Menu of Efficient and Economic Technologies and Policies to Promote Them in the UNECE Region

Working document

A Practical Framework for Best Practices and Policies that Promote Renewable Energy Uptake in UNECE Member States

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Group of Experts on Renewable Energy (GERE)

EXECUTIVE SUMMARY

This document is the follow-up development of a paper[1] prepared for the first session of the Group of Experts on Renewable Energy (GERE) held on 18-19 November 2014 with the aim to encourage the exchange of know-how and best practices between relevant experts of all member States on how to significantly increase energy production from renewable sources as a means of sustainable development and climate change mitigation.

On the basis of the recommendations made by the Group of Experts, a menu of Renewable Energy (RE) technologies and policies to promote them is here considered to transform the analysis into a framework for best practices in policies in order to accelerate renewable energy uptake in the UNECE region. It is a practical tool for collection, classification, exchange and use of information on concrete cases. The report outlines key dimensions of RE: Technical, Economic, and Social.

This tool is meant to support key stakeholders within government, non-governmental, financial and international organizations as well as energy companies and academia. When reviewed together, these key elements allow decision makers to facilitate their choice towards RE solutions based on concrete experiences. In addition, this report can be used to spread valuable information on existing project proposals. This will, in turn, promote them for further partnerships and feasible development in the UNECE region.

As the vision for RE and the processes for enhancing its uptake are ever changing, a continuous flow and exchange of information is needed and can provide a better response to the needs raising from this process in continuous evolution. This exchange allows for the discussion of case studies and best practices, of high-impact measures and procedures for an energy transition towards significantly increasing the use of RE.

This paper points out that considerable improvements of the policy, legal and regulatory framework and the untapped RE potential that still exists within the UNECE member States. In order to promote the uptake of renewable energy technologies, this paper presents case studies in which best practice and new hybrid policy tools have been implemented. In subsequent steps, long-term energy sector development strategies may take into account these and other similar experiences towards the development of national renewable energy action plans (NREAPs) that are still needed in several the countries of the UNECE region. Within a more holistic and integrated approach, RE policies may need to be redesigned and – as stated in the Hammamet Declaration[2] of the Executive Secretaries of the five UN Regional Commissions - "addressing barriers is required to fair competition vis-à-vis conventional technology, without resorting to long-term subsidies, implementing stable long-term energy policy frameworks in a future energy system context, and deploying innovative and targeted

[1] "A Framework for Developing Best Practice Guidelines to Accelerate Renewable Energy Uptake " at (http://www.unece.org/fileadmin/DAM/energy/se/pdfs/gere/gere1_18.11.2014/ECE_ENERGY_GE.7_2014_INF.3_Revised.pdf)

[2] Joint Statement of the Executive Secretaries of the United Nations Regional Commissions for the 5th International Forum on Energy for Sustainable Development, 4 November 2014, for more see at: (http://www.unece.org/fileadmin/DAM/press/pr2014/Energy_Joint_Statement_Fifth_International_Forum.pdf)

financial mechanisms. Policies should be designed in light of the economic circumstances and development challenges of countries with renewable energy potential".

In addition to the report, the annex includes a template that outlines existing information pertaining to policies, instruments, legal framework, and targets on key RE technologies by country. A second template is available to summarize concrete cases studies and best practices as well as project ideas for a preliminary consideration by key stakeholders, financial institutions, potential partners and investors operating in UNECE countries.

If of interest to member States a more ambitious project could be developed with the objective to expand the approach to all UNECE countries, analyse it, and thus provide concrete recommendations on what type of policy framework are possible to increase the uptake of RE in the UNECE region.

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1. INTRODUCTION

This paper and practical tool points out key elements of a previous report with the aim to unravel the details of developing and implementing RE projects the 'right ways', thus increase understanding on how varying nations may contribute to a common set of goals using *different* approaches. The following chapters outline the elemental challenges and opportunities within three specific RE dimensions: technical, structural, and social. It contains also examples of supportive policy measures, best practices and lessons learned. The report concludes with a matrix for each RE dimension, which is used as a tool to highlight supportive policy options for overcoming specific RE challenges. For consistency, each matrix is organized by relevant type of policy instrument. The following research and matrices are not exhaustive, and require refinement from member States and stakeholders. The attached two templates are instrumental to this process.

Nonetheless, establishing a preliminary framework for designing RE best practice guidelines will enable:

(1) Identification of appropriate cross-boundary challenges and opportunities within RE Dimensions;

(2) Consideration of the design and implementation of supportive measures addressing RE challenges;

(3)Adaptation of policy mechanisms to unique national situations;

(4) Progression towards developing national action plans that support significantly increasing RE uptake.

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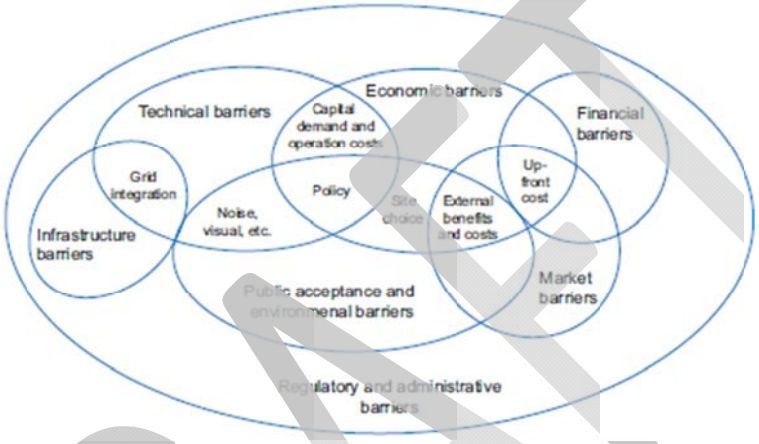
Despite unprecedented growth of renewable energy (RE) as a mainstream energy resource in the global energy mix, the implementation of RE technology is not occurring fast enough to mitigate the two degree Celsius rise in global average temperature. Additionnaly, while there are ambitious targets by governments to increase the share of renewables in energy mix, social acceptance may be considered as another factor limiting renewable energy policies. Truly, a suite of multidimensional barriers exist for RE deployment. These barriers, which are generally dynamic in nature, require acute attention and understanding before a proper policy fix can be implemented. Implementation of supportive policy measures, focused on eliminating or minimizing RE challenges is necessary if nations want to achieve affordable and clean energy services. It is important to note that a policy fix is not a one-time fix; a nation must continuously adapt the policy measure, in order for RE uptake to continuously grow.

What framework conditions are appropriate for overcoming RE barriers? What are the key elements of barriers that impede the RE market? What is the 'right way' to develop and implement RE projects in the UNECE region? Answering these key questions is imperative for developing RE technologies Employing a bottom-up approach (Figure 1), this paper proposes a best practice framework for developing effective RE best practice guidelines in the UNECE region. This work introduces an alternative to the often centralized top-down approach towards RE practices. Specifically, the framework offers a de-centralized analysis of RE challenges, opportunities to overcome each, and examples of policy-driven success stories, best practices, and lessons learned that lay the groundwork for accelerating RE uptake. Figure 2 below depicts the extensive and interwoven barriers presented and need to be overcame in order to implement RE technologies.[3]



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During the first session, the GERE noted the preliminary work undertaken by the secretariat and agreed to develop a menu of efficient and economic technologies and policies to promote them and encourage the exchange of experiences, lessons learned and best practices between experts of member States as a step to significantly increase energy production from renewable sources and therefore have a significant role in the sustainable development process and climate change mitigation efforts.

Following the GERE's discussions, the scope of this follow-up paper is to provide the framework for a menu of technologies and policies to promote them. In the coming decades, symbiotic technology and policies options will be the driving force in transforming the energy sector for renewables.

A combination of various elements and market conditions are needed for all renewable energy stakeholders to be in a position to choose the best technology to support or understand the direction to drive investments taking into account experiences and good practices occurred in other countries of the UNECE region under similar circumstances.

[3] "Renewable Energy Policy Considerations for Deploying Renewables" (https://www.iea.org/publications/freepublications/publication/Renew_Policies.pdf)

GERE intends to solicit representatives of main stakeholders from government, non-governmental, financial and international organizations as well as from energy companies and academia to develop a menu of efficient and economic technologies and policies to promote them, with a possible view of establishing UNECE standards for renewable energy in the long-term.

As annexes to this paper, two forms are attached to collect information (i) on the menu of technologies and policies to promote them and (ii) to present case studies or examples of good practices:

- Template on policies, instruments, legal framework and targets on RE technologies by country

- Template for Country Case Studies by Technologies;

Moreover, this mechanism would identify the needs, obstacles and opportunities emerging from various case studies. Using this information, GERE experts could indicate specific recommendations and assist countries with the development of national renewable energy action plans which will significantly increased the uptake of renewable energy and an energy transition in the UNECE Member States.

2. MENU OF RENEWABLE ENERGY TECHNOLOGIES AND POLICIES TO SUPPORT THEM

Taking into account the vision for renewable energy and the processes for enhancing its uptake are ever changing, renewable energy is integrating progressively into the global energy mix, although, there is much more to be done.

UNECE member States are at various levels of development in the renewable energy uptake and through a continuously evolving and interactive menu of options, all stakeholders in our region are invited to exchange lessons learned about renewable energy policies.

This cooperative mechanism will allow the GERE to discuss best practices, high-impact measures and procedures for an energy transition towards significantly increasing the use of renewable energy, with a view to establishing UNECE standards for renewable energies in the long-term.

The GERE will review the methodology for seeking, collecting, presenting and reviewing success stories that can be useful for those countries not so advanced in the development of renewable energy to gain from other experiences in the UNECE region and undertake appropriate policy measures to rapidly increase the uptake of renewable energy.

Starting with these examples, this process will allow the share of useful information on success stories by technologies, that in the end, support energy markets and systems to work more effectively and efficiently.

By analysing these cases, the GERE, through Bureau guidance and support by the secretariat, will have the opportunity to understand the factors that influence the success of renewable energy schemes and to facilitate the renewable energy increase and integration into the energy systems of UNECE member States.

According to REN21, the number of countries encouraging renewable energy deployment with direct policy support has tripled from 45 to 137 since 2004[4]. Furthermore, policy mechanisms have continued to adapt and there has been an increase in the use of policy instruments that are technology specific. Globally, the use of Feed-in tariffs (FIT) to meet legislated renewable energy targets has had the greatest impact on market penetration for renewable energy technologies. In fact, FIT policies now exist on every continent[5].

On the following page you will find a brief overview of the various types of renewable energy technologies as well as regulatory and financial mechanism put in place to support these techonologies. Then, a table is provided that lists examples on the various RE technologies along with regulatory and financial mechanisms deployed in select UNECE member States. The table is not exhaustive and only captures some of the most commonly deployed regulatory and financial mechanisms and would allow to present future case studies in an interactive and practical matrix.

[4] REN21 Renewables 2014 Global Status Report
[5] REN21 Renewables 2014 Global Status Report

2.1 OVERVIEWOF SELECTED RENEWABLE ENERGY TECHNOLOGIES

In order to target areas of best practives, it is important to have a common understanding of RE terminology. While there is generally broad consensus that renewable energy refers to energy sources that are naturally replenished, there is no universal definition on which *types* of energy sources are considered renewable.[6] Traditional biomass represents nearly half of the 18% global share of RE. However, 'traditional biomass' may not be considered sustainable because widespread extraction of wood slows the forest's natural rate of carbon sequestration, extraction of biomass may lead to deforestation and associated air pollution when used for cooking.[7] Similarly, hydropower, the second leading RE technologies in the global energy mix[8], is also not unanimously considered renewable. The environmental impacts of traditional or 'big hydropower' on fisheries and water flows leave long lasting impacts and raise questions regarding the sustainability of this technology..

Alternatively, *modern* biomass and *small* hydro are being used to describe sustainable practices for biomass and hydropower. Albeit, such terminology is not universally accepted, thus some biomass and hydropower indicators represent an aggregation of both sustainable and unsustainable practices. The SE4All Global Tracking Framework[9] report recognizes the "need to develop internationally agreed-upon standards for sustainability for each of the main [RE] technologies which can then be used to assess the degree to which deployment meets the highest sustainability standards". Renewable energy targets may be dramatically altered depending on RE definition. Therefore, in order to clarify future RE goals in the UNECE region, it is important to agree upon the type of technologies considered RE. Within the scope of this paper and taking into account the classification used by IRENA, IEA, REN21 and SE4ALL, we have broadly classified the RE technologies as follows:

[6] UN Sustainable Energy For All: Overview Global Tracking Framework 2013 (http://www.iea.org/publications/freepublications/publication/global-tracking-framework.html)

[7] RE traditional biomass vs. Modern biomass

[8] Renewable Energy Policy Network for the 21st Century: Renewables 2014 Global Status Report (http://www.ren21.net/ren21activities/globalstatusreport.aspx)

[9] UN Sustainable Energy For All: Overview Global Tracking Framework 2013 (http://www.iea.org/publications/freepublications/publication/global-tracking-framework.html)

Main Renewable Energy Technologies	
1. Solar **a.** Solar photovoltaic **b.** Solar thermal	**2. Geothermal** **a.** Deep geothermal **b.** Enhanced geothermal systems **c.** Shallow geothermal
3. Wind **a.** Onshore **b.** Offshore	**4. Bioenergy** **a.** Solid biofuels **b.** Biogases **c.** Liquid biofuels
5. Hydropower **a.** Micro **b.** Conventional	**6. Oceanenergy** **a.** Tidal **b.** Wave **c.** Ocean thermal

In identifying the various technologies, it is important to consider the RE capacity which reflects the ability for a certain technology to provide energy. In the policy arena, RE targets and standards are often measured based on *installed capacity* and may be specified for certain energy sectors. Although tracking installed capacity of RE is appropriate for monitoring incremental progress, it provides little insight into *how fully a RE unit's capacity is utilized*, masking important realities of optimizing RE projects.

Specifically, a RE's installed capacity represents the maximum power output of a generating unit, typically in megawatts (MW), and does not reflect the *actual energy* produced, measured in megawatt-hours (MWh), per given year. Rather, the RE electric generation *capacity factor* describes how often RE is putting electricity on the grid, and is expressed as the ratio of the RE unit's actual energy output (MWh) to its maximum possible output (MW) or installed capacity. Capacity factors vary significantly by fuel type. For new RE electricity projects, high capacity factors are more attractive since the owner has a greater opportunity to recover return on investment, thus lower energy price to ratepayers. Capacity factors for existing RE projects are also insightful, and elucidate opportunities for certain RE resources to provide more power to the grid and to reduce output from conventional fuels as RE prices fall and/or more capital is needed for conventional fuels to meet environmental compliance.

Despite technology developments and innovation, RE capacity factors may fall well below state-of-the-art-levels. Reasons for low or declining RE power capacity factors are multifaceted, but mainly related to maintenance performance issues, such as equipment failures, routine maintenance interruption, curtailment of electricity output because it is unneeded and/or electricity prices falling below actual cost for generation. Due to the intermittency of RE such as solar, wind and hydro, and

limited large-scale energy storage technology, the capacity factor may also be determined by the availability of the resource (sunlight, wind blowing, water), transmission line capacity, as well as plant/project design.[10]

International standard setting organizations assist in reducing uncertainty in RE project design, by recommending scientifically-sound resource assessment techniques of the potentially available RE resource. Depending on the project, by fulfilling the standard-set methodology for resource assessment, a RE project may be considered 'bankable' or robust enough (low uncertainty) for project financing. However, the declining trend of RE capacity factors, even at the global level,[11] raises concerns on whether standards are progressing at the pace needed to implement the innovation that provides the greatest reduction in project design uncertainties. In the offshore wind energy industry, research suggests standard requirements for mitigating wind project design uncertainties are different from data and analyses needed for successful offshore wind farm operations. Specifically, the pre-construction 'bankable' paths for ensuring low uncertainty and project financing are based on requirements that are "artificial, inadequate, and an artefact of limitations in our measurement opportunities that no longer apply".[12]

For the UNECE region, RE electric generation installed capacity has steadily increased, reaching 47.9% of global installed capacity in 2011. However, since 1991, the average RE electric capacity factor has declined by 5%.[13] Interestingly, the growth of RE installed capacity in the UNECE region does not necessarily reflect improvements in capacity factors as member States with the smallest fraction of RE electric installed capacity have significantly higher capacity factors than member States with the lion's share of RE electric installed capacity. Considering RE installed capacity in tandem with capacity factors exposes nuances embedded in mechanisms used to accelerate RE uptake. For the case of RE electric generation, further investigation in these issues by technology type would provide a more accurate representation on how the actual mix RE electric generation compares to non-renewable resources and elucidate opportunities to increase RE power to the electric grid. Renewable energy generation possess several characteristics that can influence facilitated integration to the power system operation and investment. Particularly, recent tendencies indicate interest in alliance between renewables and natural gas. Flexibility and efficiency of natural gas technologies can promote increase of hybrid technologies as renewable sources with low short run costs and availability (at least one source should be always present) can serve as "back up " system.

As example of a hybrid technology, more power plants could be based on a combined energy flow, including solar-based thermal energy with thermal energy from gas, diesel or other renewable energy sources.

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[10] The Energy Collective: What are the Capacity Factor Impacts on New Installed Renewable Power Generation Capacities? (http://theenergycollective.com/jemillerep/450556/what-are-capacity-factor-impacts-new-installed-renewable-power-generation-capaciti)

[11] Calculations made by UNECE Sustainable Energy Division using Global Tracking Framework database

[12] Squrr Energy: A unified approach to full Lifecycle wind assest compatibility with real world Wind Conditions 2014 (http://www.sgurrenergy.com/about-sgurr-energy/download-centre/webinars/)

[13] Calculations made by UNECE Sustainable Energy Division using Global Tracking Framework database

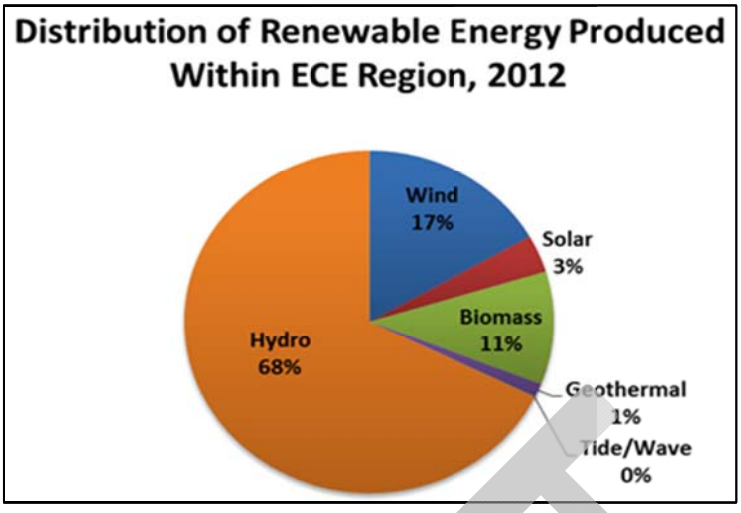


Figure 2 :RE Distribution within the UNECE Region – Compiled from USEIA's International Energy Statistics Database

Solar Power

Over the last 40 years, costs associated with producing and installing solar power have plummeted. In 1977, the global average of cost to construct a solar facility over $77 per watt. Presently, it costs an estimated $0.61 per watt[14]. More proof of dramatic decreases in solar costs can be represented in recent global solar investment figure. Global solar investments decreased 22% in 2012; however, installed capacity grew 32%[15]. Globally, solar power sources generated a total of nearly 9.6TWh of electricity in 2012. The UNECE region, alone, attributed 80% of global production[16]. In 2013, new solar projects were being installed at a rate of 100MW per day[17].Furthermore, solar has proven itself as a viable solution for rural, low density, off-grid users by increasing modern energy services to the impoverished regions of nations. Despite these promising figures, solar power still has its challenges. Inherently, solar power is reliant on the sun shining. While data exists on global solar insolation, the local average "sunny days", weather anomalies and patterns are less predictable and can prove tumultuous for solar deployment. Although costs are coming down for solar production, investments try to deal with intermittency of solar energy production. With careful analysis and planning within localities, solar could be a viable solution at both small and large scale.

Hydropower

According to the IEA, hydropower is considered a "mature, cost-competitive renewable energy source" accounting for 16% of the global electricity production and 85% of the total renewable energy generation[18]. The UNECE region contributed 41% of the global use and represents 68% of total

[14] Bloomberg New Energy Finance Report
[15] REN21 Renewables Global Status Report 2014
[16] USEIA International Statisitics Database and author analysis.
[17] IEA Technology Roadmap: Solar PV (2014)
[18] IEA Technology Roadmap: Hydropower (2012)

renewable energy generations within the region[19]. As an added benefit, hydropower plants are also commonly used as means to provide drinking water to nearby communities. Furthermore, there is still vast potential for hydropower deployment, especially in developing nations. For example, Asia and Europe still have 80% and 47% of hydropower potential untapped, respectively[20]. This untapped potential does come with challenges, however. There are many environmental and social barriers that prevent large scale hydropower production. Environmentally speaking, diverting and damming large quantities of a naturally flowing water body poses great threats to fisheries, landward habitats, and water quality. Furthermore, communities near or within the project area could become displaced due to large areas required for damming. In particular, indigenous populations are disproportionally affected. However, with hydropower proven as a cost-competitive, mature source of clean energy with vast potential still waiting to be utilized, with sustainable engineering practices hydropower could greatly help in achieving the greenhouse reductions needed. Depending on the resource availability, one of the major advantages of hydropower is its potential to be used for base load electricity generation.

Wind Power

Wind power deployment around the world continues to grow at exceptional rates. Electricity generated from wind power more than doubled from 2008 to 2012; from 250TWh to 520TWh. The UNECE region contributed 70% of the global wind power generated in 2012[21]. Due to improvements within various design aspects including height adjustments, blade length, and the transition to gearless turbines has led to increased capacity and efficiency of wind power. These improvements have led to an overall decreasing cost for installing and maintaining wind farms which translates to lower electricity costs. Total investments necessary for deployment are estimated to range from as low as $1.10 per watt in China to $2.60 per watt in Japan[22]. However, the competiveness of wind power, as well as other technologies, relies on other factors including: the cost of conventional sources, and the resource availability. The latter, like solar, demonstrates the issue with intermittency that persists with wind power, as well. Increasing the accuracy for wind load forecasting is therefore paramount for the wind power industry. According to an NREL study, increasing short term wind forecasting can yield a range of cost savings of approximately $5.05 million - $146 million[23].

Geothermal

Distinguishing itself from other renewable energy technologies by having steady base loads, geothermal does not fall victim to seasonality and variable output due to weather conditions. It is estimated that global potential for geothermal was approximately 12,500 TWh, or roughly 62% of 2008 global electricity generation[24]. Furthermore, it is estimated that by 2050, global geothermal use

[19] USEIA International Statisitics Database and author analysis
[20] IEA Technology Roadmap: Hydropower (2012)
[21] USEIA International Statisitics Database and author analysis
[22] Technology Roadmap: Wind Power, IEA (2013)
[23] The Value of Improved Short-Term Wind Power Forecasting, NREL (2015)
[24] Krewitt, W., et. al, *Role and Potential of Renewable Energy and Energy Efficiency for Global Energy Supply*

could supply for approximately 3.5% of global electricity[25]. Currently, the UNECE region produces 41% of the global total geothermal electricity output, with approximately 28 TWh generated[26]. However, variables like resource temperature and pressure, depth of resource, permeability of intended resource and distance of source to plant play major roles in the investment costs. Total investments necessary for deployment range from $2000 per kW to $4000 per kW ($2 – $4 per watt) for a typical greenfield geothermal plant[27]. High temperature "flash plants" are considered a proven technology by the IEA and proven to be cost-competitive with conventional sources of energy, with continued improvements forecasted.

Oceanenergy

Theoretically, the potential energy within the ocean has the capacity to generate and supply 100% - 400% of current global electricity demand. However, the technology is still in it's infancy in terms of global deployment. Currently, global use of ocean and tidal energy equates to 0.5TWh generated. The UNECE region generated 100% of the ocean energy until 2012, which was 98%[28]. Many of the barriers attributed to oceanenergy relate to the immaturity of the technology; most phases of oceanenergy are within R&D. Designing large networks of turbines to withstand the harsh, volatile marine environment along with connecting these systems to a grid system is still proving to be one of the largest obstacles for the industry[29]. Furthermore, there are not many detailed maps outlining regional and local energy potentials is lacking which stagnates expansion of oceanenergy technologies.

Bioenergy

Known as the largest and oldest source of renewable energy, bioenergy is used to create clean electricity, heat, and transportation biofuels. As in case of hydrpower and geothermal technologies, bioenergy is also distringuished by its minimum dependency on weather conditions and is almost always available when needed.The IEA has estimated that bioenergy could provide as much as 3,100TWh (7.5% of global electrical generation) of electricity by 2050[30]. Globally, 384TWh of electricity was generated through bioenergy sources. The UNECE region contributed more than 60% of the global electricity totals[31]. As an added benefit, biomass can be used as a co-firing product within conventional coal firing plants. Although not ideal for greenhouse gas abatement, steadily increasing the ratio of biomass over coal can continuously lower greenhouse gases as well as prevent "sticker shock" from transitioning into a new fuel source. However, environmental and social barriers exist with the use of bioenergy, particularly with biofuel production. This is due to the primary source for biofuels being also needed as sources of food and animal feed (corn, sugarcane, etc.). Many variables exist for a bioenergy to be cost competitive; taking into account the specific source of

[25] Technology Roadmap: Geothermal Heat and Power, IEA
[26] USEIA International Statisitics Database and author analysis
[27] Technology Roadmap: Geothermal Heat and Power, IEA
[28] USEIA International Statisitics Database and author analysis
[29] Ocean Energy: Technology Readiness, Patents, Deployment Status and Outlook, IRENA (2014)
[30] Technology Roadmap: Bioenergy for Heat and Power, IEA (2012)
[31] USEIA International Statisitics Database and author analysis

bioenergy, the scale of operation, the costs of the fossil fuel sources being replaced dictate the competiveness[32].

2.2 OVERVIEW OF SELECTED REGULATORY AND FINANCIAL MECHANISMS[33]

Feed-in Tariffs (FITs)

The most commonly utilized regulatory mechanism in the UNECE region (found in 82% of member States34); the FIT can be an elegant tool to encourage the deployment of renewable energy technologies. This mechanism, which pays renewable energy producers per electricity produced for fixed amount of years, is generally funded either through directly from the government, or more commonly, the power company. In the latter case, the government established guaranteed tariff and duration (usually 20 years) for the FITs are paid out by the power company who incorporates this added cost into their customer's utility bill. FITs can either be technology specific, or neutral. Typically, various pricing tiers exist within a FIT scheme. Depending on the technology type or the size of the project the price per unit of energy is altered to better reflect market conditions.

Net-Metering

In 2013, 43 a total countries around the world had net metering policies pertaining to renewable energy and within the UNECE region, currently 27% of member States have net-metering policies[35]. This regulatory mechanism allows for consumers to pay for only the "net" energy consumed. In other words, energy that is consumed minus the energy produced from their renewable source. Generally, there is a cap on renewable energy production as well as duration for renewable energy compensation, similar to the FIT. Unlike FITs, however, net-metering policies do not necessarily guarantee compensation in the event that more renewable energy is produced than consumed. This lack of potential compensation is part of the reason many nations opt for FITs over net metering.

Public Competitive Tendering (Auctions)

With more countries developing national targets and strategies for renewable energy use, public tenders have proven to be tool that encourages shift towards the increasing use of renewable energy. Between 2009-2014, the number of countries utilizing renewable energy tenders increased from 9 to 55[36]. Within the UNECE region, 36% of member States offer public tenders for renewable energy technologies. Public tenders request bids to be placed on renewable energy projects for a certain amount of renewable energy capacity or generation. An example of this can be seen in the European

[32] Technology Roadmap: Bioenergy for Heat and Power, IEA (2012)

[33] On definitions, please see more in the Glossary of the REN21's Renewables 2015 Global Status Report at http://www.ren21.net/wp-content/uploads/2015/07/REN12-GSR2015_Onlinebook_low1.pdf.

[34] Please refer to the Table in 4.5.

[35] Renewables 2014 Global Status Report, REN21

[36] Renewables 2014 Global Status Report, REN21

Union (EU) Green Public Procurement which is a voluntary process tool for EU member States to review and select more environmentally friendly goods and services including tenders for renewable energy use to meet the targets established in the EU Renewable Energy Directive[37].

Capital Subsidies & Grants

Unfortunately, many renewable energy technologies require large amounts capital investments that detract from the attractiveness for private investment. For example, the average cost to construct a wind farm ranges from $1000 - $2000 per kWe as opposed to a natural gas plant which ranges from $400-$800[38]. To increase the viability of these projects and encourage the deployment of renewables, governments establish grants and subisides for the construction of these projects. Within the UNECE region, 71% of member States have policies and financial mechanisms in place to support capital subsidies and grants.

Investment Tax and Production Credit

Simply put, the investment tax credit is designed to reduce the taxable income of a renewable energy facility based on the amount invested (in monetary values) while the production tax credit reduces the taxable income based on the amount of renewable energy produced (measured in KWh). Within the UNECE region, 45% of member States offer such financial incentives for renewable energy operators.

Public Loans and R&D

With many renewable energy technologies still not fully developed, governments seek to expedite deployment of these technologies through expanding research and development funding as well as providing loans for new projects. Globally, a total of $5.1 billion was invested in research and development from government agencies[39]. Within the UNECE region 73% of member States have financial mechanisms in place that allow for such activities.

[37] http://ec.europa.eu/environment/gpp/pdf/tbr/electricity_tbr.pdf

[38] Http://www.iea.org/textbase/npsum/eleccostsum.pdf

[39] Bloomberg New Energy Finance Report

Menu of Renewable Energy Technologies/ Specific Policy Instruments
Template with examples from UNECE countries

	Regulatory Mechanisms			Fiscal Incentives & Public Financing		
	Feed-in Tariffs	**Net Metering**	**Public Competitve Tendering (Auctioning)**	**Capital subsidy/grants/rebates**	**Investment/production tax credit**	**Public investments/loans/ grants/R&D**
Solar	**Italy** 5th Revision of "Conto Energia" Support Scheme for PV (2012)	**United States (California)** Net Energy Metering (2013)*	**France** 500MW Solar Tender (2015)	**Israel** State subsidy for electricity generation from wind and solar PV (2004)	**Austria** Investment Subsidy for Solar PV installations <5kWpeak (PV/BIPV 2013) (2013)	**Netherlands** Support Scheme for Solar Panels (2011)
Hydro	**Albania** New Tariff Methodology for Small Hydro Plants (2007);	**Canada (British Columbia)** BC Hydro Net Metering Program**	**Serbia** Public Tenders for Small Hydropower Plants - EBRD (2015)	**Uzbekistan** Decree 476 on the development of hydro energy (1995)	**Tajikistan** Tax exemptions for small hydro plants (1992)	**Portugal** Promotion of hydro and wind projects (Decree-Law no. 69/2000) (2000);
Wind	**Israel** FIT for solar PV and wind electricity (2009, amended in 2011)	**United States (Minnesota)** Cogeneration and Small Scale Production***	**France** Offshore wind tendering mechanism (2011)	**Malta** Capital grants for solar and wind (2006, amended in 2009)	**Denmark** Wind Energy Co-operative Tax Incentive (1997)	**Germany** KfW Programme Offshore Wind Energy (2011)
Geothermal	**Austria** Energy "Ökostromverordnung" (feed-in tariffs) (2012)	**United States (Virginia)** City of Danville Ordinance No. 2010 - 12.04 (Net Metering)	**Greece** Public Tender to Explore Geothermal Potenital on the Samothrace Island (2011)	**Switzerland** Risk Guarantee Scheme for Geothermal Power Projects (2008);	**United States** 30% Federal Tax Credit for Geothermal Heat Pumps	**Netherlands** Guarantee Scheme for Geothermal Energy (2009);
Oceanenergy	**Portugal** World's First Wave Energy Feed-in Tariff (2010)	**United States (Florida)** Florida Power and Light Net Metering for Tidal Energy	**United Kingdom** Offshore Renewables Joint Programme Ocean Energy (2013)	**United Kingdom** Marine Energy Array Demonstration Fund	**Belgium** Offshore Domanial Concessions for Wind and Ocean Energy Production (2004)	**Portugal** Wave Energy Pilot Zone (2008)
Bioenergy	**France** Renewable Energy FIT: Biomass (2009)	**United States (Minnesota)** Cogeneration and Small Scale Production	**France** Bioenergy Tender to Produce 60,000 tons of bioethanol (2006)	**Italy** Biomethane subsidies (2014)	**Cyprus** Tax exemptions for biofuels (2005)	**Canada** NextGen Biofuels Fund (2007)

*http://www.cpuc.ca.gov/PUC/energy/DistGen/netmetering.html
** http://www.bchydro.com/energy-in-bc/acquiring_power/current_offerings/net_metering.html?WT.mc_id=rd_netmetering
***https://www.revisor.mn.gov/statutes/?id=216b.164

3. OVERVIEW OF THE TECHNICAL, STRUCTURAL AND SOCIAL DIMENSIONS OF RENEWABLE ENERGY WITHIN THE UNECE REGION[40]

3.1 TECHNICAL DIMENSION

Regardless of socio-economic conditions, there are key technical limitations that apply generally for every country. The most commonly cited challenge is the reliability of renewable energy sources. While RE is characterised by low marginal operating costs, for certain technologies such as solar or wind are characterised by intermittencyInvestments in energy production from natural resources and accurate projection projects may be one of the ways to address natural resource intermittency and the challenges created to the industry although there are several approaches to tackle these challenges. Further, though RE resource potentials are often significant, the amount of RE that is actually transformed into usable energy may only be a small fraction of the potential. Given the high up-front capital costs of developing RE potential, such impediments related to the reliability of RE may discourage uptake.

To ameliorate the reliability of RE, a holistic view of the RE technical dimension is necessary. Inconsistent RE terminology, data quality and quantity issues, low global project efficiency, and complications that arise from integrating RE power into the electricity grid are elemental technical challenges that impact the economies of energy markets and deter investment. Investigating the intricacies of the RE industry's technical dimension will elucidate high-impact opportunities to overcome challenges accelerate RE uptake.

3.2 ECONOMIC DIMENSION

The global increase in RE investments and relatively swift transformation towards cost-competitiveness between RE and conventional resources is evidence that access to affordable, reliable, and sustainable energy services is achievable. Similar to any maturing industry, the market may be expanded, price parity accelerated, and investments increased if sophisticated policies founded on long-term government commitments are developed. Unravelling the details of RE market failure, distortions, RE costs, and financing will elucidate high-impact opportunities to overcome structural challenges and accelerate RE uptake. Trends in RE installations are reflected in RE investments. The global capacity of wind power has increased over tenfold between 2000 and 2010.[41] The size of future RE investments depends on both falling costs of RE and the implementation of RE policies founded on a long-term commitment for providing sustainable energy services.

[40] For more information on the technical, structural and social dimensions of renewable energy, related challenges and opportunities, see informal paper on "A Framework for Developing Best Practice Guidelines to Accelerate Renewable Energy Uptake " at http://www.unece.org/fileadmin/DAM/energy/se/pdfs/gere/gere1_18.11.2014/ECE_ENERGY_GE.7_2014_INF.3_Revised.pdf

[41] Renewable Energy Policy Network for the 21st Century: Renewables 2014 Global Status Report (http://www.ren21.net/ren21activities/globalstatusreport.aspx)

3.3 SOCIAL DIMENSION

The social dimension of RE implementation is an emerging field of research as the impact of social acceptance on RE uptake can be just as significant as ambitious RE policy targets. As global RE production increases, the amount of socio-political disagreements also rises. One of the fundamental difference between conventional and RE resources is location, as well as implications that arise from centralized and decentralized generation, which later affect at transmission and distribution stages. While fossil fuels energy source remained buried deep in the earth, many RE technologies require the harnessing of elements above ground, in regions that may impact society's daily line-of-sight. This geographical difference between energy sources has created new area of research regarding social acceptance of RE. Although RE has a positive image for some, high acceptance is needed for large-scale employment.[42] Limited awareness of RE projects and societal benefits is another challenge to accelerate RE. Given the various demands of ensuring a viable RE projects, communication strategies and outreach with the impacted communities is often minimal.

3.4 The Data Gap

Data quality and quantity challenges add to the complexity of designing effective RE policies that reflect achievable and affordable RE targets. In order to properly assess the feasibility of RE projects, timely, appropriate, consistent and reliable data are necessary. Although a plethora of international organizations are dedicated to RE resource and policy data collection[43], information gaps and data inconsistency in the UNECE region are prevalent.[44]

As a foundation, an accurate picture of the share of renewable energy resources in the national energy mix is necessary. However, methodological differences in calculating RE resources indicators are a reality (biomass vs. traditional and modern biomass or hydropower vs. big and small hydropower). RE indicators may also not be available in an immediate timeframe, due the lengthy data gathering process. The reliability of RE indicators, particularly in cases when it is believed to not exist, is another particular data challenge facing the industry.[45] Likewise a comprehensive picture of RE policy and framework implementation is needed to share best practices and lessons learned. The observed discrepancies between policy datasets aimed to deliver the same information create challenges in maintaining a reliable source of comparable information on the effective measures for increasing RE uptake. Finally, accurate and consistent data on RE costs or RE levelized cost of electricity (LCOE)

[42] IEA-RETD: Communication Best-Practices for Renewable Energies (RE-COMMUNICATE) 2013 (http://iea-retd.org/wp-content/uploads/2013/04/IEA-RETD-RE-COMMUNICATE-Report_Final_20130403.pdf)

[43] Report on selected international actors on renewable energy in the UNECE region may be found :

(http://www.unece.org/index.php?id=35377)

[44] Discussion Paper Number 1: Status Report on Renewable Energy in the UNECE Region

[45] Discussion Paper Number 1: Status of Renewable Energy in the UNECE Region

would be beneficial for evaluating a RE policy's *impact* on the overall competiveness of various RE technologies.

When evaluating challenges surrounding RE indicators, it is likewise important to consider the quality and quantity of tangential data sources that are also appropriate for developing effective long-term RE frameworks. Trends in energy supply and demand are also appropriate in RE target setting, as population growth and development will modify a fundamental component in the calculation of renewable energy 'share'. In other words, the total *pie* of total final energy consumed will grow contemporaneously with increased renewable energy consumption. Consideration of reliable energy demand forecasts at the national level may be important for drafting renewable energy consumption targets.

A theoretical plan to power the entire world with renewable energy has been demonstrated[46], yet information gaps exist regarding RE resource potential at the regional, national and local level. Typically, once a RE project is chosen for development, experts perform in-depth analysis on the viability of the resource potential. However, prior to this stage, there is limited information, or a reliable 'first look', of RE resource potential. Understanding resource potential also implies understanding characteristics beyond natural elements of renewables (sunlight, wind, waves, etc.). Therefore, RE potential data in tandem with information on population density, topography, land use and protected areas is needed to provide insight on RE project feasibility prior to the development of supportive policy mechanisms.

Electricity infrastructure varies by nation; thus strategies to integrate potential RE technologies into existing energy architecture may not be universal. However, cross-border exchange of experience regarding smart grid technical solutions and electricity market design, are recommended to improve the flexibility, regularity and reliability of the grid.[47] General data indicating the scope of national centralized and decentralized grid infrastructure, the roles and responsibilities of transmission and distribution operators (TSO or DSOs), as well as those communities not connected to the grid would accelerate this exchange of know-how and capacity building regarding optimal RE electricity delivery.

[46] Jacobson, Mark Z., and Mark A. Delucchi. "A plan to power 100 percent of the planet with renewables." Scientific American 26 (2009).

[47] World Smart Grid Forum 2013: Results and Recommendations 2013

(http://www.iec.ch/about/brochures/pdf/technology/WSGF2013-results-and-recommendations.pdf)

4. EXAMPLES OF SUPPORTIVE POLICY MEASURES, BEST PRACTICES AND LESSONS LEARNED

4.1 POLICY INSTRUMENTS

Given the diversity of the UNECE region, this framework for best practice guidelines is designed to serve as tool for exchanging information on the various paths available to achieve a common objective of significantly increasing the uptake of RE in the UNECE region. In line with the bottom-up approach, the following section briefly describes a range of RE policy instruments used to address RE technical, structural, and social challenges and specific examples[48] of supportive policy measures, best practices, and lessons learned that reflect opportunities to accelerate RE uptake. For consistency, examples are organized by relevant policy instruments and sub-divided into technical, structural, and social dimensions (Figure 7-9).

Although with varying objectives, there are a variety of policy instruments that support RE. Research and development (R&D) policy support for RE technology innovation and the broader components of the RE industry brings the critical solutions needed to build a next-generation energy system to the forefront. Regulations and standards may support RE directly or indirectly. Direct regulations and standards generally aim to increase the demand for RE or remove non-economic barriers. Indirect regulations benefiting RE may target non-renewable power sources. For example, setting emission restrictions or other performance standards for fossil-fuel power plants indirectly boosts RE uptake, as well as designing policies that mitigate non-economic barrier such as lack of grid access.

Policy 'quantity' instruments are market-based tools design policies based on quota of RE production. Quantity setting instruments are unique, since they allow the prices of incentive amounts to be determined by the market. Two commonly implemented quantity instruments, which are often used in tandem, are Renewable Portfolio Standards (RPS) and Renewable Energy Certificates (REC). Renewable Portfolio Standards (also referred to as renewable electricity standards, renewable obligations, mandated market shares), mandate a certain percentage of RE or absolute quantity of RE capacity or generation at unspecified prices.

RECs are non-tangible, tradable commodities that represent proof that electricity was generated from a RE resource (per MWh). Often times, RECs are used to increase the flexibility of RPS policy and lower costs. RECs are supplied by RE producers and may be bought or sold with or without electricity (bundles or unbundled respectively). The demand for RECs is from consumers and utilities. Through voluntary markets, consumers can purchase RECs to demonstrate the use of clean electricity, providing further incentives for RE producers. On the contrary, in the compliance market, electricity distributors use RECS to meet the formal requirements of RPS policies, local and international targets.

[48] Policy mechanism introduced reflect best practices and success stories from IEA: World Bank: Energy Sector Strategies for Green Growth modules and the authors on research.

Government procurement is another tool that requires purchasing of RE, except this time the responsibility is for national or sub-national governments. Procurement policies may leverage public-sector energy demand by requiring public facilities to meet a certain percentage of their demand with RE, allowing public-sector to meet part of a requirement with on-site RE power generation, and/or integrating governments into the RPS or REC schemes.

Price instruments, such as fiscal incentives and Feed-in Tariffs (FITs), other mechanisms used to mature RE markets. Price instruments reduce costs and pricing-related impediments by establishing favourable RE price regimes. By lowering costs of RE project construction and operation, fiscal incentives increase the competitiveness between the RE and fossil fuel industry. A variety of fiscal incentives exist, ranging from production/investment tax credits to public investment loans or grants. Similarly, FITs are a form of unique form of fiscal incentives that may be used to accelerate RE investments. FIT policy design typically include a preferential tariff, guaranteed purchase of electricity produced over a significant period, and guaranteed access to the grid.

In addition to the traditional suite of policy tools for RE uptake, an emergence of next generation or hybrid policy mechanisms have been implemented with great success. With the RE market and political landscape changing rapidly, policies need to be able to adapt and still promote growth within the RE sector. By pairing multiple existing policy instruments, these hybrid policies seek to[49]:

- Diversify the investor as well as the scale of RE projects,
- Adapt to markets where socket parity has been reached, or surpassed,
- Integrate non-hydro RE technologies,
- Guarantee premium for RE production while requiring interaction with the wholesale market to increase price competitiveness.

Finally, international cooperation, particularly through data-sharing and national partnerships, may contribute significantly to greening the energy sector. Policies designed to promote collaboration and exchange of experience, whether lessons-learned or best practices, strengthen the impact of both domestic and national RE strategies. Data-sharing, including methodological choices for indicators, are further examples of effective capacity building through international cooperation policy mechanisms.

[49] NREL: "The Next Generation of Renewable Energy Policy" (http://www.nrel.gov/docs/fy15osti/63149.pdf)

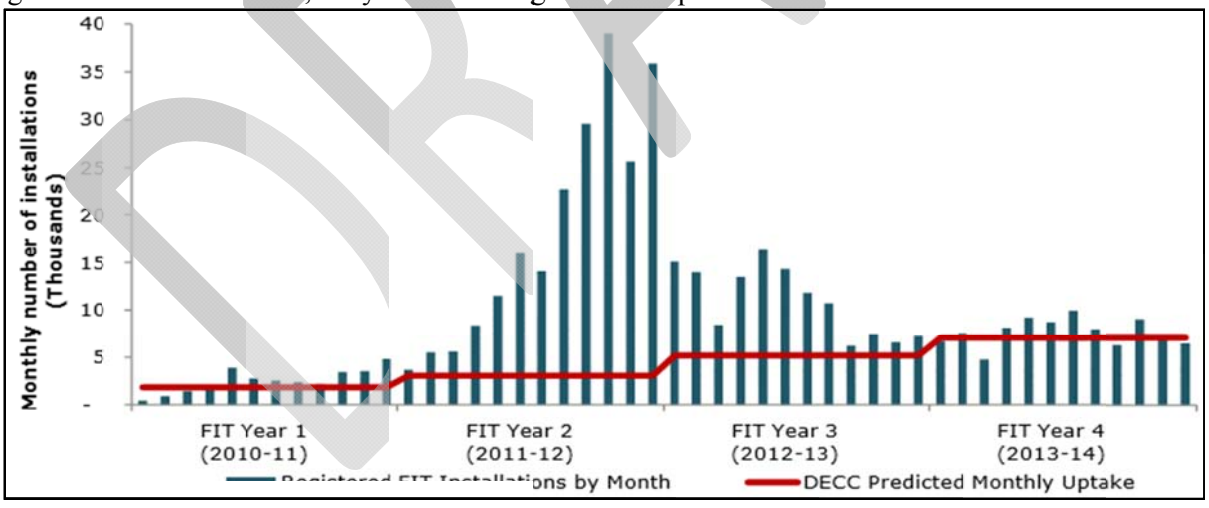
4.2 CASE STUDIES

With countries seeking to decrease their dependency of imported energy and increase energy security, the desire to diversify energy portfolios with renewable technologies has been observed within the UNECE Region. Between the years 2008–2012, the cumulative renewable energy generation within the UNECE Region increased from 405,000 GWh to 704,000 GWh with an average increase of 15% year to year[50]. In order to sustainably implement renewable energy technologies, UNECE member states have adopted a wide range of tried and true policy mechanisms.

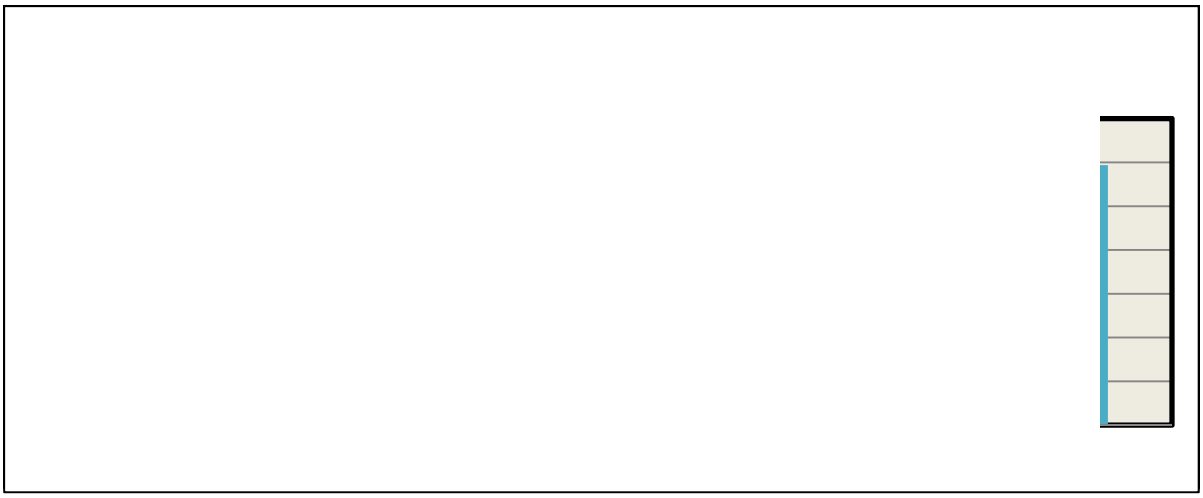
Two examples of these policy mechanisms are feed-in tariffs (FITs) and competitive tendering. These policies incentivise the investment of renewable energy projects both large and small. FITs provide guaranteed pricing for renewable energy production for a fixed amount of years. On the other hand, competitive tendering solicits bids for a given amount of renewable energy supply or capacity to be constructed, and those who offer the lowest construction and operational costs are generally selected for contracts. Within the UNECE region, 82% of member states utilize FITs, and 36% offer competitive tendering[51]. The following are case studies that highlight the success of pairing certain policy mechanisms aimed at increasing the uptake of renewable energy technologies.

2010 United Kingdom Feed-In Tariffs Scheme

Since its inception, the United Kingdom (UK) has seen an incredible uptake of small scale, renewable energy technologies. Solar photovoltaic (PV), in particular have seen the largest uptake. In the first year alone (2010-2011) solar generation increased by more than 500%[1]. Moreover, there have been 561,185 solar installations with approximately 2,500 newly registered installations per week. Figure 3 illustrates the success of the FIT scheme in the UK[52]. Once the law was adopted in 2011, the subsequent year observed a substantial increase, outpacing the predicted monthly uptake in the monthly number of installations. Figure 4 depicts the dramatic increases in solar PV energy generation in 2011- 2012, the years following the FIT implementation.



[50] Compiled from USEIA's International Energy Statistics (http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm)
[51] Renewable Energy Policy Network for the 21st Century: Renewables 2014 Global Status Report (http://www.ren21.net/ren21activities/globalstatusreport.aspx)
[52] OFGEM Feed-in Tariff Annual Report 2013-2014 (https://www.ofgem.gov.uk/ofgem-publications/91945/feed-intarifffitannualreport20132014.pdf)



The 2010 FIT scheme was enacted in order to boost the use of small-scale, renewable and low-carbon energy technologies and to help meet the binding target of 15% renewable energy use by 2020[53]. The scheme limits the total installed capacity to five megawatt (MW) from solar photovoltaic (PV), wind, hydro, and anaerobic digester technologies with up to 10MW for community based energy producers[54]. The law also requires accredited licensed electric suppliers to pay for the generation of the renewable and/or low carbon energy to the supplier. In addition, the UK scheme is one of few "hybrid" policy mechanisms in which support transitional fossil fuels, specifically combined heat and power from fossil sources. The law stipulates that if the energy supplier utilizes up to the capped renewable and low carbon technologies, they may include up to two kilowatt of fossil fuel derived energy sources[55].

2011 France Off-Shore Wind Tendering

The French tendering process created an investment opportunity with predefined policy goals and clear financial returns that spurred the innovation and price competitiveness of wind farm industry in France. The tendering process resulted in the installed capacity of six gigawatts (GW) of off shore wind power by the year 2020. The projects that were selected will not only contribute to the reduction in GHG but will have great economic impact to local communities as well. Between the two rounds of tendering, approximately 16,000 jobs will be created over the next decade for the construction, installation, and maintenance of the wind farms.[56] In addition, the French tendering process offers potential investors with clear risks and returns with the following advantages[57]:

[53] National Renewable Energy Action Plan for the United Kingdom (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47871/25-nat-ren-energy-action-plan.pdf)

[54] UK Department of Energy & Climate Change Press Release: More community energy projects to get support under Feed-in Tariffs (https://www.gov.uk/government/news/more-community-energy-projects-to-get-support-under-feed-in-tariffs)

[55] OFGEM Feed-in Tariff Scheme, Fact Sheet (https://www.ofgem.gov.uk/ofgem-publications/85793/fitfactsheet.pdf)

[56] Areva Press Release: Results of invitation to tender for offshore wind farms: GDF SUEZ, EDP Renewables, Neoen Marine and AREVA awarded Tréport and the Isles of Yeu and Noirmoutier

- Gives security/visibility to investors: Guaranteed 20 year FIT with pre-defined adjustments.
- Risks of non-construction significantly reduced due to pre-defined location determination.
- Optimized project costs, which translates to electricity costs optimized.
- One-stop-shop for administrative procedures and facilities work of relevant authorities.
- Simplifies exchanges with a single operator for each site.

The 2011 French tendering program has proven to be a large success. The two stage competitive tendering program was created in order to achieve six GW of off-shore wind capacity. These tenders support France's overall wind energy target of 25 GW by 2020 with 19 GW to be achieved onshore in support of the Renewable Energy Directive goals set forth by the European Union to achieve 23% renewable energy use by 2020[58].

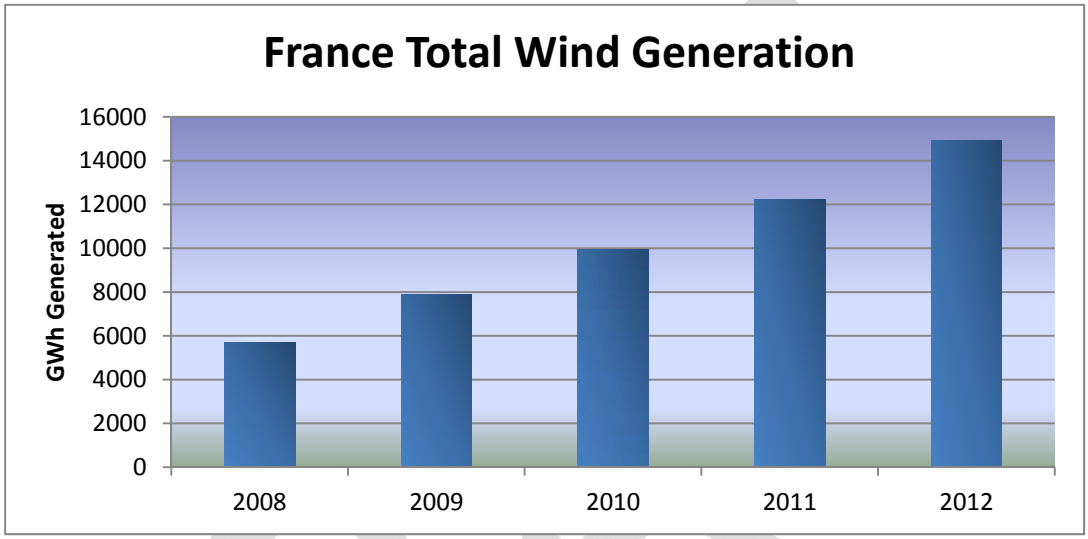


Figure 5: France Total Wind Generation, 2008-2012, Compiled from USEIA's International Energy Statistics Database

Japan's Improved FIT Policy Following the Fukushima Disaster

Following the tragic 2011 Fukushima Daiichi Nuclear Plant meltdown, residents of Japan lost confidence in supporting nuclear energy. The aftermath saw a country where nearly 30% of the energy consumed came from nuclear sources was eliminated following the meltdown. This significant loss in energy supply was supplemented by Japan becoming the world's largest importer of liquefied natural gas, second largest importer of coal, and third largest in crude and other oil products[59]. This

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http://www.areva.com/EN/news-10196/results-of-invitation-to-tender-for-offshore-wind-farms-gdf-suez-edp-renewables-neoen-marine-and-areva-awarded-trport-and-the-isles-of-yeu-and-noirmoutier.html

[57] Offshore Wind Support Policies, France (http://iea-retd.org/wp-content/uploads/2012/10/14-Grenon-France-offshore-wind.pdf)

[58] IEA Policies and Measures Database (http://www.iea.org/policiesandmeasures/)

[59] US EIA Japan Analysis (http://www.eia.gov/countries/cab.cfm?fips=ja)

newly found dependency on imported energy also led Japan's energy prices to increase by 20-30%[60]. With the increased prices and decreased energy security, rolling blackout became common throughout Japan. The need for cleaner energy dependence and affordability, lead rise to an aggressive movement named "setsuden" which in Japanese translates to "power saving". Acting in solidarity, Japanese citizens worked in offices with lights off, rode trains that ran slower, and homes that used less air conditioning.

This symbolic gesture resonated loudly with Japanese policymakers and in response, passed legislation that set ambitious goals for increased renewable energy consumption targets. In 2012, the Innovative Strategy for Energy and Environment set renewable energy targets to be met by 2030[61]. Japan is seeking to produce 190 billion KWh of their electricity from solar PV; this would be an eight fold increase from 2010 levels. In order to support this target, Japan overhauled their 2009 FIT policy with increased premium rates for renewable energy producers. This resulted in historical installed capacity increases in distributed solar PV technology as well as the largest residential solar market in the world[62]. Figure 6 below shows the timeline in which correlates the timing of the nuclear meltdown and the popularity of the FIT measure and how that translated to record increases in solar PV installations. From 2012-2014, nearly 9 GW of solar PV capacity installed, most of which occurred during fiscal year 2013-2014 with 7.04 GW[63].

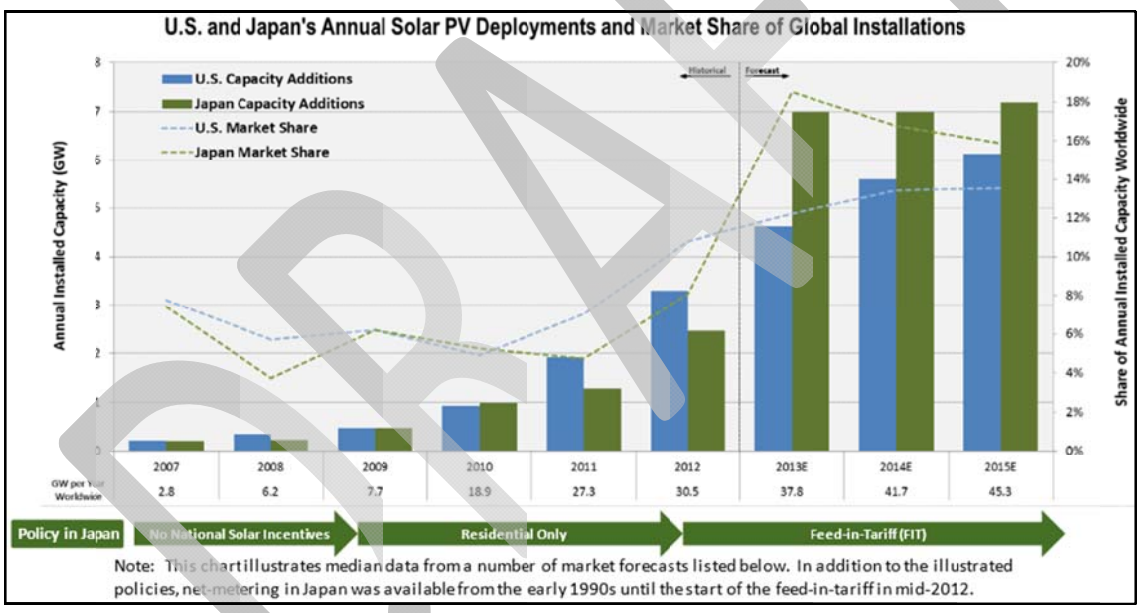

Figure 6: Japan vs. US solar PV Deployment

[60] MIT Tecnology Review
(http://www.technologyreview.com/featuredstory/533451/can-japan-recapture-its-solar-power)
[61] IEA/IRENA Policies and Measures Database
(http://www.iea.org/policiesandmeasures/renewableenergy/index.php?country=Japan)
[62] "Japan's Solar Photovoltaic (PV) Market: An Analysis of Residential System Prices"
(http://www.nrel.gov/docs/fy14osti/60419.pdf)
[63] PV Magazine: "Japan Installed 7 GW of solar capacity in last fiscal year", June 19, 2014
http://www.pv-magazine.com/news/details/beitrag/japan-installed-7-gw-of-solar-capacity-in-last-fiscal-year_100015475/#axzz3VyTvVuSN

4.3 TECHNICAL MATRIX OF SUPPORTIVE MEASURES

Figure 7 provides a menu of supportive policy measures, best practices and lessons learned for addressing RE technical challenges. The examples of supportive measures are categorizes by type of policy instrument and represent a collection of best practice policies identified by the IEA and World Bank, as well as through the authors' research. A brief description and resource for more information is provided for each measure. The list of polices are not meant to be exhaustive, but rather to provide a preliminary assessment for discussion of specific opportunities within the technical dimension of RE that may assist with accelerating uptake.

	Policy Instrument	Objective	Example	tion
Technical Supportive Measures	R&D support	Support innovation for electricity market reform	United Kingdom: Electricity market reform & Contracts for Difference Program (CFD)	https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/267735/EMR_-_Update_on_Terms_for_the_Contract_for_Difference_v8.pdf
		Support innovation for increasing RE technology efficiency	United States: National Renewabl Energy Lab's Simulator For Wind Farm Application (SOWFA) software modeling tool to increase wind farm efficiency	http://gcn.com/Articles/2014/10/16/Wind-farm-modeling.aspx?Page=1
	Regulation & Standards	Direct support: Clarifies RE resources	Albania: Specifies small hydropower as a renewable energy resource	http://www.irena.org/DocumentDownloads/events/2013/December/Background_Paper-A.pdf
		Direct Support: Upgrading Grid Infrastructure	Germany: Lessons Learned- upgrade in power grid infrastructure necessary for Re integration	http://cleantechnica.com/2012/06/03/germany-to-expand-power-grid-great-for-renewables/
		Direct Support: Energy Storage Target	California: 'Energy Storage' target of 1,325MW of energy storage by 2020	http://www.greentechmedia.com/articles/read/californias-massive-om-paper-grid-energy-storage-market
		Direct Support: Flexible Grid Access	Net-metering Allows a two way flow of electricity and only charges consumers for their net electricity use	http://www.eei.org/issuesandpolicy/generation/NetMetering/Documents/Straight%20Talk%20About%20Net%20Metering.pdf
	International Cooperation	Data-Sharing	CLEAN ENERGY MINISTERIAL Accelerating the Transition to Clean Energy Technologies — Provides a global forum to share best practices that support clean energy policies	http://www.naruc.org/international/Documents/Schwartz_NARUC%20Black%20Sea%20Regulatory%20Initiative_Eng.pdf
		Partnership	National Association of Regulatory Utility Commissioners — Black Sea Regulatory Initiative: focused on electricity grid regulatory developments in an expanded regional context	http://www.naruc.org/international/program.cfm?page=27

Figure 7: Technical Supportive Measures

4.4 ECONOMIC MATRIX OF SUPPORTIVE MEASURES

Figure 8 provides a menu of supportive policy measures, best practices and lessons learned for addressing RE economic challenges. The examples of supportive measures are categorized by type of policy instrument and represent a collection of best practice policies identified by the IEA and World Bank, as well as through the authors' research. A brief description and resource for more information is provided for each measure. The list of polices are not meant to be exhaustive, but rather to provide a preliminary assessment for discussion of specific opportunities within the structural dimension of RE that may assist with accelerating uptake.

Structural Supportive Measures	Policy Instrument	Objective	Example	nation
	Regulations and Standards	Direct Support: Increase demand of RE	Denmark: Danish Energy Agreement 2012: Denmark 50% wind energy for electricity by 2020 (100% RE electricity 2050)	/26/denmark-percent/
			Israel: National level solar hot water mandate	/07/90-of-ipped/
			Azerbaijan: State Agency of Alternative and Renewable Energy Sources	n/rea/news/articl utput-of-
		Indirect Support:Restrictions on non-renewable power sources	France: Natural Gas Fracking Ban	articles/2013-ch-court-as-
	Price Instruments	Increase Supply	Germany: Lessons-Learned from FIT policy	3R_INTERNET_he+German+Feiges.pdf
			Netherlands (SDE+): Scheme designed so that level of subsidy keeps up with the market price of energy.	les/2013/11/Enur_version)_0.
			Russia: Renewable Energy Source Development Measure	ct/RegProjectrate_site/hom
		Increase Demand	United Kingdom: Home Energy Renewable Energy Loan	s-27759217
	Quantity Instruments	Renewable Energy Credits	Maryland: Offshore Renewable Energy Credit	sejenkins/196pment-new-
	International Cooperation	Climate Financing	Kazakhstan: Renewable Energy Investment Forum	ms/edm/single/59&cHash=790#.VFt2FfnF90
		Partnership	Norway-Sweden: Joint Swedish-Norwegian Electricity Certificate System	en/Sustainabilin/
				ms/edm/single/59&cHash=790#.VFt2FfnF90

Figure 8: Economic Supportive Measures

4.5. POLICY OVERVIEW FOR THE UNECE REGION

	National		Regulatory Mechanisms							Fiscal Incentives & Public Financing			
UNECE Member States	Renewable Energy Targets	Renewable Energy Strategy or Plan	Feed-in Tariffs	Renewable Portfolio Standards	Net Metering	Biofuels Mandates	Heat Mandate	Public Competitve Tendering (Auctioning)	Tradeable Renewable Energy Credits	Capital subsidy/grants/rebates	Investment/production tax credit	Energy Production Payment	Public investments/loans/grants/R&D
Albania													
Andorra													
Armenia													
Austria													
Azerbaijan													
Belarus													
Belgium													
Bosnia and Herzegovina													
Bulgaria													
Canada													
Croatia													
Cyprus													
Czech Republic													
Denmark													
Estonia													
Finland													
France													
Georgia													
Germany													
Greece													
Hungary													
Iceland													
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Italy													
Kazakhstan													
Kyrgyzstan													
Latvia													
Liechtenstein													
Lithuania													
Luxembourg													
Malta													
Moldova													
Monaco													
Montenegro													
Netherlands													
Norway													
Poland													
Portugal													
Romania													
Russian Federation													
San Marino													
Serbia													
Slovakia													
Slovenia													
Spain													
Sweden													
Switzerland													
Tajikistan													
The former Yugoslav Republic of Macedonia													
Turkey													
Turkmenistan													
UK and Northern Ireland													
Ukraine													
United States of America													
Uzbekistan													
Total	50	50	46	16	15	32	8	20	23	40	25	12	41
Percent of ECE	89%	89%	82%	29%	27%	57%	14%	36%	41%	71%	45%	21%	73%

No Policies in Place | Policies in Place | Subnational

Source: Compiled from REN21 Global Status Report, REN21 Map, IEA Policy and Measures Database, & UN Publications

4.6 SOCIAL MATRIX OF SUPPORTIVE MEASURES

Figure 9 provides a menu of supportive policy measures, best practices and lessons learned for addressing RE social challenges. The examples of supportive measures are categorizes by type of policy instrument and represent a collection of best practice policies identified by the IEA and World Bank, as well as through the authors' research.[64] A brief description and resource for more information is provided for each measure. The list of polices are not meant to be exhaustive, but rather to provide a preliminary assessment for discussion of specific opportunities within the social dimension of RE that may assist with accelerating uptake.

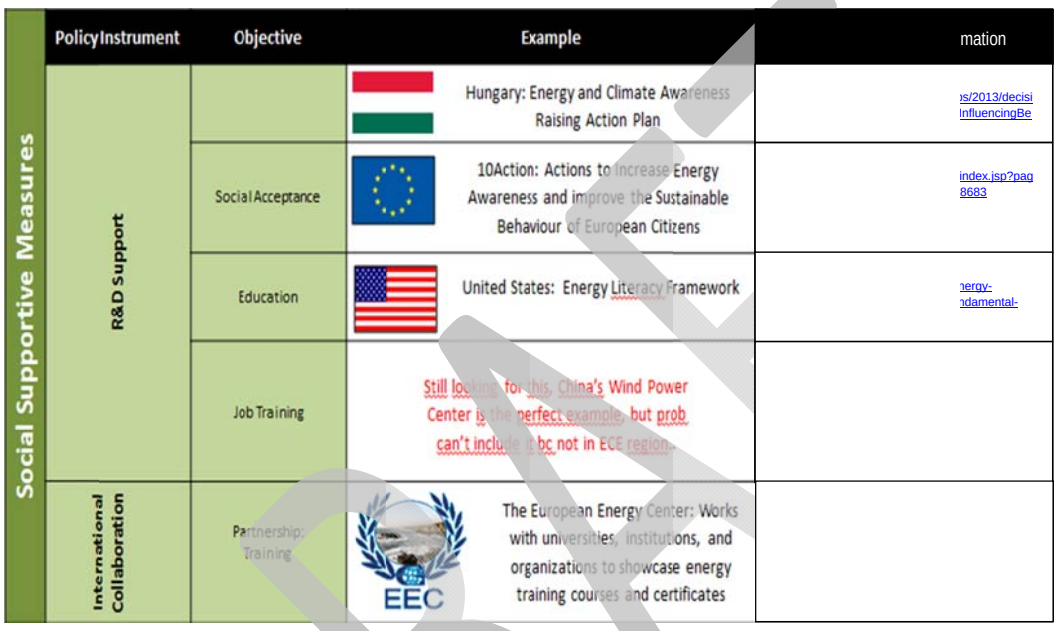

Figure 9: Social Supportive Measures

5. THE ROLE OF UNECE

In light of the technical challenges set forth above, UNECE Member States will gain from a mechanism developed by GERE that allow the exchange of information, best practices and lessons learned and subsequently address the most relevant obstacles with targeted activities. Promoting active engagement of member States in the international data collection process is important for filling data gaps and improving the quality of existing RE databases. Since clarification on how to gauge the sustainability of a RE technology is critical for RE policy targets, it will likewise be important for member States, through both the GERE and the Expert Group on Resource Classification, to work towards establishing universal RE terminology and enhance the gathering and dissemination of information on renewable energy resource potential. The inadequate information at the RE project level presents an opportunity for collaboration with technical committees, private sector, and academia to assist in further investigating and improving capacity RE technology capacity factors in the UNECE region. Finally, collaboration with renewable energy technology standard setting organizations such as the ISO and IEC would assist with establishing appropriate normative instruments (including standards as needed) to streamline know-how of optimal RE terminology, project design, and RE power integration.

Instrumentally, GERE will create a best practice task force trying to represent all countries and stakeholders views in its composition to assess the most relevant challenges and effective policy measures within the technical, structural, and social renewable energy dimensions and indicating possible direction of work and ways to respond to key needs with ad hoc capacity building activities and dedicated advisory services in a demand-driven basis.

6. CONCLUSIONS AND RECOMMENDATIONS

This paper has demonstrated that increasing RE uptake within the UNECE region will require decision makers to develop hybrid policy and technology packages that are best suited for their national circumstances. Hybrid or 'new generation' policies are emerging throughout the world and many have been created or adopted within the UNECE region. Through past successes and failures these new mechanisms have created scenario that minimize political and investment risk while maximizing fiscal and environmental returns. Likewise, analysing energy landscape of individual countries, it becomes apparent that renewable energy transition requires multifaceted and strategic approach that will bridge government policy, technological innovation and financial investments. Enhanced integration of renewable energy to the system is the way towards development of low carbon energy system.

There is no 'one size fits all' when it comes to policy and technology pairing; thus, meaningful evaluation of the three key dimensions outlined in this paper (social, technological, and structural) will allow for the most appropriate RE solution. The case studies outlined in this paper illustrated examples of tools that fostered the accelerated uptake of RE by establishing favourable policies that promoted the market development of RE technologies in both large and small scale. Intiating the exchange of best practices and policies,and with ample opportunity reminaing for RE development, the UNECE region is in a favourable position to standardize and lead the world in RE deployment.

Further recommendations for policy makers would need to be developed during and after discussions at the annual GERE meeting in a continous process of exchange of information.

ANNEX I

Legal and regulatory framework

Key legal and regulatory documents in support of renewable energy for UNECE member States	
Albania	Renewable Energy Law (2013); Law on Power Sector (2003, amended in 2009); New tariff methodology for small hydro plants (2007); Law on Heat Savings in Buildings (2002)
Andorra	
Armenia	Scaling Up Renewable Energy Program for Armenia (SREP Armenia) (2014); The Law on Changes and Amendments to The Energy Law of RA (2013); The Strategic Development Program of Hydro energy Sector of the Republic of Armenia (2011); The Action Plan of the Government of Republic of Armenia Aimed at the Implementation of the National Program on Energy Saving and Renewable Energy of Republic of Armenia (2010); Energy Saving and Renewable Energy Law (2004); Energy Law (2001)
Austria	Investment Subsidy for Large Solar Thermal Plants (2013); Investment Subsidy for Solar PV installations <5kWpeak (PV/BIPV 2013) (2013); Energy "Ökostromverordnung" (feed-in tariffs) (2012); "Klimaschutzgesets KSG" (law on climate protection) (2011); Combined Heat and Power Law (2009); Climate and Energy Fund (2007, amended in 2009); Amendment to the Mineral Oil Tax and the Fuel Ordinance (2004); Green Electricity Act (2002, amended in 2009, 2010 and 2012); Federal Environment Fund (2001); Eco-Plants FIT (2001); Renewable Energy Targets (2000)
Azerbaijan	RES targets adopted (2013); Rules of issuing Special Permission to Activity Concerning Alternative and RES (2010); State Agency on Alternative and RES established (2009)
Belarus	National Program of Local and Renewable Energy Sources Development (2011); National Energy Saving Programme 2011-2015 (2011); Law on Renewable Energy Sources (2011); Decree on biofuel product norms (2011);Tax relief for renewable energy investors (2009); FIT for RES-E (1994, revised in 2011)
Belgium	Decree on wood pellets for non-industrial heating appliances (2011); Decree on biofuel product norms (2011); Royal decree on energy efficiency and emissions of solid fuels heating appliances (2011); National Renewable Energy Action Plan (NREAP) (2010); Federal level: Law on obligation for the incorporation of biofuels in fossil fuels (2009); Excise Tax Reduction for Biofuels (2006); Offshore Domanial Concessions for Wind and Ocean Energy Production (2004); Green Certificate Scheme (2003); Tax deductions for investments in energy efficiency and renewable energy (2003); Royal Decree on the Introduction of Mechanisms Promoting Renewable Electricity Generation (2002); National Green Certificate Scheme (2001); Access to the Grid (Renewables and CHP) (2000); RUE/Electricity Generation Fund (1996); Tax Deduction for investments in energy efficiency & renewable energy by enterprises (1992); Provincial level (Flanders, Wallonia, Brussels region etc.): grants for solar PV and solar thermal, ecological investment subsidies, RE in tertiary sector buildings, grants for small-scale heat production, RE investment subsidies, Green Certificate Schemes, demonstration projects, technology subsidies) (1990-2014)
Bosnia and Herzegovina	Law on Renewable Energy and Efficient Cogeneration (2013. amended in 2014); Law on Electricity in the Federation (FBiH) 2013); Rulebook on incentives for generation of electricity from renewables and efficient co-generation (RS) (2012); FIT for electricity from renewables and cogeneration (RS) (2012); Decree on generation and consumption of electricity from renewables and cogeneration (RS) (2011); Regulation on the use of renewables and cogeneration (RS) (2010); Energy Law (RS) (2009); Electricity Law (RS) (2008, amended in 2009 and 2011); Connection rules (2008)
Bulgaria	Energy Act (2013); Energy from Renewable Sources Act (2012); FIT for electricity from renewable sources (2011); Renewable and Alternative Energy Sources and Biofuels Act (2007); Energy Act (2003)

Canada	Clean Energy Fund (2009); Ontario FIT Programme (2009); ecoENERGY for Biofuels BIll (2008); Accelerated Capital Cost Allowance (2007); NextGen Biofuels Fund (2007); Green Municipal Fund (2001); Canadian Renewable Conservation Expenses (1996)
Croatia	Energy Act (2012); Tariff system for the production of electricity from renewables and cogeneration (2012), Ordinance on the Use of Renewable Energy Sources and Cogeneration (2007); Environmental protection Act (2007); Regulation on the Minimum Share of Electricity Produced from RES and Cogeneration whose Production is Incentivised (2007); Electricity Market Act (2004); Environmental Protection and Energy Efficiency Fund (2003); Regulation on incentive fees to promote electricity production from renewables and cogeneration (2001, amended in 2011)
Cyprus	Law for the Promotion of Renewable Energy and Energy Efficiency in Public Consumption (2012); Support scheme for renewable electricity generation and energy savings (2009); Tax exemptions for biofuels (2005); New Grant Scheme (2004 ,amended in 2006); Law regulating the electricity market (2003); Law no. 33 on the Promotion of Renewable Energy and Energy Efficiency (2003)
Czech Republic	Green Investment Scheme: NEW GREEN SAVINGS 2014+ (2014); National Renewable Action Plan (NREAP) (2010); Sustainable Use of Energy Sources Green Investment Scheme (2009); Biofuels Blending Requirements (2007); Act on the Promotion of the Use of Renewables Energy Sources (2005, amended in 2006 and 2011); Tax exemption for renewable energy use (2005); Promotion of crops for energy use (2004); Excise tax exemptions for biofuels (2004); Bill on Promotion of Power and Heat Generation from Renewable Energy Sources (2003); Energy Management Act (2001, amended in 2006 and 2010); New Energy Act (2001); Subsidies for biodiesel production (1999)
Denmark	Danish Energy Agreement for 2012-2020 (2012); Regulation on Net-Metering for the Producers of Electricity for Own Needs (2012); Promotion of Renewable Energy Act (2009), Feed-in premium tariffs for renewable power (2009); Subsidies for Renewable Electricity Generation (2004), New Rules for Payment of Green Electricity (2001), Net Metering for Small-Scale PV (1998), Carbon Tax / Green Tax System (1999), Wind Energy Co-operative Tax Incentive (1997)
Estonia	Support to investments in wind energy (2010); Electricity Market Act (2003, amended in 2007); Green Certificates System (2001); Energy Act (1998)
Finland	FIT for electricity from wind, biogas and wood chips (2010); Decree on Notification of the Origin of Electricity (2005); Energy Grants for Residential Buildings (2003); Energy Aid Scheme (1999); VAT Reduction (1999); Tax subsidies for renewable electricity (1997, modified in 2007)
France	Offshore wind tendering mechanism (2011); Renewable Energy FIT: Biomass (2009); Flexible depreciation scheme (2003); New Energy Technologies Demonstration Fund (2008); Renewable Energy FIT: Hydropower IV (2007); Renewable Energy FIT IIII (2006); Tax Credit for Energy Saving and RE Equipment (2005); Renewable Energy FIT II (2002); Electricity Law 2000 (2000); Tax Credit for Renewable Energy in New Buildings (2000); Reduced VAT for Residential Renewable Energy Equipment (1999); Renewable Energy Purchasing Conditions (1999)
FYR of Macedonia	Energy Law (2006, amended in 2008, 2011, 2013, new amendments in progress); FIT (2007, amended in 2008 and 2010)
Georgia	
Germany	CHP Agreements with Industry (Vereinbarung zwischen der Regierung der Bundesrepublik Deutschland und der deutschen Wirtschaft zur Steigerung der Energieeffizienz) (2012); Law on Energy and Climate Fund (2011); "Energy of the Future" monitoring process (2011); KfW Programme Offshore Wind Energy (2011); National Energy Action Plan (NREAP) (2010); Biofuels Quota Act (2010) Energy Concept (2010);KfW Renewable Energies Programme

	(KfW-Programm Erneuerbare Energien (2009); KfW-Programme Energy-Efficient Rehabilitation (Energieeffizient Sanieren) (2009); Renewable Energies Heat Act (EEWärmeG) (2009); Climate Legislation Package Enacted under the Integrated Climate Change and Energy Programme (2008); Integrated Climate Change and Energy Programme (2007)
Hungary	Certification of origin from high efficiency cogeneration or renewable energy (2013); Green Investment System (2009); Green Investment System (2009); Electricity Act 2007 and Green Certificates Scheme (2008); Excise tax exemption for biofuels (2007); Electricity Act (2005); Government resolution on the use of biofuels (2004); FIT (2003)
Iceland	Act on the Guarantee of Origin of Renewable Electricity (2008, amended in 2010); Electricity Act (2003); Regulation on the National Energy Fund (2003); Act on the National Energy Authority (2003)
Ireland	Statutory Instrument 147 (2011); Biofuels Origination Scheme (2010); Renewable Energy FIT (2005); Greener Homes Scheme (2005, updated in 2007); Sustainable Energy Act (2002); Tax relief for renewable energy investments (1998)
Israel	FIT for solar PV and wind electricity (2009, amended in 2011); State subsidy for electricity generation from wind and solar PV (2004); Incentives for renewable electricity generation (2002)
Italy	Decree on the Cut of Incentives for Photovoltaic Plants (Spalma Incentivi) (2014); Biomethane subsidies (2014); New support scheme for renewable heat from small installations (2013); National Energy Strategy (2013); New Support Scheme for Non-PV Renewable Power (2013), 5th Revision of "Conto Energia" Support Scheme for PV (2012); "All inclusive" FIT for Small Renewable Power Plants (2008); Biodiesel aid scheme quotas (2008); "55%" fiscal support scheme for small renewable heat installations (2007); Kyoto Rotation Fund (2006); "Conto Energia" feed-in premium for photovoltaic systems (2005); Introduction of the White Certificates System for renewable heat and energy efficiency installations (2001); Introduction of the Green Certificates System (1999); Carbon Tax (1999)
Kazakhstan	Green Energy Concept 2013 (2013); Law 166-IV amending existing laws to support renewables (2009); Law on the Use of Renewable Energy Sources (2009); Decree on the transition to sustainable energy development (2006)
Kyrgyzstan	Regulation on small hydro power plants (2009); Law on Renewable Energy (2008)
Latvia	Regulation on the Production of Renewable Electricity and the Procedures to Determine the Prices (2010); Regulations Regarding Electricity Production and Price Determination upon Production of Electricity in Cogeneration (2009); Climate Change Financial Instrument (2009); Biofuel Quota (2009); Electricity Tax Exemption (2007); Reduction of excise duty for biodiesel (2007); Guidelines for Use of Renewable Energy 2006-2013 (2006); Mandatory admixture of biofuel (2005); Financial support quotas for biofuel (2005); Electricity Market Law (2005); Law on Energy (1998)
Lithuania	FIT for Electricity Produced from RES (2013); Resolution of the FIT for Electricity produced from RES (2013); The promotion rules for energy production from RES (2012); Law on Energy from Renewable Sources (2011); Law on Financial Instruments for Climate Change Management (2009); Law on the Heat Sector (2003); Pollution Tax (2002); Law on Energy (2002); Tax exemptions for biofuels (2001); Law on Electricity (2000, amended in 2013); Law on biofuel, biofuels in transport and bio-oils (2000, amended in 2009)
Liechtenstein	
Luxembourg	Financial aid programme for energy savings and renewable energy in housing (2013); National plan for near zero energy buildings (2013); Energy performance requirements for residential buildings 2012-2020 (2012); Act on production, remuneration and commercialisation of biogas introducing feed-in tariff (Règlement du 15 décembre 2011) (2011); National Renewable Action Plan (NREAP) (2010); Grants for energy efficiency and renewable energy investments (2010); Compensation mechanism for renewable electricity (2010); Feed-in tariffs for renewable energy and cogeneration (Règlement du 12 février 2008 et du 23 novembre 2012) (2008)

Malta	National Energy Policy (2012); Plug in vehicles (2012); Biofuel substitution obligation (2011); Capital grants for solar and wind (2006, amended in 2009); Biomass content of biodiesel exempted from excise tax (2005); FIT for solar energy (2004, amended in 2010); Use of Biofuels for Transport Regulations (2004, amended in 2012); Malta Resources Authority Act (2000)
Monaco	
Montenegro	Energy Law (2010); Comprehensive regulatory framework for RE established (2011); FIT (2011) - all documents currently under revision
Netherlands	Support Scheme for Solar Panels (2011); Guarantee Scheme for Geothermal Energy (2009); Transport Biofuels Act (2007); Energy Tax Regime (2005); FIT (2003, amended in 2008 and 2011); Energy Premium (EPR) and Energy Performance Advice (EPA) (2001); Renewables for Government Buildings (2001); Green Certificate Trading (2001); Regulatory Energy Tax (1996); Green Funds (1995)
Norway	Enova investment aids (2013); Renewable Heat Production (2013); Norway-Sweden Green Certificates Scheme (2012); Enova and Energy Fund established (2002); Offshore Energy Act (2010); Energy taxes and CO2-tax (1999)
Poland	BOCIAN - support for distributed renewable energy sources (2014); PROSUMER - programme supporting deployment of RES microinstallation (2014); Elimination of low emission sources through support of energy efficiency and development of dispersed renewable energy sources. Part 1) pilot program KAWKA (2013); Biofuels targets 2013-2018 (2013); Regulation on funding of activities related to the production of bio-components, liquid biofuels or other renewable fuels and their usage in transport (2013); Order on the Quota Obligation (2012); Green Investment Scheme (2009); Bio-Components and Liquid Biofuels Act (2006); Obligation for Power Purchase from Renewable Sources (2005, amended in 2008 and 2012); Tax exemptions for renewable electricity (2002); Energy Law (2007, amended in 2002, 2005, 2007 and 2010)
Portugal	Feed-in tariffs for micro and mini generation for 2014 (2014); Micro-generation Law (2010, amended in 2011); Solar Thermal Incentive Scheme (2009); Wave Energy Pilot Zone (2008); Biodiesel Blending Requirement (2009); Biodiesel tax exemption (2009); Biofuels Law (2006, amended in 2008); New FIT for Renewables (2001, amended in 2005, 2007 and 2013); Promotion of hydro and wind projects (Decree-Law no. 69/2000) (2000); Tax Reduction for Renewable Energy Equipment (1999)
Republic of Moldova	Draft Law on Promotion of Energy from Renewable Sources in Parliament discussion (2014); Law on Electricity (2009,amended in 2014); Law on Natural gas (2010, amended in 2014); Heat Law (2014)
Romania	Biofuel Quota (2011); Decree 22/2008 promoting the final consumption of renewable energy sources (2008); Law establishing a system for the promotion of renewable electricity (2008, amended in 2011 and 2012); Energy performance of buildings Law (2007); Electricity Law (2003, amended in 2007 and 2012); Law on the Environmental Fund (2000)
Russian Federation	Decree 449 (2013); Resolution 850 (2010); Federal Law Introducing the Capacity-Based Scheme (2010); Renewable Energy Target (2009); Decree 426 on Qualifying a Renewable Electricity Generating Facility (2008); Law on Electricity Industry amended to introduce the Electricity Premium Scheme (2007)
San Marino	
Serbia	National Renewable Energy Action Plan (NREAP) (2013); FIT for renewable energy sources and CHP generation (2009, amended in 2013); Decree on the Requirements for obtaining the Status of Privileged Power Producer (2009, amended in 2013); Energy Law (2004, amended in 2011 and 2012)

Slovak Republic	Concept of development of electricity generation from small renewable energy sources in Slovakia (I. Stage) (2013); Act on Energy and amendments to certain acts (No. 251/2012) (2013); Act 136/2011 on the promotion of the renewable energy and highly efficient cogeneration (2011); Act 309/2009 on Support of Renewable Energy Sources and High Efficiency CHP (2009, amended in 2010 and 2011); Excise Tax Exemption for Renewable Electricity (2008); Minimum biofuel requirements (2007); FIT for renewable energy (2005, updated yearly); Act 656/2005 on Energy and Amendments (2005); Excise tax exemption for biofuels (2004, amended in 2007); Act on Regulation in Network Industries (2001, amended in 2007)
Slovenia	Decree on Green Public Procurement (RS 102/2011) (2011); Energy Act (2010, amended in 2013); Decree on the support for Electricity Generated from Renewable Energy Sources (2009); Promotion of the Use of Biofuels and Other Renewable Fuels for the Propulsion of Motor Vehicles (2007); Tax exemptions for liquid biofuels (2004); FIT and Premiums (2002); Eco-Fund (2000); Energy Act (1999)
Spain	Royal Decree Law 24/2013 on the Electricity Sector (2014); Royal Decree Law 9/2013 on urgent measures to guarantee financial stability in the electricity system (2013); Law 15/2012 on tax policy aimed at energy sustainability (2013); Royal Decree Law 1/2012 revocation of public financial support for new electricity plants from renewable energy sources, waste and CHP (2012); Sustainable Economy Law (2011); Mandatory Biofuel Content in transportation fuels (Royal Decree 459/2011) (2011); Regulation on small power plants connection to the electricity grid (Royal Decree 1699/2011) (2011); New Regulatory Framework for Administrative Procedures for RE Facilities (Royal Decree Law 6/2009) (2009); Royal Decree 1578/2008 on PV Electricity Price (2008); Law 12/2007 and Mandatory Biofuel Requirement (2007-2008, amended in 2011); Royal Decree 661/2007 (2007); Royal Decree 314/2006 on technical Building Code (2006); Royal Decree 436/2004 (2004); Royal Decree 2818/1998); Law 54/1997 on the Electricity Sector (1997); Royal Decree 2366/1994 on FIT (1994, amended in 1998, 2000, 2004, 2007, 2009, 2010 and 2012)
Sweden	Sweden-Norway Green Certificates Scheme (2012); Electricity Certificates Act (2011); Act on Sustainability Criteria for Biofuels and Bioliquids (2010); Support for the development and implementation of biogas technologies (2009); Support for the installation of solar panels (2009); Grants for Residential Heating Conversion (1006); Green Certificate Scheme (2003); Support for Small Scale Electricity Production (2000); Guaranteed Power Purchase Contracts (1997); Environmental Bonus for Wind Power (1994, regularly amended); Tax exemptions for renewable electricity (1994)
Switzerland	Action plan for coordinated energy research (2013); FIT for RES (2009); Risk Guarantee Scheme for Geothermal Power Projects (2008); Mineral Oil Tax Exemption for Biofuels fulfilling sustainability criteria (2008); Electricity Supply Act (2007); Nature Made Labelling Scheme (2000); Federal Law on the Reduction of CO2 (1999); Energy Act (1999)
Tajikistan	Law on the use of renewable energy (2010); Law on Power Engineering (2000, amended in 2005); Order no. 267 on Development of Small Power Engineering (1997); Tax exemptions for small hydro plants (1992)
Turkey	Regulation on the Promotion of Renewables and the Certification of their Origin updated (2011); Renewable Energy Law 2010 (2011); FIT (2008); Law 5686 on Geothermal Resources (2007); Renewable Electricity Law (No. 5346) 2005); Electricity Market Licensing Regulation (2001)
Ukraine	National Renewable Energy Action Plan (NREAP) (2014); Law on Promotion of Biological Fuels Production and Use (2009); FIT (2009, amended in 2013); VAT and customs duties exemptions for renewable energy equipment (2008); Law on Combined Heat and Power (Cogeneration) and Waste Energy Potential (2005); Presidential Decree on the production of fuels from biomaterials (2003); Law on Alternative Energy Sources (2003); Law on Alternative Liquids and Gaseous Fuels (2000, revised in 2009 and 2012)
United Kingdom	Renewable Heat Incentive (2011); Energy Act (2010); FIT for Renewable Electricity (2010); Renewable Transport Fuels Obligation (2008); Energy Act (2008, amended in 2010); Climate Change Act (2008); Environmental Transformation Fund (2007); Climate Change and Sustainable Energy Act (2006); Scottish Biomass Support Scheme (2006); Marine Research Development Fund (2005); Renewable Energy Guarantees of Origin (2003); Renewables

	Obligation (2002, last amended in 2009); Preferential Tax Regimes for Biofuels (2002, last amended in 2008); Bio-Energy Capital Grants Scheme (2002); Offshore Wind Capital Grants Scheme (2002); Bio-energy capital Grants Scheme (2002); Climate Change Levy (2001)
United States of America	Appropriations for Clean Energy under the American Recovery and Reinvestment Act (2009); Cellulosic Biofuel Producer Tax Credit (2009); Grants for Production of Advanced Biofuels (2008); Energy Independence and Security Act (2008); Food, Conservation and Energy Act (2008); Residential Renewable Energy Tax Credit (2006, amended in 2008 and 2009); Farm Security and Rural Investment Act (2002); Federal Renewable Electricity Production Tax Credit (1992, last updated in 2013); Federal Business Investment Tax Credit (1992, last updated in 2009)
Uzbekistan	The Programme for Development and Reconstruction of Generating Facilities 2010 of SSC Uzbekenergo and the Scheme of Energy System Development 2020 (electricity and heat cogeneration) (2010), Law on Rational Energy Utilisation amended (2003); Decree 476 on the development of hydro energy (1995)

Main sources: IRENA Renewable Energy Country Profiles, IEA/IRENA Policies and Measures Database, EC and EFTA member countries legislation related to RE.

ANNEX II.

Template on policies, instruments, legal framework and targets by renewable energy technology by country

	CURRENT (YEAR)						PROJECTED (YEAR)				
Country X	Policies	Enforcement Measures for Non-Compliance?	Best Practices	Dedicated Funds for RE	Examples of RE Investment and Training	% of Overall Energy Mix	Anticipated Policy Goals	Areas to Improve Practices/Seek Additional Expertise	Anticipated Budgetary Increases	Target % Energy Mix by 2030*	Recommendations
Solar											
Hydropower											
Wind											
Geothermal											
Ocean Energy											
Bioenergy											

**Should meet SE4ALL Targets

ANNEX III.

Template for Country Case Studies by Technologies

Case Study/ Best Practice/ Project Name:
Description (type of renewable energy[65], approach, objectives, business purposes, total cost, components, outputs, phases, duration, benefits; transition impact; technical cooperation for studies, design, etc.):
Organizations involved and their roles (contact persons, phone, fax, email address, Home page, for sponsors, main shareholders, borrowers, guarantors, government agencies, financial sources, consultants, contractors, suppliers, main users, etc.):

[65] Solar PV (Distributed), Solar PV (Utility Scale) Concentrating Solar Power, Thin-Film PV, Solar Hot Water, Micro Hydro, Conventional Hydro, Micro-Grids, Onshore Wind, Offshore Wind, Geothermal, Tidal, Waste-to-Energy, Biogas, Biofuel

Sources of finance	Type of instrument	Amount
Financial institutions (sources of finance) full names and details (addresses)		

Country	
Name, Title	
Organization	
Telephone	
Email	
Web	

GLOSSARY

Feed-in Tariff (FIT) – The basic for of feed-in policies. A guaranteed minimum price (tariff) per unit (normally kWh or MWh) is guaranteed over a stated fixed-term period when electricity can be sold and fed into the electricity network, normally with priority.

Capital Subsidy – A subsidy that covers a share pf the upfront capital cost of an asset (such as solar water heater). These include, for example, consumer grants, rebates, or one-time payments by a utility, government agency, or government-owned bank.

Net-Metering – A regulated arrangement in which utility customers who have installed their own generating systems pay only the net electricity delivered from the utility (total consumption minus on-site self-generation). A variation that employs two meters with differing tariffs for purchasing electricity and exporting excess electricity off-site is called "net-billing".

Production Tax Credit – A taxation measure that provides the investor or owner of a qualifying property or facility with an annual tax credit based on the amount of renewable energy (electricity, heat, or biofuel) generated by that facility.

Public Competitive Bidding (Auction) – A procurement mechanism by which public authorities solicit bids for a given amount of renewable energy supply or capacity, generally based on price. Sellers offer the lowest price that they would be willing to accept, but typically at prices about standard market levels.

Investment Tax Credit – A taxation measure that allows investments in renewable energy to be fully or partially deducted from the tax obligations or income of a project developer, industry, building owner, etc.