

A Glance to Renewable Energy Prospects: Unleashing Future Perspectives of Generating Energy with Potential Use of Renewables

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Abstract—International demand for energy is rising fast due to population and economic progress, particularly in developing market economies. While accompanied by enhanced prosperity, increasing demand creates new tests. In contrast to these progress, humankind is nowadays facing troubles, such as greenhouse gas emissions (GHG), air pollution, water and soil contamination and many other ecological problems and challenges. In this scope, renewable energy presents opportunities for economic development, specifically as they are existing ubiquitously.

As a negative externality, carbon dioxide emission is one of the most chronic problems on environmental pollution. The main cause of carbon dioxide emitted into the atmosphere is the fossil fuels used to generate both electricity and heat, which paves the way for a greater greenhouse effect known as global warming. Unless strong policy action is taken into action in this context, atmospheric carbon dioxide concentrations will have been twice over the upcoming 50 years leading to chronological global warming.

Furthermore, energy crises have negative effects on expectations of humanity. In this regard, renewable energy sources are an option worthy of serious contemplation for governments. Hence, renewable energy sources may be simply recognized and discovered without causing main accidents or hazardous situations affecting life on the world. If technology and infrastructure of renewables can be steadily developed, the energy generation will be very low-cost in the long run.

The aim of this study is to frame the world energy politics by specifically focusing on European Perspective and using official statistics that have released recently.

Index Terms— Environmental Economics, Green Economics, Renewable energy, World Energy Prospects

I. INTRODUCTION

Global population growth, which will surpass 10 billion by the year 2050, stimulates the world especially range from policy-makers to energy generation firms to deal with increasing energy demand issue. Fossil fuels consist of the primary basis of energy, accounts for more than 90% of the rise in demand. International oil demand will rise by about 1.6% per year, from 75 million barrel a day in 2000 to 120 million barrel a day in 2030. So, fossil originated energy policies remain common solution to energy consumption. In contrast to being traditional energy, generating from conventional sources and

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using this type of energy supply leads to severe ecological disasters. Gas emissions are main negative externalities of this type of energy production.

In this regard, carbon dioxide emission is one of the most detrimental problems on ecological environment. The leading cause of carbon dioxide emitted into the atmosphere is the fossil fuels used to produce both for electricity and heating, which leads to more greenhouse effect known as global warming. Unless resilient policy action is implemented, atmospheric carbon dioxide concentrations would twice over the upcoming 50 years leading to chronological global warming. In this regard, Renewable energy resources seem to be the one of most proficient and effective solutions.

Worldwide demand for energy is expanding firmly, in accordance with population growth and trade and industry development, particularly in emerging market economies. While accompanied by greater prosperity, soaring demand makes new struggles. With regard to this, humanity is facing today such as greenhouse gas emissions, air pollution, water and soil contamination and many other ecological problems and challenges.

Besides, in order to produce energy, using nuclear fuels contain many dangers that threaten human being's health and safety, as well as the environment. Human faults and massive mechanical errors could pay huge price and demolishing effects on human health deteriorate tens of thousands mankind in a short term and majority in the long period of time because of the radioactive contamination produced, along with large zones of radioactively polluted land.

According to International Energy Agency studies, the role of nuclear power generation will reduce significantly because limited new reactors will be constructed and some of this old stations will be shut down. Thanks to this, nuclear production will only become its top level at the end of this decade and then decrease progressively. Its share of world primary consumption remained stable at around 7% through 2010, then will be declined to 5% by 2030 [1].

II. RENEWABLE ENERGY TYPES

Numerous of the renewable energy technologies, specifically wind energy, hydro power plants, and solar thermal applications, are economically feasible and competitive. Industrial competitiveness of other forms of renewable energy, particularly the energy from biomass, be influenced by other factors on increasing demand and thus on production size in order to attain the economies of scale, which are necessary for

the industrial competitiveness. These forms of renewable energy, which are not competitive under present market environments until now, necessitate proper market supervisory implements, in order to attain the essential economies of scale in the short term and to develop competitiveness in the long term [2].

Renewable energy has similarly some influences on the ecology, but they are considerably lower. On one hand, biomass constructions may emit carbon dioxide and on the other hand wind energy could alternate the land and effect loss or injury of some animals due to establishment of specific tools. The installation of hydropower plants could also harm flora and fauna, changing ecosystem processes. Paralleled to fossil fuels usage, the effects of constructing renewable energy technologies are minor and localized; however they must be sensibly scrutinized in order to be lessened where it is possible [3].

According to Kancs's article, written in 2007, the short-term competitiveness of the renewable energy industry can be enhanced via different methods of government interferences by putting on diverse strategy tools. The choice of a fitting renewable energy backing instrument with optimum policy actions, which have to be assessed, arranged, and applied throughout the next financial agenda 2007–2013, need to be executed seeing the background of renewable energy policy goals of doubling the renewable energy portion within next half decade in order to accomplish the requisite levels by 2010 and by 2020 [2].

A. Solar Photovoltaic Energy Generation

The second most important development in renewable energy capacity has been in the solar PV technology following the wind power technology. The solar PV system price declines of around 75% in less than 10 years have brought solar power close to cost competitiveness in several countries and market segments. The total capacity of solar PV crossed the 178 GW in 2014 and predicting 233 GW by the end of 2015 [4].

The greatest growth in solar PV capacity over the last ten years has been in Europe. Approximately 70% of all solar PV installations worldwide are in Europe. However, China's market has been growing rapidly since 2012. China's annual built solar PV capacity raised from 0.3 GW in 2009 to 10.95 GW by 2013 [4], [5]. China is followed by Japan (6.9 GW) and the United States (4.8GW). Germany accounts for 3.3 GW of solar PV with the UK and Italy both contributing 1.5 GW [6].

B. Wind Power

The greatest progress in the renewable energy industry has been on the basis of the wind power technology [7]. Technology improvements and competition have led to lower prices for wind power. Hence, governments around the world have started to prefer wind power industry to fossil fuels [6]. Total wind power capacity of the entire world has increased from 48 GW in 2004 to 370 GW in 2014. Moreover, in the last 35-40 years, the wind turbine capacity has been increased approximately 40 times [8].

When considering the additions of the wind power capacity by regional; China, America, Germany, India and Brazil are

countries that contribute mostly. By year 2014 over 240,000 wind turbines are operating in more than 90 countries [6].

C. Geothermal

Geothermal energy is more attractive when compared to conventional fossil fuel systems. Benchmarking with traditional energy sources, geothermal energy is generally defined clean and renewable energy sources with low or zero GHG [9]. Geothermal resources offered an approximately 805 PJ (223 TWh) of renewable energy in 2013, on the account of 66% for heating and the rest of the generation for electricity. The increase of geothermal power production is mainly in six countries which are United States, Philippines, Indonesia, Mexico, Italy and New Zealand. On the other hand, the usage for heating is growing rapidly in a number of countries and reached an estimated 91 GWth of capacity in 2013 [5].

D. Hydropower

Hydro power generation is the renewable energy source par brilliance, limitless, nonpolluting, and more economically selective than other possibilities. Hydro electrical constructions emit much less greenhouse gas than do thermal ones. Green-house gas emissions of hydro energy are caused by the deterioration of flora in waterlogged zones and by the widespread usage of cement in the dam building. Regrettably, there are domestic influences of the usage of waterways, public as well as environmental, and they are gaining significance as individuals become conscious of how those influences affect living values. Most renewable foundations of energy hydropower generation are capital concentrated but have lower functioning costs than thermal and nuclear possibilities [1].

E. Bio Mass

Energy generation of Biomass contains fuelwood, farming residues, wastes of animal, charcoal, and other fuels derived from organic and biological things [1].

III. WORLD RENEWABLE ENERGY PROSPECTS

Global energy consumption will increase gradually over 2030 in the referenced development. Global primary energy demand is predicted to rise by 1.7% per year from 2000 to 2030, reaching a yearly level of 15.3 billion tons of oil equivalent. The estimated growth is, however, slower than growth over the past three decades, which becomes at 2.1% per year. Approximately, 75% of the rise in consumption will come from the transportation industry. According to International Energy Agency, petroleum products will remain the fuel of choice in highway, maritime and flight transportation [1].

Demand for natural gas will increase more powerfully than for any other fossil fuels. Primary gas usage will double in 2030, and the share of gas in world energy demand will increase from 23% to 28%. New power plants will take over 60% of the increase in gas supplies over the next 30 years. Gas is also often chosen to coal and oil for its relatively compassionate environmental effects, particularly its lower carbon content. In spite of this, consumption of coal will also rise, but more gently than that of oil and gas. Indeed, India and China together will consume almost 66% of the rise in global coal demand over the estimation year of 2030 [1].

TABLE I: WORLD GROSS FINAL ENERGY CONSUMPTION (MTOE)

	1971	2000	2010	2030	2000–2030* (%)
Coal	630	554	592	664	0.6
Oil	1,890	2,943	3,545	4,956	1.8
Gas	604	1,112	1,333	1,790	1.6
Electricity	377	1,088	1,419	2,235	2.4
Heat	68	247	260	285	0.5
Renewables	66	86	106	150	1.8
TOTAL	3,634	6,032	7,254	10,080	1.7

Source: [1]

On the other hand, Renewable energy is a plentiful, well-planted technology. The core input to generate that energy is almost limitless and costless. Besides, the fact that globally only eight nations have 81% of all crude oil reserves and solely six nations have 70% of all natural gas reserves. The peak verified oil assets counting non-conventional oil reserves are in Venezuela (20% of global reserves), Saudi Arabia (18% of global reserves), Canada (13% of global reserves), and Iran (10.6%). The uppermost verified natural gas deposits are in Russia (24% of global reserves), Iran (16.8% of global reserves) and Qatar (12.5%) [10].

Furthermore, 89% of all coal reserves are belong to only eight countries whole around the world. As a continent perspective, it is fact that more than half of Asia, Africa and Latin America import over half of all their energy demand. Most of these nations export the domestic crops that equals low prices aggregate. But these countries import energy at high costs cause a worsens on foreign exchange balance of them. This difficulty is getting much worse by the statistics that power consumption is steadily soaring in these countries [1].

The policy related to growing the usage of renewable energy sources, to minimizing the anthropogenic effect on climate change as well as to augmenting the security of supply through dispersed to regions generation systems has been one of the most discussed subject universally[11].

In this context, globally, politicians have agreed on progressively diminish emissions of greenhouse gases, particularly carbon dioxide by 2050 in order to lessen the scale of climate change influence [3].

With benchmark on international scale, renewable energy usage raised by 28 % (from 17 EJ to 76 EJ) between 2005 and 2013, while whole energy usage increased by only 18 % over the identical period. As a result, the share of renewable energy in gross energy consumption increased from 13 % to 14 % between 2005 and 2013. Although in most world regions the absolute consumption of RES increased over this period too (even considerably in some world regions, such as in China), in relative terms a region's RES share could have diminished throughout the period if its energy consumption from non-renewable fuels increased by more than its RES energy consumption [12].

A. Russia

Approximately 220 GW of energy power are set up in Russia currently. Conventional power stations using fossil fuels produce roughly 68% of all energy generation. Nuclear power stations consist 11% and renewable energies (hydro,

geothermal, wind and solar) the remaining 21%. 99% of the latter is generated by large hydropower plants, 0.6% by biomass plants, 0.3% by small hydro-power units and 0.1% by wind and solar power systems [11].

The Russian Renewable Energy Package – planned till 2030- was launched in 2010. With this program, by 2020, 4.5% of the whole electricity demand should be produced by renewable energy sources (the production from large hydro systems is not measured within this goal). To achieve this purpose, it is predicted that about 14.7 GW of new renewable volume should be set up in the Russian Federation [11].

Last decade, Renewable energy has even exceeded hydropower in terms of the quantity of recently planted power facilities. At current, roughly 10 large and 1600 minor wind parks are set up in Russia. The country has outstanding potential for wind power production. An effort to use only 25 percent of its whole potential would produce some 175,000 MW of energy generation. The peak wind energy potential is intense along the coastlines, in the massive terrains of the steppes and in the highlands [11].

B. Iran

Iran experiences noteworthy potential for renewable energy sources such as solar, wind, geothermal and hydro power. Progress of renewable energy technology is as a development of divergence of energy bases and construction of an alternative energy preference that will assist detrimental effects of global climate change.

Iran is wealthy in both conventional and renewable energy sources. Petroleum has ruled the politico-socio-economic agenda of this nation, however Iran has no documented strategy and visualization for its enormous assets. Iran has a predictable 155 billion barrels of verified oil deposits. This amount accounts for more than 10% of the world's total deposits and 13% of Organization of the Petroleum Exporting Countries deposits has been projected that the remaining lifespan of Iran's oil is roughly 94 years [10].

This poses a main encounter to policy creators and the citizens of this nation. It is essential to have a visualized portrait of Iran's energy position upcoming years indicating the stream of energy supply, demand, usage, import and export to identify how the energy position in Iran is and classify its faults and strong points. The point is that, Iran lacks policy agendas that existing roadmap for sustainable advance in energy industry, so with a 30,000 MW demand for electricity in the nation and a inhabitants of 76 million, Iran's future policy requires basal changes in energy sector policies [10].

Reference by the Iranian Renewable Energy Organization, the Photovoltaic capability and curriculums are 7.5 GW of Intense solar power stations under construction or in process and 8.5 GW under construction. Parabolic troughs power plants are the common system which has been used generally [10].

Wind power concentration was stated for Iran is 275 W/m². In general, this wind energy concentration is sufficient for electric energy creation, but it cannot be categorized as well as optimum wind districts such as northern Europe [10].

Initial endeavors on biogas tasks have triggered since 1970s in Iran and till 2008 over 70 projects were carry out, from which less than 5 projects were currently operational [10].

* Average annual growth rate, in percent

Finally, there are some sorts of policies in the fourth development program and a two decades' Iranian development strategy to backing and promise the development of renewable energy in Iran. In spite of these policies and efforts, merely 38% of the fourth development program goals were accomplished and the field of using renewable energies, such as biofuels, geothermal, tidal energy, is quiet very undeveloped and at the official and theoretical research level [10].

C. China

Coal-fired power production accounts for 70% of China's total production capacity. China's power industry's most serious problems are as follows [13]:

- Power industry deficiencies investment for production side and power networks and the recent generated capacity is unable to encounter the power demand.
- The power networks were not strong enough particularly in countryside zone, part of users in countryside zone cannot get access to power networks.
- The power networks are not able to struggle with disasters and accidents.

In 2000's, in China's electric power industry, the investment for generation side and power networks was insufficient and the deficit between power supply and demand kept expanding. In order to figure out these energy problems, Chinese Central Government has been carried out power industry reform in 2002. The reform in 2002 known as "No. 5 Document" has made a chains of attainments, as well as the enrichment of operation productivity of power industry and the satisfaction of power demand all over the nation [13].

The purpose of this policy is to form a free market between the production side and network, transmission and distribution enterprises. Yet, projected fallouts were not accomplished through the reform in 2002, imbalanced competition phenomena kept developing due to the deficiency of market contributors. It is already stated in the text that the investment for power industry is quiet unsatisfactory [13].

Above and beyond, For the purpose of ecological shield and to break the pollution phenomena, a great number of clean energy generation plants have newly been built. The encouragements of the investment for renewable energy generation were stimulated by government policies particularly subvention policies, not market-oriented [13].

With the enhancing severe air smog, Chinese government has implemented Renewable Energy Law in 2006. Subsequently, large amount of renewable energy production plants has been built and put into generation. The actual condition in China's power industry, although the previous pricing mechanism was not market-oriented, the on-grid price deficit somehow demonstrates that the operation cost of renewable energy production is higher compared with coal-fired production and has led to greater marginal cost so they lack effectiveness in the electricity market. Besides, under the present report outline, few elastic generation plants are willing to provide max out service for Renewable Energy generation in China [13].

Government and civil services have already laid some of the

innovative technologies or mechanism into practice, however the point is that the greater operation cost and unpredictability of generation still made renewable energy production less economical in China's electricity market. Thus, China's government, in accordance with energy generation organizations and research associations should make their preeminent accomplishments to discover the appropriate mechanism for present situation of China's power industry as well as evolving advanced Renewable Energy generation combination technologies [13].

IV. AN OUTLOOK TO EUROPEAN UNION ENERGY PROSPECTS

European Union member states are reliant on imports of fossil energy, specifically oil and gas, around half of energy usage coming from imports. The increasing demand for energy rises fossil petroleum imports from nations abundant in natural gas and oil, which contain economic costs. Political and economic risks and encounters of supplier nations are a cause of ambiguity and in security in energy supply [3].

The achievement of the Energy Union requires a fundamental transformation of Europe's energy system. Renewable energy is essential for this transformation to take place as it contributes to all of the Energy Union purposes: the distribution and transmission of security of supply, conversion to a sustainable energy system with minimized greenhouse gas emissions, industrial development leading to growth and employment and lesser energy expenditures for the EU economy [14].

EU energy weakness caused by high import dependency may cause severe difficulties in security of energy supply in the absence of measures to deal with this struggle. Moreover, the oil markets are very unstable with great price modifications from one period to another. Enhancing security in energy supply includes not only declining imports and rising inland production, which according to the European Commission would mean a too simpleminded method to figuring out problem, but necessitates the credentials of severe and multifaceted solutions. Such an attitude would embrace, among others, the divergence of energy and alternate energy, the improvement of technologies in the pitch and a fresh energy demand supervision [3].

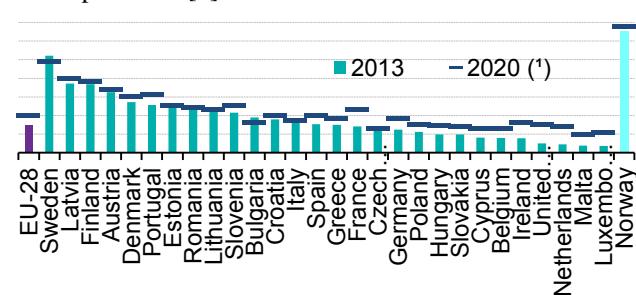


Fig. 3: Share of renewables in gross final energy consumption, 2013 and 2020 (%)



Fig. 1. Primary Production of Renewable Energy (1,000 tons of oil equivalent)

Source: [15]

EU head of states have founded to diminish greenhouse gases emissions 80-95% below 1990 levels by 2050. Another European Union commitment set for 2020 states to decreasing greenhouse gases emissions 20% below 1990 levels, which is one of the key goals of Europe 2020 Strategy. In addition, EU 15 member states are participants to the Kyoto Protocol in order to diminish their cooperative emissions 8% below 1990 levels, and most countries having a member the EU on May 2004 are on track to accomplish the goals of Kyoto Protocol [10].

The Renewable Energy Directive with the legitimately requisite 20% EU target, 10% target for renewable energy usage in transportation and the binding national goals for 2020 forms a fundamental part of the EU energy strategy. In the point of employment, The European renewable energy production currently services 1.15 million people. There is now a strong awareness from several Member States to practice the collaboration instruments for accomplishing 2020 targets, and dialogs on this issue are in progress [14].

The recent report similarly mentions that approximations of the gross effects of renewable energy substitution on Greenhouse gas emissions, fossil fuel consumption and primary energy consumption. In 2014, the additional consumption of renewable energy, compared with the level of gross final RES consumption in 2005, allowed the EU to [12]:

- diminish total GHG emissions by 380 Mt (million tons of oil equivalent) CO₂ equivalent to around 9 % of entire EU GHG emissions;
- curb its demand for fossil products by 114 Mt, or roughly 10 % of total EU fossil fuel consumption;

All in all, At the EU level, primary energy consumption has been declining almost persistently since 2005. This downwards tendency is the consequence of a number of interrelating factors, sometimes with contrasting effects in connection with statistical accounting procedures and descriptions in practice. For instance, factors driving the accounting of primary energy consumption downwards include [12]:

- A declining portion of nuclear energy and thermal energy production (combined heat and power is not included)

- A soaring portion of certain renewables, for instance Hydro- and wind power, in electricity generation

The European Energy Agency (EEA) predicts that the contagious usage of renewables since 2005 diminished primary energy consumption by 32 Mt in 2014. The projected decline in primary energy consumption in 2013 was 26 Mt. Unless the growth of renewable energy were implemented since 2005, primary energy consumption in the EU-28 in 2013 could have been 2 % higher than current statistics [12].

According to EEA calculations, in 2013 the major comparative declines of fossil fuels usage were grasped by Sweden (28 %), Denmark (18 %) and Austria (14 %), while in absolute terms the highest amounts of fossil fuels were avoided in Germany and Italy [12].

Norway (Even this country is not a member states of European Union, it is included in Eurostat statistics) and Sweden became a leading countries in the context of using renewable energy in gross final consumption and their projections seem to be persistent on that policy. These two Scandinavian countries are planning to get at least half of energy consumption via renewables.

In 2014, the highest quantities of total abstained GHG emissions were referable to onshore wind energy (126 Mt CO₂) and heat from solid biomass (32 Mt CO₂), solar PV energy (70 Mt CO₂). Onshore wind and solar-PV energy are also the greatest significant suppliers to avoided fossil fuel consumption and avoided primary energy consumption [12].

TABLE I: THE SHARE OF RENEWABLES IN EU, 2005, 2013 AND 2020

Country	2005	2013	2020
EU-28	8.7	15.0	20.6
Sweden	40.5	52.1	49.0
Latvia	32.3	37.1	40.0
Finland	28.8	36.8	38.0
Austria	23.9	32.6	34.0
Denmark	15.6	27.2	30.0
Portugal	19.5	25.7	31.0
Estonia	17.5	25.6	25.0
Romania	17.6	23.9	24.0
Lithuania	17.0	23.0	23.0
Slovenia	16.0	21.5	25.0
Bulgaria	9.4	19.0	16.0
Croatia	12.8	18.0	20.1
Italia	5.8	16.7	17.0
Spain	8.4	15.4	20.0
Greece	7.0	15.0	18.0
France	9.6	14.2	23.0
Czech Rep.	6.0	12.4	13.0
Germany	6.7	12.4	18.0
Poland	6.9	11.3	15.0
Slovakia	5.9	9.8	14.0
Hungary	4.5	9.8	13.0
Cyprus	3.1	8.1	13.0
Belgium	2.3	7.9	13.0
Ireland	2.9	7.8	16.0
United Kingdom	1.4	5.1	15.0
Netherlands	2.3	4.5	14.0
Malta	0.2	3.8	10.0
Luxembourg	1.4	3.6	11.0

Source : [16]

With regard to total avoided GHG emissions in 2013, the Member States with the leading predictable gross reductions are Germany (95.6 Mt CO₂), Italy (54 Mt CO₂) and Spain (31.8 Mt CO₂). In relative terms, significant GHG emission reductions were recorded in six Member States in 2013 (Sweden, Denmark, Austria, Finland, Italy and Portugal) [12].

Sweden is primary the manner in the European Union. The decent natural circumstances such as rainfalls, distribution of rainfalls during the year and inflow permitted the advancement of hydro-power plants and improved renewable electricity production. In addition, Sweden is categorized by one of the peak percentage of land covered by forest, explicitly 53% of land cover, while the worldwide average is 30%. Thus, about 85% of bioenergy is generated by this industry [3].

Renewable energy production has had a key role in Denmark's energy policy given that there is a rise in the diversity of sources of prospective supply and decreasing greenhouse gas emissions. Denmark has a well-built renewable energy sector, though it is practically entirely lacking of hydropower resources. The whole involvement of renewable energy to all energy consumption was 23.6% in 2011. Since 1970 the policy in the arena has significantly advanced wind power constructions and related investments placing the nation among the world leaders in way of built wind power per capita. The renewable proportion in the country's national electricity mix is high, the participation of wind energy roughly equals to 28.2% in 2011 [3].

In order to rise the percentage of renewables in total electricity consumption, the Danish government has announced a premium tariff and net-metering measurement. Other incentives, like loan assurances and subventions are carried by the authorities with the purpose of boost the construction of wind power plants and the building of small-scale renewable energy systems. The renewable cooling and heating industry is sustained through a mixture of policies: tax exceptions, a compulsion to use renewable cooling and heating systems in new buildings or restored living places and a straight premium tariff for the sustainable use of the biogas technology. The use of biofuels or other renewable fuels for transportation is currently stimulated through a quota system [3].

V. CONCLUSION

To achieve forward-thinking climate policies, world has to decarbonize its energy supply and use ecological healthy raw materials. Furthermore, it should be stated that prospective climate policies of countries have to be integrated with each other in the long term via supervision of energy regulation institutes. As it is mentioned all World Energy Outlook scenarios that energy demand rises, but it is also stated that government policies play a prevailing role in emplacing to get an action against on the pace of the growth and the degree to which greenhouse-gas emissions follow the same path. To give a concrete example, European Union has significant future policies and directives on this issue.

The progress of the renewable energy industry is advantageously significant for numerous aims:

- Renewable energy has a noteworthy role to play in curbing and declining Carbon Dioxide (CO₂) emissions, which is also a key European Community goal in the twenty-first century;
- With regard to Energy policies side, to whom have energy supply dependency, growing the portion of renewable energy in the total energy balance increases energy supply security by decreasing the countries' growing dependence on trade in energy sources;

Against the background of recent energy price fluctuates, renewable energy prices are estimated to economically become competitive with conventional energy sources in the medium to long run.

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