



Overview report

Status and Perspectives for Renewable Energy Development in the UNECE Region 2017

ADVANCED VERSION

Imprint

Publisher

Deutsche Energie-Agentur GmbH (dena)
German Energy Agency
Chausseestrasse 128 a
10115 Berlin, Germany
Tel: +49 (0)30 66 777 - 0 (bei Bedarf 6XX/7XX)
Fax: +49 (0)30 66 777 - 699
E-mail: info@dena.de
Internet: www.dena.de

Authors

Oliver Frank, dena
Tibor Fischer, dena
Laura Prawatky, dena

Pia Dorfinger, dena
Yannik Simstich, dena
Marten Westphal, dena

Reviewer:

Gianluca Sambucini, Secretary, UNECE GERE
Lisa Tinschert, UNECE GERE

This is an updated and extended version of the 2016 “Status and Perspectives for Renewable Energy Development in the UNECE Region” study realised in the framework of the International Climate Initiative (IKI).

This paper was prepared within the context of the work of the Group of Experts on Renewable Energy (GERE) of the United Nations Economic Commission for Europe.

Date: 12/2017

Photo credits:

©istockphoto.com/adamkaz

©wagner-solar.com

Supported by:



Federal Ministry
for Economic Affairs
and Energy

on the basis of a decision
by the German Bundestag

Foreword

The countries comprising the region of the United Nations Economic Commission for Europe (UNECE) are distinct and diverse. This is true not just for language, culture and economic development, but also and especially for their energy markets. When it comes to the use of renewable energy for heating and electricity generation, potential is enormous in virtually all parts of the region. Still, the renewable energy environments of the 56 countries display enormous differences in terms of shares, progress, market structure and policy architecture.

Replacing conventional with renewable energy sources is a matter of sustainability. However, if we have learned one thing from the German energy transition, it is that the process is also a catalyst for profound technological, entrepreneurial and societal innovation. Over the last years, Germany has provided many examples of how such a transition process can work – but also what should rather be avoided. This holds true for all UNECE states. Pooling, sharing and exchanging experience, information and practical knowledge are crucial for the consolidation and further advancement the regional energy transition. On this path, the report offers a meaningful step.

Andreas Kuhlmann
Chief Executive
German Energy Agency (dena)

Contents

- Imprint2**
- Executive Summary7**
- 1 Introduction.....9**
- 2 Setting the scene for the deployment of renewable energies..... 10**
 - 2.1 Key dimensions and factors 10
 - 2.2 Global trends 13
 - 2.3 Fields of application..... 15
 - 2.4 Conclusion..... 16
- 3 Status quo of renewable energy deployment and electricity pricing in the UNECE region..... 18**
 - 3.1 Development of renewable energies 18
 - 3.2 Dynamic renewable energy markets for electricity: PV and wind energy..... 21
 - 3.3 Electricity prices 23
 - 3.4 Conclusion..... 28
- 4 Renewable energy policies in the UNECE region..... 30**
 - 4.1 Promotion of renewable energies in the electricity sector 30
 - 4.2 Promotion of renewable energies in the heat sector..... 34
 - 4.3 Conclusion..... 36
- 5 Policy options to promote renewable energies 37**
 - 5.1 Conclusion and lessons learned 37
 - 5.2 Policy toolbox..... 38
- 6 Making the energy transition work: Implementing policies successfully..... 42**
 - 6.1 Political framework and market regulation..... 44

6.2	Economic viability and financing	50
6.3	Infrastructural capacity and technical feasibility	53
6.4	Acceptance and awareness rising	58
6.5	Conclusion	62
	Figures	63
	Tables	64
	Bibliography.....	65
	Abbreviations	67

Executive Summary

The UNECE region, comprising 56 countries in the Northern hemisphere, is considered a promising region for the deployment of renewable energy technologies. In the region, the development stages of renewable energy deployment are very heterogeneous. The UNECE region includes some of the leading renewable energy markets but also countries with very low levels of renewable energy deployment. The costs of renewable energy technologies were decreasing over the last two decades which led to the emergence of new growth and future markets.

While several UNECE countries offer sound market conditions and an established infrastructure for further deployment of renewable energies, other UNECE countries still provide high potential for picking the 'low hanging fruit' within mostly fairly unexploited renewable energy markets.

In recent years UNECE member States have been characterised by increasing strategic planning in the area of renewable energy deployment, aiming at a transition within their national energy systems. However, in many UNECE countries the inherent potential for renewable energy deployment is inhibited by a number of challenges. Barriers such as an inadequate state of legal and regulatory framework, distorted pricing of energy commodities due to prevailing energy subsidies, a lack of market liberalisation, absence of public acceptance or poor knowledge about the application potential of renewable energy resources still hamper the uptake of renewable energy technologies in the UNECE region.

Within the given scope of encountered market barriers of renewable energy technologies the implementation of locally appropriate and tailored policy measures plays a vital role for renewable energy deployment in UNECE member States. This report aims at supporting the market uptake of renewable energies in the UNECE region by demonstrating the potential for renewable energy deployment and applicability of renewable energy promoting policy instruments for UNECE member States. With this objective, the report on one hand examines the current situation and challenges of renewable energy deployment in the UNECE region and on the other hand presents different policy options for the promotion of renewable energies, their current state of implementation and applicability in UNECE member States. The report draws from rich experience of renewable energy market development in several UNECE countries as well as on the results of two expert discussions held in November of 2017 alongside COP23 with regional energy insiders.

The report reveals that the UNECE region comprises a fairly developed renewable energy market with an installed renewable energy electricity capacity of 869 GW in 2016, accounting for almost half of the 1971 GW worldwide installed renewable energy electricity capacity (without pumped hydro and mixed hydropower). Hydro energy is identified as the most established renewable energy technology for electricity generation, making up 412 GW (388 GW corresponding to large hydro plants) of total renewable energy electricity capacity. Wind energy and PV represent the second and third largest renewable energy electricity markets with installed capacities of respectively 254 GW and 140 GW, however, both markets are identified as the most dynamically growing renewable energy electricity markets. Between 2013 and 2016 the wind energy market grew by a compound annual rate of 7.6% and the PV market by 10.3%.

On the policy level the report concludes that the majority of UNECE member States have adopted renewable energy promotion schemes, specifically 49 member States in the electricity sector and 41 member States in the heat sector. In the electricity sector the most widely established renewable energy promotion schemes are feed-in tariffs or premiums, tax reductions and investment incentives, with each type of these policy instru-

ments being implemented in more than 40 UNECE member States. Promotion schemes within the heat sector are mostly used to encourage heat generation from solar thermal energy, followed by energy from biogas or biomass and geothermal energy.

In summary, the report concludes that no general blueprint can be applied for strengthening the uptake of renewable energy in the UNECE region due to major differences between the structures and stages of renewable deployment in the individual national energy systems. Even if policies are in place, they do not necessarily stimulate renewable energy investment. Therefore ways and strategies on how to implement energy transitions are described. The report develops and presents a toolkit for policy makers which summarises major renewable energy promotion schemes, including their strengths and good practice examples, based on lessons learned from countries with higher renewable energy uptake. The policy toolkit can be applied to individual countries or on a regional level to support further renewable energy market development within the UNECE region. Measures and guidelines for shaping a framework which helps to implement renewable energy projects within the national energy markets are developed in Chapter 6.

1 Introduction

The major aim of the United Nations Economic Commission for Europe (UNECE) is to promote pan-European economic integration among its 56 member States. The UNECE work on sustainable energy is designed to improve access to affordable and clean energy for all and to help reduce greenhouse gas emissions and the carbon footprint of the energy sector in the region. It promotes international policy dialogue and cooperation among governments, energy industries and other stakeholders. The focus is on energy efficiency, cleaner electricity production from fossil fuels, renewable energy, coal mine methane, natural gas, classification of energy and mineral reserves and resources, and energy security. The Group of Experts on Renewable Energy (GERE) has been set up to focus on activities that help significantly increase the uptake of renewable energies and to achieve the objective of access to energy for all in the UNECE region.

The UNECE region is considered to have great potential for renewable energy deployment. On the one hand it comprises established renewable energy markets within several UNECE countries, which offer a sound market environment and well-developed infrastructure for deploying renewable energies. On the other hand, other UNECE member States provide the opportunity of picking the “low hanging fruit” of fairly unexploited renewable energy markets. Nevertheless, the uptake of renewable energies in UNECE member States is partly hampered by a number of challenges, such as an inadequate state of legal and regulatory framework, distorted pricing of energy commodities owed to prevailing energy subsidies, a lack of market liberalisation, absence of public acceptance and/or sometimes little knowledge about the application potentials of renewable energy resources.

The following short report “Status and Perspectives for Renewable Energy Development within the UNECE region” has been commissioned to support the work of GERE as follow up research to the working document “Menu of efficient and economic technologies and policies to promote them in the UNECE region.” The report aims at encouraging the uptake of renewable energies in the UNECE region by raising awareness on the status quo and the prevailing potential of renewable energy deployment in UNECE member States to support decision makers in meeting the encountered challenges. It provides information on policy options to support a transition towards a more sustainable energy supply in the UNECE region, which in turn contributes to achieving the UN Sustainable Development Goals and works for climate change adaption as well as mitigation through the reduction of greenhouse gas emissions.

The report is divided into six chapters. The first and second chapter give an introduction into the theoretical background of renewable energy deployment, analysing its key dimensions, global trends and fields of application. Within the third chapter the status quo of renewable energy deployment and electricity pricing in the UNECE region is investigated. The fourth chapter presents an overview of major renewable energy promotion schemes or measures, examining their current implementation in both the electricity sector and heat sector for each UNECE member State. The fifth chapter summarises main findings and lessons learned through the report, concluding with a policy toolkit and recommendations for the future work of the UNECE GERE. The last chapter focuses on crucial factors on how to make energy transitions work and how to implement policies successfully.

2 Setting the scene for the deployment of renewable energies

For the last few decades the international deployment of renewable energies has been politically encouraged in order to mitigate climate change and to increase environmental protection, security of energy supply as well as economic development. An increased share of renewable energies in national energy mixes helps to mitigate CO₂ emissions and offers opportunities for low-carbon economic growth. Electricity and heat generation from renewable energies is also beneficial for diversifying national energy mixes, which reduces national dependencies on fossil fuels and energy imports, leading to an increase in national energy supply security. Further, the establishment of renewable energy markets helps to stimulate the economy and employment as well as innovation, especially in rural areas and the agricultural sector.

In the following, the background and theoretical underpinning of renewable energy deployment is analysed by determining the corresponding key dimensions and factors, investigating the emergence of important global trends and defining fields of application for each renewable energy source.

2.1 Key dimensions and factors

In terms of economic development, the prevalence of renewable energy technologies, underlying legal frameworks, and availability of natural resources, the UNECE is a heterogeneous region. The given heterogeneity in national energy markets poses a challenge for the application of universal policy solutions for the promotion of renewable energy deployment.

Promotion schemes and mechanisms can help to facilitate the introduction and uptake of renewable energies. However, underlying political, economic, technical and social key factors determine the initial situation of each energy market and have a strong influence on the future trajectory of each renewable energy technology and its field of application.

The following chart Figure 1 provides an overview of important key dimensions (marked by dashed yellow lines) and the corresponding key factors (dark-blue boxes with black borders) for the market development of renewable energies on a national level. Major possible attributes and subcategories of each key factor are listed vertically (boxes with no borders).

The four key dimensions are (1) political/ regulatory, (2) economic, (3) social and (4) technical.

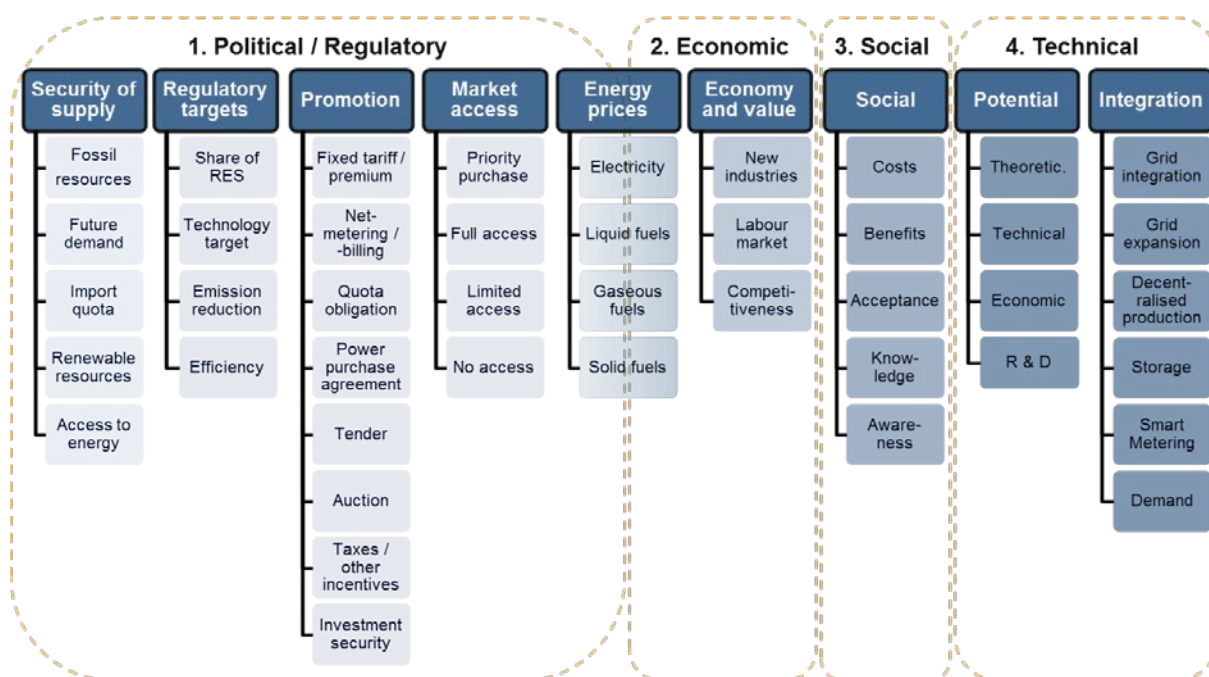


Figure 1 Key dimensions and important drivers for the market development of renewable energies

Political and regulatory dimension

On the political and regulatory level, the five major key factors of renewable energy deployment are energy supply security, regulatory targets of renewable energy, renewable energy promotion schemes, regulations of market access for renewable energy producers and the level of energy market prices. Security of supply is a prevailing motive in energy policies. Increasing renewable energy shares in national energy mixes is considered a potent strategy for enhancing national energy supply security, which is based on the entailed decreasing dependencies on limited fossil fuel reserves and increasing diversification of national energy mixes. The particular level and implemented type of renewable energy regulatory targets also strongly affect the development of renewable energies, since policy targets set the strategic direction of renewable energy promotion schemes. Renewable energy promotion schemes, in turn, can be considered as tools to achieve the respective renewable energy policy targets. The last two key factors, the prevailing regulation of market access for renewable energy producers and energy prices, also particularly the prevalence of energy price subsidies, are fundamental for the market entry and integration of renewable energies, since they influence the competitiveness of renewable energies within national energy markets.

Economic dimension

The national deployment of renewable energies is generally considered as economically favourable, since in-state value added, new industrial branches and employment are created. As key economic factors of renewable energy deployment electricity prices and energy market conditions need to be considered. The level and stability of electricity prices and sales revenues are decisive for the uptake of renewable energies. Low energy prices hamper the market entry of renewable energy technologies if no further promotion schemes are implemented to lift renewable energy prices above energy market prices in order to support the competitiveness

of renewable energies against conventional energy sources. On the other hand, high energy prices might reduce the international competitiveness of local energy intensive industries.

Social dimension

In the social dimension of renewable energy deployment, the key factors are electricity costs, social acceptance, public knowledge and awareness of renewable energy deployment. The particular level of electricity costs constitutes a trade-off between energy affordability or social acceptance and the magnitude of renewable energy promotion, since promotion costs are usually passed through to energy consumer. Additionally, social acceptance for renewable energy deployment is highly dependent on the infrastructural planning of renewable energy expansion, particularly concerning the impact on local landscapes and natural habitats. Therefore social acceptance can be encouraged by proper energy price monitoring and by including the public as relevant stakeholders into the planning process of renewable energy expansion, for example through new business models like community-based renewable energy projects or natural resource management. Also, increasing knowledge about renewable energies is essential for the successful deployment of renewable energy as the application of relatively new technologies is highly dependent on a broad public awareness.

Technical dimension

For a successful technical planning process, a country's renewable deployment potential and system integration requirements for renewable energies need to be analysed. An increasing renewable energy share within national energy mixes changes the entire existing energy system. Therefore the existing system needs to be adapted to the specific characteristics of electricity and heat generation from renewable energy technologies, particularly their fluctuating and decentralised feed-in. Measures to increase the system integration of renewable energies include the expansion of grid capacities, flexible power plant capacities, load management, demand side management and storage, the reduction of 'must run' capacities, as well as the implementation of local supply concepts. Regional cross-border integration can furthermore increase a system's flexibility.

There are major interdependencies between each of the defined key dimensions and factors. Policy makers should be aware of these interdependencies, since the prevailing attributes of the individual key factors might be contrary to the effectiveness of newly or already implemented renewable energy promotion schemes or measures and might hinder further market development of renewable energy technologies. For example, the introduction of promotion schemes for energy efficiency might be ineffective if prices for electricity are low. Policy makers should understand the four key dimensions generally as fields of action, in which barriers for renewable energy deployment can be identified and minimised by considering the key drivers for the direct and indirect promotion of renewable energies.

In summary, no blueprint for a successful approach for shaping stable frameworks for renewable energy deployment exists. Policies and mechanisms need to be applied in a differentiated manner depending on the prevailing national market conditions.

2.2 Global trends

In the early stages of global renewable energy deployment in the 1990s and 2000s the mere expansion of renewable energy technologies had been set as the major renewable energy policy priority. Since then the political, regulatory, economic and technical framework for the deployment of renewable energies has been evolving rapidly, following some distinguishable global trends. The following chart (Figure 2) gives an overview of the emergence of some important trends distinguishing between political, economic and technical level.

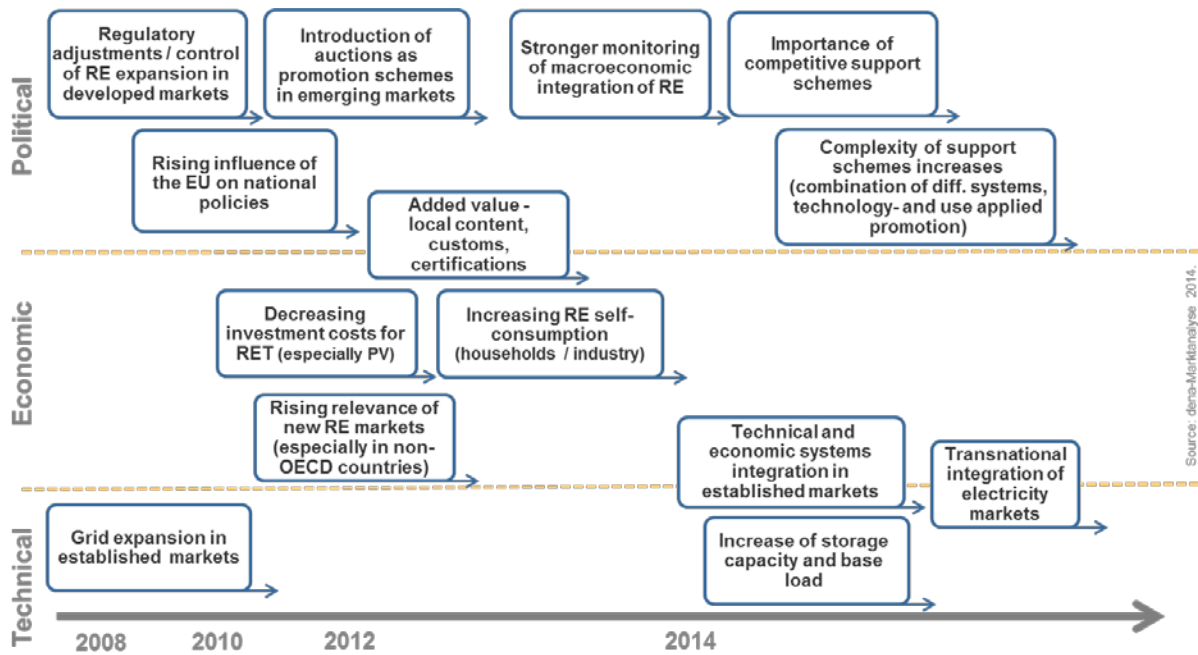


Figure 2 Emergence of important global trends in international renewable energy deployment

After the first phase of global renewable energy deployment, which had been characterised by low political monitoring and a strong focus on the initial creation of renewable energy markets via feed-in tariff implementation, the year 2008 represented a clear break within the political and regulatory landscape of renewable energy deployment. Retroactive cuts on guaranteed feed-in tariffs or the retroactive implementation of taxes were put into effect to limit the further expansion of renewable energies in established markets, such as Spain or the Czech Republic (PV), as feed-in tariffs became too expensive and led to high procurement costs.

Since 2008, governments have been increasingly steering and controlling the deployment of renewable energies through the adoption of new legislation and policy scheme amendments.

Simultaneously, on the technical level, the expansion of grid capacities gained more importance due to increasingly decentralised electricity generation and the fluctuating feed-in of renewable energy electricity, especially from wind energy and PV.

On the political and regulatory level, an increasing influence of EU legislation on national energy policies led, for example, to the mandated obligatory development of National Renewable Energy Plans and EU verifications of national energy legislation, such as the review of the German feed-in-tariff system by the European Commission.

Due to continuous technological development, the investment costs for renewable energy technologies have been decreasing significantly over time, particularly for PV. In the private sector and industry sector, this led to an increased number of entities that generate electricity partly or entirely for their own use, referred to as autoproducers. This resulted in an uptake of new policies improving the integration of autoproducers into the infrastructural and regulatory system.

Furthermore, the decrease in technology costs led to the emergence of new renewable energy markets, especially in developing countries. Up until 2014, industrialised countries consistently contributed the majority of worldwide investments in renewable energies. In 2015, developing countries first invested more in renewable energy (excluding large hydropower) than their developed peers, with 167 and 145 Billion US-Dollars of new investment respectively. Furthermore, investment in renewable energies has recently overtaken investment in conventional energy sources. In 2016, roughly 227 Billion US-Dollars were invested in renewable energy plants (excluding large hydro), with an additional 23 Billion US-Dollars invested in large hydro installation. In contrast, investment in fossil and nuclear power plants only amounted to about 144 Billion US-Dollars in 2016.¹ As a result of the emergence of new renewable energy markets, auction schemes gained international importance as a renewable energy promotion scheme, being initially implemented mainly in emerging renewable energy markets in developing countries and now also often used in other countries as a competitive form of promoting renewable energies.

On the political/regulatory and economic level, local content rules and other local economy promoting market regulations have increasingly been set up in various countries, such as Brazil or Turkey, in order to establish new in-state value changes and to secure national value added in the renewable energy industry.

With the ongoing expansion and uptake of renewable energies, their macroeconomic integration grew more complex. Stronger monitoring of electricity pricing mechanisms, such as the electricity retail price formation, the distribution of renewable energy promotion costs and the influence of “greener” national energy mixes on CO₂ emission prices of emission trading schemes has become increasingly important.

Besides the macroeconomic integration, the technical grid integration of renewable energies has evolved to a crucial aspect in established renewable energy markets. Fluctuating feed-in of renewable energy electricity has made grid balancing and enhancing the grid system’s flexibility new priorities. Fewer and more flexible baseload capacities, increased storage capacities, extended demand-side-management and load management, transnational electricity market coupling etc. have become essential for further renewable energy deployment.

On the political and regulatory level, the complexity of implemented renewable energy promotion schemes has increased. Promotion schemes have become more technology-specific and are combined to a stronger degree. A common trend from implementing purely expansion-oriented feed-in tariffs to introducing more competitive and market-based promotion schemes, such as auction schemes and feed-in premiums, can be observed. This has been particularly supported by the EU regulation mandating the introduction of auction schemes as principal renewable energy promotion schemes by 2017 in all EU countries.

¹ All investment data from the Global Trend in Renewable Energy 2017 report by the Frankfurt School-UNEP Centre.

2.3 Fields of application

Renewable energy sources can play an essential role in the future supply of power, heating and cooling. Figure 3 provides an overview of the various renewable energy technologies and their possible fields of application: (1) Utility scale, (2) industry / commercial, (3) private households and (4) off-grid. The fields of application (2) and (3) refer to autoproducers, which are businesses or private households generating electricity or heat wholly or partly for their own use as an activity which supports their primary activity.² Further Figure 3 illustrates whether a technology only provides power, heating / cooling, or both.

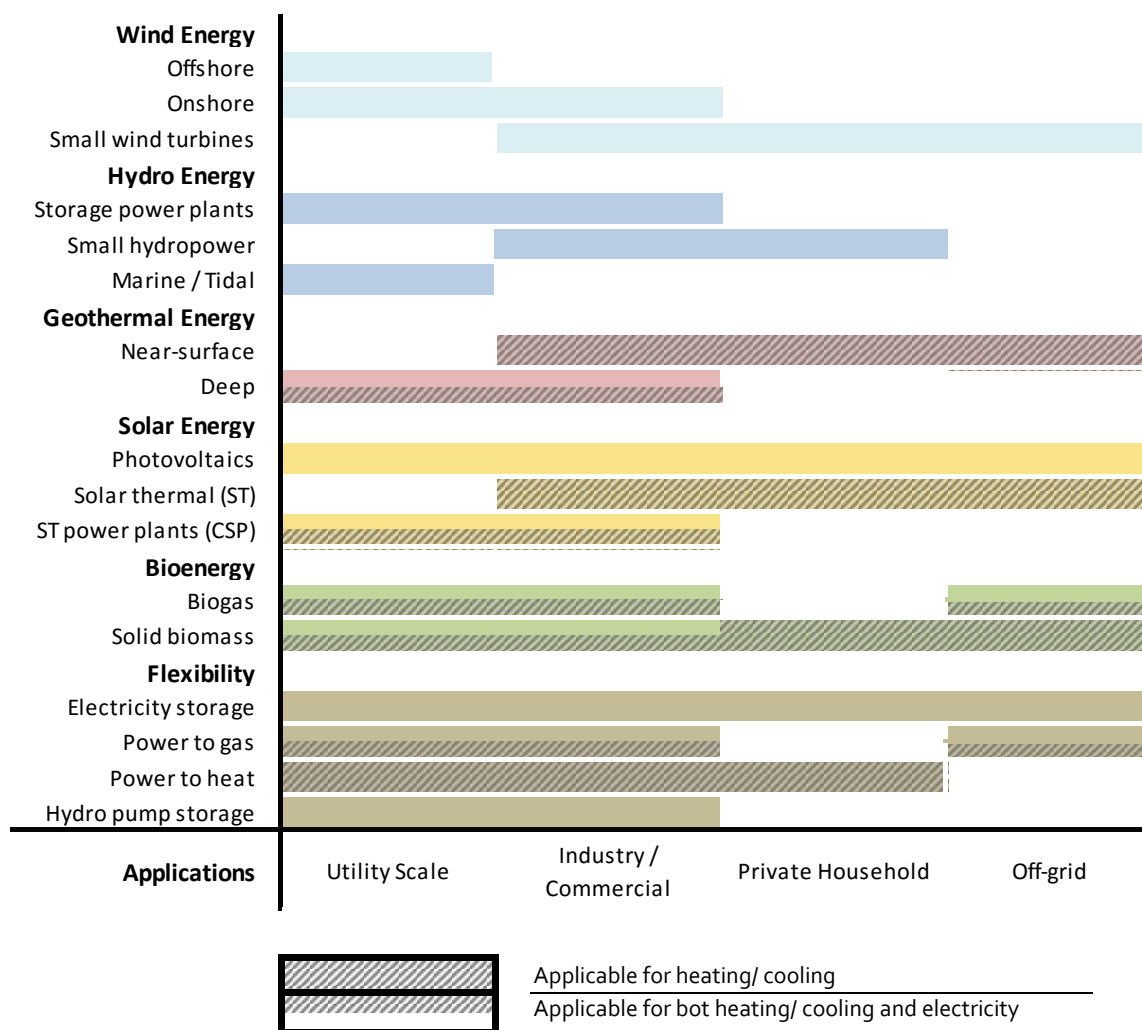


Figure 3 Fields of application of renewable energy sources^{3 4} (except renewable fuels)

² OECD Energy Statistics Glossary

³ Biofuels are not included since they are not an original source of renewable energies but a particular pro-cessing stage of biomass.

⁴ Small scale wind turbines and hydro power plants have been evaluated separately in order to differentiate their fields of application from turbines and plants with high capacities.

The size of wind energy installations largely determines their field of application. Large offshore wind parks only operate on the utility scale, whereas small onshore wind turbines also provide energy for private households or small industrial consumers. While some technologies are only applicable in one or two areas, other technologies can cover a wide array of applications, such as PV, which can provide electricity for vastly differing types of electricity demand, also particularly for off-grid electricity demand. Some technologies are limited to generating either electricity or heat, despite having a common energy source, for example in the case of solar thermal and photovoltaic installations. Other technologies are more versatile, such as biogas, and provide energy which can be used for both, heat and electricity generation.

In the deployment of various renewable energy technologies however, there still must be an accounting of GHG emissions. The special report of the IPCC on “Renewable Energy Sources and Climate Change Mitigation” assesses the total GHG emissions of one kilowatt hour electricity for each energy source by performing life cycle assessments. The findings of the study state that on average, renewable energy technologies generating electricity have significantly lower GHG emissions than fossil fuels, even those employing CCS. The array of renewable energy technologies has values falling on a spectrum of 4-46 g CO_{2eq}/kWh, whereas fossil fuels typically fall from 469-1,001 g CO_{2eq}/kWh. Next-generation biofuels in particular, possess the potential for higher degrees of mitigation by utilising residue and waste products.

2.4 Conclusion

It has been revealed that the deployment of renewable energies is influenced by the impact of key factors from political and regulatory, economic, social and technical key dimensions. These key dimensions and corresponding key factors need to be seen as interrelated fields of actions, in order to define and introduce individual renewable energy promotion schemes and to minimise undesirable obstructions.

The analysis of the development of renewable energy deployment revealed that the emergence of some distinguishable global trends can be recognised. In the early stages of renewable energy deployment the promotion has been particularly concentrated on industrialised countries, with developing and less developed countries gaining in importance in the early 2010s and eventually contributing the majority of the worldwide investments in renewable energies in 2015 and subsequent years. A significant drop in investment costs over time, transnational technology transfer and the international emergence of renewable energy policy goals led to increasing renewable energy deployment also in developing countries. Additionally, the initial primary political objective of merely expanding renewable energies has evolved towards the aim of achieving a cost-efficient and steered deployment. In established renewable energy markets the complexity of promotion schemes has increased, with promotion schemes becoming more technology-specific and being combined to a stronger degree. Furthermore the need to adapt the existing grid and energy system infrastructure to the fluctuating and decentralised feed-in of renewable energies has emerged, requiring the expansion of grid capacities and more system integration via enhanced storage capacities, demand-side-management and more flexible power plants. Also, the integration of an increasing number of autoproducers and newly evolving business models has become a crucial issue. On the macroeconomic level the monitoring of electricity pricing mechanisms and the influence of renewable energy deployment on emission trading schemes has gained particular relevance.

Furthermore, it has been shown that each type of renewable energy source has a variety of possible fields of application, which can be mainly distinguished either into applications for electricity or heat generation and into utility scale applications, lower scale applications in the private or industry sector, or off-grid applications.

When introducing a technology-specific renewable energy promotion scheme the corresponding possible fields of application need to be taken into account in order to identify the systemic requirements in regard to the required infrastructure and promotion mechanisms.

When talking about renewable energies and the promotion of their deployment it is important to critically examine their contribution to climate change mitigation. The special report of the IPCC on “Renewable Energy Sources and Climate Change Mitigation” reveals that the electricity generation from renewable energies compared to the electricity generation from the combustion of fossil fuels does not only produce less GHG during the electricity generation process but also considering the entire life cycle assessment of one kilowatt hour of generated electricity.

3 Status quo of renewable energy deployment and electricity pricing in the UNECE region⁵

This chapter will provide a glance at the status quo of renewable energy deployment in the UNECE region. To a great extent, the research emphasis will lie on the status quo of electricity generation from renewable energy sources, since the regional electricity sector has been the focus of most UNECE countries so far. PV and wind energy will be analysed more thoroughly because they have been the most rapidly expanding technologies (in relative terms) in recent years, requiring particular political focus and regulatory intervention. Furthermore, electricity prices in the UNECE region will be analysed, since they have a strong influence on the potential and success of renewable energy expansion.

3.1 Development of renewable energies⁶

During the last decade the worldwide expansion of renewable energies progressed rapidly. In 2016, the installed electricity capacity of renewable energy sources in the UNECE region (without pumped storage and mixed plants) amounted to about 869GW, of which 388 GW corresponded to large hydropower plants⁷ (LHP). The electricity capacity from renewable energies in the UNECE region accounted thereby for almost half of the 1971 GW installed renewable energy electricity capacity worldwide.⁸ Thus, renewable energies sources for generating electricity other than LHP have developed more expeditiously and dynamically over the last years and therefore contributed the bulk of newly installed capacities.

Across the UNECE region there are differing degrees of establishment and implementation of renewable energy technologies. While some renewable energy sources are exploited in many countries, others have yet to emerge. Hydropower is the most established source of renewable energy for electricity generation, being derived from both, large and small hydropower plants. About one third of all UNECE countries have well established hydropower markets. While hydro energy is used for electricity generation across the UNECE region, it is important to note that markets for wind energy, PV, solar thermal, geothermal, biogas and biomass power generation are almost exclusively established in UNECE countries that belong to the OECD.⁹

There are significant amounts of national energy markets generating electricity from wind and PV as energy sources. Among countries with established onshore wind energy markets are Cyprus, Italy, Lithuania, Portugal and Spain. Significantly fewer countries have strong offshore wind markets, with the biggest being situated in Belgium, Denmark, Germany, the Netherlands, Sweden and the United Kingdom. While wind energy is more prevalent in Western European countries, PV markets have also emerged elsewhere, like Bulgaria, Romania,

⁵ Consideration and use of data from REN21 UNECE Renewable Energy Status Report 2017

⁶ Data from the IRENA Renewable Energy Capacity Statistics 2017

⁷ Large hydropower plants include all installations with a capacity of 10 MW or larger, defined by the International Renewable Energy Agency - IRENA.

⁸ This report considers wind, solar and hydropower, bioenergy, geothermal and marine energy to be renewable energy sources. Pumped storage and mixed storage and hydropower plants are not counted.

⁹ UNECE countries that are members of the OECD: Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, Canada, United States of America (28).

UNECE countries that are not members of the OECD: Albania, Andorra, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Georgia, Kazakhstan, Kyrgyzstan, Latvia, Liechtenstein, Lithuania, FYR Macedonia, Malta, Republic of Moldova, Monaco, Montenegro, Romania, Russian Federation, San Marino, Serbia, Tajikistan, Turkmenistan, Ukraine, Uzbekistan (28).

Slovakia, Slovenia and the Czech Republic. Both wind energy and PV energy markets are increasingly growing all across the UNECE region.

The diagrams (Figure 4 - Figure 7) display the latest renewable energy development in the UNECE region.¹⁰ Depicted are the installed electricity capacities of PV, wind energy, bioenergy and hydropower, and the corresponding growth rates, measured by the compound average growth rate (CAGR).

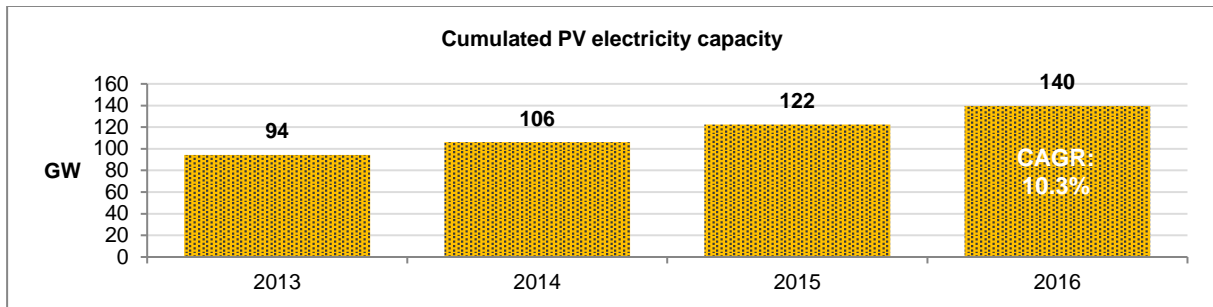


Figure 4 Recent PV development in the UNECE region

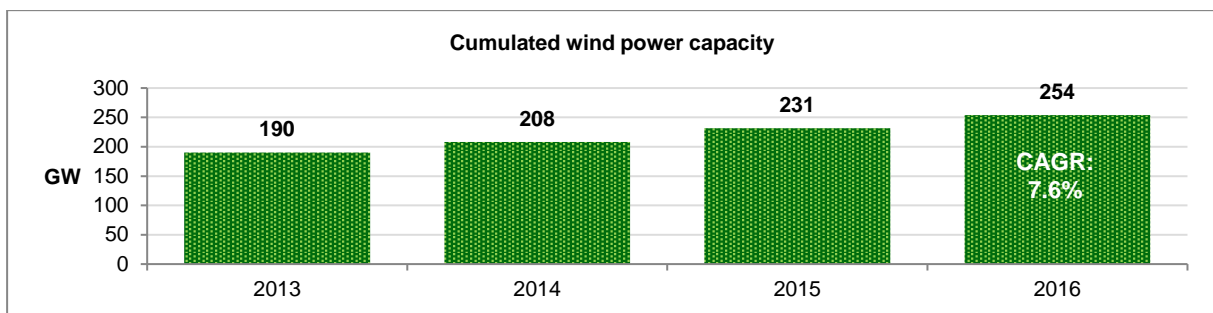


Figure 5 Recent wind energy development in the UNECE region

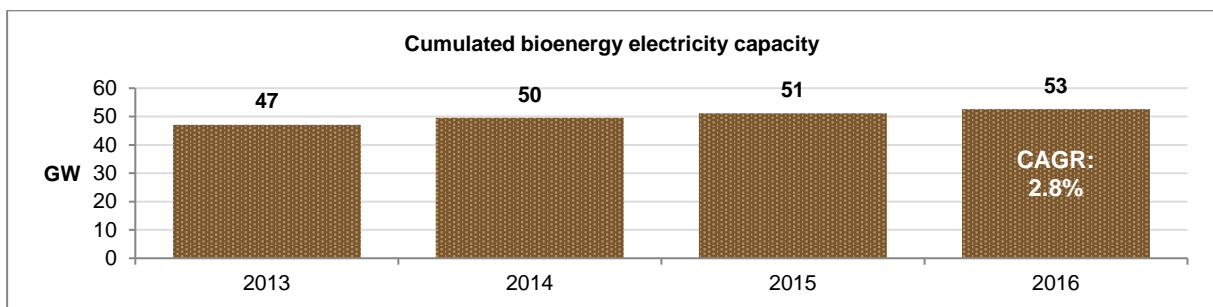


Figure 6 Recent bioenergy development in the UNECE region

¹⁰ Data source: IRENA, Renewable Energy Capacity Statistics (2016). Wind energy includes onshore and offshore installations. Only countries for which data were available are included.

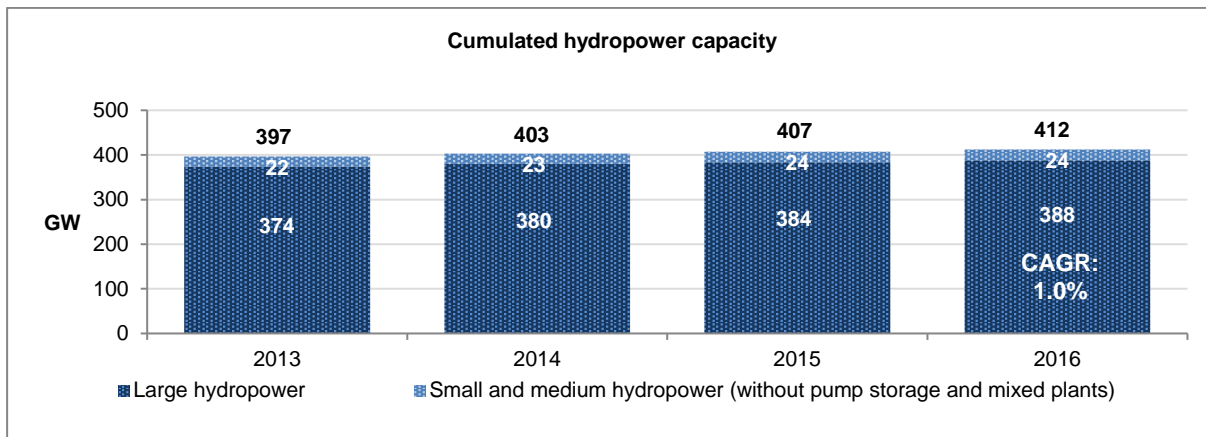


Figure 7 Recent hydropower development in the UNECE region

The size differences of the columns illustrate the growth of the cumulated PV, wind energy, bioenergy, and hydropower capacities in GW between 2013 and 2016. These four technologies are the most significant sources of renewable energy in the UNECE region, contributing 859 GW out of 869 GW installed renewable energy electricity capacity in 2016. The two most rapidly developing renewable energy technologies since 2013 are wind energy and PV.

The cumulative graphs show that recent developments of PV and wind energy differ notably from the growth rate of hydropower and bioenergy. From 2013 to 2016, wind energy capacity has increased annually on average by 7.6%, growing from 190 GW to 254 GW. In the same time period, the PV sector has prospered even more rapidly, with an annual growth rate of 10.3%, growing from 94 GW to 140 GW.

Hydropower capacity has grown less or stagnated in recent years, and at times even receded in UNECE member States. Many countries are already utilising much of their economically exploitable hydropower potential, which implicates a less dynamically growing market with fewer new installations. In the majority of UNECE countries, a significant portion of hydropower comes from LHP, making up between 70% and 100% of hydropower installed capacities. Few countries obtain the majority of their hydropower from small and medium sized plants, pumped storage and mixed plants. In Belgium for example, however, LHP contributes only 39% to the total hydropower capacity. Most notably, the LHP sector has hardly increased in size between 2013 and 2016; its capacities have grown by an average of 0.9% annually. Small and medium sized plants, pumped storage and mixed hydropower plants have increased by over 2 GW brought forth by an average annual growth rate of 1.7%. Overall, the hydropower sector has expanded annually on average by 1.0%.

In numerous countries the modern use of biomass (as opposed to the traditional use like burning wood) and biogas for electricity generation is either already established or new markets are recently evolving. However, bioenergy¹¹ had the smallest electricity generation capacity of the four technologies in the UNECE region amounting to 54 GW in 2016. The sector has grown annually on average by 2.8% from 47 GW to 53 GW between 2013 and 2016.

As described, PV, wind energy, bioenergy, and hydropower are the main renewable electricity sources. The markets of other renewable energy technologies are either not very developed or are mainly used for the generation of heat.

¹¹ IRENA defines bioenergy as “energy derived from organic, non-fossil material of biological origin (biofuels), which can be used for the generation of heat or electricity.”

Main sources for renewable heat generation are geothermal, solar thermal, bioenergy as well as concentrated solar power. Albeit its potential, geothermal energy is exploited only in some UNECE countries. However, there are many countries with potential, and several countries in which markets for geothermal heat are emerging. Solar thermal, on the other hand, is a more established renewable source of heat. Countries, such as Israel, Switzerland, Turkey, and the United States, have significant solar thermal markets. In many other countries, this technology is gaining in importance. The modern use of bioenergy for heat generation is less common in the UNECE region. Concentrated solar power plants are only relevant in the United States and Spain due to site requirements with high solar radiation. Overall, the renewable heat sector of the UNECE region is not as developed as electricity generation from renewable energy sources despite a high potential in many member states.

3.2 Dynamic renewable energy markets for electricity: PV and wind energy

The markets of PV and wind energy can be determined as “dynamic” renewable energy markets for electricity, since their relative growth is noticeably higher compared to other renewable energy sources. Due to their vast expansion, requiring particular political focus and regulatory intervention, deployment of PV and wind energy is more thoroughly analysed in this report. The two graphs below show the recent development of PV and wind energy markets in the UNECE region for each member state. The y-axis displays the compound annual growth rate (CAGR) of installed electricity capacities of PV (Figure 8) and wind energy (Figure 9)¹² from 2013 until 2016 for each UNECE member State, as an indicator for the market growth of the respective national PV and wind energy markets. The x-axis reflects the market share of the particular renewable energy technology as a percentage of total national electricity generation capacity for each UNECE country in 2016. The bubble diameter represents the cumulative national installed electricity capacity of the respective renewable energy technology in 2014. Thus, the two graphs Figure 8 and Figure 9 display national wind energy and PV market growth rates set in relation to their level of national electricity market penetration in the individual UNECE member States. In order to cluster and analyse the countries, the graphs are divided into 4 quadrants (Table 1).

	x-axis left half	x-axis right half
y-axis upper half	Quadrant 2 below-average market share above-average growth rate	Quadrant 1 above-average market share above-average growth rate
y-axis lower half	Quadrant 3 below-average market share below-average growth rate	Quadrant 4 above-average market share below-average growth rate

Table 1 Description of the four quadrants: market share and growth rate

UNECE member States having no or low installed electricity capacities of the particular renewable energy technology, “start” in quadrant 3 (Q3). When their installed capacities start to increase, as new installations are

¹² Data sources: IRENA: Data for renewable energy capacities. EIA: Data for total electricity installed capacity 2014. Values for 2016 are estimates based on calculated trend projections. Only countries for which data were available are included. California is displayed for the purpose of the case study. However, averages were computed omitting California since it is already included in the data for the USA.

added to the low initial capacity, UNECE member States “move” up to quadrant 2 (Q2). Regarding the recorded growth rates within Q2, it needs to be emphasised that high market growth rates values can be attained, since the initial starting values of installed electricity capacities of the particular renewable energy technology are low. Thus, market growth rates especially within Q2 need to be interpreted taking into consideration the initial values of installed capacities of the respective renewable energy technology. High growth rates can often be sustained in the short- to medium-term even if the market share of the renewable energy technology increases, which is the case of UNECE member States in quadrant 1 (Q1). When the growth rate of the particular renewable energy technology eventually slows down, countries “drop” to quadrant 4 (Q4), in which established markets of the respective renewable energy technology can be found. Since the quadrants are not definitive cut-off rules, established markets can also be found in Q3, when they have a large installed electricity capacity of a particular technology, whose market share, however, is small.

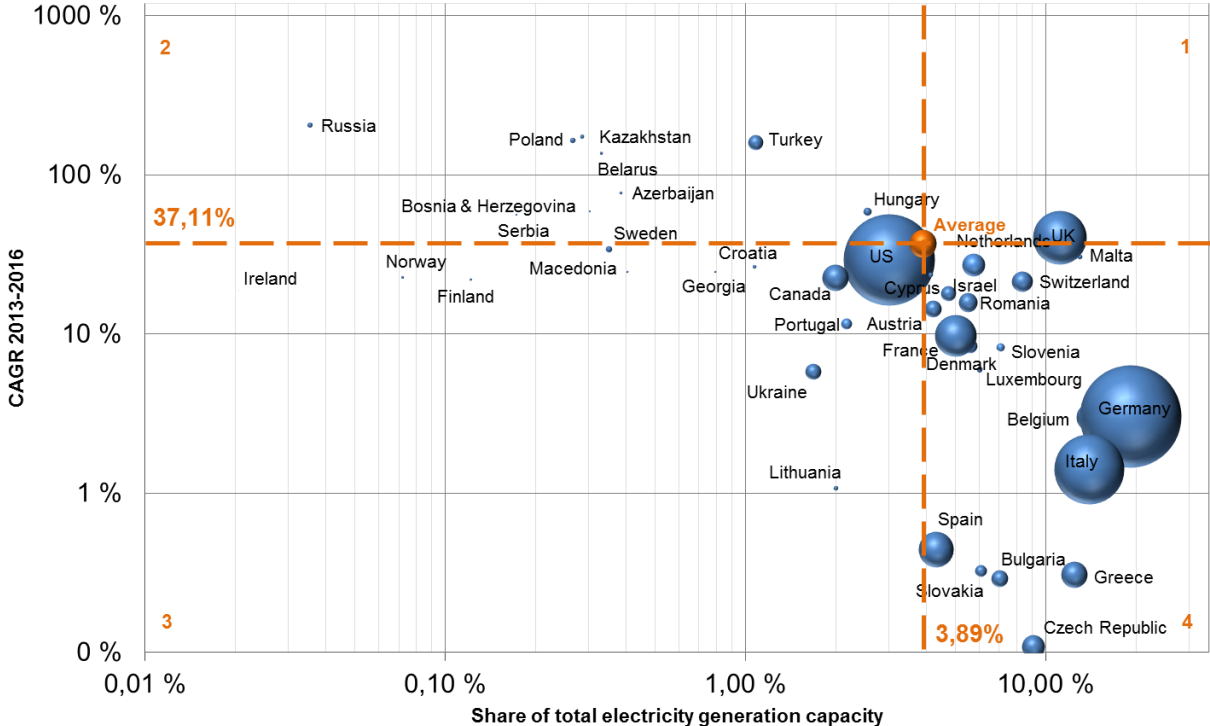


Figure 8 PV market growth in relation to the PV share of total electricity generation capacity in the UNECE region in 2016

Analysing the UNECE deployment of PV, which is depicted in Figure 8, it can be noticed that the average market growth rate³³ between 2013 and 2016 has been high, amounting to 37.1%. At the same time, the share of total electricity generation capacity has stayed low, covering 3.89%. Ireland, Finland, and Norway have been identified as UNECE member States that recently established their PV markets. UNECE countries with still fairly unexploited PV markets but high market growth rates are Kazakhstan, Turkey, Russia and Poland. In Q1 the most promising PV markets with high market shares and high market growth rates are shown, including

³³ Note that the average CAGR in Figure 8 differs from the CAGR in Figure 4. The average for Figure 8 does not weight the countries’ growth rates according to their overall PV capacity. Therefore, small markets like Romania with extremely high growth rates boost the average, as the larger market size of countries with lower growth rates is not accounted for. Hence below-average growth rates are not synonymous to low growth rates. For wind energy, the difference between the CAGRs in Figure 9 and Figure 5 is due to the same reason.

the UK and to a lesser extent Malta. In contrast, established PV markets with high market shares but relatively low market growth rates are Spain, the Czech Republic, Slovakia, Italy and Germany.

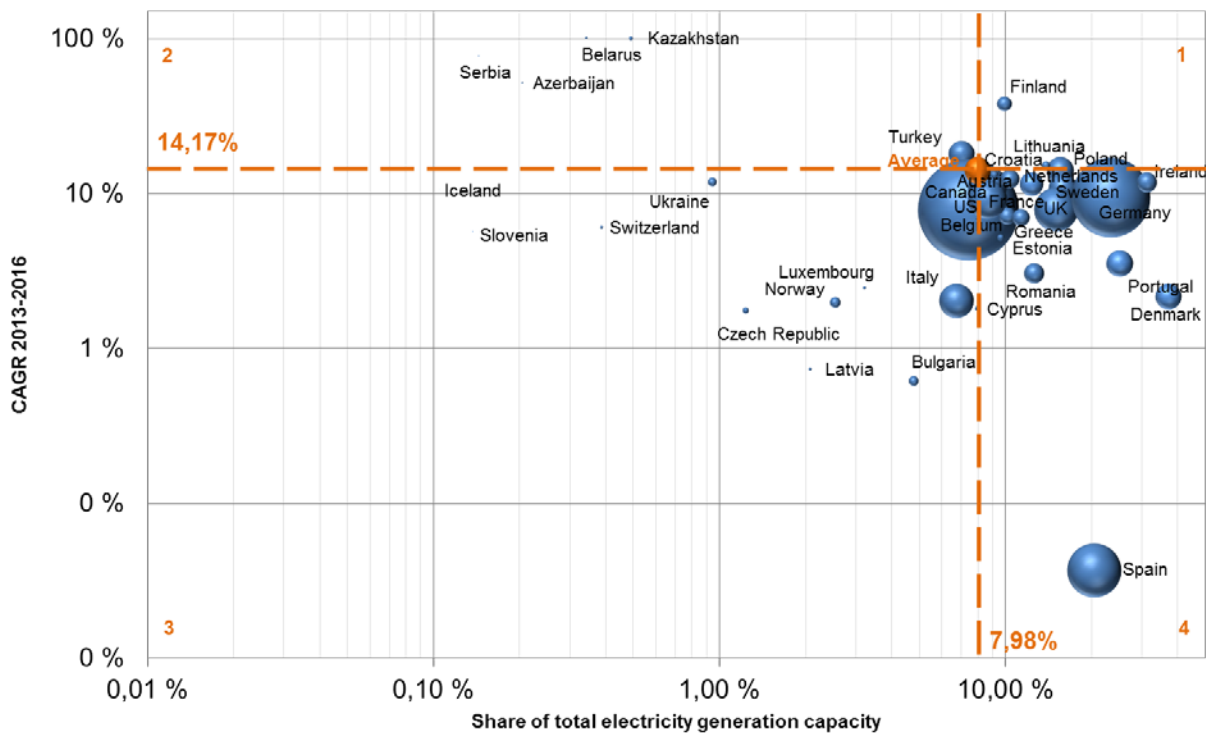


Figure 9 Wind energy market growth in relation to the wind energy share of total electricity generation capacity in the UNECE region in 2016

Looking at the recent wind energy development in the UNECE region displayed in Figure 9, we can observe that the average annual growth rate between 2013 and 2016 has been lower than that of PV, amounting to 14.2%. However, it can also be noticed that the average UNECE wind energy market share of total electricity generation capacity in 2014 was higher than the PV market share, reaching almost 8%. UNECE member States with below-average market shares and below-average market growth rates of wind energy capacities are Latvia, Slovenia and Luxembourg. UNECE member States with below-average wind energy market shares but strong corresponding growth rates are Azerbaijan, Serbia, Belarus and Kazakhstan, Poland and Finland are examples for UNECE member States, in which wind energy markets are already established with high market shares and high growth rates. Established wind energy markets, which have high market shares, are for example Spain, Portugal, Denmark, Ireland or Germany.

3.3 Electricity prices

Electricity prices are a crucial factor for the deployment of renewable energies, since they have a major influence on the economic viability of renewable energy generation and social acceptance for renewable energy expansion, and are a competitive factor for local energy-intensive industries.

Electricity prices are composed of electricity generation costs and an added share consisting of taxes and levies. Electricity generation costs from all types of electricity generating plants determine the electricity market price and are therefore decisive for the level of economic viability of renewable energy generation. UNECE

member States with particular low electricity prices or subsidised electricity derived from conventional energy sources constitute a difficult starting position for the uptake of renewable energies, making the implementation of renewable energy promotion schemes even more important. However, the implementation of promotion schemes entails promotion costs, which are usually redistributed in form of taxes or levies and allocated on top of final consumer electricity prices. This leads to increasing or higher electricity prices, which in turn might result in a decrease of social acceptance for renewable energy deployment. At the same time, given high electricity prices, local energy-intensive industries might suffer competitive disadvantages and consider shifting their production sites abroad.

Hence, in the context of renewable energy deployment the level of electricity prices constitutes an important trade-off between the level of implemented renewable energy promotion schemes, social acceptance and the international competitiveness of local industries. Therefore a thorough consideration and monitoring of electricity price formation is necessary for the successful uptake of renewable energies.

Analysing UNECE electricity prices, a strong heterogeneity between UNECE member States can be recognised for both electricity prices for households (Figure 13) and electricity prices for industrial consumers (Figure 14).¹⁴ In both figures, the y-axis displays the end-consumer electricity price in €-cents, including taxes and levies, and sets it in relation to the respective country's GDP per capita, shown on the x-axis.

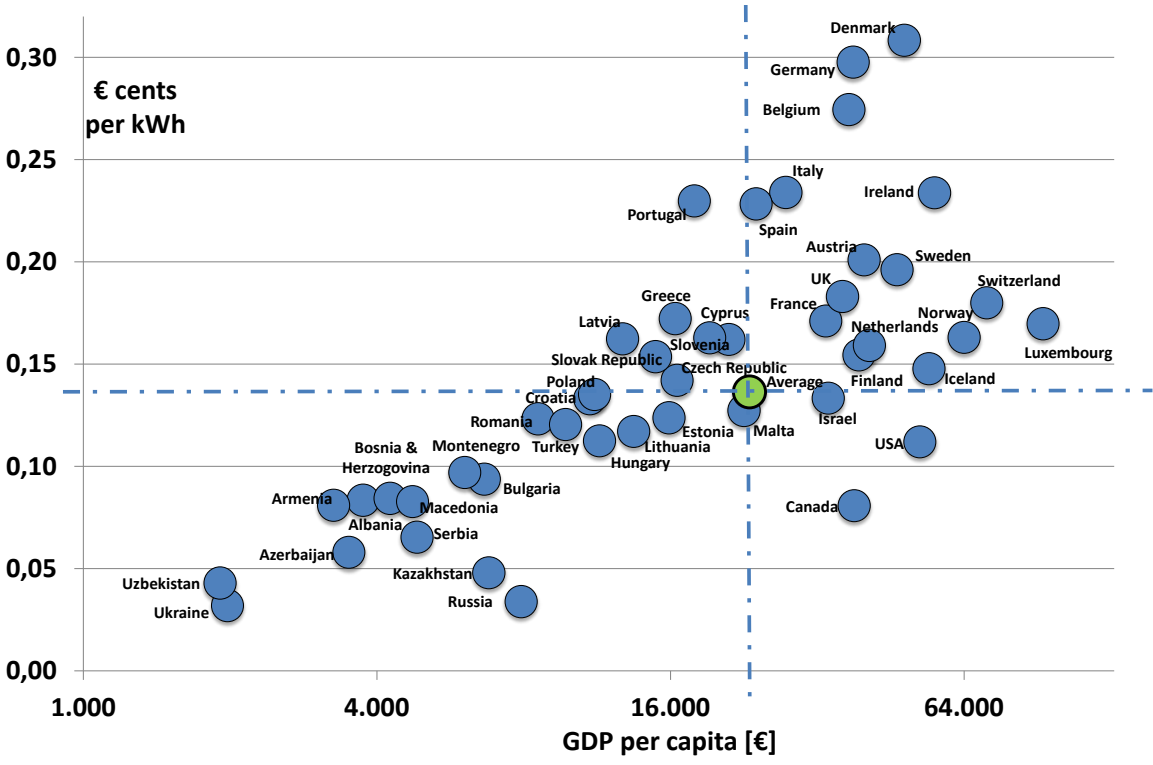


Figure 10 UNECE electricity prices for private households in relation to GDP per capita in 2016

¹⁴ For Figure 10 and Figure 11 all data for GDP per capita are from 2016. Data sources: World Bank.
 For Figure 8- Figure 13 all electricity prices are from 2016, except Albania (2016/2013), Armenia (2014), Azerbaijan(2013), Belarus (2015), Canada (2017), Georgia (2015), Kazakhstan (2011), Kyrgyzstan (2015), Russia (2015), Ukraine (2016/2012), USA (2017), Uzbekistan (2013). Data sources: Eurostat and others.
 Only countries for which data were available are included.

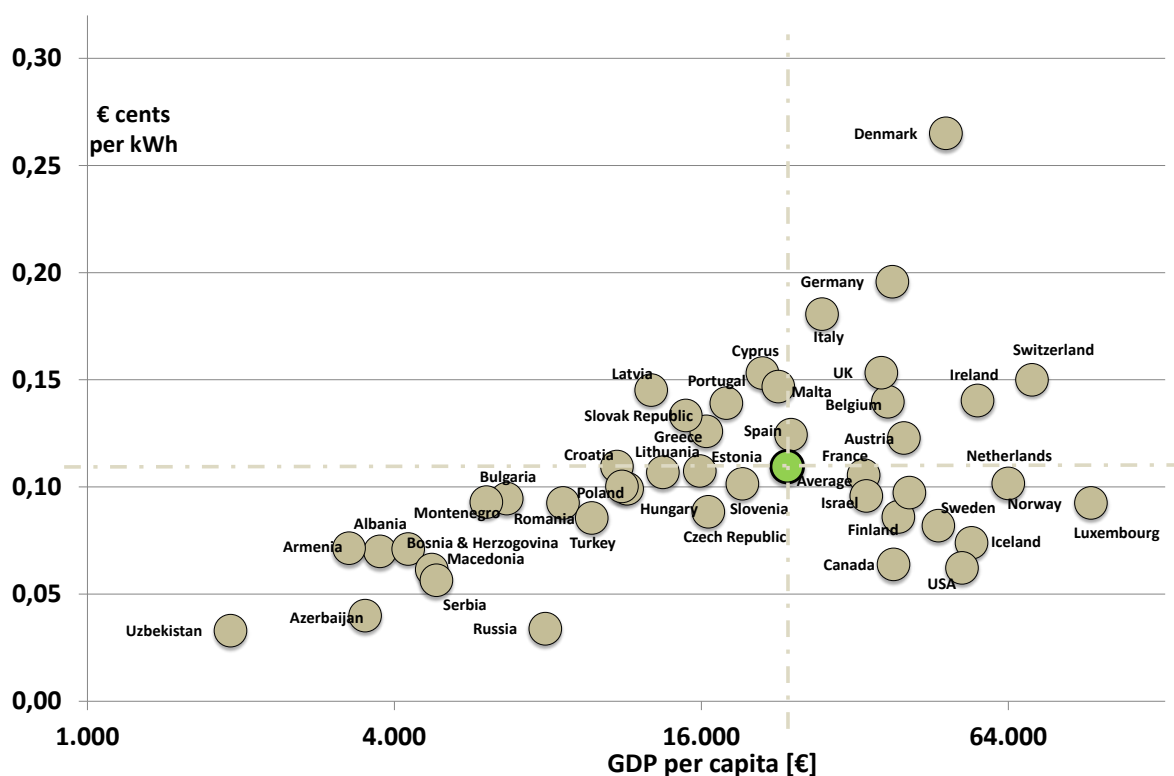


Figure 11 UNECE electricity prices for industrial consumers in relation to GDP per capita in 2016

There here is a significant, positive correlation between the prices end-consumers pay and the GDP per capita of the respective country. While the significant positive correlation also exists for industrial consumers, it is not as strong.¹⁵

Noteworthy is the difference in electricity price levels for households, which are – with only few exceptions – evenly distributed in the range between five and 25 €-cents. This difference is less distinct in the industrial sector. Here, the majority of countries show electricity prices in the range of five and 20 €-cents.

All UNECE electricity prices for households and industrial consumers are displayed in Figure 12 and Figure 13.

The bars in Figure 12 in Figure 13 – arranged in descending order – display both the full price charges to the consumer and the included particular share of taxes and levies.¹⁶

As discussed in the analysis of Figure 10 and Figure 14, UNECE household electricity prices show a much wider range. Also, it should be noted that while in some countries, such as Denmark and Germany, taxes and levies make up more than half of the electricity price charged to consumers, in other UNECE member States taxes and levies are only a small fraction of the price. Lastly, electricity generation costs, including network costs, do not differ greatly across UNECE member States, with the exception of island countries, which consistently show higher electricity generation costs.

¹⁵ The significance of the positive correlations was determined in one sided t-tests at the 1% significance level.

¹⁶ For households, data are taken from an annual consumption range between 2,500 and 5,000 kWh; for industrial consumers the range lies between 500 and 2,000 MWh. Defined by Eurostat. For single-coloured bars, no data were available for the different electricity price components. Taxes and levies include VAT and recoverable taxes.

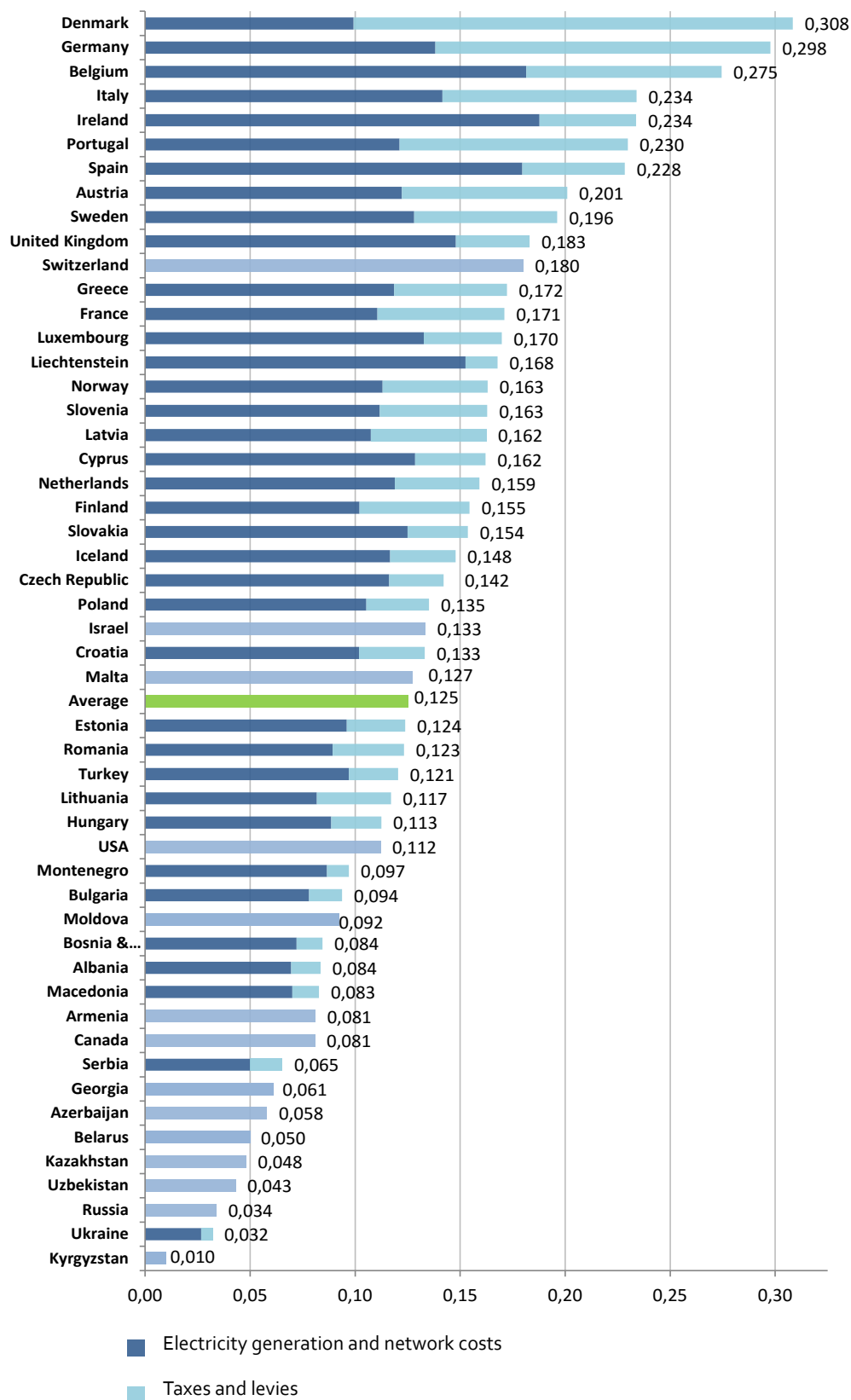


Figure 12 Composition of UNECE electricity prices for households in 2016

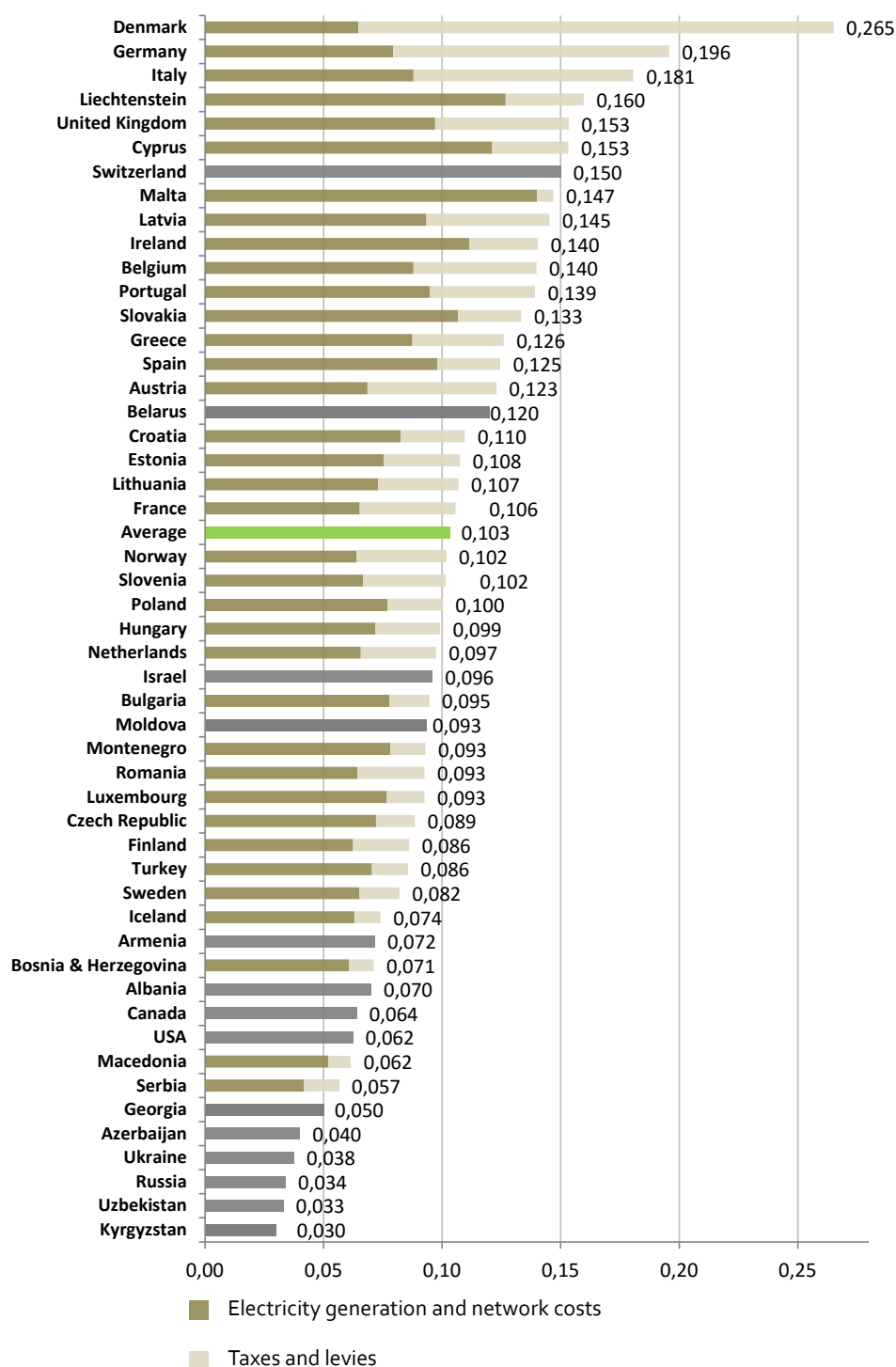


Figure 13 Composition of UNECE electricity prices for industry in 2016

Figure 14¹⁷ shows the differences in average UNECE electricity prices between the private and industrial sector. As we can observe, industrial electricity prices in OECD or non-OECD member states in the UNECE region

¹⁷ Only countries for which data were available are included.

show a smaller divergence than electricity prices in the OECD and non-OECD private sector. The similarity of electricity prices – despite varying levels of GDP per capita in OECD and non-OECD countries – in the industrial sector can be linked to the interest within national economies of strengthening locational competitive advantages by keeping industrial electricity prices low.

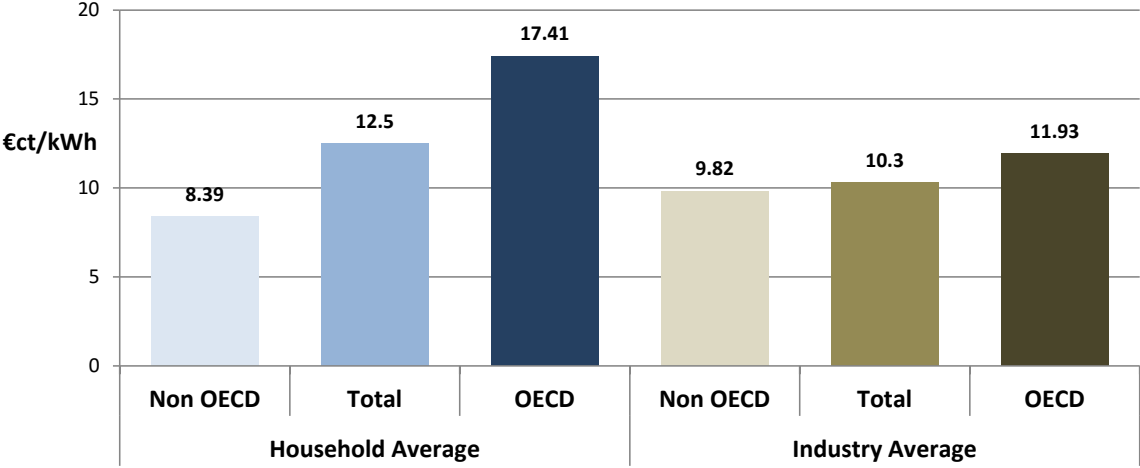


Figure 14 Average UNECE electricity prices for households and industry in 2016

Taxes included in electricity prices are usually refunded to companies. As observable in the graphic, average household electricity prices in non-OECD countries are relatively low, both compared to industrial prices within the non-OECD region and to household prices in OECD countries.

Taxes do have a strong influence on the formation of electricity prices. In some countries electricity prices for households are even lower than electricity generation costs. As discussed above, low, often subsidised electricity prices in combination with a lack of promotion schemes can hinder the market uptake and integration of renewable energy technologies, as renewable energy technologies will be unable to compete with conventional electricity generation technologies on the energy market. Here, promotion schemes such as feed-in tariffs or premiums, quota systems or auction schemes or the reduction of fossil fuel subsidies can help to make renewable energies more competitive, lifting the renewable energy electricity sales price above the electricity market price based on different mechanisms.

3.4 Conclusion

The status quo analysis shows that the renewable energy deployment in the UNECE region varies considerably across its member states. Electricity capacities from renewable energy sources have grown substantially for more than a decade. While the “dynamic” renewable energy technologies, wind energy and PV, are expanding at high rates, hydropower and bioenergy markets have had lower growth rates. Large hydropower plants contribute a great amount to the total installed renewable energy electricity capacity. Overall, the renewable electricity market is much more developed than the renewable heat sector in the UNECE region.

The analysis of UNECE electricity prices depicts that the price range is greater for households than for industrial consumers, which can be linked to the interest of national economies to strengthen locational advantages and attract further investment. While electricity generation costs, including network expenses, are comparatively homogenous across UNECE member States, a greater heterogeneity can be recognised between the UNECE national shares of electricity taxes and levies. The shares of taxes and levies, which are included in the

total electricity price, range from close to zero to almost two thirds. Very low electricity prices hinder the market entry of renewable energies. In this context direct or indirect subsidies of conventional energy sources should be minimised to support the deployment of renewable energies. Furthermore, the implementation of renewable energy promotion schemes can help to increase the competitiveness of renewable energies.

4 Renewable energy policies in the UNECE region

Renewable energy promotion schemes aim at facilitating the market entry, system integration and market growth of renewable energies. The respective success of each implemented promotion scheme depends on various factors. On the one hand, policies need to be predictable, consistent and steady in the long term in order to create stable market conditions and planning security for all stakeholders, such as plant operators, investors and end consumers (Swisher and Porter, 2006). On the other hand, the effectiveness of renewable energy policies strongly depends on their applicability within the prevailing energy market structure and the given attributes of the key dimensions and factors of renewable energy deployment, as described in Chapter 2.1. Also, if several renewable energy promotion policies are combined their reciprocal impact needs to be considered in order to avoid mutual obstructions.

In the following first subsection, major renewable energy promotion schemes and measures for the electricity sector are presented and explained before their current status of implementation is analysed for each UNECE member State. Although the application of renewable energy promotion schemes and measures can be restricted to certain technologies, the evaluation of their current stage of implementation in the UNECE region will be analysed on an aggregated technological level to avoid excessive complexity. In the second subsection, the current state of renewable energy policy implementation in the heat sector is examined for each UNECE member State, distinguishing the existing promotion schemes by the promoted renewable heat source. Furthermore, the existence of promotion schemes for renewable energies in the UNECE building sector is investigated for each UNECE member State.

4.1 Promotion of renewable energies in the electricity sector

As revealed in the status quo analysis of the UNECE renewable energy deployment in Chapter 3.1, the market of renewable energy electricity generation is rapidly growing in the UNECE region. This is strongly linked to the implementation of a wide range of renewable energy promotion schemes and measures in the UNECE electricity sector, which are listed and explained in Table 2. These major renewable energy promotion schemes and measures of the electricity sector can be broadly categorised into non-financial and financial support schemes.

Non-financial policy instruments support the deployment of renewable energies by facilitating their market entry and integration through the improvement of the given infrastructural framework conditions. These non-financial instruments comprise for example, officially communicated renewable energy electricity expansion goals, guaranteed grid access, priority feed-in, net metering or net billing etc. Guaranteed grid access entitles independent power producers (IPP) and autoproducers, such as private households or industrial entities, to grid access. The guaranteed grid access for power plants might be limited by a certain minimum or maximum capacity value. Priority feed-in builds upon guaranteed grid access and prescribes the mandatory purchase of renewable energy electricity by utilities. Net metering or net billing are billing mechanisms which credit renewable electricity generating entities for the net value between their supplied electricity fed into the grid and their demanded electricity. Produced electricity surpluses are thereby remunerated either as electricity credit counting towards future electricity demand (net metering) or as direct financial compensation at an agreed rate or tariff (net billing).

Financial support policy instruments promote renewable energy deployment by setting investment incentives for renewable energy technologies. They can be categorised into general financial support instruments and into support schemes, which are implemented to lift electricity sales prices for renewable energies above electricity market prices, in order to overcome the lacking competitiveness of renewable energies compared to conventional energy sources.

The first category of financial support schemes, referred to as general financial support instruments, comprises investment subsidies, credit grants, reduced rates of interest, tax credits or exemptions, governmental R&D expenditures, etc.

The second category of financial support schemes, which have been defined as electricity-price-related support schemes, can be subdivided into price-based, quantity-based or hybrid promotion schemes.

Feed-in tariffs or premiums are referred to as price-based promotion schemes, since they grant long term stable remuneration for the generation and feed-in of renewable energy electricity. The feed-in of renewable energy electricity is either remunerated with a fixed tariff (feed-in tariffs) or at the electricity market price, which is topped up by a varying market premium (feed-in premiums).

Quantity-based renewable energy promotion schemes are mainly quota systems. When implementing quota systems, such as renewable portfolio standards or renewable obligations, a certain renewable energy share of total electricity generation is mandated from national utilities. Quota systems are often combined with a trading system of certificates, which are referred to as green certificates or renewable energy certificates. These certificates are issued to electricity generating entities for each unit of generated renewable electricity and can be traded. The price for each certificate is determined by the market, based on the total amount of traded and supplied certificates and the demanded amount of certificates, which is highly influenced by the mandated renewable energy quota.

Auction schemes can be considered as hybrid renewable energy promotion schemes, since they include elements of both price-based and quantity-based promotion schemes. In the context of renewable electricity projects, auctions are public bidding processes, in which long term contracts are awarded for the purchase of renewable electricity. These contracts are referred to as power purchase agreements (PPAs) and are awarded either for an agreed amount of renewable electricity generation or for the electricity output of an auctioned amount of installed renewable electricity capacity. Auctions allow for a stable remuneration for renewable electricity generation, as also guaranteed by price-based promotion schemes. At the same time, auctions enable legislators to have a quantity control on the expansion of installed renewable electricity capacities, as also guaranteed by quantity-based promotion schemes. In auctions, the auctioned long-term contracts are awarded exclusively based on price criteria, such as lowest electricity generation costs. By contrast, in tendering procedures long-term contracts are awarded based on various factors, which is why tendering is referred to as multi-criteria auction.

Promotion Scheme	Description
Expansion goal	Definition and official communication of (technology-specific) binding or non-binding expansion goals.
Grid access /	Guaranteed grid access for independent power producers or auto-producers possibly restricted by capacity limits.

Grid access with capacity limits	Prescribes the mandatory purchase of renewable energy electricity by utilities.
Priority feed-in	Billing mechanisms, in which renewable electricity generating entities are credited for the net value between their supplied electricity fed into the grid and their demanded electricity. Produced electricity surpluses can be remunerated as electricity credit counting towards future electricity demand (net metering) or as direct financial compensation at an agreed rate or tariff (net billing).
Net Metering /	Remuneration for the feed-in of renewable energy electricity. The feed-in of renewable energy electricity is either remunerated with fixed tariffs (feed-in tariffs) or at electricity market prices topped up with an adjusting market premium (feed-in premiums).
Net Billing	Obligatory renewable energy share of energy electricity supply or demand, mandated from utilities. Quota systems are often combined with a trading system of certificates, which are referred to as green certificates or renewable energy certificates.
Feed-in tariff or premium	Tradable certificates, which are often used in combination with quota systems. The certificates are issued for each unit of generated and supplied renewable energy electricity.
Quota system (renewable portfolio standards, renewable obligations)	Definition and official communication of (technology-specific) binding or non-binding expansion goals.
Green certificates/ Renewable energy certificates	Guaranteed grid access for independent power producers or auto-producers possibly restricted by capacity limits.
Auctions	Prescribes the mandatory purchase of renewable energy electricity by utilities.
Tender	Multi-criteria auctions.
Other financial incentives	Investment subsidies, credit grants, reduced rates of interest, tax credits or exemptions, governmental R&D expenditures etc.

Table 2 Renewable energy promotion schemes and measures in the electricity sector

The current stage of promotion scheme implementation for renewable energies in the electricity sector is depicted in Figure 15, which reveals that UNECE member States do not only have expansion goals in place but have implemented various promotion schemes and measures to support the market entry, integration and growth of renewable energies.

Country	Official expansion goals	Grid access	Grid access with capacity limits	Priority feed-in for renewables	Feed-in tariff or premium	Renewable Portfolio Standard / Quota System	Green certificates	Auction	Tenders	Net Metering / Net Billing	Investment incentives / tax benefits / subsidies
Albania											
Armenia											
Austria											
Azerbaijan											
Belarus											
Belgium											
Bosnia & Herzegovina											
Bulgaria											
Canada											
Croatia											
Cyprus											
Czech Republic											
Denmark											
Estonia											
Finland											
France											
Georgia											
Germany											
Greece											
Hungary											
Iceland											
Ireland											
Israel											
Italy											
Kazakhstan											
Kyrgyzstan											
Latvia											
Lithuania											
Luxembourg											
Macedonia											
Malta											
Moldova											
Montenegro											
Netherlands											
Norway											
Poland											
Portugal											
Romania											
Russia											
Serbia											
Slovakia											
Slovenia											
Spain											
Sweden											
Switzerland											
Tajikistan											
Turkey											
Turkmenistan											
Ukraine											
United Kingdom											
USA											
Uzbekistan											
52	45	33	15	25	43	13	8	14	18	14	44

Figure 15 Renewable energy promotion schemes and measures in the electricity sector of UNECE member States

Out of 52 analysed UNECE member States¹⁸, 45 have official, to a certain extent technology-specific, renewable energy expansion goals. While in 33 UNECE countries utilities, IPPS and lower scale autoproducers in the industrial and private sector have unlimited grid access, 15 countries restrict their guaranteed grid access by capacity limits. Priority feed-in is set up in 25 UNECE countries.

While 43 UNECE member States promote renewable energy deployment via price-based feed-in tariffs or premiums, only 13 UNECE member States impose quantity-based obligatory renewable energy electricity shares within a quota system. Eight UNECE member States have introduced tradable green or renewable energy certificates alongside their quota system and six UNECE member States have implemented a trading scheme of green or renewable energy certificates without establishing a quota system. Auctions are increasingly used as a renewable energy promotion scheme. They are deployed in 14 national energy markets, while tendering is even used in 18 countries.

Net metering or net billing is deployed in 14 UNECE member States. Tax reductions and other investment incentives for renewable energies often play a complementary role to other measures and are used in 44 UNECE member States.

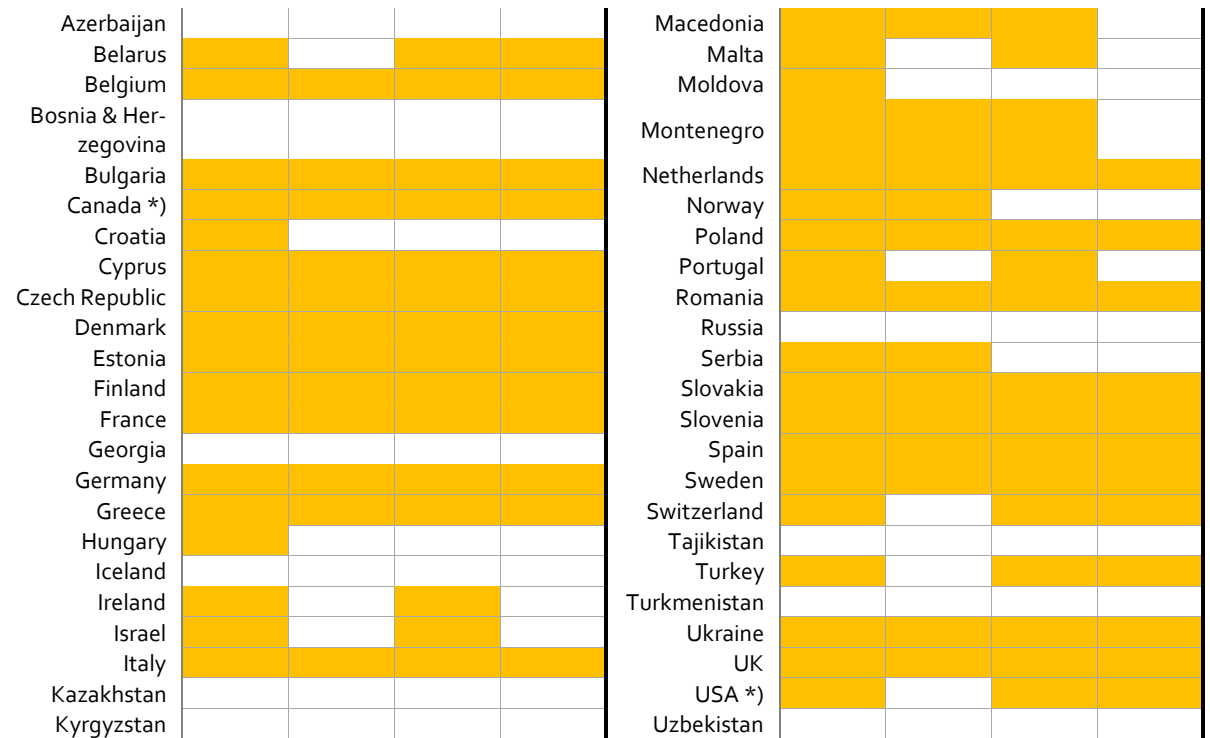
4.2 Promotion of renewable energies in the heat sector

Figure 17 gives an overview of the UNECE countries that have policy schemes and measures in force for promoting renewable energies in the heat market, mostly through subsidies, low-interest loans, tax regulations, or a combination of these instruments. While the first column indicates whether or not there is at least one promotion scheme in place, the remaining columns describe which renewable heat technologies are promoted in the respective country. Out of 52 analysed UNECE countries, 41 (more than two thirds) promote at least one technology. However, the majority of countries with promotion schemes in place support all three technologies, i.e. biogas/biomass, solar thermal and geothermal energy. Overall, heat from solar thermal energy is promoted the most.

In Figure 18 legal requirements and promotion schemes for the use of renewable energy technologies in the building sector are displayed. Certain UNECE member States promote renewable energies in the building sector through financial incentives; others have established legal requirements for the use of renewable energies and some countries do both. More than half of the UNECE countries have already implemented renewable energy promotion schemes in the building sector, while eight countries are still developing suitable renewable energy promotion schemes and ten are even not yet planning to promote renewable energies in the building sector.

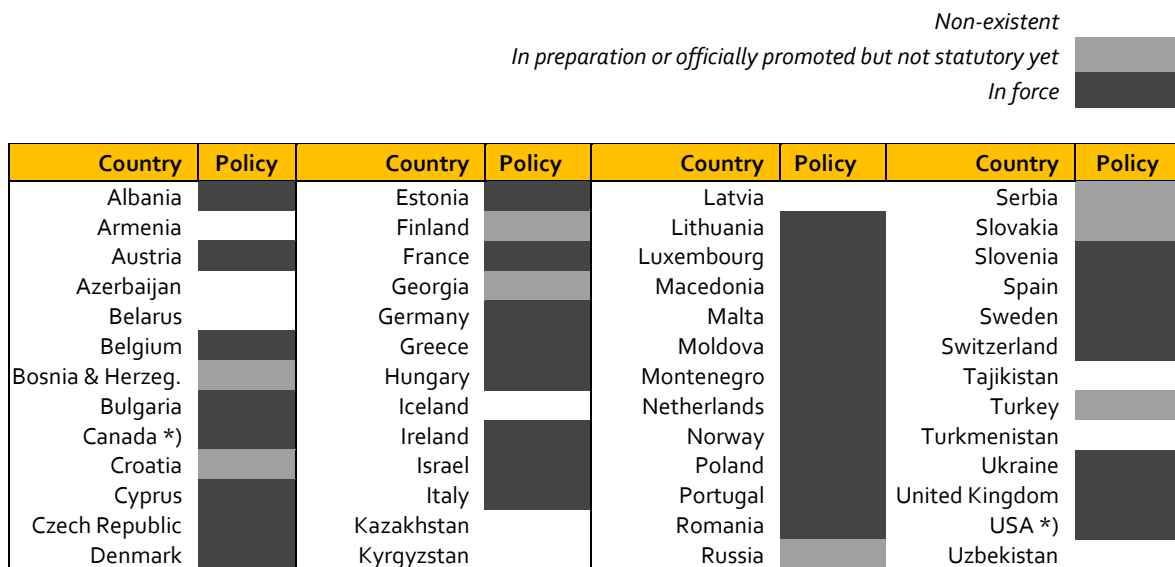
Country	Promotion scheme(s) in force	Biogas/ Biomass	Solar thermal	Geothermal	Country	Promotion scheme(s) in force	Biogas/ Biomass	Solar thermal	Geothermal
Albania					Latvia				
Armenia					Lithuania				
Austria					Luxembourg				

¹⁸ Andorra, Liechtenstein, San Marino und Monaco have not been included due to a lack of data.



*) Schemes are not always based on federal promotions, different support schemes on state or provincial level
Sources: RES Legal, IEA, solarthermalworld.org and others

Figure 16 Renewable energy promotion schemes and measures in the heat sector of UNECE member State



*) Schemes not always based on federal promotions, different support schemes on state or provincial level, Sources: BuildUp.eu and others

Figure 17 Legal requirements or promotion schemes for renewable energies in the building sector of UNECE member States

A comparison between the existing implemented promotion schemes for renewable heat and renewable electricity generation reveals that, until today, governments mainly focus on the renewable energy promotion in the power sector. Renewable heat is still a niche of policy making despite the great potential, particularly in

the UNECE region, since its member states are geographically situated in the Northern hemisphere, which is why their energy markets also possess larger heat markets than countries in warmer regions.

4.3 Conclusion

The analysis reveals that the large majority of the 52 analysed UNECE member States have not only officially set renewable energy expansion goals, but also implemented a wide range of renewable energy promotion schemes and measures in the electricity and heat sector to achieve these goals. The integration of renewable energies within the electricity sector has thereby received greater political emphasis, which is indicated by 49 UNECE member States having adopted renewable energy promotion schemes or measures in the electricity sector, as opposed to 41 UNECE member States in the heat sector.

The most widely adopted policy instruments in the electricity sector are feed-in tariffs or feed-in premiums, tax reductions and investment incentives, with each type of these policy instruments being implemented in 43, respectively 44 UNECE member States. In the heat sector the most strongly supported renewable energy source is solar thermal energy, followed by energy derived from biogas or biomass and geothermal energy. These renewable energy heat sources are respectively promoted by 35, 29 and 28 UNECE member States. In the building sector the integration of renewable energy sources is promoted by two thirds of the UNECE countries, while eight UNECE member States are currently still developing renewable energy promotion schemes or measures and ten UNECE member States have no promotion scheme or measure in place or planned.

Although the revealed status quo of renewable energy policy implementation in the UNECE region seems to be at an advanced level, it needs to be emphasised that the mere implementation of renewable energy promotion schemes and measures does not necessarily lead to an uptake and integration of renewable energies in the UNECE electricity and heat sector. In order to be effective, renewable energy policies need to be predictable, consistent and steady in the long term, aligned to the prevailing energy market structure, adjusted to the attributes of the defined key dimensions and factors of renewable energy deployment and coordinated with other implemented policies.

5 Policy options to promote renewable energies

In view of the UNECE GERE objective of promoting the uptake of renewable energies, improving the access to affordable energy sources and increasing energy efficiency, this report analyses the status and perspectives for renewable energy development in the UNECE region. Within this scope, first, the given background of renewable energy deployment has been outlined, identifying key dimensions and factors, the emergence of global trends and fields of application. Second, the current status quo of renewable energy deployment and the corresponding growth of renewable energy markets in the UNECE have been examined. Furthermore, all major promotion schemes have been described and the status of their implementation in the UNECE electricity and heat sector has been determined for each member state. Eventually six exemplary case studies of renewable energy policies and deployment in UNECE member States have been presented, identifying possible courses of action and evaluating gathered experience in order to draw conclusions on major market entry barriers, opportunities and good practice for renewable energy development in the UNECE region.

5.1 Conclusion and lessons learned

When looking at the development of international renewable energy deployment, there is a clear emergence of some distinct global trends. In the early stages of global renewable energy deployment, the promotion of renewable energies has taken place especially in developed and emerging UNECE countries. In the course of time, investment costs for renewable energy technologies have dropped and transnational technology transfer as well as the international dissemination of renewable energy policy goals have increased, which led to an increase in the uptake of renewable energies particularly in developing UNECE countries. In established renewable energy markets, policies aiming initially at mere renewable energy expansion have evolved into policies pursuing a cost-efficient and steered renewable energy deployment. Also, the complexity of promotion schemes and the need to adapt energy system infrastructures to the highly fluctuating and decentralised feed in of renewable energies have increased. Further, the regulatory integration of renewable energy auto-producers and newly evolving business models has gained importance. On the macroeconomic level, the monitoring of the influence of renewable energy deployment on pricing mechanisms, such as on the level of electricity and energy prices or CO₂ prices within emission trading schemes, has become a crucial aspect.

Analysing the status quo of renewable energy deployment in the UNECE region, the report has revealed that the uptake of renewable energies has already progressed well, although major differences considering the stage of renewable energy expansion have been recognised between the individual UNECE member States (see Chapter 3, referring to shares of total generation capacity). With an installed renewable energy electricity capacity of 869 GW, the UNECE region accounts for almost half of the 1971 GW worldwide installed renewable energy electricity capacity. Hydro energy has been identified as the most established renewable energy technology for electricity generation, making up 412 GW (388 GW corresponding to large hydro plants) of total renewable energy electricity capacity. Electricity capacities from renewable energy sources have grown substantially in the UNECE region over the last few years, which is largely due to the rapid expansion of wind energy and PV, showing high growth rates in several UNECE countries such as Ukraine and Kazakhstan (wind energy), Russia and Turkey (PV). Although wind energy and PV markets are the most dynamic growing renewable energy electricity markets in the UNECE region, with a compound annual growth rate of respectively 7.6% and 10.3% between 2011 and 2014, they represent only the second and third largest renewable energy electricity markets with installed capacities of respectively 254 GW and 140 GW.

The level of electricity prices has been highlighted as a crucial factor in the transition of energy markets with increasing renewable energy shares, since electricity prices have a major influence on social acceptance for renewable energy deployment. Electricity prices are considered a deciding competitive factor for energy-intensive industries and do strongly affect the economic viability of renewable energy technologies, as well as the effectiveness of renewable energy promotion schemes. UNECE member States with particular low electricity prices might constitute a difficult terrain for the uptake of renewable energies, since low electricity market prices hamper the economic viability of renewable energy technologies, especially when strongly competing with conventional energy sources. Additionally, it might prove difficult to implement effective energy efficiency promotion schemes, since low electricity prices reduce energy saving incentives. Therefore, a thorough consideration and monitoring of electricity price formation is necessary for the successful uptake of renewable energies.

Against this background UNECE electricity prices have been determined and split into shares of electricity generation and network costs and into shares of taxes and levies for each UNECE member State. The comparison of UNECE electricity prices has shown that the level of electricity prices and the included shares of taxes and levies vary noticeably within the UNECE region. A significant correlation between the level of electricity prices and GDP per capita has been observed in both the private and the industry sector. However, the analysis reveals a smaller divergence between electricity prices of OECD and non-OECD countries¹⁹ in the industry sector compared to the private sector. On average, OECD industrial electricity prices are 21% higher than non-OECD industrial electricity prices, while in the private sector OECD electricity prices are 107% higher than non-OECD electricity prices. The recognised stronger similarity of electricity prices in the industrial sector can be explained by industrial electricity price subsidies, which are granted mainly in OECD countries to inhibit local competitive disadvantages arising from high electricity prices.

The report finds that the large majority of UNECE member States have already adopted renewable energy promotion schemes, 49 member states in the electricity sector and 41 member states in the heat sector. In the electricity sector the most widely established types of renewable energy promotion schemes are feed-in tariffs or premiums, tax reductions and investment incentives, with each of these types of policy instruments being implemented in more than 40 UNECE member States. Promotion schemes in the heat sector are most widely used to encourage heat generation from solar thermal energy, followed by energy from biogas or biomass and geothermal energy. In the building sector renewable energy promotion schemes are implemented by roughly two thirds of the UNECE countries, while another eight UNECE member States are currently developing renewable energy promotion schemes or measures. So far, the electricity sector has received greater political emphasis as field of application of renewable energies than the heat sector. It is important to note that adopted renewable energy promotion schemes do not automatically translate into a substantial expansion of renewable energies in the respective country, as can be seen from the analysed renewable energy market development in the UNECE member States (see Chapter 3). There is a high amount of adopted promotion schemes in the region, but ultimately, the uptake of renewable energies largely depends on market access and the effective implementation of promotion schemes rather than their sheer existence.

5.2 Policy toolbox

¹⁹ The analysis comprises only OECD and non-OECD countries of the UNECE region.

Based on the obtained report results, a toolbox for policy makers has been developed, which is presented in Table 3. The toolbox provides an overview of the impact dimension and description of all major renewable energy promotion schemes and measures, their particular strengths and primary outputs as well as examples of UNECE and Non-UNECE countries, which have shown good practice when implementing their respective promotion scheme or measure. Policy makers can consider elements from these toolboxes as basis for decision-making processes within the framework of promotion scheme implementations. Good practice examples are especially useful as reference sources in case policy makers need more detailed information about the implementing process of particular promotion schemes. However, this toolbox does not provide a template for decision-making or on how to develop or implement policies. Further information is ultimately needed to inform decision-makers in their renewable energy policy making.

Promotion schemes and measures	Impact dimension	Description	Strengths / primary output	Good practice
Official targets for renewable energies	Political	Definition and official communication of (technology-specific) binding or non-binding expansion goals.	Planning security	EU member States, USA (state level)
Market access / grid access	Political / Regulatory	Guaranteed grid access for independent power producers or autoproducers possibly restricted by capacity limits.	Market integration	Chile
Net Metering / Net Billing	Political / Regulatory	Billing mechanisms, in which renewable electricity generating entities are credited for the net value between their supplied electricity fed into the grid and their demanded electricity. Produced electricity surpluses can be remunerated as electricity credit counting towards future electricity demand (net metering) or as direct financial compensation at an agreed rate or tariff (net billing).	Market integration	Australia, USA (state level), Turkey
Priority feed-in and feed-in tariff or premium	Political / Regulatory	Priority feed-in prescribes the mandatory purchase of renewable energy electricity by utilities. Feed-in tariffs or premiums grant long term stable remuneration for the feed-in of renewable energy electricity, either via fixed tariffs (feed-in tariffs) or at electricity market prices topped up by a adjusting market premium (feed-in premium).	Financial support, market integration, investment and planning security, investor diversity	Germany, Italy
Green certificates, Renewable energy certificates	Political / Regulatory	Tradable certificates, which are often used in combination with quota systems. The certificates are issued for each unit of generated and supplied renewable energy	Market integration	Sweden, Norway

		electricity.		
Quota system	Political / Regulatory	Obligatory renewable energy share of energy electricity supply or demand, mandated from utilities.	Financial support, market integration, expansion control, cost effectiveness, promotion of innovation	USA (state level), India (state level)
Auctions	Political / Regulatory	Public bidding process, which awards long term electricity purchase contracts for an agreed amount of produced renewable electricity or for the electricity output from a certain auctioned quantity of renewable electricity capacity. Long-term contracts are awarded exclusively according to price-based criteria.	Financial support, investment security, market integration, expansion control, cost effectiveness, promotion of innovation	Brazil, Uruguay, India
Tender	Political / Regulatory	Multi-criteria auctions.	Financial support, investment security, market integration, expansion control, cost effectiveness, promotion of innovation	Kenya, Japan
Renewable Heating Obligations	Political / Regulatory	Obligated minimum share of energy demand for heating from renewable energy sources or CHP plants demanded from building owners.	Financial support, market integration, expansion control.	Denmark, Germany
Further investment incentives	Political / Regulatory	Investment subsidies, credit grants, reduced rates of interest, tax credits or exemptions, governmental R&D expenditures etc.	Financial support, promotion of innovation	USA (federal and state level), Germany, France

Table 3 Policy toolbox: Political and regulatory promotion schemes and measures.

The following table gives an overview of mayor fields of actions and measures which commonly are not directly linked to policies promoting renewable energies, but also play a crucial role for their further development.

Fields of action and measures	Impact dimension	Description	Strengths / primary output	Good practice
Renewable energy system integration	Technical	<u>National:</u> Renewable energies are integrated into the energy system by expanding grid capacities and increasing the flexibility of the power system. A flexible power	Grid balancing, electricity supply security	California (obligation for utilities)

	Political / Regulatory, Technical	<p>system can be achieved by replacing 'must-run' capacity by flexible power plants, expanding load management, demand side management and storage capacity and by developing local supply concepts</p> <p><u>International:</u></p> <p>Internationally the flexibility of the power system can be further increased by cross-border technical and economic integration of electricity markets, referred to as market coupling.</p>		EU
Public educational work	Social	Measures to raise public knowledge and awareness about renewable energy deployment	Public knowledge and awareness about RE	IRENA
Public participation	Political / Regulatory, Social	Public participation can be increased by including relevant stakeholders and introducing new business models	Social acceptance	Denmark
Research and development	Political, Economic	Research and development can be promoted by financial support but also by creating a favourable institutional framework e.g. via a patent system	Innovation, technology transfer	USA

Table 4 Further fields of action and measures

6 Making the energy transition work: Implementing policies successfully

As discussed in Section 2, successfully establishing renewable energy technologies depends heavily on a variety of key drivers.

Even if policy measures to foster renewables are in place, they do not necessarily and automatically lead to renewable energy investments. Adverse effects and obstacles indirectly linked to the political and regulatory framework of energy markets may have a negative impact on project realisation. If we are looking at renewable energy policies as instruments to increase the share of clean technologies in energy markets, we must understand how to successfully implement these policies. This section will therefore begin by examining barriers that could hinder effective policy implementation, and will then provide good-practice examples of how to overcome these obstacles.

Two expert meetings organised in Germany during COP23 in November 2017 focused on the successful implementation of renewable energy policies in the electricity sectors and heating markets of countries within the United Nations Economic Commission for Europe (UNECE countries). The main idea was to identify constraints that hinder the successful implementation of policies, and to share experiences on overcoming these barriers. The discussions were arranged around four main topics derived from the more general dimension of Figure 1 in Section 2.1.

The key factors influencing the success of renewable energy policies at the implementation level can be grouped as follows:

1. Political framework and market regulation
2. Infrastructure capacity and technical feasibility
3. Economic viability and financing
4. Acceptance and awareness raising

Besides the general **policy implementation pathways** that emerged from the expert meetings held during COP23, this section also describes the detailed outcomes of three national UNECE Hard Talks, which were held in 2016 and 2017 in Ukraine, Georgia and Azerbaijan. The following subsections present an analysis of each factor, the specific barriers associated with it and the recommendations derived from the Hard Talks.

Overall, this section aims to demonstrate the importance of a well-implemented renewable energy framework.

Hard Talks in brief

The Hard Talk' is a specific policy dialogue event format organised by the United Nations Economic Commission for Europe (UNECE), in cooperation with host countries, local counterparts and other partners - e.g. the Renewable Energy Policy Network for the 21st Century (REN21), the German Energy Agency (dena) and Revelle Group sprl- which has been already implemented in three countries (Georgia, Ukraine and Azerbaijan). Hard Talks are adapted to the specifications and requirements of each host country.

They aim to:

- Investigate barriers that hinder the full unfolding of renewable energy potential in the host country.
- Facilitate the exchange between political decision makers, project developers, investors and technology providers and thus between the public and private sector.
- Point out solutions to improve the investment climate for renewable energies and to foster discussion to what the UNECE can provide with similar initiatives.

At the heart of the Hard Talk format is the Discussion Paper, a “problem/solution” format document which facilitates a practical dialogue. Before the event, a review of the renewable energy situation in the host country is undertaken, with the view to identify issues which could potentially interfere with uptake of renewable energy sources and, particularly, with private sector investment in renewables. Subsequently, recommendations are formulated, based on international experience and good practices that could contribute in de-blocking private investment by addressing the issues identified. The first version of this Discussion Paper is introduced to the first-day, expert-level participants of the Hard Talk event, with the purpose of focusing the discussions. The outcomes of the first-day discussions are incorporated into an updated Discussion Paper, adding participants’ perspectives and viewpoints, and the revised, second version of the Discussion Paper is presented to the participating decision-makers during the second day of the event. The decision-makers have the chance to offer insights on the second version of the Discussion Paper. The Discussion paper is then finalised with the comments offered during the second day of the event and is disseminated in its final form (Recommendation Paper) to the events participants and other stakeholders for further action.

Experience with this unique policy dialogue format is drawn from the three countries that have hosted them: Azerbaijan, Georgia and Ukraine. The common denominator of the Hard Talk experience is that, despite the many differences in the three host countries, common themes have arisen that prove that the main influencing factors to renewable energy uptake are fundamentally identical. Moreover, the discussions in all three Hard Talks have proven that the experience and good practices associated with addressing those common, largely identical influencing factors are easily transferable from one country to another. Therein lays the added value of the Hard Talks: mobilising international experience to address domestic issues.

Why is renewable heat lagging behind renewable electricity?

Heat accounts for 50% of global final energy consumption. This figure is even higher in the UNECE region, where heat accounts for 70% of final energy consumption. Renewable heat therefore has huge potential to help decarbonise the energy sector, especially in the Northern Hemisphere.

Nevertheless, the deployment of renewable heat technologies is still lagging behind renewable electricity. Several factors are responsible for the different development and deployment pathways. Two of the main factors for the slow uptake of renewable heat are the comparatively high subsidies for gas and oil, and a lack of incentives and subsidies for renewable heat. While fossil fuel prices often do not reflect real costs, renewable heat technologies also face high upfront costs (this is the case with geothermal heat, for instance), unfavourable pricing and tariffs, and few or no incentive schemes and programmes. Capital costs are even higher for renewable heat than for renewable electricity.

Heat supply also depends on access to (capital-intensive) infrastructure such as heating networks where ownership structures can hinder the supply of renewable heat. Building regulations, energy efficiency regulations and different standards for the fuel and the technologies add to the complexity of the renewable heat sector. Furthermore gas networks directly compete with networks for district heating. The often much easier “plug-and-play” situation that can be found in the electricity sector does not apply to the heating sector.

6.1 Political framework and market regulation

In any given country, the political framework and market regulation governing the energy sector influence the uptake of renewable energies. If governments are to develop a comprehensive renewable energy strategy, they need a vision, clear political commitment and regulations tailored to the market structure, market organisation and infrastructure.

Issues concerning the political framework and market regulation are the most important when it comes to unlocking investments in renewable energy systems. This is because they provide investors with basic confidence that enables them to eventually raise the necessary capital for their projects. A comprehensive and reliable set of laws and regulations for renewable energies creates a healthy environment for developing projects, which can reassure investors and consequently attract new investments. In this regard, having a good sense of the status and potential of the renewable energy industry (this includes having access to reliable statistical data) could offer a solid foundation for regulatory interventions and ensure that reality and policymaking are better aligned.

Once a country has set its renewable energy targets and formulated the corresponding strategies and policies, it must, crucially, guarantee stability and planning security. Unexpected changes in policies for promoting renewable energy production – e.g. partial suspension of green certificates and the (retroactive) removal of feed-in tariffs – have compromised renewable energy deployment in UNECE countries in the past.

In terms of designing and implementing relevant policies for renewable electricity and heat, different factors and prerequisites need to be considered. In general, obstacles exist in the areas of bureaucracy, processing

times, permit procedures and market design. Policies need to take into account that renewable energies are deployed and integrated into existing infrastructure that is very often fully amortised and based on conventional electricity and heat generation. Furthermore, each UNECE country faces different situations and conditions depending on their individual energy market and access to resources.

In general, renewable heat deployment in the UNECE region is still lagging behind that of renewable electricity. To a certain extent, this is due to the absence of robust heating policies and a lack of guidance and management in the sector. The type of policies that can drive the renewable heat sector forward will depend on existing regulations – for example, whether households are allowed or required to be connected to a district heating network instead of getting connected to the natural gas grid.

Policy implementation pathways:

When designing renewable energy policies, the following guiding questions can support successful strategies and policies in the field of political framework and market regulation:

- Does the government have a vision for and a clear commitment to renewable energies?
- Does a stable political framework exist?
- How does infrastructure ownership affect market access? Different policies can be considered depending on whether ownership is private or public.
- Is new infrastructure needed, or can existing infrastructure be upgraded or modernised?
- What role does innovation play in public tenders? When awarding concessions or public tenders, innovative approaches to and integration of clean energy can play an important part in the selection criteria.
- What existing regulations affect market access for renewable energies? Market access for renewable heat, for example, is influenced by factors such as building regulations, energy efficiency regulations and technical standards.
- What are the ownership structures in the buildings sector? Different policies will apply when the share of renewable energies is increased in a rental property market with few homeowners.
- Is there a clear enough understanding of energy demand and corresponding renewable generation? Energy mapping is important for accurately understanding electricity and heat consumption, and for connecting it with the highest possible share of renewable electricity and heat generation. In the case of heating, a certain amount might be covered by both renewable heat and excess heat from industry.
- What policy options are already being implemented or are available on a local level? The local level is key to achieving decarbonisation goals, and often has a high degree of policy effectiveness.
- What are neighbouring countries doing to increase their share of renewable energy? International cooperation between neighbouring UNECE countries can lead to a more sustainable electricity and heat supply, as the countries often face similar challenges. Country clusters and collaborations can produce joint strategies and measures.

Outcomes from the Hard Talks: Ukraine

Threats to the country’s energy security have urged the Government of Ukraine to create a comprehensive set of regulations and laws as well as tangible targets to support RE development.

The desire to promote renewable energy as an alternative to fossil fuel contributed in making radical changes to Ukraine’s regulatory environment. The Ukrainian example also exemplifies the value of the Hard Talk format as a tool to focus and encourage implementation of renewable energy measures. Indeed, many of the solutions proposed during the Hard Talk event held in Kiev in December 2016 have already been implemented.

The issues associated with the Ukrainian power purchase agreement (PPA) at the time of the Hard Talk in 2016 revolved around three aspects: PPA signing, PPA duration and PPA template. PPAs are essentially long-term offtake agreements executed with a creditworthy off taker to enable repayment of debt by providing an adequate and predictable revenue stream. International practice guarantee that PPAs are signed before major investments in infrastructure are made, which gives the financiers enough confidence to deploy the needed capital. Moreover, PPAs should be able to guarantee a certain duration of guaranteed offtake to make projects bankable (i.e. remove both volume and price risk for the produced power). Procedures for the PPAs in Ukraine were not in line with international practices, as they increased and exposed both project developer and investors to additional risks. The issues identified at the time of the Hard Talk, and the corresponding recommendations, were:

	Issues	Recommendations
PPA Timing and Feed-in tariffs	PPA is signed only after construction and commission of a project	Adoption of the new draft Electricity Market Law establishing the signing of the PPA before construction of any facility
	Green tariffs (FiT) are secured and received only after construction and commission of a project	Regarding FiTs, the following should be considered: <ul style="list-style-type: none"> ▪ Locked-in terms should be withdrawn after a period of time that would be adequate for construction and commissioning ▪ Possibility to change dynamically to reflect changes in market- i.e. reduction of installation costs, number of pending applications, etc. ▪ A mechanism to monitor market and system conditions and periodically adapt the FiT for new plants should be set in place ▪ Grandfathering provisions for existing agreements explicit in Law and changes should only apply to future licenses
PPA Duration	Current PPA is signed for only one year with the state-owned enterprise 'Energorynok' and producers are obliged to re-sign annually.	<ul style="list-style-type: none"> ▪ The Draft Electricity Market Law provides for an extension of agreements falling under the "Green Tariff" regime until 1 January 2030. ▪ This approach, insofar as it takes under consideration the depreciation of the asset, addresses the respective barrier and should be adopted during the Second Reading.

	Issues	Recommendations
PPA Template	The current PPA does not reflect international standards and does not provide proper protection clauses for the investor.	Revision of PPA template on the basis of international standards of legal certainty, transparency and legal equality: <ul style="list-style-type: none"> ▪ Extension of the FiT duration (amendment is already foreseen in the Draft Electricity Market Law – see A.2). ▪ Guaranteed offtake for the lifetime of the project, with regards to volume ▪ Address change-in-law risks with regards to FiT, exchange rate mechanisms etc. ▪ Provisions for curtailment compensation ▪ International arbitration in third country

Table 5 Political framework and market regulation issues and recommendations Hard Talk Ukraine

It is indicative of the value of the Hard Talk format that all three of those issues identified in December 2016 have already been addressed by the Ukrainian legislators and many of the adopted solutions are in tandem with the proposals mentioned above. Indeed, a conditional PPA can now be signed at the early phases of the project, it has a duration until 1 January 2030 and the revised template is largely in line with bankability requirements and international standards.

Outcomes from the Hard Talks: Georgia

With a view to guarantee security of supply, to rely less on imported electricity in the winter months (whereas it is a net electricity exporter in the summer months), and to diversify its energy mix, Georgia has started examining the substantial potential for renewable sources such as wind, solar, biomass, and geothermal. Up to the point in time when the Hard Talk was held (December 2016), the government has been mainly focusing towards hydropower production, making other generation sources still lag far behind in terms of cost-effectiveness.

Held at the same time that Georgia’s accession to the Energy Community Treaty was announced, the Tbilisi Hard Talk was the first event of its type focusing on discussions between all involved stakeholders (including the Ministries of Energy, of Finance and of Agriculture) a comprehensive legislative and regulatory framework for renewable energy. There was no national renewable energy strategy in place, with specific, quantified and feasible targets for RE for 2020 and beyond, nor a support scheme for RE generation.

Tariffs in Georgia were calculated on a case-by-case basis and did not apply horizontally, which makes the tariffs system lacking clarity in its methodology and monitoring in its calculation.

Recommendations from the Hard Talk discussions highlighted the following:

	Issues	Recommendations
--	--------	-----------------

	Issues	Recommendations
Feed-in tariffs	<ul style="list-style-type: none"> ▪ Unclear methodology for tariffs calculation and monitoring ▪ Determination of tariffs on a case-by-case basis ▪ Non-horizontal application of tariffs 	Transparent and fair methodologies for RES electricity purchase price (tariff) calculations should be adopted which will facilitate project bankability and subsequent financing

The Hard Talk discussions highlighted the need to undertake three key actions:

1. Embracing an integrated approach to RE development:

The country is endowed with a huge potential for hydropower production, which currently accounts for more than 80% of Georgia's generating capacity and between 75% and 90% of power generation. However, the country's dependence on hydropower means that the reliability of supply is threatened in the winter months when power demand is high and hydropower capacity is reduced due to depleted storage in reservoirs. In this context, taking an integrated approach to RE development, which encompasses all available sources, complementing each other rather than competing, has the potential to strengthen energy security. Activities such as modelling and developing energy scenarios, as well as implementing systems of tracking the progress of RE development (through data collection and capacity building) could help in looking at the country's broader energy picture and formulating strategies that take into account all RE possibilities.

2. Carrying out multi-stakeholder consultation:

This should be seen as part of a continuous dialogue and ensuring appropriately participatory processes capturing inputs of all key stakeholders (i.e. Ministry of Energy, Georgian National Energy and Water Supply Regulatory Commission- GNERC, TSO/DSO, private developers and international donor and financial institutions). These consultations/processes should be seen in the context of an ongoing dialogue between relevant actors on how responsibilities can best be shared to ensure the development and success of a national energy strategy.

3. Formulating a comprehensive national strategy for renewable energy development

This includes two elements. First, the adoption of a legislation on RES, which also includes the design of a National Renewable Energy Action Plan according to Energy Community ascendancy obligations and the finalisation of the National Energy Efficiency Action Plan (NEEAP). Second, a comprehensive support scheme, with specific long term targets aiming for 2020 and 2030, which would include defined support measures to resources specific RES by technology and relevant provisions.

At present, the NEEAP has been finalised and will be implemented by January 2019. Yet, the legal framework in Georgia still does not include a special law for renewables and the NEEAP has yet to be developed. Similarly,

the country still lacks specific targets for renewable energy in the electricity, heating and cooling and transport sectors. However, it is expected that with the adoption of the NEEAP, the rest of the legal measures and regulations will follow and will be designed and implemented by mid-2019. Moreover, Georgia's accession to the Energy Community Treaty is foreseen to catalyse even more changes. The Protocol on the Accession of Georgia to the Energy Community Treaty was signed on 14 October 2016, during the 14th Energy Community Ministerial Council (weeks before the Tbilisi Hard Talk) and the accession agreement was ratified by the Georgian Parliament on April 24, 2017. Therefore, more developments in this field (such as a single legislative act on renewables and further approximation with E.U. acquis by introducing a regime that is compliant with the requirements of Renewable Energy Directive 2009/28/EC) are considered to be in the pipeline.

Outcomes from the Hard Talks: Azerbaijan

In 2016, the country adopted the 'Strategic Roadmap for Public Utilities', which outlines the key milestones and targets to be achieved covering the short, medium and long-term horizon. However, concrete and well-structured actions are still lacking in the current strategy, indicating a clear need for more detailed planning on its formulation and implementation. Moreover, most of the existing tasks under the 'State Programme on Use of Alternative and Renewable Energy Sources in the Republic of Azerbaijan' have been completed and therefore an update is needed.

Similarly, the renewable energy sector is mainly regulated by four different laws, each of them containing sub-clauses, all covering the interest of the entire sector, but still having gaps. In this context, the revision of the current legislation and preparation of a comprehensive and unified primary and secondary law would speed up the process of renewable energy deployment in the country.

Renewable energy generation also lacks both a comprehensive support scheme, as well as a transparent support mechanism, which makes investors reluctant to be involved even in pre-screened, viable projects.

Renewable energy tariff calculation methodology in Azerbaijan is not clearly defined. This is a key barrier to RE developments because in order to attract private investors, renewable energy tariffs should have a clearly defined structure.

Recommendations from the Hard Talk discussions highlighted the following:

	Issues	Recommendations
Feed-in tariffs	Unclear definition of tariff calculation methodology	<ul style="list-style-type: none"> ▪ Transparent and fair methodologies for RES electricity purchase price (tariff) calculations should be adopted which will facilitate project bankability and subsequent financing ▪ Request donor-funded technical assistance for developing a computation methodology ▪ Incorporate and reflect added benefits from renewables (health, environmental, Natural Gas savings, added value etc.).

The existing model of the Power Purchase Agreement (PPA) does not comply and is not done according to international standards. In this regard, the main recommendation from the Hard Talk was that a standard PPA

template accommodating specific requirements of different technologies should be prepared and made available.

This was the situation in October 2017, when the Baku Hard Talk was held, and the discussions highlighted that efforts should channelled towards four key actions:

1. Preparation of a study on renewable energy development options

The study should aim at providing an overview of RE potentials in the country and ultimately help to define and meet targets, taking into account the advantageous synergies between gas and renewables for power generation.

2. Formulation of a comprehensive National Renewable Energy Action Plan (NREAP)

The NREAP should be based on the above-mentioned study. It should address mid and long-term targets, with a clear vision regarding the involvement of the private sector and should include a revised and updated version of the 'State Programme on the Use of Alternative and Renewable Energy Sources in the Republic of Azerbaijan'.

3. Development of a sound, unified and transparent legal instrument

The instrument should clearly and efficiently regulate renewables. It should also include the drafting and implementation of a new "Law on Energy from Renewable Resources", that not only incorporates current good practices but also properly responds to the needs and realities of Azerbaijan.

4. Development of a sound, unified and transparent legal instrument

The scheme should primarily include an update of existing laws as well as proposed new laws that will regulate the area of renewable energy, energy efficiency and the environment as a whole. It should also target RES producers through the establishment of a 'Special Fund for RES', which could be funded with additional export revenues of natural gas saved by the use of RES and support their payments.

6.2 Economic viability and financing

The economic viability of renewable energy projects has improved vastly over the last few years and has led to a substantial increase in renewable energy deployment in the UNECE region. This is primarily the result of reductions in technology and capital costs in UNECE countries with stable renewable energy promotion policies and currencies.

Certain factors can reduce the economic viability of renewable energy projects. These include fossil fuel subsidies, a lack of stable revenues from renewable energy supply, difficulties in accessing investment or financing options, and high investment costs – particularly if the equipment and components for the renewable energy system have to be imported into countries with high customs duties and import taxes. In the context of successfully implementing strategies and policies, it is important to note that local fossil fuel prices in some UNECE countries do not reflect the real cost of the fuels and generation. As a result, fossil fuel subsidies do not just distort competition between energy generation from fossil fuels and renewable energy sources; they also put a strain on national budgets.

With regard to a country's investment climate, a credible counterparty for the offtake agreement is needed to ensure project bankability. In the absence of such a counterparty (e.g. a wealthy public, a state-owned entity or an industrial offtaker), some form of insurance must be used to mitigate any risk.

Policy implementation pathways:

When designing renewable energy policies the following guiding questions can support successful strategies and policies in the field of **economic viability and financing**.

- What are the energy pricing aspects in the country? When considering the economic viability of renewable energy projects, it is important to look at externalities such as pollution in energy retail. Energy prices should reflect real costs, and include the negative environmental effects of generation, so that they can function as an incentive for renewable energies.
- How easy is it to access financing and cover capital costs? These two aspects are crucial for the development of renewable energy projects. Local banks need to have the capacities and resources to finance renewable energy projects, especially in the face of high upfront costs.
- Are loans from development banks such as the EBRD or the World Bank on offer? Having access to these loans can help reduce financial costs, increase financial security and thereby make renewable energy projects feasible.
- What are the balancing costs of renewable energies? Balancing costs relate to the costs of integrating renewables into the grid. The limited predictability of renewables means that operational reserves must be maintained in order to respond to forecasting errors and ensure secure system operation. Allocating and deploying these reserves costs money. If balancing costs are applied, project financiers require visibility and predictability in terms of operating expenses during the power plant's lifetime. Investors will have to mitigate potential variations in costs according to the cost item in question.
- Are (high) import taxes and custom duties imposed on renewable energy technologies and components? High levies and taxes have a significant impact on the viability of renewable energy projects in countries that must import most of the necessary equipment.
- What standards apply in the country? Having different standards in place increases capital costs when entering new energy markets abroad.
- How much bureaucracy is involved in implementing renewable energy projects? The difficulty and time involved in processing and receiving permits and licenses influences the economic viability of projects. The longer it takes, the higher the upfront costs.
- How stable is the local currency? Fluctuations and devaluations in local currencies are major challenges to the economic viability of renewable energy projects. This is because local currencies are often used to pay for the energy generated.

Outcomes from the Hard Talks: Ukraine

Economic and viability issues in Ukraine were mostly related to project financing, investment climate/country risk and balancing costs. Project financing in Ukraine was not easily accessed at reasonable rates. Ukraine was

still experiencing a difficult climate for investments and still has a high country risk. Private investors in RES in Ukraine were exposed to a relatively high level of counterparty risk given the fragile state of the Ukrainian economy (credit rating CCC). Additionally, it still is difficult for investors to find to insurance against counterparty risk. For example, it has been understood that the Multilateral Investment Guarantee Agency is providing political insurance for projects in Ukraine only to a limited extent, while private insurance is very expensive and sometimes not available.

Ukraine’s Fitch Rating has remained at B- and no significant credit enhancement tools have been introduced. Discussions for a Green Fund are still active and spearheaded by the State Agency on Energy Efficiency and Energy Saving of Ukraine. The Green Fund is a financing institution, focussing on providing initial financing for renewable energy projects and thus foreseen to facilitate investment. Ukraine recently introduced a similar Energy Efficiency Fund in 2017 and the option to mobilize its funds for projects dealing both with energy efficiency and renewable energy (such as replacing obsolete district heating gas-fired boilers that have significant losses with biomass or CHP) is also being examined. The Kiev Hard Talk findings were:

	Issues	Recommendations
Project financing	Ukrainian banks offer: <ul style="list-style-type: none"> ▪ Loans with high interest rates (up to 24%) ▪ Corporate financing only and use credit lines of the international banks, such as the EBRD and the European Investment Bank. A 100% guarantee is the only requirement for the recipient of a loan 	Improvement of project financing conditions and access to financing from local banks through: <ul style="list-style-type: none"> ▪ Development of a special-purpose fund for RES ▪ Introduce a financing programme of renewable energy projects on reasonable terms and conditions (including a grant scheme to reduce project development costs for developers). ▪ Examine possibility to include some RES projects under the Energy Efficiency Fund – e.g. retrofitting district heating with biomass / CHP ▪ Address financial management and budgeting rules in district heating companies and municipalities in order to encourage their role in attracting private investors at local level.
Investment risk	<ul style="list-style-type: none"> ▪ Ukrainian economy still fragile although Fitch Ratings were upgraded in November 2016 upgraded from 'CCC' to 'B-' ▪ Insurance is too expensive or not available 	Introduce new forms of credit enhancement through: <ul style="list-style-type: none"> ▪ Bilateral or multilateral agencies ▪ Export Credit Agencies ▪ Sovereign guarantee ▪ Government-funded account ▪ Replacement of state offtake counterparty with more creditworthy customers

	Issues	Recommendations
Balancing cost	<ul style="list-style-type: none"> Balancing costs are foreseen to be borne by RES producers under the draft Electricity Market Law. 	Balancing costs should take into consideration: <ul style="list-style-type: none"> Need for increased capacity in forecasting and modelling methodologies and tools Need for certain market maturity and market-specific conditions Need to evaluate RES penetration and impact on the market. Balancing Costs should be revisited after a more comprehensive analysis

The New Electricity Market Law was adopted by the Ukrainian Parliament in April 2017 and became effective on 11th June 2017 (6 months after the Hard Talk). However, certain provisions, including those related to the balancing markets, day-ahead market and other market sub-segments, will be enacted later and should become operational from July 1st 2019.

Outcomes from the Hard Talks: Azerbaijan

An interesting perspective offered in the Baku Hard Talk is the option to finance a FiT-based RES Support Scheme with the profits made from exporting gas (the price of which, as a scarce resource, will continue to increase) that would otherwise have been used to fuel the domestic needs that will be covered by renewables (with dropping installation costs and zero fuel costs). This option shows that even for countries with abundant and cheap fossil fuels, renewable energy can make sense from a financial standpoint. Another aspect of economic and viability issues with RES in Azerbaijan is bankability.

With regards to bankability, Hard Talk discussions highlighted the following:

	Issues	Recommendations
Bankability	Bankability hindered by the high interest rates and high securities requirements from local banks	Involvement of donors and international financial institutions into the process can potentially reduce risks and build capacity for local banks to provide funding for renewable energy projects

6.3 Infrastructural capacity and technical feasibility

One of the biggest challenges in achieving a secure, stable and sustainable energy system is how to integrate large amounts of fluctuating renewable energy into the heating and power grids. While this is one of the key barriers to a more extensive and rapid deployment of renewable energies, technological innovations in generation, trade, distribution and flexibility have been developed to tackle the challenge.

One of the tasks facing virtually all UNECE countries involves updating and investing in their heating and power networks. In addition, when expanding the share of renewable energy in electricity generation, flexible power systems, such as hydropower plants, and storage systems are needed to balance out fluctuations in the energy generated by PV and wind. Nuclear, coal and other fossil fuel plants may not be capable of providing the necessary flexible supply response.

Other flexibility options include demand side management, where customers (private, commercial and industrial) are incentivised to adapt their power consumption to available power generation.

Various technical challenges also apply to integrating renewable energy technologies into heating supply systems: Large-scale heat generation from solar, biomass and geothermal energy needs access to heating networks, and small-scale heat generation technologies have to be integrated into existing and new building heating systems.

Governmental and regional support influences the planning and development of new district heating networks. It also affects the conversion of existing networks based on biomass, biogas, geothermal energy, large-scale solar thermal heat plants with seasonal storage, and waste-to-energy plants.

One of the differences to electricity in terms of market access is that it is harder to feed excess heat or heat from a renewable source into an existing network. From a technical perspective, many more factors need to be taken into account (temperature, content, water quality, etc.) than with electricity.

Again, standards and higher efficiency on the demand side are crucial to the success of renewable heat supply – as are properly designed grid codes and straightforward licensing procedures. With this in mind, some countries have already begun simplifying matters by adopting a “one-stop-shop” approach.

Policy implementation pathways:

When designing renewable energy policies the following guiding questions can support successful strategies and policies in the field of **infrastructural capacity and technical feasibility**.

- Is there an accurate forecasting system in place? Predicting energy supply and demand helps to balance power grids and integrate renewable energies.
- What standards are in place, and do they comply with international standards? Standards on matters such as integrating renewable energy into existing grids are important. They need to be properly designed and implemented, and should take account of different system requirements (grid codes, licensing procedures, etc.). Currently, standards vary from country to country, which hampers the cross-border use of renewable energy and excess heat. International standards can help improve cross-border energy use and thus make the overall energy supply system more efficient.
- Does the country already produce a large amount of renewable electricity? Technologies that link different energy sectors offer new possibilities for sustainably generating heating energy. Efficient biomass waste-to-energy plants make it possible to combine heat and electricity supplies while also solving waste disposal problems.
- What are the plans for increasing energy efficiency? It is important to look at the targets for energy efficiency when forecasting future heat demand, as an increase in efficiency will reduce demand.
- Do heating networks exist in any areas? Especially in urban areas, heating networks can be the backbone of a low-carbon or zero-carbon heating supply. Hence, the existence of inefficient district heating networks, a lack of heating networks, or efforts to dismantle networks are obstacles to developing renewable heat. Plans for heating networks must consider both renewable and excess heat supply and demand, and future gains in efficiency. An example: Many heating networks still work with very high temperatures from conventional heat generation. However, renewable heat technologies and excess heat producers can supply heat via low-temperature heating networks.
- Does the country have sufficient expertise to operate renewable heat and excess heat supply systems? There are many possibilities in the UNECE region, such as using waste heat from oil refinery processes, geothermal heat and heat from bioenergy for industry, agriculture and public buildings.
- Do connections with neighbouring countries exist? Such connections can be beneficial when it comes to balancing the electricity grid and using natural resources efficiently on an international level.
- What laws and regulations govern land use? It is important to be able to assess the availability and quality of resources, but this has proven difficult in some UNECE countries (analysing geothermal potential is one example). Particularly in densely populated areas, renewable electricity and heat are competing for space and land use rights.
- How complex and lengthy are planning procedures? Complex permit applications and planning procedures can have a big impact on renewable energy development. The longer and more complicated they are, the more they hinder a successful and rapid expansion of renewable energies.

Outcomes from the Hard Talks: Ukraine

Infrastructural capacity and technical feasibility issues in Ukraine are mostly related to grid connection, land zoning and permitting.

Investors in Ukraine faced bureaucratic barriers in order to secure grid connection in a timely manner and with reasonable connection terms. Additionally the procedures for re-zoning of land for RES are very complicated and time consuming, while investors need transparency and consistency in land usage and zoning rules. Permitting is another important issue, related in particular to non-transparent, un-predictable and variable procedures as well as to the fact that legal deadlines are not well enforced against public actors.

In order to create a favourable environment for investors, Hard Talk discussions suggested the following:

	Issues	Recommendations
Grid connection	<ul style="list-style-type: none"> ▪ Grid connection is cumbersome. Investors currently face significant bureaucracy. Negotiations, approvals, official mailing, are lengthy and significantly delay the time needed to complete a project ▪ Lack of transparency on connection points and available capacities. 	<ul style="list-style-type: none"> ▪ Provide guarantees that grid connection will be provided on time ▪ Be transparent on: <ul style="list-style-type: none"> ○ Technical specifications ○ Connection points ○ Available capacities ▪ Streamline administrative procedure ▪ Ensure closer cooperation between grid operator and regulator to better coordinate administrative & technical processes
Re-zoning of land	Land re-zoning procedures for RES are complicated and time consuming	<ul style="list-style-type: none"> ▪ Adoption of the Draft Law 2529a from 08.26.2015 "On Amendments to Certain Legislative Acts of Ukraine about simplification procedures on land allocation and/or power generation facilities from renewable energy and/or biofuels" ▪ Allowing for the construction of power and heat generation facilities from renewable energy/ biofuels without changing the utilisation purpose of land.
Permitting	<ul style="list-style-type: none"> ▪ Non-transparent, un-predictable and variable permitting procedures ▪ Legal deadlines are not enforced 	<ul style="list-style-type: none"> ▪ Introduction of one-stop-shop for RES developers, preferably with online capabilities to shorten duration of permitting procedures and reduce their number ▪ Permitting procedure could be done by an independent central agency which oversees the permitting procedure, ensures transparency and impartiality and has the administrative obligation to reply within a few months ▪ Introduction of a small fee per application could help to finance the process.

Although changes in the last year focused more on the first influencing factor (new Electricity Market Law, new PPA template, discussions on the Green Tariff), on the ground reports indicate that there has been some

progress in making the grid connection process less cumbersome and time consuming. The permitting process is currently being scrutinised as well, in line with the requirements of the new legal environment.

Outcomes from the Hard Talks: Georgia

Grid connection and grid code in Georgia display a threefold problem. Firstly, the country lacks definite and pre-established technical standards for connection terms (including connection method), leading to lack of transparency and possibility of abuse (e.g. imposition of inefficient technical requirements). Secondly, there is no regulation of RES grid access. Finally, there are still technical issues related to the physical access to grid (long waiting times, lack of transparency), the incomplete distribution network unbundling and the insufficient support of distributed generation.

Economic and viability issues in Georgia are mostly related to permitting, namely to the fact that there are too many actors involved in the process and that there is a lack of a comprehensive mapping of permitting processes before the project take-off.

Key issues and recommendations of the Tbilisi Hard Talk include:

	Issues	Recommendations
Grid connection	<ul style="list-style-type: none"> ▪ Lack definite and pre-established technical standards for connection terms ▪ Lack of regulation of RES grid access ▪ Technical issues related to: ▪ Physical access to grid ▪ Incomplete distribution network unbundling ▪ Insufficient support of distributed generation 	The grid capabilities for integrating RES should be re-examined after taking into account latest international good practice of integrating renewables
Permitting	<ul style="list-style-type: none"> ▪ Too many actors involved ▪ Lack of comprehensive mapping of permits and processes before project take-off. 	Simplification of the permitting process

Outcomes from the Hard Talks: Azerbaijan

Both Grid connections and grid codes in Azerbaijan are not in line with international standards, procedures are not well regulated and connection is not cost-efficient. In addition, there is a lack of experience and knowhow on behalf of the grid operator on how to develop technical solutions to accept renewable energy integration into the grid.

Possible identified actions concerning grid connection and permitting include:

	Issues	Recommendations
Grid connection	<ul style="list-style-type: none"> ▪ Non-compliance and non-regulation of grid connections and codes with international standards ▪ Lack of technical capacity and knowledge to integrate RE into the grid 	<ul style="list-style-type: none"> ▪ Introduction of an updated Grid Code, with the support of donors. ▪ Provision of information on connection points and on available capacities to interested parties. ▪ Clear definition and adoption of technical standards (including type of connection method) for the integration of renewable energy sources into the grid ▪ Integration (where available) of renewable resource mapping for technologies into grid expansion ▪ Increase know-how of grid operator through exchanges of good practices and cost-efficient solutions to renewable grid integration and connection.
Permitting	Procedure in the field is not easily accessible for foreign investors	Production of a clear, concise and practical Guide for investors describing the project development process. This will make the environment more accessible and understandable to foreign investment actors.

6.4 Acceptance and awareness rising

If renewable energies are to become an integral part of a country's energy system, then awareness, knowledge and capacities among all relevant stakeholders are vital. Given the different levels of deployment between countries with advanced renewable energy markets and those at an earlier stage of renewable development, the potential for mutual learning, knowledge transfer and capacity building is enormous.

A lack of awareness is one of the main obstacles to greater renewable deployment in many parts of the UNECE region. The general population, businesses and even (local) governments are sometimes unaware of the importance and viability of renewable energy sources. This may result in a lack of public acceptance of renewable technologies and energy efficiency measures – a situation that can be further aggravated by the relatively small number and low visibility of best-practice examples. Such reference points, communicated via public programmes, for instance, could play an important role in raising awareness.

Within the UNECE region, awareness about the advantages of renewable heat, for instance, is clearly still lacking, while the disadvantages of a fossil heating supply (such as health risks, particularly from old, inefficient and polluting stoves) are somewhat overlooked. Raising awareness about the opportunities and benefits of renewable energies is vital, though often quite difficult in practice.

Policy implementation pathways:

When designing renewable energy policies the following guiding questions can support successful strategies and policies in the field of **acceptance and awareness rising**.

- Does the country have any flagship projects in place? To increase awareness and encourage a positive social perception of energy from renewable sources, official commitments by public decision-makers and the existence of visible and symbolic flagship projects matter a great deal. Target groups include installers (especially in countries where basic knowledge is lacking), consultants such as energy auditors, final consumers, policymakers, public administrators, and opinion leaders in the media and civil society.
- What myths and misperceptions exist around the functioning and effects of renewable energies? Awareness campaigns can be a big help in debunking myths and drawing attention to the importance and viability of renewable power. Sound scientific studies and demonstration projects can also help reduce fears and concerns among the population.
- What is the level of public acceptance for renewable energies? Even if awareness for renewable energies is high, public acceptance for the deployment and promotion schemes may not be. Public acceptance can be increased by linking renewable energy projects to a high-ranking figure or a public personality. This can potentially lead to more public coverage, increase the visibility of the projects and improve the public's perception of them. In addition, the public sector can effectively show what is possible: Public funds could be used for renewable energy and energy efficiency projects (e.g., solar thermal, PV, heat pumps) in schools, kindergartens, hospitals and sports facilities.
- What role can education play in creating social acceptance and public awareness? Educating the population on renewables can be a crucial task. Education policies and information on environmental integrity and climate change are essential elements of a comprehensive awareness-raising strategy.
- Are any dialogue formats in place for exchanging ideas and good practices with other countries? Schemes that encourage dialogue between different countries raise each country's awareness of its own performance and allows it to gain knowledge about efforts and progress elsewhere. A country with little renewable energy capacity might be more likely to set expansion targets, enact policies and launch programmes to foster renewable energies if other countries with similar needs and in comparable circumstances have already successfully taken that path. Furthermore, exchanging information on what worked and what did not work could make it much easier to draw up effective policies.
- Is there any scope for tapping into international cooperation programmes? A wealth of international cooperations, collaborations and programmes exist that can be tapped into and used to increase knowledge and awareness about renewable energies. Exchange programmes, train-the-trainer programmes and other capacity-building schemes can be a major boost to sharing information, increasing knowledge and driving renewable energy deployment.

Outcomes from the Hard Talks: Ukraine

There is a high public awareness of the seriousness and importance of Ukraine’s energy security threat and developing renewable energy sources is seen as the country’s only road to energy independence from gas imports from Russia. Energy independence has become a matter of national security in Ukraine, which explains the country’s progress and commitments towards a clean energy transition.

Technical information about Ukraine’s RE potential and project pipeline is only available to a limited extend of considered unreliable unless carried out by a reputable international firm. Such information is also very costly to obtain.

	Issues	Recommendations
Technical information	Limited and unreliable technical information on the country’s RE potential and project pipeline	The preparation of a comprehensive assessment of Ukraine’s RE potential by region/city through the production of a RE Atlas would be highly welcomed as it could provide data-driven basis for RE project development. International Donors and International Financing Institutions have been identified as instrumental in assessing this highly technical field by providing their technical assistance, building capacity, as well as financing comprehensive mapping.

Donor support remains active in Ukraine through various programs, focusing mainly on technical assistance and capacity building. However, since the Hard Talk in December 2016, no comprehensive assessment of renewable energy potential has been carried out yet.

Outcomes from the Hard Talks: Georgia

The lack of awareness on renewable energy in Georgia is pervasive and widespread amongst consumers, end-users and local residents. In addition, the country experiences social and political resistance related to renewable energy (“Not In My Backyard” concerns by special interest groups). Moreover, there is the deeply held impression, even by institutional actors, that large hydro is a viable alternative to RES like wind, solar and small hydro and that no need for diversification exists.

Similarly, there is a significant lack of RE technical knowledge and capacity, particularly outside the capital-Tbilisi and technical information about non-hydro RE potential and project pipeline is limited and costly to obtain.

To address these issues, the Hard Talk discussions highlighted the following:

	Issues	Recommendations
Awareness and capacity	<ul style="list-style-type: none"> ▪ Lack of awareness on renewable energy amongst consumers, end-users and local residents ▪ Lack of RE technical knowledge and capacity 	<ul style="list-style-type: none"> ▪ Undertake public outreach and awareness raising activities for RES. Information exchange activities and trainings should be outlined, formulated and implemented as part of renewable energy development strategy.

	Issues	Recommendations
		<ul style="list-style-type: none"> ▪ Increase technical capacity through a number of activities, such as: Technical education programmes, courses and degrees; Advanced learning on RES for trained professionals; Establishment of knowledge validation and certification programmes Universities ▪ Undertake comprehensive assessment of non-hydro RE potential by region/city through the production of a RE Atlas in sectors not already available, to provide data-driven basis for project development. In parallel, transposing the experience and lessons gained from hydro project development to non-hydro renewables could speed their development.

Less than a year since the Tbilisi Hard Talk event was held, the Energy Community Secretariat organised under the auspices of the EU4Energy Governance Project a similar event called the “High-level Policy Talks on the electricity market of Georgia”, held on November 9, 2017. These events and all follow-up activities, represented by constant dialogue, are seen as an established and successful tool to raise awareness and build capacity in the country.

Outcomes from the Hard Talks: Azerbaijan

Discussions have highlighted that Azerbaijan’s public sector enterprises lack technical knowledge and capacity in new RES technologies and methods.

To address these issues, the Hard Talk discussions highlighted the following:

	Issues	Recommendations
Technical knowledge and capacity	<ul style="list-style-type: none"> ▪ Lack of technical knowledge and capacity in new RES technologies and methods. 	<ul style="list-style-type: none"> ▪ Strengthening of domestic technical capacity through: ▪ Technical education programmes, courses and degrees ▪ Advanced learning on RES for trained professionals ▪ Establishment of knowledge validation and certification programmes

6.5 Conclusion

The discussions held and experience gained during the three Hard Talks and two expert meetings show that, besides political targets and accompanying policies, the actual form of policy implementation is crucial to successfully fostering renewable energy use in the electricity and heating sectors.

In addition to focusing on directly promoting renewable energies, strategies should also consider the different aspects that might result in the non-realisation of renewable energy projects. To implement policies effectively, policymakers must take account of the various drivers and obstacles discussed in the four key factors set out in this section.

The market conditions for renewable heat appear to be more challenging than those for renewable electricity. Policymakers should be aware of the specific challenges that renewables face in the heating sector.

Expert meetings and talks of the kind held in Ukraine, Georgia and Azerbaijan create scope for identifying constraints and sharing examples of good practice in renewable energy development. Stakeholder-based dialogue can therefore help to accelerate the deployment of renewable energies in the UNECE region.

Figures

Figure 1	Key dimensions and important drivers for the market development of renewable energies.....	11
Figure 2	Emergence of important global trends in international renewable energy deployment.....	13
Figure 3	Fields of application of renewable energy sources (except renewable fuels).....	15
Figure 4	Recent PV development in the UNECE region.....	19
Figure 5	Recent wind energy development in the UNECE region.....	19
Figure 6	Recent bioenergy development in the UNECE region.....	19
Figure 7	Recent hydropower development in the UNECE region.....	20
Figure 8	PV market growth in relation to the PV share of total electricity generation capacity in the UNECE region in 2014.....	22
Figure 9	Wind energy market growth in relation to the wind energy share of total electricity generation capacity in the UNECE region in 2014.....	23
Figure 10	UNECE electricity prices for private households in relation to GDP per capita in 2016.....	24
Figure 14	UNECE electricity prices for industrial consumers in relation to GDP per capita in 2016.....	25
Figure 12	Composition of UNECE electricity prices for households in 2016.....	26
Figure 13	Composition of UNECE electricity prices for industry in 2016.....	27
Figure 14	Average UNECE electricity prices for households and industry in 2016.....	28
Figure 15	Renewable energy promotion schemes and measures in the electricity sector of UNECE member States.....	33
Figure 17	Renewable energy promotion schemes and measures in the heat sector of UNECE member State.....	35
Figure 18	Legal requirements or promotion schemes for renewable energies in the building sector of UNECE member States.....	35

Tables

Table 1	Description of the four quadrants: market share and growth rate	21
Table 2	Renewable energy promotion schemes and measures in the electricity sector.....	32
Table 3	Policy toolbox: Political and regulatory promotion schemes and measures.....	40
Table 4	Further fields of action and measures	41
Table 3	Political framework and market regulation issues and recommendations Hard Talk Ukraine.....	47

Bibliography

Analytical Center for the Government of the Russian Federation (2015): Russian Energy – 2015.

CER – Center for Economic Research (2012): “Green” Buildings in Uzbekistan: Technologies, Legal framework and Incentives, <http://www.cer.uz/upload/iblock/b5d/green%20buildings%20in%20uzbekistan.pdf>, accessed on 15.02.2016.

CIF – Climate Investment Fund (2014): Information about the Kyrgyz Republic for participation in the Scaling-Up Renewable Energy Program for Low Income Countries (SREP), https://www-cif.climateinvestmentfunds.org/sites/default/files/meeting-documents/kyrgyzrep_eoi_o.pdf, accessed on 15.02.2016.

dena-Factsheet: Albania (2014), Armenia (2014), Ukraine (2014).

dena-Marktanalyse (2014): Status und Perspektiven für die weltweite Entwicklung erneuerbarer Energien.

dena-Länderprofile: Azerbaijan (2013), Kazakhstan (2012), Tajikistan (2014), Uzbekistan (2013).

Database of State Incentives for Renewables & Efficiency (2016): <http://www.dsireusa.org/>, accessed on 15.02.2016.

Deutsch-Israelische Industrie- und Handelskammer (2017): Factsheet Israel.

EIA – Energy Information Administration (2016): Average Price of Electricity to Ultimate Customers by End-Use Sector, https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a accessed 13.12.17.

EIA – Energy Information Administration (2016): Electricity Data, <http://www.eia.gov/electricity/data/browser/>, accessed on 06.12.2017.

Energocredit (2016): Renewable Energy in Armenia, <http://www.energocredit.am/en/renewable-energy>, accessed on 12.02.2016.

Energy Charter Secretariat (2013): In-Depth Review of the Energy Efficiency Policy of the Republic of Belarus, http://www.energycharter.org/fileadmin/DocumentsMedia/IDEER/IDEER-Belarus_2013_en.pdf, accessed on 16.12.2015.

Energy Community (2017): Implementation, <https://www.energy-community.org/> accessed 14.11.2017.

enviacon international/ adelphi- Länderprofile: Belarus (2015), Georgia (2015), Kyrgyzstan (2015), Switzerland (2016).

EUROSTAT (2017): Energy Database, <http://ec.europa.eu/eurostat/web/energy/data/database>, accessed on 03.11.2017.

Global Solar Thermal Energy Council (2016): <http://www.solarthermalworld.org/>, accessed on 11.02.2016.

Hydro Quebec (2017): Comparison of Electricity Prices in Major North American Cities 2017.

IEA – International Energy Agency (2017): Policies and Measures, <http://www.iea.org/policiesandmeasures/renewableenergy/>, accessed on 02.11.2017.

Intelligent Energy Europe (2017): The European portal for energy efficiency in buildings, <http://www.buildup.eu/en>, accessed on 02.12.2017.

- International Hydropower Association (2016):** Profile Georgia, <https://www.hydropower.org/country-profiles/georgia> accessed 6.12.2017
- IPCC (2011):** Renewable Energy Sources and Climate Change Mitigation. Special Report of the Intergovernmental Panel on Climate Change, <http://www.ipcc.ch/report/srren/>, accessed on 15.07.2016.
- IRENA (2017):** Renewable Energy Capacity Statistics.
- IRENA (2015):** REmap 2030 Renewable Energy Prospects for Ukraine, https://www.irena.org/remap/IRENA_REmap_Ukraine_paper_2015.pdf, accessed on 18.01.2016.
- Natural Resources Canada, Office of Energy Efficiency (2016):** Directory of Energy Efficiency and Alternative Energy Programs in Canada, <http://www.nrcan.gc.ca/energy/efficiency>, accessed on 15.02.2016.
- Office of Energy Efficiency & Renewable Energy (2016):** <http://energy.gov/eere/office-energy-efficiency-renewable-energy>, accessed on 15.02.2016.
- REN21 (2017):** Global Status Report 2017.
- REN21 (2015):** UNECE Renewable Energy Status Report.
- Renewable Market Watch (2014):** Kazakhstan Solar and Wind Power Markets 2014, Development Opportunities, <http://renewablemarketwatch.com/news-analysis/121-kazakhstan-solar-and-wind-power-markets-2014-development-opportunities>, accessed on 18.01.2016.
- RES Legal (2017):** Support Schemes, <http://www.res-legal.eu/compare-support-schemes/>, accessed on 13.12.2017.
- Riwatt Solar Co.,Ltd (2015):** Solar Water Heaters in Montenegro, <http://riwatt.com/news/Domestic-Hot-Water-and-Heating-News-Italy.html>, accessed on 17.02.2016.
- UKEEP – Ukraine Energy Efficiency Programme (2015):** <http://www.ukeep.org/en/ukeep-for-enterprises/eligibility-criteria.html>, accessed 16.12.2015.
- World Bank (2017):** Data GDP per capita, <http://data.worldbank.org/indicator/NY.GDP.PCAP.CD>, accessed on 08.11.2017.
- Swisher, Randall and Porter, Kevin (2006):** Renewable Policy Lessons from the US: The Need for Consistent and Stable Policies, In: Mallon, K. (ed.) Renewable Energy Policy and Politics: A Handbook for Decision-making, Earthscan, UK

Abbreviations

ABK	Abbreviation
CAGR	Compound annual growth rate
CHP	Combined heat and power
COP23	23 rd Conference of the Parties
CSP	Concentrated solar power
dena	Deutsche Energie-Agentur (engl.: German Energy Agency)
EBRD	European Bank for Reconstruction and Development
GDP	Gross domestic production
GHG	Greenhouse gas
GW	Gigawatt
HPP	Hydropower plant
IPP	Independent power producer
kWh	Kilowatt hour
LHP	Large hydropower
MW	Megawatt
NEEAP	National Energy Efficiency Action Plan NEEAP
OECD	Organisation for Economic Co-operation and Development
PPA	Power-Purchase-Agreement
PV	Photovoltaic(s)
RE	Renewable energy
RES	Renewable energy sources
RPS	Renewable portfolio standard
ST	Solar thermal
UK	United Kingdom
UNECE	United Nations Economic Commission for Europe
USA	United States of America

