two calls per year, which are published in the media and on the LEIF website.	www.laaif.lt/
Fund for the Special Programme for Climate Change Mitigation	Lithuania	Offers loans for applicants not engaged in economic and commercial activities €1,447,270 and for applicants engaged in economic and commercial activities €199,723. The Ministry of Environment and the applicant have to sign a finance agreement and applications have to be sent to LEIF.	www.laaif.lt/
ERDF	Hungary	Via the Operational Programme Environment and Energy small RE developers (geothermal, biogas, wind up to 50 KW, solar up to 500 KW, SHPP up to 2 MW and biomass up to 20 MW) can apply to the National Development Agency to be selected for a subsidy of up to 70 percent of the total eligible costs or maximum HUF 1500 million (approximately €5.07 million) or a loan of maximum HUF 800 million (approximately €2.6 million) at a reduced interest rate of 0.5 percent.	www.nfu.hu/
Eko sklad	Slovenia	The Environmental Fund of the Republic of Slovenia awards low-interest loans to renewable energy projects via tendering. Currently the fund calls for applications to subsidize the reconstruction and renovation of renewable energy plants. Eligible investors are private and public legal and natural persons in Slovenia with a maximum loan of €24 million for municipalities, enterprises and other legal entities (15 years credit period) and €5 million for residents (10 years' credit period).	www.ekosklad.si/

Institution	Countries Available	Terms of Financing	Website
Subsidy Scheme of the Ministry for Infrastructure	Slovenia	The Ministry for Infrastructure and Spatial Planning of the Republic of Slovenia awards subsidies via a tendering process to companies that invest in energy efficiency, renewable energy and CHP projects covering a maximum of 50 percent of the eligible costs of an investment project.	www.mzip.gov.si/
Regional Operating Financing Institutions			
Green Growth Fund	Albania, Armenia, Azerbaijan, Serbia, Croatia, Bosnia and Herzegovina, Montenegro, FYR of Macedonia, Turkey, Moldova, Ukraine, Georgia	Provides direct and indirect (through financial intermediaries) financing for small scale renewable energy projects usually not larger than €50 million.	www.ggf.lu/
NEFCO	Russia, Ukraine	Complements financing from other interested parties and/or financial institutions for eligible projects having a Nordic company or institution as business partner.	www.nefco.org/
Eurasian Development Bank	Kazakhstan Kyrgyzstan, Tajikistan, Russia, Belarus, Armenia	Prioritizes investment in power generating renewable energy projects by providing debt from $30 million to $100 million.	http://eabr.org/e/
Asian Development Bank	Armenia, Azerbaijan, Georgia, Kazakhstan Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan	Asian Development Bank finances private or public organizations with clear development impacts (covering, among others, climate change and environmental sustainability) as well as a sound rate of return.	www.adb.org/
International Finance Corporation	All	Provides loans and equity to eligible private, technically sound and profitable projects either via direct capital or financial intermediaries.	www.ifc.org/
EBRD	All	Provides equity, loans and guarantees in projects from one to 15 years.	www.ebrd.com/pages/workingwithus/projects.shtml
EU Means EIF EIB Structural Funds	Hungary, Slovenia, Serbia, Montenegro, FYR of Macedonia, Turkey, Estonia, Latvia, Lithuania, Romania, Bulgaria, Poland, Czech Republic	Loans and guarantees via commercial banks as intermediaries and private equity/venture capital is available.	http://europa.eu/youreurope/business/finance-support/access-to-finance/

Sources: Own Creation

Table 11: Renewable Energy Investment Opportunities in the Region

Country	Activity	Website
Serbia	The Ministry of Energy, Development and Environment Protection together with UNDP published investor guides for renewable energy technologies. The guides explain in detail the construction process of small hydro, wind, solar, geothermal, or biomass power plants as for example the licences and permits required for plant commissioning or which authorities are involved.	www.undp.org/content/serbia/en/home/presscenter/articles/2013/02/27/guides-for-investors-in-renewable-energy-in-serbia/
Georgia	User manual for the commissioning of SHP power plants is available explaining potential developers finance, negotiation and permit processes.	http://smallhydrogeorgia.org/en/
Georgia	Interactive map illustrating potentially exploitable SHP sites.	www.energy.gov.ge/en/4756
Georgia	List of available and potentially exploitable SHP sites including Pre-Feasibility Studies.	www.energy.gov.ge/en/4756
Kazakhstan	Wind atlas illustrating and measuring the wind potential of the entire country.	www.atlas.windenergy.kz
Kazakhstan	Potentially available wind farm investment projects with pre-feasibility studies.	www.windenergy.kz/eng/pages/Ereymentau_investment_projects.html
FYR of Macedonia	Investors have resources to detailed rulebooks on RES, on RES for Electricity Generation, and on The Method of Obtaining Status of Preferred Generator of Electricity, generated from RES.	www.mek.gov.me/en/library/pravilnici
Azerbaijan	Azpromo, the state owned investment agency of Azerbaijan, offers a list of available RE investment projects.	www.azpromo.az/uploads/structure/files/renewable percent20energy_51f63f05d4ce0.pdf
Bulgaria	Invest in Bulgaria, the state owned investment agency of Bulgaria, offers a list of available RE investment projects.	www.investbg.government.bg/en/projects/environment-and-res-56.html
Slovenia	Invest in Slovenia offers a list of available RE investment projects.	www.investslovenia.org/investment-opportunities/select_category/19/

Sources: Own creation

Table 12: Assumptions for LCOE Calculations

Technology	LCOE in $/MW-h	Plant Capacity in MW	Capacity Factor	Cost of Equity	Cost of Debt	Instalment Costs in $/KW	O&M costs for plant in $/year	Tax	Duration in Years
Turkey: Wind Optimistic LCOE	71.62	1	0.32	12%	6%	1,250	28,032.00	20%	10
Turkey: Conservative LCOE	244.71	1	0.2	18%	8%	2,500	52,560.00	20%	10
Slovenia: Biomass Optimistic LCOE	32.52	1	0.95	12%	6%	2,000	572,696.40	17%	15
Slovenia: Biomass Conservative LCOE	301.94	1	0.4	18%	8%	7,000	968,849.60	17%	15
Ukraine: Solar PV Optimistic LCOE	124.62	1	0.25	12%	6%	2,000	24,690.00	19%	15
Ukraine: Solar PV Conservative LCOE	709.65	1	0.1	18%	8%	4,000	24,750.00	19%	15
Ukraine: Small Hydro Optimistic LCOE	18.78	1	0.55	12%	6%	500	5,000.00	19%	15
Ukraine: Small Hydro Conservative LCOE	92.42	1	0.4	18%	8%	2,000	80,000.00	19%	15

Sources: Installation costs, O&M costs and capacity factors were derived from IRENA (2013), representing upper and lower bounds for the region. For missing values proxies of EIAb (2013) for the U.S.A. were used. Cost of equity and debt, duration and plant size are own assumptions. Tax expenditures were estimated using the corporate tax rate in Slovenia, Ukraine and Turkey derived from E&Y (2014). An equity-debt share of 30:70 was assumed. To keep consistency in the body of the paper, the final LCOE $ values were converted into €.

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