THE RENEWABLE ENERGY POLICY OF THE EUROPEAN UNION

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DECLARATION

I declare that the dissertation entitled **"The Renewable Energy Policy of the European Union"** submitted by me in partial fulfillment of the requirements for the award of the degree of **MASTER OF PHILOSOPHY** of this University is my own work and has not been previously submitted for any other degree of this or any other University.

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CERTIFICATE

We recommend that this dissertation be placed before the examiners for evaluation.

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LIST OF ACRONYMS

AGIP	*Azienda Generale di Petrolio*
CFP	*Compagnie Francaise des Petroles*
CFR	*Compagnie Francaise de Raffinage*
CIA	Central Intelligence Agency
CNPC	China National Petroleum Corporation
CSIS	Center for Strategic and International Studies
EAP	Environmental Action Programme
ECCP	European Climate Change Programme
ECSC	European Coal and Steel Community
EEC	European Economic Community
ENI	*Ente Nazionale Idrocarburi*
ENTSO-E	European Network of Transmission System Operators for Electricity
ERAP	*Entreprise de Recherches et d'Activites Petrolieres*
EREC	European Renewable Energy Council
EU	European Union
EU ETS	European Union Emission Trading Scheme
EUA	European Unit of Account
FDI	Foreign Direct Investment
GHGs	Greenhouse Gases
IEA	International Energy Agency
IEM	Internal Energy Market
IOCs	International Oil Companies

LNG	Liquified Naural Gas
Mb/d	Million barrels per day
Mtoe	Million tonnes of oil equivalent
NIOC	National Iranian Oil Company
NOCs	National Oil Companies
OECD	Organisation for Economic Co-operation and Development
OEEC	Organisation for European Economic Cooperation
OPEC	Organization of Oil Producing and Exporting Countries
PDVSA	Petroleos de Venezuela S.A.
RD&D	Research, Development and Demonstration
RES	Renewable Energy Sources
RES-E	Electricity from Renewable Energy Sources
SEA	Single European Act
TYNDP	Ten Year Network Development Programme
UNCED	United Nations Conference on Environment and Development
UNFCCC	United Nations Framework Convention on Climate Change

PREFACE

Today, renewable energy sources are globally looked upon as the energy resource of the future. This outlook can be attributed to the developments in the global energy sector which embarked a paradigm shift and forced a rethink of the energy strategy worldwide. The 1973 oil crisis reflected the vulnerability of the industrialised economies because of their reliance on energy importance and reiterated the need for energy security. In recent decades, climate change and sustainable development have gained importance on the international political agenda and are presently important variables in energy policy making. Renewable energy sources, because of their local orientation and minimal CO_2 emissions provide a solution to the threefold conundrum of energy security, climate change and sustainable development. On this ground, they have evolved as an important tool in the EU's integrated approach to address climate change, sustainable development, and security of energy supply in the past two decades. Presently, the European Union (EU) energy policy has four overriding objectives: the transition to a low-CO_2 energy future, diversification of supply, further integration of national markets into a single European market, and promotion of renewable energy.

The study seeks to analyse the evolution of the EU's renewable energy policy as a part of its integrated approach to combat climate change, tackle energy related issues, and pursue sustainable development. The approach has been to first investigate into the developments concerning energy and environment in the world as well as the EU that commanded a revision of the development strategy in the region in favour of a low-carbon economy. Thereafter, the study scrutinizes the rise of renewable resources as a principal candidate in context of the EU's quest for clean development. It provides the definition of renewable energy sources assented by the Union and analyses how Member States have promoted different technologies within the scope of the defined criterion.

The dissertation concludes with identifying the predicaments and the gaps in the policy framework of the EU for supporting renewable resources and suggesting some measures that the EU can take to seek optimal solutions to its energy-climate dilemma.

Chapter 1

Factors leading to the Evolution of Renewable Energy Sources in the European Union's Energy Mix

Renewable energy sources are hailed as the mainstay of the global energy system of the future. Renewable sources of energy such as wind power, solar-thermal, solar photovoltaic and concentrated solar thermal, hydro power, tidal power, geothermal energy and biomass are essentially seen as alternatives to the present energy system. The European Union (EU) acknowledges the potential of renewable resources and has worked proactively to put in place conducive conditions for promotion and integration of the new resources. It has, over a period of time, invested in the research and development of the upcoming technologies and laid plans for their market entry. Thereafter, it provided for a legal framework, various policy instruments and support schemes to help the new resources to set foot in the competitive market. The eventual goal remains provision of a comprehensive solution to the energy needs by becoming the mainstay of the energy mix.

The EU is a global forerunner in the field of renewable energy and has a very progressive renewable energy strategy. On the back of their policymaking, EU Member States such as Denmark and Germany are among global leaders in wind and solar photovoltaic technologies respectively. (Danish Wind Energy Association Portal 2011; *Bundesverband Solarwirtschaft* Portal 2011) In order to put into perspective the genesis of the European renewable energy strategy, it is imperative to scrutinise the factors and global developments causing policymakers to consider the renewable option and stimulating unprecedented growth of renewable resources. The drawbacks of conventional energy carriers and limitations of the present energy system have pushed the EU to take stock of the plausibility of its energy projections and plans. Developments in the global energy and environmental spheres caused the EU to instigate measures to lessen its reliance on precarious conventional energy sources.

Energy security, climate change and climate protection are inevitably linked with global energy policies, leading to an energy-climate nexus with far-reaching foreign and

security implications for regional and global stability, and human security. Lack of energy security and climate change will adversely affect the growth patterns. Therefore, energy security and climate change rank high on the international political agenda. There is a strong need to mitigate these factors and find a plausible long term solution. Mitigating climate change and securing energy supply requires a radical change in production, transformation and the use of energy globally. Present energy trends are not sustainable. Policymakers need to address the twofold interrelated challenges of energy security and climate change to put the world on a path of sustainable development. Security of the global energy system and greenhouse gas emissions reductions are preconditions for sustainable development.

Renewable energy sources address this challenge as they offer manifold advantage over their conventional counterparts. They have relatively lesser or nil greenhouse gas emissions and diversify energy supply. Securing a constant flow of energy resources may involve a threefold diversification: countries of origin, transit routes, and energy carriers i.e. fuel or the source of energy. Renewable energy sources address all the three strategies. They are local in orientation so the concerns about reliance on foreign actors for supply and transit are diminished. They are a basket of technologies thus diversify the energy mix by providing a multitude of energy carriers. In the longer term, diversification of energy carriers and thus, a transition from conventional to renewable or low-carbon energy resources will be more fruitful for the EU in its pursuit of energy security.

Development of renewable energy sources into a bustling sector will create employment and early movers in this sector are likely to create a lead through innovation and translate it into business opportunity. (EU Renewable Energy Portal 2011) In the medium term, the EU expects renewable energy to take substantial responsibility in its energy mix and even replace fossil fuels in certain sectors. The EU's renewable energy strategy derives impetus from and aims to negotiate three pressing issues, i.e. energy security, climate change, and sustainable development. It is imperative to consider the course of developments in the field of energy and environment which necessitated

measures favouring renewable energy sources as a new entrant in the energy scenario of the EU and in due course of time, as the perceived mainstay of the energy mix.

History of European energy policy

Before the Second World War coal was the main source of energy providing 90 per cent of the primary energy needs. The War caused substantial losses to the energy supply in the continent and resurrection of the energy infrastructure was a pre-condition for the post-war revival of the European economy. To this end an *ad hoc* body called the European Coal Organisation (ECO) was formed. It apportioned coal imports and mining equipment among the participating countries. In Western Germany, the International Ruhr Authority exercised control over the coal industry. In wake of rapid economic revival, the Authority could not regulate the German coal industry any longer but France would not allow the German coal industry to break free from restrictions. Hence, in 1950, the erstwhile French foreign minister, Robert Schuman proposed to establish the European Coal and Steel Community (ECSC) placing Franco-German coal and steel industry under a common High Authority and make any further war between the two countries "not only unthinkable but materially impossible". (See Lucas 1977: 4) The Treaty of Paris creating the ECSC was signed in 1951; other than France and Germany, it was signed by Belgium, Italy, Luxembourg and Netherlands. The ECSC had both political and economic motives. France established itself as a leader in continental Western Europe and retained control of German coal and steel. Germany too gained political respectability and trust of its neighbours. The ECSC was also expected to promote free trade and competition, and expand markets. The United Kingdom declined to join as it did not see any merit in surrendering powers to the supranational body. (Lucas 1977: 4-6)

Although coal was the primary energy carrier before the advent of the Second World War, oil had made inroads into the European energy mix. Despite the fact that in 1938 oil provided for only 8 per cent of the total energy consumption in Western Europe, many western European countries held substantial stakes in major oil reserves. The U.K was involved in Iran through its stake in British Petroleum (erstwhile Anglo-Persian Oil

Company). Later, to counter U.S dominance in the oil industry it extended the benefit its political presence in the Middle East to its oil company. Shell enjoyed a similar relationship with its home country, the Netherlands, which supported the oil major in Indonesia. France entered the oil industry a little late when it acquired stake in Turkish Petroleum Company per Treaty of Versailles. France was the majority shareholder in its oil companies namely, *Compagnie Francaise des Petroles* (CFP), *Compagnie Francaise de Raffinage* (CFR) and *Entreprise de Recherches et d'Activites Petrolieres* (ERAP) through which it had substantial stakes in oil reserves in Iraq and Algeria. Italy's *Ente Nazionale Idrocarburi* (ENI) was resurrected after the Second World War and together with its subsidiary *Azienda Generale di Petrolio* (AGIP) managed to make inroads in Iranian and Egyptian oil fields. Both the companies were state owned. Germany remained at best an insignificant player in the oil industry with meager refining capacity and a few private sector companies involved in exploration abroad. (Lucas 1977: 8-9; Parra 2004: 9- 21)

The oil scenario in Europe was very different from coal, which explains the dissimilar fate of oil in the resurrecting continent. Unlike coal, oil reserves were not indigenous. It was not a major contributor in the energy mix of post-war Europe either and hence did not form the basis of the economy. Importantly, Germany's lack of access to oil ensured that the neighbouring countries were not necessitated to put their oil assets under supranational supervision. By 1940, recovery price for oil reserves in the Middle East had sunk significantly which triggered a boom in the oil industry. West European countries, to benefit from this boom had set up refineries near the oil reserves and later, by 1950 refining operations were shifted to newly set up large European refineries. (Chick 2007: 8-17; Lucas 1977: 9) This was an omen of the substantial role oil was to play in the European economy, energy mix and foreign policy. The U.K. had denied joining the supranational arrangement for coal and steel, the ECSC because it was likely to gain too little from the surrender of its resources. The haves in continental Europe retained control of their possession in case of oil. The High Authority of the ECSC did not venture to create a pan European institution for oil. Instead, it laid its bets on the embryonic nuclear technology.

In 1955, foreign ministers of the six member states of the ECSC appointed an intergovernmental committee under Paul-Henry Spaak in Messina to study the feasibility and scope of further European integration in the four areas of general common market, conventional energy, atomic energy and transport. By December, conventional energy and transport were dropped and the report of committee emphasised urgent action on atomic energy and Common Market. Then, Europe was in pursuit of cheap energy sources and the committee zeroed in on the promise of nuclear energy. Although it would not have been cheap in the beginning but the Community seemed ready to pay the premium in return for security of supply. In 1956, Europe's oil supplies shrank substantially during the Suez crisis raising concerns about dependence on imported fuel in the longer term. The committee proposed to establish Euratom, an organisation to catalyse the formation and expansion of nuclear industry in the continent and enable the transition of the economy from coal to a nuclear base. The report was adopted in 1956 and the Treaties of Rome setting up Euratom and European Economic Community were signed in 1957. (Lucas 1977: 12- 15)

The Euratom could never achieve what it set out for. European economy underwent transition but from coal to oil. The European Commission's, the High Authority's successor, reputation too took a beating because of the failed nuclear experiment. Overlooking the scope of oil was a result of miscalculations regarding the future of oil as an energy source. Also, the case of oil as an area of integration was not as compelling because of its lower importance in intra-Community affairs as well as long term interests of the of member states. The reason behind the High Authority's enthusiastic approach towards nuclear energy was the wrong estimation of its scope as well as determined French support for Euratom. It was envisioned to promote peaceful use of nuclear energy. However, the French predilection for a nuclear bomb was to determine the course of the new institution. There was a mismatch between the aspiration and capability of the French in this particular sector. They lacked access to fuel, technical know-how and an industrial base. They expected to achieve technical knowledge by keeping avenues for cooperation with Organisation for European Economic Cooperation (OEEC) countries open. It particularly aimed to achieve such an arrangement with the U.K. In a Common

Market, France could access fuel resources of fellow countries, especially Belgium, which controlled uranium reserves in Congo. An advanced research and industrial base in Germany could come in handy for the French ambitions. France also aimed to bind Germany early into a collective arrangement to prevent it from mastering the technology on its own at a later stage. (Lukas 1977: 26) (Mayne 1958: 4-64) Eventually, it exercised power in the negotiations on Euratom shaping the new body to its needs simultaneously retaining an escape clause for its defence nuclear programme. France developed an exuberant national nuclear programme and much of the research work was not shared with other countries on the pretext of being military secret. Nuclear energy was employed in other states as well but not as extensively as in France and Euratom failed to achieve its targets.

At the same time, some developments in the oil producing countries were about to significantly affect the oil scenario in the coming years. In 1958, Venezuela and Iraq toppled their undemocratic governments and the two major oil-exporting countries had new radical nationalist governments in power. Venezuela, notably, had nailed powerful big oil companies in its territory and levied higher taxes on them. Oil prices continued their southwards move owing to increasing competition in the industry but to the dislike of producing countries. In August 1960, Venezuelan government blocked crude sales at discounted prices to curb revenue loss it caused to the exchequer. Exxon, the market leader in the Middle East, declared price decrease for the region. This move attracted sharp and immediate reaction from the producer countries, which were in no mood to tolerate oil companies' unilateral moves. In September 1960, major oil producing and exporting countries namely Iran, Iraq, Kuwait, Saudi Arabia and Venezuela founded the Organization of Oil Producing and Exporting Countries (OPEC). The main aim of the organization was to delegate a system for the stabilization of prices through the regulation of production. OPEC, in its early years could not accomplish much except freezing of posted prices and minor royalty and tax increases. OPEC members never wanted to indulge in a major confrontation with the companies as the memories of defeat of Iran at the hands of oil major companies, the CIA and Britain in 1953 were still afresh. Moreover, the rise of other oil producing countries such Algeria, Libya, Nigeria and

United Arab Emirates which were not members of the organisation acted as a dampener. This effectively meant that western oil giants could enjoy their supremacy in the sector. (Parra 2004: 90- 105)

Indonesia and Libya joined the OPEC in 1962 and UAE, Algeria and Nigeria followed suit in 1967, 1969 and 1971 respectively and strengthened the cartel. An important achievement of the OPEC was bringing all the oil producers in one boat. Oil producers could now flex their muscles and they did. Tehran and Tripoli agreements of 1971 provided for increase in oil revenues for producers. Many countries negotiated to hold substantial stakes in the oil companies and set out for eventual nationalisation. By October 1973, OPEC members in the Middle East threatened to cut back production and proclaimed an oil embargo in the aftermath of the Yom Kippur war. The oil companies were further debarred of their ability to negotiate. The oil crisis of 1973 was a watershed event as it marked the loss of control over price for the major companies. (Parra 2004: 112- 122)

The crisis was an eye opener for the Community and the world as well. Prior to the crisis, energy issues were dealt with by the ECSC and Euratom and no substantive measures were taken to formulate a common energy policy. However, the official documents after the crisis not only mentioned energy policy as desirable but also laid long term energy policy goal. The Council Resolution of September and December 1974 in specific analysed the implications of the crisis and evinced that stable energy prices and supply are a key component of economic growth and a disruption in its supplies derails the economy and leads to unemployment and inflation. Resultantly, energy security made it to the top of the international political agenda. (European Communities 1974a; European Communities 1974b) Energy security refers to securing a constant supply of energy resources at stable prices. The task of securing energy supply primarily includes minimizing the risk of a disruption at any point in production and distribution chain, which could arise due to political instability in energy producing regions, attacks on infrastructure, competition or manipulation of energy supplies, accidents and natural disasters. (Clawson 1995: 11)

The Community needed fundamental changes in its energy scenario to yield to the parameters above. An urgent need to shift reliance off oil to indigenous energy sources and reducing energy consumption was felt. The Council Resolution of December 1974 set energy policy objectives for 1985. Although, oil was to remain the mainstay of the energy mix natural gas and solid fuels were to take greater responsibility. Nuclear energy was to carry the bigger burden as it was the only available option which could be stepped up in the longer term to quench the ever rising demand for cheap energy.

Nuclear energy production capacity of the Community was to be increased to at least 160 GWe and if possible, to 200 GWe, a fourteen fold increase. Nuclear energy flourished in the coming years. In the intermediate stock taking of the energy scenario by the Commission in 1984, nuclear energy was already a substantial contributor to the energy mix and showed satisfactory progress concerning targets for 1985. In 1982, nuclear energy's share in electricity production was 14 per cent, which rose to 22 per cent in 1983 and was likely to rise to 25 per cent in 1984. In 1983, a total of 8 reactors were commissioned in the Community and 14 more were to be commissioned in the next year. Indigenous atomic energy saved the Community 30 Mtoe oil and gas imports that year. (Commission of the European Communities 1984: 34-37)

Table 1.1: Total primary energy requirements in percentage

EU-10	1973 estimates	1985 initial forecasts	1985 revised
Solid Fuels	22.6	10	17
Oil	61.4	64	41
Natural Gas	11.6	15	23
Hydro & Geothermal	3	2	3
Nuclear Energy	1.4	9	16
Total	100	100	100

Source: European Communities 1974: 26

Encouraged by the results, the Commission presented the energy reference projection, *Energy 2000* to the year 2000. Nuclear energy was given more responsibility. It was the only source with production levels likely to soar till the target year.

Table 1.2: Total primary energy requirements in percentage

EU-10	1983		Projection 1990		Projection 2000	
	mtoe	%	mtoe	%	mtoe	%
Solid Fuels	174	34	175	31	172	28
Oil	132.5	26	111	20	108	17
Natural Gas	119.8	23	115	21	108	17
Nuclear Energy	76.1	15	145	26	215	35
Hydro & Geothermal	12	02	13	2	14	2
Renwables & others	1.7	0	3	0	7	1
Total	516.1	100	563	100	625	100

Source: Commission of the European Communities 1985a: 15

Electricity emerged as the fastest growing energy vector. It was expected to grow at 3 per cent per annum between 1983 and 2000. Nuclear energy was to be the main contributor here as well. It was to double output in power generation to 43 per cent by 2000.

Table 1.3: Total electricity production by sources

EU-10	1983		Projection 1990		Projection 2000	
	TWh	%	TWh	%	TWh	%
Solid Fuels	529.6	43	631	42	733	32
Oil	158.5	13	83	5	71	4
Natural Gas	111.8	9	119	8	72	4
Nuclear Energy	275	22	534	35	792	43
Hydro & Geothermal	147.4	12	150	9	165	9
Renwables & others	7.0	1	8	1	14	1
Total	1229.3	100	1523	100	1847	100

Source: Commission of the European Communities 1985a: 17

The European Community had found a long term solution of its energy issues in nuclear energy. It had lessened reliance on imported oil and was being promoted to replace oil and gas to a large extent in both the overall energy mix as well as electricity production. The Commission was quite relaxed with regard to the growth of nuclear sector. However, this complacency was short lived. Europe's energy planning suffered a

major setback in form of Chernobyl nuclear accident in 1986. Clouds of doubts were cast over the energy source, which was upheld as the mainstay of the Community's future energy mix. Growing safety and environmental concerns regarding nuclear waste, specifically after the Chernobyl accident, dampened the enthusiasm immediately. Although nuclear plants already in service were not decommissioned, nuclear energy targets for the year 2000 were abandoned. The nuclear option had to be shunned. The European Commission's Communication *Energy and Environment* (Commission of the European Communities 1989) conceded the problems associated with nuclear energy and indicated to step up renewable resources to fill up the void created by shunning the nuclear option. Budget allocations were made for research and development of the new basket of energy technologies.

Even the Chernobyl accident could not embark the era of renewable energy sources. Renewables were not fit for commercial exploitation yet. Global oil scenario had normalised after the oil crises, therefore, there was no urgent need to look for alternatives. The Commission decided to move ahead with their strategy of energy efficiency to keep energy demand in check. The deficit between energy demand and supply were to be bridged by hydrocarbons, where gas was to take lead over oil. For the longer term perspective, the Commission saw renewables also contributing a larger share and earmarked budget for research and development of the new technologies. By the end of the century, gradual global developments started to show their impact on the global oil scenario and resurrected the concerns about energy security once again. This new trend in the energy scenario is likely to gain momentum in the future and has already caused a more urgent need to introduce, integrate and promote renewable energy in the European Union in recent times.

The demand for oil and gas will remain strong in the coming years. Oil will provide an estimated 30 per cent of the global energy until 2030 and gas 22 per cent of the global primary energy. (World Energy Outlook 2008: 78) Demand will rise by 40 per cent from 12000 million tonnes of oil equivalent (Mtoe) to 16800 Mtoe at an average annual rate of 1.5 per cent between 2007 and 2030. (World Energy Outlook 2008) Developing Asian

countries are the main drivers of this growth in demand. A speedy economic growth in developing countries, primarily China and India, in the recent decades, has resulted in fundamental shift in the traditional consumer base of global oil and gas markets. According to the IEA estimates, China and India will be responsible for a respective rise of 43 per cent and 19 per cent in the demand growth. Fossil fuels will remain dominant sources of the global primary energy demand, accounting for over 75 per cent of the overall increase in energy use. (World Energy Outlook 2008) the European Union and other developed countries will face competition for energy resources from the emerging economies.

The supply side story is fraught with uncertainty. Decades of constantly rising production levels has left world's low cost conventional oil fields nearly exhausted. Between 2012 and 2015, an increase of 12.5 million barrels per day (mb/d) in the gross capacity is needed to meet the demand; 8.4 mb/d is needed to compensate for the declining capacities of existing oil fields and another 4.2 mb/d is needed to meet the growing demand. The collective output of the OPEC countries should rise to 46 mb/d in 2015 and 61mb/d in 2030, thus, increasing the OPEC's share in global output from 42 per cent in 2006 to 52 per cent in 2030. But estimated increase in oil production levels relies critically on investments, which seem uncertain at present. Moreover, input costs of drilling equipment and technology have soared manifolds. The actual investments levels in this sector fall miserably short in comparison to the rising demand and soaring cost of oil and gas exploration. The principle reason behind this the lack of access to foreign capital in lieu of the resource nationalization carried out in the late 70s and beyond. Countries like Saudi Arabia, Russia, Iraq, and Iran together hold over 50 per cent of the global oil and gas reserves are reluctant to allow access to FDI to develop production capacities. By 2030, there will be an estimated deficit of US$ 6.5 trillion in investments in oil and gas exploration and production. (Accenture Report 2006) Thus, oil and gas production may actually fall short of meeting the rising demand making the global oil scenario more difficult.

Consequences of higher demand and limited supplies are already visible. Energy prices have soared in the past decade. In 2008, crude oil prices had quintupled from 2003 levels. The recent rise in oil prices seems different from previous spikes, which occurred because of political or military conflicts. This spike in prices is likely to be more permanent in nature as it emanates from supply side issues. (Umbach 2010:1230) Energy prices softened after the economic collapse in the latter half of 2008, but they soon picked up with the growth picking up in the developing countries. The EU relies heavily on imported oil and gas. In 2007, oil and natural gas were the EU 27's major energy carriers contributing 36.4 and 23.9 per cent respectively to the energy mix. Importantly, its import figures stood at 82.6 per cent and 60.3 per cent respectively. (Eurostat 2010: 36-46) This implies that the EU relies on external factors for a key ingredient for its growth, which are not benign and increasingly unfathomable. It is imperative for the EU to secure its energy supplies to ensure stable growth. Soaring oil and gas prices have caused increased burden on the European exchequer and in the likelihood of higher oil prices, import budget is likely to shoot up unless energy imports are substituted by indigenous resources.

Oil and gas have always been politically charged commodities, as they have been the primary sources of global energy supply and will continue to be so. Energy, therefore, is not a purely economic good, which adheres to market forces. Energy security dimensions are changing rapidly too. Today, the purview of energy security has enlarged to enclose concerns related to exploration, refining, and transportation of oil as well as natural gas. Investment in energy infrastructure, rise of new consumers and concerns regarding use of energy for political ends also figure in the new list of issues dealt with under energy security head. The rise of national oil companies (NOCs), which work in concordance with respective national governments, has heralded the use of energy as an important foreign policy tool. In 2006 and 2009, when Russia turned off gas supplies to Ukraine, the transit country Russia and the EU region, the EU too got a glimpse of the new role energy plays in the international scenario. The innovative use of energy resource by the countries in possession does not augur well for the markets as it sidelines transparency,

which creates a perpetual sense of insecurity about the timing of the next use of energy as a political tool.

Although, the world has ample oil but there is need to develop new reserves as present reserves are depleting. The balance of power between producer and consumers of energy has tilted significantly in favour of the producers. (Umbach 2010: 1230) They are the price setters and they set the rules of the game too. Furthermore, the consumer countries' increasing reliance on oil and gas imports from a much smaller number of producing countries, many of them politically unstable, exacerbates energy security concerns. A study by the Center for Strategic and International Studies (CSIS) projects that by 2020, 50 per cent of the estimated global oil demand will be met by countries that pose a high risk of internal instability. Five of the seven countries designated by the U.S as sponsors of terrorism and 'rogue states', i.e. Iran, Iraq, Libya, Sudan, and Syria are energy producers. Moreover, Iran, Iraq, and Libya are major producers with Iran and Iraq together holding about 20 per cent of the global proven oil reserves. (See Umbach 2010: 1233) Absence of ample options in the energy markets has bolstered market dominance of select oil and gas producing countries. Thomas L. Friedman's First Law of Petro-politics posits that the price of oil and the pace of freedom in oil-rich states always move in opposite directions. Moreover, windfall profits from crude prices have empowered many producer countries to flex their muscles in the international political arena. (Friedman 2006)

In this light, many governments, having smelled danger, are jumping into the energy playfield, thereby intensifying momentum of change. This is a clear indication that the demand for oil and gas is rising and has acquired the shape of a scramble for energy resources. Thus, there exists a great mismatch between the global and the European energy scenario. In times of resurgence of the geopolitical play, the EU has delisted energy from its political and strategic issues by leaving it to the industry. The EU lacks energy players who can perceive the long term interests of the region, compete with NOCs and negotiate security supply concerns reckoning oil and gas to be the main energy carriers.

The global energy markets, having acquired a much more significant geopolitical character in recent past, have moved in the opposite directions. The global oil and gas scenario is no longer congruent with the design of the European Internal Energy Market (IEM), an institution discussed in greater detail in the next chapter. The newly emerged national oil companies (NOCs) in other parts of the world are outwitting the earlier masters, i.e. the international oil companies (IOCs). Re-nationalisation of energy resources and concomitant resource nationalism has played an important role in the burgeoning of geopolitical dimension of international oil and gas. In the 1960s, the IOCs had access to about 85 per cent of oil and gas reserves. Today, they control 10 per cent of the total oil and gas production and hold just 3 per cent of the reserves. Saudi Aramco, Russia's Gazprom, CNPC of China, NIOC of Iran, PDVSA of Venezuela, Petrobas from Brazil and Petronas from Malaysia are termed as the new 'seven sisters', who call the shots in the international market. (Hoyos 2007) NOCs easily outbid their private sector rivals as they have deep pockets and can work on lower margins. Unlike private players, they work with long term strategic interests of the country as guiding principles and not short term profits.

The EU, after having undergone liberalisation of energy markets in the region, is not very well suited to scramble it out with other players in the international energy market. Therefore, important questions that arise are: Will the E.U lag behind if it does not take part in this rush? Will the E.U have reliable access to oil and gas at a reasonable price in future? Thus, should the E.U also take part in this rush?

After years of smooth market functioning, the EU went a little lax in the matters concerning energy security as it assumed that the energy scenario will remain constant in future. (Umbach 2010: 1230) The EU with its underlying futuristic vision of having competitive markets conducive for smaller players and new energy carriers can no longer outwit competitors in the present oil and gas scenario. Hence, it should not involve in the global oil rush and concentrate on working on its envisioned energy future and create a competitive edge by incubating new energy technologies on its turf.

Even if the EU is not a major player in the oil and gas sector, it is unlikely that the European oil and gas grids will run dry. It is erroneously presumed that energy politics is a zero-sum game, thus one country's guarantee of access to energy resources is other's lack thereof. Fact of the matter is that despite resource nationalization and emergence state players on the global oil stage markets have not gone obsolete. China imports only 10-15 per cent of the total production of its international assets and sells the rest in the global markets. It also buys oil from the world market to meet its demands. Another national oil company (NOC), Saudi Aramco sells its produce to global markets and does not rely on state deals. (Goldthau & Witte 2009: 374-381) The EU is likely to rely on a mix of state deals and international oil and gas markets, more so in times of crises. The strategy of relying on markets will pay off in a better manner if the EU lessens the weight of oil and gas in the energy mix.

A shift towards a mercantilist and geopolitical approach in energy policy making where governments play an increasingly important role is detrimental to the global energy scene. Analyzing this matter from a geopolitical point of view is an extremely reductive exercise. It is seminal to understand the factors that fuel the fears of a supply crunch viz. emergence of new consumers, dwindling low-cost reserves and lack of investment and research and development. However, the present global trend seems to be marked by panic instead of finding solutions to the pressing issues. Following these precedents, the international oil and gas scenario is likely to get murkier.

The EU in its capacity as a soft power relies on strengthening of market forces instead of becoming a bigger player to adapt to the new scenario. Oil, which is not purely guided by market rules, thus, does not fit in the EU's vision and should henceforth be considered the fuel of transition. (Umbach 2010: 1230) Renewable energy sources (RES), if harnessed in a planned manner, can score over oil and gas in terms of security of supply primarily because of their local orientation and inexhaustible supplies. As majority of these energy resources will be placed on the EU's home turf a much lesser number of external factors would meddle with supply mechanism. Energy supply variables will be domestic and could be tackled domestically, hence more secure. Renewable energy sources (RES) are inexhaustible so depletion of energy reserves unlike oil and gas is

ruled out too. These traits of renewable energy have exalted it to being a legible potential energy carrier in the EU's energy mix and have caused the EU to work aggressively to shift on to them.

Climate Change and Sustainable development

Climate Change is presently seen as one among the gravest challenges facing humanity. It demands urgent mitigation measures, which are challenge in themselves but also provide a window of opportunity. The EU has been a very prominent actor regarding environmental issues and sustainable development. It has been developing its domestic policies on climate change keeping in mind its commitment to stringent climate policy measures. Climate change will affect all aspects of human life: social, economic and environmental. As greenhouse gases emissions are the prime culprits behind global warming, it is important to address the sources of such emissions. It is an issue that cuts across several policy domains, from the environment to energy, transport, industry, and agriculture among others as all such domains contribute to overall emissions. Present trends are not sustainable and continuing in this fashion would be catastrophic, hence the promotion of renewable energy in its energy mix is an overriding objective of the EU's energy policy. (Belin 2010)

The EU (erstwhile EEC) got its first piece of legislation on environment in form of the *Directive for Harmonised Classification and the Labelling of Dangerous Chemicals* in 1967. Despite the Directive, its environment policy started only after the United Nations convened the Conference on Human Environment in Stockholm in 1972, when the first Environmental Action Programme (EAP) was launched considering the commitments made by the European Council in the conference in 1973. The conference facilitated a major discussion of environmental issues at the international level and caused a subsequent increase in public awareness and understanding of the impact, which economic growth had on environment. (Wynberg 1993: 1)

EAPs are non-binding policy guidelines which set targets and contain a list of planned activities for concerned sectors. The First EAP emphasised the need for a comprehensive

assessment of the impacts of policies in other fields. It proposed to define environmental quality objectives by carrying out research activities on the causes and impact of pollution setting criteria for environmental objectives. The main objectives of the programme were prevention, reduction and containment of environmental damage, conservation of ecological equilibrium and rational use of natural resources. The approach focused on protection of single environmental media viz. water, air, soil etc and provided environmental quality norms for the same. The second EAP (1977- 1981) was essentially a follow up of its predecessor. (Hey 2005: 19) In both the earlier Environmental Action Plans, judicial and sustainable use of resources was at the forefront of policy making.

As a next step to the Stockholm Conference, the United Nations, in 1983, convened the World Commission on Environment and Development, also known as the Brundtland Commission. The purpose of the commission was to examine strategies and means by which the world community could deal more effectively with environmental concerns. In 1987, the Commission published its report *Our Common Future* and set out the concept of 'sustainable development' as an integrated approach to policy and decision making in which environmental protection and long-term economic development are seen complementary processes. The Commission defined sustainable development as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (United Nations 1987: 43). Sustainable development ties together three issues: sustainability of the environment, economic sustainability and social acceptance. Because the causes and repercussions of climate change cut across many policy fields such as energy, environment and agriculture, it is necessary to put together a response cutting across various policy fields, a phenomenon also referred to as mainstreaming of the climate policy. The EEC realised the nexus between various sectors of economy and environment and this reflected in its policies in the coming years.

The launch of the third EAP (1982-1987) coincided with the erstwhile European Community's Internal Market project as well as growing environmental consciousness

among the people. It is imperative was to harmonise the upcoming Internal Market with environment standards. In fact, it used environment norms as a catalyst for the smooth introduction of the new market project. It emphasised the benefits of environmental policies to the Internal Market and promoted the linkage between the internal market and environmental policies as the key driver for programming and activities. Environmental emissions standards needed to be harmonised to avoid distortions to industry competitiveness. Product regulations had to be harmonised to avoid non-tariff barriers emanating from different norms of the Member States. In this case, emissions proved a better benchmark compared to quality for the purpose of standardisation. Environmental policy approach showed initial signs of the modification from quality orientation to emission orientation. (Hey 2005: 19) A shift towards an emissions oriented approach meant an overhaul of the development model and a transition to low-carbon economy in the longer term.

The fourth EAP (1987- 1992), like its predecessor, emphasised harmony between the objectives of the Internal Market and environmental protection. However, 1987 was a breakthrough year for the Union's environment policy as it received a separate chapter in the Treaty establishing the European Union. Mainstreaming of environmental issues picked up momentum. Environment protection was now to be integrated into economic decision making as an important factor and was not be perceived as an additive reference policy. The Fourth EAP embarked upon a sectoral approach, where it analysed the impact of strategic economic sectors on the environment. It was during the span of the fourth EAP that the EU environmental policy attained a sustainability frame. (Hey 2005: 21) With the new decade approaching, sustainable development became a normative reference point and the EU was on track to formulate a new development model in which it could meet both its environmental and economic objectives. The Union eyed decoupling of economic growth and environmental degradation by increased integration of clean technologies. (Commission of the European Communities 1993)

Meanwhile, the publication of the Brundtland Report catalysed an international consultation process. Considering the report, the United Nations called for the Conference on Environment and Development (UNCED), in Rio de Janeiro in 1992. The

primary goals of the Summit were to reframe an understanding of development that would support socio-economic development and prevent the continued deterioration of the environment, and to lay a foundation for a global partnership. The Conference stressed on public participation allowing for increased communication and co-operation between governmental and non-governmental organisations. The integration of environmental issues in policy making got further recognition with the adoption of the Agenda 21, a comprehensive programme of action containing detailed proposals for action in social, economic and other areas of relevance to sustainable development. In Article 2, the participating countries also agreed upon the binding United Nations Framework Convention on Climate Change (UNFCCC) (United Nations 1993). The objective of the Convention was to stabilize greenhouse gas concentrations in the atmosphere, through international action, at a level that would prevent dangerous anthropogenic interference with the climate system. In article 25, parties to UNFCCC are classified as: Annex I countries, i.e. industrialised countries and economies in transition, Annex II countries, i.e. developed countries which pay for costs of developing countries and Non Annex I countries, i.e. developing countries. The EU falls into the Annex I of the Convention. [1](United Nations 1993)

The European Commission adopted the fifth EAP in 1992. It was prepared in parallel with the Rio agreements and had common strategic objectives and principles. It was the Community's principal instrument for implementing the Agenda 21 and preparing for sustainable development strategy. The action programme supported a sectoral approach to integrate environment into all the policies and actions of industry, government and consumers from scratch. It also proposed structural change in favour of public transport, energy efficiency and waste prevention. It also sought to broaden participation by instigating a spirit of shared responsibility among all key actors, viz. central and local government, public and private enterprise, and the general public, thus responding to the

[1] In 2002, Johannesburg Conference was called as a follow up to the Rio Earth Summit. The EU, assuming leadership, pushed for and got an agreement on the Johannesburg Renewable Energy Coalition committing to promotion of renewable energy sources. It was an indication of the fact that renewables are an inevitable tool in the EU's climate and energy strategy.

call of the Conference of mainstreaming environment and enlarging the participants' base. The new consensus-oriented approach sought to involve non-governmental organisations and local/regional authorities to represent the general interest of the environment and invite innovative concepts, raise public awareness, and enforce the implementation of EU directives. The fifth EAP was to set the strategy for the EU's environmental policy until the year 2000.[2] (Wilkinson 1997: 158) (Hey 2005: 23)

In the 1990s, Member States concentrated largely on the competitiveness of industries and followed decentralised environmental policies, which contradicted the spirit of the fifth EAP. For example, the German reunification shifted the focus away from environmental issues to the economic problems of reunification became a primary concern. Consequentially, work on environmental programmes slowed down considerably. The 1992 Communication, entitled *A Community strategy to limit carbon dioxide emissions and improve energy efficiency*, emphasized in particular the important role of reductions in energy demand, an increase in energy efficiency and a modification of the energy sources used. To this end it called for an energy/carbon tax, an instrument which was characteristic of a paradigmatic change in the environmental policy. (Commission of the European Communities 1992a) But the proposal met stiff resistance and idea of an EU wide energy tax had to be ultimately abandoned in 1994. (Collier 1996: 158) Watering down of the tax proposal was a symptom of the problem of implementing the paradigmatic change. It was evident that the Commission was overly optimistic on the willingness of Member States to follow policy guidelines and that the progress on policies directed towards structural change was piecemeal and slow. Meanwhile, the EU, in the White Paper *An Energy Policy for the European Union,* recognised that combustion of fossil fuels was the main cause of greenhouse gas emissions. It also acknowledged the renewable energy sources respond to the dual challenge of energy supply and environment and therefore, will be the main source of

[2] The fifth EAP was followed the sixth and ongoing EAP. It maintains that environment protection requires a broader approach beyond environmental legislation. In context of enlargement of the EU, it emphasises the need for consolidation of existing legislation.

sustainable energy in the long term. As renewable resources were not competitive yet, it maintained a considerable degree of flexibility in the final shape of the future fuel-mix and reaffirmed the possibility of renewable resources playing a greater role in the energy scenario soon, as some renewables were on the threshold of economic viability and many could follow suit. It pledged to undertake every step to promote the new technologies. (Commission of the European Communities 1995b) The EU environment policy required another trigger to shift gears and put environmental issues back on the political agenda. This trigger was achieved with the adoption of the Kyoto Protocol.

The Kyoto Protocol of 1997, a legally binding protocol to the UNFCCC, mobilised international action for the stabilisation of greenhouse gas concentration in the atmosphere. Prior to the adoption of the Protocol the Commission re-emphasised the correlation between climate change and energy in its Communication, *The Energy Dimension of Climate Change*. Keeping in mind the lethargy concerning environmental actions in the previous years, it demanded that "political commitment" of 15 per cent reduction in greenhouse gases from 1990 levels, which was to be adopted along with the Protocol, be backed by "political willingness" to achieve it. (Commission of the European Communities 1997b: 1) It also gave the sectoral emissions in business-as-usual or *Pre-Kyoto* scenario:

Table 1.4: Emissions increase per cent over 1990

1995	2000	2005	2010	2020
-2%	+2%	+6%	+8%	+16%

Source: Commission of the European Communities 1997b: 16

The Protocol placed climate change and sustainable development high on the international political agenda. In 2007 and 2008, these issues featured on the agendas of the United Nations General Assembly, the United Nations Security Council as well as the G8 and G20 summits. It committed the Annex I countries to cut their collective greenhouse gases emissions by 5.2 per cent from the 1990 levels. (United Nations 1998) Moreover, the Kyoto Protocol substantiated the emission reduction orientation that was

on cards for some time in the EU. Emission reduction was now to be pursued with renewed vigour and renewable resources were already acknowledged as key instrument for the purpose. Thus, the need for promotion of renewable energy sources became more pressing as environment and energy related issues demanded concerted endeavours.

With the adoption of the Kyoto Protocol as the precedent, the EU environmental policymaking gained momentum and the first European Climate Change Programme (ECCP) was launched in 2000. The objective of the programme was to identify and develop tools necessary for the implementation of the Protocol. The foremost intent was to develop a cost effective and viable mechanism for mitigation of greenhouse gases emissions. It successfully brought together stakeholders from different backgrounds. In 2005, the second ECCP was launched to continue the work commenced by its predecessor. (Rusche: 2010) In 2005, the EU launched the Emission Trading Scheme (EU ETS). It employs the cap and trade principle, whereas cap refers to a limit on the total amount of certain greenhouse gases that can be emitted by the industrial units, power plants etc. Industrial units receive emission allowances which can be traded. The limit on the total number of allowances available ensures that they have a value. Thus, emissions are given a price tag. The number of allowances is reduced over time so that total emissions are reduced. Trading of emission allowances allows for emission cuts to be made where it costs least. (EU ETS Portal 2010) This comes as a boost for a low-carbon sector such as the renewables, which can trade surplus carbon credits and reap profits.

Since the early 1990s, the EU has been a very prominent actor regarding environmental issues and sustainable development. It has been developing its domestic policies on climate change keeping in mind its commitment to stringent climate policy measures. On the launch of negotiations on the Climate Change Convention in 1991, the EU, although unsuccessfully, pushed for binding emission reduction targets for industrialized countries. During Kyoto protocol negotiations, the EU proposed deepest emission cuts and accepted the highest reduction target of 8 per cent below 1990 levels among the major industrialised countries. In March 2007, it unilaterally committed to 20 per cent reduction

in the greenhouse gas (GHG) emissions from the 1990 levels by 2020. The EU played a major role in the launch of negotiations on a post-2012 climate agreement. Its actions as an international and regional actor in this sector can justifiably claim the leadership role for itself. (Oberthür and Roche Kelly 2008: 35) The EU's domestic politics and institutional underpinnings have been the driving forces behind its leadership on climate change. Environmental policy has become an important driver of European integration. Environmental protection has constantly received high support in the region for more than two decades. Moreover, increasing importance of the issue opens a window of opportunity for the EU to enhance its legitimacy by moving climate change into the centre of the European integration process. In the international system, the EU has for some time pursued the objective of enhancing its role as a global actor and is a strong proponent of multilateralism. This factor also supports EU leadership on climate change. Climate change and the Kyoto Protocol enjoy a high international profile and leadership in this area, which could be utilised to build upon the Union's soft power resources. The EU has grabbed the opportunity and established itself as a leader in the sector. (Oberthür and Roche Kelly 2008: 35- 42)

To retain its leadership status the EU needs to ensure that its domestic policy measures live up to its international commitments and negotiating stance. Because the causes and repercussions of climate change cut across many policy fields such as energy, environment and agriculture, the EU needs to put together a response cutting across various policy fields, i.e. mainstreaming of the climate policy. It has gained momentum at the strategic level through the decision of the EU to give priority to energy and climate goals in Europe's 2020 strategy. (EU Climate Policy Portal 2010) In this context, the EU seeks to overhaul its energy system and emphasise low-carbon and greener fuels among them renewable energy sources.

In the past two decades, the EU has taken many actions to promote the penetration of renewable energy sources. In 1992, the Commission proposed the decision concerning *specific actions for greater penetration of renewable energy resources, i.e. ALTENER* (Commission of the European Communities 1992b) In 1993, the programme was

launched aiming non-technical assistance for promoting the use of renewable energy sources. Quantified targets for renewable energy sources were set for the first time; it set a non-binding target of 8 per cent share of renewable resources in the EU's energy mix by 2005. (Commission of the European Communities 1992) Additionally, integration of renewable energy resources in the energy market by striving for an Internal Energy Market was targeted too.[3] In 1997, the Commission declared in the White Paper, *Energy for the Future: Renewable Sources of Energy*, its intention of having renewable sources as a major contributor to the energy mix. The target for renewable resources was pegged up to 12 per cent share in the energy mix by 2010. (Commission of the European Communities 1997a) The agreement on the White Paper established renewable energy sources and opened doors for further policy support required for their market integration. In 2007, the European Council agreed on the integrated 'climate and energy package', and set the 20-20-20 target. The EU's climate and energy policy aims to achieve a careful balance between the two parameters, i.e. security of supply and environment to achieve sustainable development. Renewable energy sources have gained importance in light of the threefold challenge and are likely to play a very important role in the overall strategy. In the mid- and long-term, the EU will be secure and prepared to cope with these challenges. (Umbach 2010: 228)

The need for an overhaul of the energy system in the EU was felt in the past decades and renewable energy sources emerged as the eligible technologies. But a lot of work needs to be done to introduce the new energy resources into a competitive market. Providing a legal framework for renewable was a daunting task as the Commission too did not command authority on energy matters. The next chapter analyses the evolution of renewable energy policy by studying the policy documents of the European institutions over the years.

[3] ALTENER was followed by ALTENER II (1998- 2002) and Intelligent Energy Europe (2003-2006) to achieve the targets.

Chapter 2

The Policy Framework for the Promotion of Renewable Energy Sources in the European Union

Renewable energy sources are a relatively young player in the energy sector. After years of promotion of research and development in the new technologies, commercial exploitation of renewable appeared on the agenda of the European Union only in 1996, when it published the Green Paper on Community strategy on renewable energy sources. Nonetheless, they too like other energy carriers fall under the purview of energy policy, a policy area where, traditionally, the European Commission has not enjoyed much competence. Energy policy is a complex issue in the European Union. In fact, its very existence in the Union has been debatable, largely owing to the European institutions, primarily the Commission not having enough weight in energy matters.

The unprecedented rise of renewable energy resources owes a lot to the conducive environment in the European Union. The rise of the European Commission as a potent energy player in the recent past and a simultaneous transfer of some competencies by the Member States in the energy sector to the supranational level are important variables in creation of the conducive environment talked above. The empowerment of the Commission in issues concerning energy has enabled it to formulate policy at the Union level and set targets for the Member States. This could be considered as the beginning of a much sought after supranational energy policy. N.J.D. Lucas (1977: 162) calls this a European common energy policy where the Community 'takes a number of measures in common, sufficient to demonstrate a degree of solidarity' as against the traditional understanding where competencies should first be transferred to the Commission, which in turn will lay down detailed plans for energy future of the union.

While discussing energy issues in the European Union (EU), one must consider the role played by the European institutions in formulating policies concerning energy. A very important component of policymaking is the dialogue between the Commission and the Council, which symbolises the relation between sovereign member states and the

Executive. The political environment, especially in case of energy matters, is influenced by the way power sharing in policymaking among the Member States and the Executive has been addressed by different treaties from where the European institutions derive authority. The earliest treaties, i.e. the Paris Treaty of 1951 establishing European Coal and Steel Community and the Treaties of Rome establishing European Economic Community (EEC) and the Euratom were instrumental in defining the relation between the various executive bodies, which were later to be merged into the European Commission and the member states. Considering the need to install a supranational authority from grass root levels, the Treaty of Paris assigned a powerful High Commission the role of implementing the treaty. The High Commission was, therefore, required to consult the Council, which represented the interests of the member states on limited and very important matters. However, by the time the plans EEC and Euratom were underway, the need to transfer equivalent competences to the supranational body was not as urgent. Thus, a plan for a stronger or even as strong a Commission, which could command member states on contentious issues, would have been neither feasible nor appropriate. The authority of the Commission was skillfully guarded by arranging for power of policy initiative for the Commission and providing for a unanimous vote instead of majority of the Council to amend proposals without the consent of the Commission. (Dainith and Hancher 1986: 14) (Lucas 1977: 82)

Even after the signing of Merger Treaty of 1967, when the Executives under the different treaties were merged the relation between the Commission and the Council retained its characteristics. A merged executive was expected to promote a common energy policy for the Community. The war in the Middle East and the following blockade of the Suez Canal in the same year, although did not curtail oil supplies to continent significantly, but were stark reminders of the Community's reliance on external regions. By now oil, which was governed by big oil companies, had established itself as the mainstay of the European energy mix and the Commission had little say in the management of a resource of prime importance for the Community. The Commission forewent the opportunity of establishing itself as a strong player in energy matters by taking too long to prepare exhaustive and elaborate guidelines. With supplies normalising

the fear of supply hiatuses could not serve as a catalyst to draw member states into relinquishing their hold over their oil assets to accomplish a common policy for oil in the name of energy security. (Lucas 1977: 46-47) The oil companies, as discussed in the earlier chapter, had managed a constant supply of fuel at cheap prices so far leaving little incentive for the member states to shuffle the system in the name of improving competitiveness. In January 1973, the U.K.'s, another country with substantial petroleum assets globally, joining the Community did not strengthen the case for a common energy policy as there was still an absence of similar energy interests. The Commission had to wait for a watershed event to break the ice and materialise its place in energy policymaking as an unavoidable candidate.

This event came in the form of oil crisis. In December 1973, the Commission had successfully attained the 'ritual expression of political will' in favour of a common energy policy in the Community at the Copenhagen Summit. (Lucas 1977: 46) It was quick to grab the opportunity this time. As a an immediate measure, the Commission, *Problems in the Energy sector,* presented an analysis of the energy scenario and proposal to boost intra Community trade in crude oil and petroleum products in order to meet shortages in case oil was available elsewhere in the Community. (Commission of the European Communities 1974a) In its Communication to the Council, *Towards a new Energy Policy Strategy for the European Community*, the Commission was unequivocal about the need for cooperation among member states to make for a fair sharing of burden among the oil haves and have-nots. For this purpose, the Commission advocated a unified energy market as its main instrument wherein energy should be dealt with as a purely economic good and competition should be the basic guiding principle. It expected competition to compel energy companies to be efficient and find alternative fuels to diversify energy supply. It produced detailed medium term energy projections and exalted nuclear energy as the fuel of the future. It also suggested that the Community should look to diversify its energy supplies by developing more secure energy resources and cut down on its energy needs. (Commission of the European Communities 1974b)

The idea of creating a unified energy market was not new, this had earlier been the Commission's proposition as well, when after merger in 1967, it strived to formulate a common energy policy. This time, however, the Commission was upfront in demanding more competences. It laid down, "The Community cannot seriously expect to achieve such objectives if it does not possess instruments of persuasion or support operating at the Community level, and following an overall strategy... The requisite support towards achieving all these tasks could be assigned to a Community agency having a legal personality and financial authority. It would be under the control of the Commission and would be assisted by a consultative committee composed of representatives of the Member States and interested parties." (ibid: 3) The Commission's attempt to gain some influence in energy matters received a setback, when in July 1974 the U.K. refused to accept the resolution on the new energy strategy, as it doubted the consequences of such a strategy. The British Minister for energy was unenthusiastic about the Community plans on energy, as being home to oil majors, the U.K. would have to shoulder the burden. France, the other heavyweight, backed the new strategy to counter the U.S. move to set up an international oil sharing platform in the form of International Energy Agency. Such an arrangement would put Europe in line with other consumers neglecting the special relationship the European countries enjoyed with the producer countries in the Middle East. Oil formed an important component of the foreign policies of both France and the U.K. in the region, but France maintained that joining a consumer group would restrict them and it was better to practice an independent policy. Moreover, it asserted that the Community needed to accede to a common policy to become effective on the global front. The Commission had the difficult task of mediating between the interests of different Member States and reflecting them in a single policy. (Lucas: 62-67)

In December 1974, the Commission did achieve a compromised resolution. An intra Community oil sharing arrangement was dropped from the agenda. Instead, the Community chose an international sharing arrangement under the aegis of the IEA. The Commission's new role in the energy matters was restricted to present long term guidelines for investment required to achieve the sectoral objectives of the new energy strategy against what it aspired for. In February 1975, the Commission submitted *Views*

on the measures to sustain the development of energy resources. The Communication urged for specific incentives for promoting investments in energy sources. It called for attractive returns on investments in research and guarantee against budgetary cuts in the field in face of normalising of oil prices in future. Importantly, it also appealed that in case a technology appeared promising in the long term, it must be allowed into production despite high costs. (Commission of the European Communities 1975)

This plan was more or less a follow up of a research and development plan, *Energy for Europe: Research and Development* (Commission of the European Communities 1974c) laid down in July 1974. Although the emphasis was on conventional energy sources and possibilities of substitution of imported oil, it also, for the first time, proposed to make allocations for new non-conventional energy resources. The energy resources referred to under this head were geothermal energy, solar passive, photovoltaic, solar thermal and nuclear fusion. At this juncture, both renewable energy sources and the Commission as energy player had little to promise. Geothermal and various forms of solar energy were technologically proven but were very expensive. Others like wind energy, tidal energy and biomass did not find mention for research and development allocation. The Commission remained a dwarf failing to attain a substantial role other than periodical submission of studies and reports. The Community, too, in choosing intergovernmental cooperation as a tool to cope with the new reality of energy system lost the opportunity of using energy as an instrument for strengthening integration.

The Council Regulation of June 1978 (European Communities 1978) expanded the purview of the preceding research and investment plans. The Regulation addressed the new energy technologies as alternative energy sources, referring to any potential source of energy, with the exception of nuclear energy and fossil fuels exploited by conventional means. It focused on geothermal energy, solar energy, wave energy, tidal energy and wind energy. It announced plans for a post research stage financing instrument for alternative energy projects, as financial risks involved and high capital cost of such projects could not attract private capital. But the new resources were far from contributing to the energy mix in the medium term. The Commission calculated that

despite strong policies and massive investment non-oil energy resources were not likely to become commercially viable.

A follow up Regulation (European Communities 1979) declared to provide financial support for demonstration projects focusing on geothermal energy and various forms solar energy. The Community allotted 22.5 m EUA (European Unit of Account) for each technology. Amid great interest for the scheme, the Commission sought an increase in the budget to 100 m EUA. Importantly, the Commission was accredited with the supervision the development of the new energy resources. It was delegated to examine each project applying for financial assistance and to set up and chair an advisory committee for the management of these projects. The Commission herewith got a little more grasp on energy matters, although they concerned a branch of energy which could at best be considered a fledgling.

By the end of the decade, the European Community could not sustain the growth rates it had enjoyed up to 1973. Consequently, the Commission felt the need defining targets for 1990 and requested the Council to discuss the matter in *Energy Objectives for 1990 and Programmes of the Member States*. (Commission of the European Communities 1978) It also hinted that the targets set for 1985 will be met towards 1990 due to lower economic forecasts. By forwarding a request for such targets to the Council, the Commission had served a warning that that the oil scenario will remain difficult and the Community should be prepared for more measures to better cope with the scenario. It was a clear hint towards attaining a unified energy market, an idea the Member States had been evading ever since early days of the Community. Sectorally, it claimed nuclear energy and solid fuels though still remained the mainstay of European energy projections but the former was still not growing at pace where it could serve as panacea. The energy policy needed to acknowledge this gap and strategise for filling it. Halting of oil production by Iran too acted as a trigger to show more urgency in energy matters. The Commission, in this general context, proposed to develop renewable energy sources to play subordinate to nuclear energy as long term goal. To this end, it requested the Council to speed up research, development and market introduction. (Commission of the

European Communities 1979) A latter Communication (Commission of the European Communities 1980a) confirmed the Council's approval for encouraging the new energy sources. Resultantly, the Member States launched programmes to promote research, development and demonstration suitable renewable technologies. Renewable resources had achieved their break but they were not the only thing the Commission pushed for in the Communication.

The resolution concerning the objectives for 1990 was adopted in June 1980. The Commission welcomed the development in its Communication, *Energy Policy in the European Community: Perspectives and Achievements* as it was now provided with a legal framework to 'coordinate, stimulate and complement national energy policy measures. It reasserted the lack of a common market in energy hindering the free movement of goods, a principle which formed the very basis of the Community. However, it treaded with caution as it refrained from demanding central level regulation and appeared content with the role of bridging the national energy policies of Member States it got recently. Nonetheless, one could sense that despite indifference of the Member States, a common energy market and thereby a restructuring of the energy system in the European Community from a monopolist to a competitive orientation remained on cards. (Commission of the European Communities 1980b)

The Member States took cognizance of the fact that slowing GDP growth and unpredictable global energy markets necessitated the readjustment of their energy projections to the new realities. (Commission of the European Communities 1982) Although, commitments to nuclear energy were scaled up and renewable energy sources were taken seriously, the measures at hand were not enough. The Member States now had to reconsider the risks and rewards of following individual energy policy, which was earlier tilted against a common market for energy. There was need for change but this would not come in the energy sector right away, which was inflexible and marred by cartels to resist any change in the status quo. Thus, energy was addressed in the coming years under the garb of competition, an area where the Commission enjoyed more authority.

Sluggishness on the economic front caused frustrations in the political and business circles, particularly in France, and Germany. In 1981, the German Foreign Minister Hans-Dietrich Genscher called for greater political cooperation among the European Ten. The German initiative backed by Italy was put forward in the form of a reform proposal which culminated in the signing of *The Solemn Declaration of the European Union* in Stuttgart in 1983. The Declaration had a much larger scope than merely economic and aimed to resolve the economic problems facing the Member States by strengthening cohesion in the Community paying particular attention to the economic and political aspect of security. It also sought to facilitate the creation of an internal market by removing the obstacles to the free movement of goods, capital and services within the region. (European Communities 1983) In 1985, the Commission produced a White Paper on completing internal market with the same title. It laid down a plan for the removal of physical, technical and fiscal barriers which prevailed in the Community and hindered the free movement of goods, people and capital. The development of a free trade area was foreseen as a precursor to European Unity as it would bring about the economic integration of the Community. The Paper also suggested the timeline with 1992 as the deadline for completing the Internal Market. The above steps culminated in the signing of the *Single European Act* (SEA) in The Hague on 17th February 1986. The objective of the Act was to accelerate the process of creation of the Internal Market, which it defined as "an area without internal frontiers in which the free movement of goods, persons, services and capital is ensured in accordance with the provisions of this Treaty". (European Communities 1986a: Art 8a) The SEA also amended the earlier treaties and redefined the decision-making procedure. With the introduction of Qualified Majority Voting, the Council was no longer required to decide on cases unanimously which caused frequent delays in the past. The Act strengthened the Parliament as well as the Commission in that it conferred the power of implementing the rules laid down by the Council. The goal of a common market in the Community paved way for breaking the monopoly of energy giants and bring about deregulation and liberalisation of the energy sector in the longer term by establishing an Internal Energy Market. The deregulation and liberalisation of the energy sector in the European Community which came under the garb of the IEM was a

prerequisite for the successful introduction of renewable energy sources and make for them to evolve on competitive grounds. Introduction of the competitive new energy sources in a captive energy would not have been successful. The energy giants would have easily smothering the new entrants making them perpetually reliant on financial support.

A common energy policy was a distant goal for the Commission, however, the idea of a Community energy market gained currency with the signing of the SEA. Deregulation of the energy sector was a precursor for this to happen. In fact, the UK had predated the Commission in initiating this process. Between 1980 and 1990, the all pervasive government hand started withdrawing from the energy sector as a part of the overall privatisation drive of the Thatcherite government. The main aim was to promote competitiveness and efficiency. The government's new job was that of a regulator which had to enforce the vertical disintegration to break the monopoly of energy companies and later to oversee the function of competitive market. The British Gas Corporation was privatised and at a later stage was forced to relinquish its ownership of the transmission grid to allow third parties access to the grid. The transmission system was now to be owned by an independent entity which facilitated competition by not allowing any party the undue advantage of controlling the grid. The same practice was exercised in the electricity sector sparing the nuclear sector. Notably, the UK was vehemently opposed to the Commission's intervention in its energy sector, though the measures undertaken at the domestic front overlapped with those proposed by the Commission. The success the UK had enjoyed caused other Member States to instigate a reform of their respective energy sectors. In principle, none of the Member States were opposed to it but different countries resisted different aspects energy sector liberalisation which went against their national energy priorities. (Matlary 1997: 30-32) The varied strategic response of the Member States to the IEM was to reflect in the near future in their policymaking for market deployment of renewable energy sources.

France perceived the concept of the Internal Energy Market as an opportunity to boost its electricity exports. It therefore supported all aspects of the IEM except third party

access to the electricity grids, which would have diluted the stake of the state electricity monopoly, *Electricite de France*. The French government aggressively pursued the agenda of the IEM by proactively ceding ground in the gas sector as a compromise. Much to the displeasure of the public sector gas utility, *Gaz de France*, it made provisions for third party access to the gas grid. France, unlike the UK did not privatise its utilities and maintained a strong grip on the energy sector. Germany on the other hand gave a mixed response to the IEM. Although, it was dedicated to the general principle of a common market at the European level, it was against the third party access clause. Moreover, the energy sector in Germany was largely governed by market forces with the exception of nuclear and coal. In Germany, coal industry was not perceived solely as an energy source, rather it was an important component of the German social and employment policy as well. Therefore, the sector was heavily subsidised and regulated and the IEM sought to deregulate the sacrosanct policy area. The third party access clause also caused the private sector gas and electricity utilities to lobby against the IEM as major pipelines in Germany transiting Russian gas lie in private hands. (Matlary 1997: 32-35; 79-85)

Deregulation of the coal sector was also likely to affect electricity production in Germany as its share therein approximated 55 per cent. Germany would have been forced to open the gates for imports in case of a power shortfall, a scenario, the French were keen to exploit by supplying their nuclear produce. France avidly supported the IEM attracting the Commission's attention towards Germany's coal subsidies. This remained the cause of a tiff between the two countries until Germany had to yield to the French demands of abiding by the Community's coal subsidy rules and cooperating in electricity trade in barter for their approval to the German Reunification in 1989. It did not accept the third party access clause nor pursued the energy companies to undergo vertical disintegration. Italy too favoured the IEM but was not able to implement it in its territory. (Matlary 1997: 82-85) The Commission presented a White Paper titled *The Internal Energy Market* in 1988 laying down a concrete plan for the realisation of the community energy market. The liberalisation drive started under the aegis of the IEM continues till date. Although, ensuring a conducive environment for renewable energy sources was never put as a goal of the IEM, it was a prerequisite for the successful market deployment

of the new energy technologies. (Matlary 1997: 79-85) (Commission of the European Communities 1988)

Meanwhile, when the work on the IEM was still on, the European Community was obliged to reassess its energy projections it had made for the year 2000 after the Chernobyl nuclear accident in 1986. The nuclear accident was a watershed event which tilted the risk reward ratio much towards the former. The acceptance levels for nuclear energy were not high and it faced stiff resistance of the environmental activists after the calamity. The low-carbon energy source which since the oil crisis was looked upon as the potential mainstay of the energy mix was forced to abandon this status. The Community had some respite as oil prices had normalised. But, the possibilty of another crisis in the global circles could not be ruled out. Hence, despite a show down for nuclear energy, the Commission could not abandon the task of substituting oil with more secure and, by now, cleaner energy sources. It proposed renewable energy sources as the next most plausible candidate to fill in the void created by shunning of the nuclear option. In its Resolution of 26 November 1986, the Council yielded to the request and permitted the Commission to actively pursue measures designed to promote the usage of renewable resources in the Community. (Commission of the European Communities 1985; European Communities 1986b)

As discussed in the previous chapter, environmental issues had attracted considerable attention globally and more so in the Community. In 1989, the Communication titled, *Energy and the Environment*, consolidated the case of renewable energy sources in the Community's energy mix. The Commission's aim was to commence the mainstreaming of environment into other policy areas which administered activities impacting environment. It emphasised the scope of the new resources in redressing the reduction of greenhouse gases as well as the pressing need for putting an act together. At the Community level, research, development and demonstration (RD&D) in the new resources were accomodated in the ongoing Framework Programmes for Research and Technological Development. It proclaimed the JOULE and THERMIE programmes under the Third Framework Programme (1990-1994) to supervise the work of research

and development and demonstration respectively. The national RD&D budgets, on the other hand, had peaked by this time and had also gained substantial results. (OECD/IEA 2004: 53) Some of the technologies such as wind and solar photovoltaic were ready to be introduced into the market. The Commission now had to lay down plans for coordinated market penetration of the new energy technologies in the Community. (Commission of the European Communities 1989)

The Commission had already been urged by the Council in its Recommendation of 9 June 1988 to lay down appropriate legislative, administrative and financial measures for development of renewable energy sources and ensure that the measures are mutually compatible. The Commission was also asked to facilitate cooperation among industries producing renewable energy equipment within the purview of the Internal Energy Market. (European Communities 1988) The Commission carried out opportunity and feasibility studies and suggested *Specific Actions for greater Penetration for Renewable Energy Sources: ALTENER* in 1992. The purpose of the programme was to promote market promotion of renewable energy in the Community energy market and increase trade in products and services concerning the sector within and outside the Community. This was the first Community level legislative provision aimed at removing the hindrances in way of effective market deployment of the new resources. A point in case was the call for harmonization of legislative and technical standards in the Member States so that financial and economic incentives could yield results at the Community level. In line with the recent Community policy of integrating environment with energy sector, the proposed programme sought to reduce greenhouse gases by simultaneously the share of renewable energy in the total energy supply. For the first time, quantified targets for renewables were laid down aimed at setting a framework providing for guidelines for coordination and harmonization of national policies. This task also included improving upon dissemination of information among Member States. Although, the programme was devised for a period of six years, the goals were set for the year 2005. ALTENER aimed to raise the contribution of renewable energy from 4 per cent in 1991 to 8 per cent in 2005. In figures, it translated into rise from nearly 43 Mtoe in the base year to 109 Mtoe in the target year. The long term objective targets also signified the Community's

determination of pursuing the renewable option as well as its commitment to the environmental protection. (Commission of the European Communities 1992b)

Table 2.1: Energy Production from New and Renewable Energy Sources (NRES)

NRES	Production 1991 (Mtoe)	Objective (Mtoe)
Thermal Uses		
Biomass	22.7	58.0
Geothermal	0.4	3.0
Solar	0.2	1.2
Total	23.3	62.2
Biofuels	0.0	11.0
Electricity		
Small Hydro	1.3	2.6
Geothermal	1.9	5.4
Biomass and Waste	2.7	8.6
Wind	0.1	1.7
Photovoltaic	0.0	0.1
Total	6.0	18.4
NRES Total	42.6	108.7

Source: Commission of the European Communities 1992b: Annex 1

The ALTENER programme identified small hydro, wind power, solar thermal, solar photovoltaic, biofuels and geothermal as renewable energy sources and declared to submit proposals for Directives regarding each. To promote investor confidence in the new energy resources the Commission proposed to extend the third-party financing measures available so far for energy-efficiency projects to renewable energy projects. To cover the financial risks and the resulting hindrances, the Commission proposed guarantee funds financed by public authorities, which in exceptional cases involving high risk could also be financed by the Commission. These funds could also provide bank guarantees to procure investment loans. The rationale was to promote participation of the private sector by creating an investor friendly atmosphere.

Further items on the Commission's agenda were involvement of the local bodies of governance in planning, and execution of renewable energy projects as it is local in its

orientation, preparing ground for newer resources such as biomass and biofuels. To this end, the Commission expressed optimism that the agricultural sector could initially provide for a large market for the two resources. Moreover, considering the massive change in the international political scenario caused by the dissolution of the USSR and the subsequent tearing down of the Iron Curtain, cooperation with third countries, largely countries of Central and Eastern Europe also found place in the agenda of the ALTENER programme.

In the decade of 1990, environmental concerns shot up to the top of the international political agenda. In 1992, the United Nations called for the Conference on Environment and Development (UNCED), in Rio de Janeiro. The primary goals of the Summit were to reframe an understanding of development that would support socio-economic development and prevent the continued deterioration of the environment, and to lay a foundation for a global partnership. The participating countries also agreed upon the binding United Nations Framework Convention on Climate Change (UNFCCC). The objective of the treaty was to stabilise the concentration of greenhouse gases in the atmosphere. To this end, it sought to create international consensus for taking up measures to fulfill the aim. (United Nations 1993) The decade was also quite eventful for the European Community as well. The fall of Communism in Central and Eastern Europe opened a window of opportunities and also posed a challenge. In this scenario, focus shifted in the Member States away from environmental issues to exploiting the available opportunity to boost sluggish economies. This general trend acted as a hindrance in the Commission's attempts of creating a harmonized climate-energy policy. A point in case is the ultimate abandoning of the carbon/energy tax proposed by a 1992 Communication, entitled *A Community strategy to limit carbon dioxide emissions and improve energy efficiency.* (Commission of the European Communities 1992a)

The energy policy needed a reappraisal to accommodate the developments in the Union's immediate neighbourhood, increasing awareness about environmental issues on the international front and to promote market penetration of renewable energy in the

domestic markets.[4] The Commission launched policy discussion by preparing the *Green Paper for a European Union Energy Policy* in 1994. (Commission of the European Communities 1994) It clearly expressed its dissatisfaction with the way energy, by now coupled with environmental issues, issues by posing an upfront question as its primary objective, i.e. evaluating whether or not the Community had a greater role to play in the energy sector. It asserted the need for reinforcing concerted cooperation among the Member States. It urged because of similar reasons that Community and national energy policy should be perceived as comprehensive whole as the factors involved are trans-national in nature. The Commission tabled an unequivocal demand for more powers in energy matters.

The Green Paper identified security of supply, energy efficiency, environment and sustainable development as priorities for the energy sector. These goals were to be addressed in a general competitive scenario governed by the market forces. The Community should place effective instruments to regulate the markets to maintain effective competition. Effectively, it was the Commission which donned the hat of the regulator in the energy sector and its task involved supervise national energy regulatory bodies working in various verticals. To optimize energy use, it were to promote coordination between various national regulatory authorities and strengthen network management, especially in case of electricity. These measures, although not exclusively meant for promoting renewable energy, were likely to play a great role in creating suitable conditions for the new resource. Of particular importance was the Commission's emphasis on the role local bodies of governance in implementing renewable energy technologies and other energy efficiency measures in their territories. The ECSC Consultative Committee adopted the Green Paper on 11 January 1995 and requested the Commission to compile guidelines for long term energy policy in the Union. (Commission of the European Communities 1994; Commission of the European Communities 1995a)

[4] The Maastricht treaty established the European Union on its coming into force on 1 November 1993

As required by the Committee, the Green Paper was soon followed by the White Paper titled *An Energy Policy for the European Union.* The White Paper re-laid the Union's priorities in the energy sector for the coming years. Security of supply and energy efficiency, which had been on the Community's agenda continued to hold their position and new items such environment, sustainable development, research and development for technological edge. It assimilated the suggestion of enhanced role for urban and rural regions put forth in the Green Paper and recognised that cooperation among regions could boost market penetration of renewable energy. To this end, the Commission also expressed its intent of setting up a comprehensive strategy for renewable energy sources. (Commission of the European Communities 1995b)

In the 1990s, although there was not much enthusiasm among most of the Member States with regard to environmental issues, the Commission continued to emphasize the relation between energy issues and climate change. In 1989, the Commission officially called for the redressal of environmental problems by the energy policy.[5] Later, it proposed *A Community Strategy to Limit Carbon Dioxide Emmissions and to improve Energy Efficiency*, wherein it proposed a carbon/ energy tax to discourage wasteful use of energy and internalise the external costs, which are not reflected in pricing of conventional fuels. (Commission of the European Communities 1992) An important trigger in this case was the upcoming United Nations Conference on the Environment and Development in Rio de Janeiro. The proposed tax regime could not see daylight. The Commission yet again produced a reminder of the energy-climate nexus in the form of a Communication titled, *The Energy Dimension of Climate Change* before the agreement on Kyoto Protocol. The Commission herewith announced its intent of assuming a leading role in the Kyoto process and hence a substantial emission reduction target.

For this purpose, the document reemphasized the increasingly important role renewable energy could play. The Commission declared its view of increasing the share of renewable energy sources from 6 per cent to 10 per cent in 2010. It also opined that a

[5] Energy and Environment (Commission of the European Communities 1989 COM(89) 369 final)

'best policy scenario' of 12.5 per cent renewable energy share could help the Community in achieving a reduction in carbon dioxide emission of 386 million tonnes per annum by the year 2010. It also testified that the new energy technologies were now competitive and to improve their penetration, they should now be integrated into the centralised energy systems. (Commission of the European Communities 1997b: 7) This task could only be accomplished with an active involvement of the Member States as they had the authority of executing the plans laid down by the Commission in their territory.

The Commission built upon its aim, as expressed in the White Paper, *An Energy Policy for the European Union,* of laying down a coherent and comprehensive strategy for renewables entailing a wide range of initiatives and policies and tabled the Green Paper, *Energy for the Future: Renewable Sources of Energy.* The Green Paper stimulated consultations among industrial, political, administrative and civil circles. By now, much progress was achieved towards the completion of the Internal Energy Market. Agreement on the first phase of liberalisation of the electricity sector had also been reached and work was underway. This move opened up the markets providing for the new resources to set foot in a competitive market. The technological potential of renewable energy was much higher than their contribution to the energy mix. In this general atmosphere, the Commission sought to design a Community-wide strategy to shape the course of evolution of the new energy resources and to avoid imbalances between the Member States distorting the energy markets. The task at hand was difficult as the levels of exploitation of renewable energy varied significantly among the Member States. Therefore, it provided a broad policy framework. The Member States were required to design compatible national energy strategies suited to their energy systems and availability of resources. (Commission of the European Communities 1996)

The Commission proposed a strategy consisting of four distinct elements. Firstly, it professed a substantial rise in the renewables' contribution to the energy mix almost doubling it to 12 per cent in 2010. Secondly, it reminded that Member States cooperation on renewable energy should be enhanced. This was necessary for better policy implementation in the national regions, given the different levels of development of the

new technologies in various Member States. Thirdly, it urged the Community to reinforce its policies in this sector. The Treaties now provided ample room to pursue various goals like internalisation of the external costs regarding conventional fuels, research and development, and training and awareness programmes at the supranational level. Also, it called for the Community to exercise its powers to facilitate the strategy through external factors viz. foreign, regional and fiscal policy. Lastly, it proposed strong and effective monitoring of the actions undertaken at all levels. (ibid: 6)

The Commission drew a comparative analyses of the EU's standing in the renewable energy sector vis a vis the United States and Japan. The Commission was being calculative in assessing its chances of exploiting the business opportunity presented by the vast potential of renewable energy sources. It emphasised that clean energy would be the key to regional development, employment, and social and economic cohesion. Overall, the Green Paper marked a break from the past in renewable energy policy making in the Community. It was the first policy document fully devoted to the cause of renewable resources, which by initiating a Union-wide debate went beyond the loose commitments of the past. (ibid: 9-10; 23-28)

In 1997, the Green Paper was followed by the White Paper with the same title. With the adoption of the Kyoto Protocol in sight, the Member States along with the EU were handed greenhouse gases emission reduction targets. This caused the national governments to shed the lethargy which was pervasive throughout the past decade with regard environment policy. The White Paper was a manifestation of the Commission's intent of promoting the promising and futuristic energy technologies, whereby it confirmed the indicative objective of 12 per cent contribution to the total primary energy consumption by 2010 by renewables. It reiterated that renewable energy industry was maturing gradually, but needed better policy framework to improve their marketability. In this light, it termed the 12 per cent goal as ambitious but realistic. The Commission tabled a cost-benefit analysis of deploying renewable energy sources and concluded that increased penetration of renewables would spur the economy, create jobs and create

export opportunities in addition to the traditionally professed emission reduction and security of energy supply. (Commission of the European Communities 1997a)

The White Paper entailed an action plan for the promotion of renewable energy as well. The first measure eyed by the Commission was fair access for the renewables to the electricity markets. Electricity accounted for 40 per cent of the gross energy consumption in the EU15, which made it the most important energy vector in the energy mix. Although most Member States had already made or were in the process of making arrangements for giving preference to procurement of electricity from renewable sources. The Commission also sought to revamp fiscal and financial incentives. Under this head, it proposed provisions such as flexible depreciation of investments made in renewable energy sources, favourable taxation regime for third-party financing of renewables, start up subsidies for setting up new plants, especially in case of small and medium enterprises, and financial incentives facilitating the purchase of renewable energy installations and services for the customers. The Commission explained that biofuels and biomass among other sources are of great importance for the Community energy strategy. Respective studies were already in pipeline and would result in policy guidelines on individual technologies. It declared the renewable energy has a great potential in housing and service sector, therefore, energy efficient and greener building techniques should be promoted. New buildings and those under renovation should incorporate active and passive solar heating and cooling techniques, geothermal heating and heat pumps, and solar photovoltaic installations. (ibid.: 14-18)

Renewable energy had already set foot and proven that it was technically and economically viable. The EU now needed to build on this platform to increase the reach of the new energy resources. To this end, the Commission proposed in the White Paper and Action Plan the Campaign for take-off. The campaign included various programmes for improving market penetration of renewable energy sources with 2010 as terminal year. The 1,000,000 Photovoltaic Systems Programme aimed to spur demand for photovoltaics by setting an ambitious target, wherein 500,000 PV installations were meant for the domestic market and the rest for an export initiative. Other initiatives

included 10,000 MW of Large Wind Farms and 10,000 MW of biomass installations. It also included a pilot project named Integration of Renewable Energies in 100 Communities, to be carried in regions with a potential of 100 per cent power supply from renewables. (ibid: 24-30) ALTENER, the Community's multi annual programme for the promotion of renewable energy sources, running out in 1998 were to play an important role in development of sectoral market strategies standards, standards and harmonisation. Therefore, an extension of the programme was already sought early in the year. (Commission of the European Communities 1997c)

Now that the broad framework for promotion of renewable energy had been laid down, the Commission focused on setting guidelines for specific sectors of renewable energy technologies. In 2000, the Commission tabled a *Proposal for a Directive of the European Parliament and of the Council on the promotion of electricity from renewable energy sources in the internal electricity market.* Electricity was the most important energy vector in the European energy mix and was also well suited for incorporating renewable energy technologies such as photovoltaic, and wind, which were at that time the most viable energy technologies. Thus, it was a wise move to promote a cluster of technologies under the hood of electricity from renewable energy sources prior to specific technologies as an energy vector versatile as electricity provided greater potential for market penetration. (Commission of the European Communities 2000a)

The Proposal addressed at the outset the debate over converting the indicative target of 12 per cent contribution by renewable energy by 2010 into a binding target. The benefits of making the target a binding one were many. It would provide a greater impetus to the Member States to achieve the goal and also help in achieving the targets set under Kyoto-Protocol negotiations. Achieving its targets would certainly add to the EU's status in the international circles. Despite the lure of accelerated work in the sector, the Commission chose to maintain large degree flexibility in its policy framework so as to allow the Member States to tailor for themselves the best suited strategy within the framework. With dedicated renewable energy policy making still in infancy, the Commission opted for a slow and steady growth path and pushed the task of setting binding targets to a later

stage. It also calculated that the 12 per cent share of renewable energy in the gross energy consumption could be achieved only if the share of electricity from renewable energy sources (RES-E) in the electricity mix of the Union reaches 22.1 per cent by 2010. This too was an indicative target. (ibid.)

The Proposal also laid down a basic definition of electricity from renewable energy sources for the purposes of the draft Directive: "[It] is electricity generated from renewable non-fossil fuels, and notably "wind solar, geothermal, wave, tidal, hydroelectric installations with a capacity below 10 MW and biomass" where biomass is defined as products from agriculture and forestry, vegetable waste from agriculture, forestry and from the food production industry, untreated wood waste and cork waste." It was important to redefine RES-E energy sources and standardise it as a variety of non fossil fuels were considered renewable in different Member States as per their availability and usage in their specific territories. The aim was to gradually develop a Community wide market for electricity from renewable energy sources, within the internal electricity market. (ibid.)

Besides standardisation of the definition of RES-E, there was a need for a mechanism allowing for the identification of electricity from renewable sources and differentiating it from electricity from other sources so that it could avail the benefits laid down in various support instruments. It was also a prerequisite for trade in RES-E at the Union level. To this end, the Commission proposed certification of 'Guarantee of Origin' of the RES-E. The proposed certificate would specify the primary energy sources used for generation of electricity and ensure buyers that the electricity being purchased originates from renewable resources. The certificates were to be issued by Member States and were to be mutually recognized by other Member States to facilitate trade at the Union level. (ibid. 8-11)

The proposal was adopted by the European Parliament and the Council in 2001 as the Directive on the promotion of electricity produced from renewable energy sources in the internal electricity market. The Directive also adopted the indicative targets for different Member States laid down by the Commission in the proposal. Article 3 of the Directive

required the Member States to take appropriate and proportionate measures to promote RES-E in their territories. It also required the Member States to publish every two years a report on the success achieved in achievement of the indicative targets. Article 7 addresses grid access for RES-E, whereby it prioritizes transmission and distribution of RES-E. It required the transmission and distribution system operators to provide grid access any new producer wishing to be connected along with a detailed estimate of the costs associated with the connection.

The Directive however, maintained silence on the choice of support schemes i.e. quota based support schemes or feed-in-tariffs, a matter dealt in greater detail in the following chapter. Although, support schemes based on competition, which were also compatible with the ongoing liberalization of the electricity market, should have gained support, but there was not much practical experience regarding quota based schemes. On the other hand, feed-in-tariffs had been deployed by Denmark, Germany and Spain and had yielded substantial results. As renewable energy policymaking was still in its early days, Article 5 of the Directive laid down rather general guidelines for support schemes and did not delve into making a choice between the instruments. (European Communities 2001; Lauber 2005: 46-47)

The Directive on the promotion of RES-E provided the urgent and vital impetus for the promotion of renewable energy sources associated with power generation. The Commission was yet to provide a similar boost to other renewable energy technologies so far not associated with power generation viz. biomass and biofuels by requesting the Parliament and the Council for dedicated Directives on similar lines. Meanwhile, the Commission had launched Union wide discussions on the future of energy policy in the EU with its Green Paper, *Towards a European Strategy for the Security of Energy Supply.* (Commission of the European Communities 2000b) It analysed that to achieve the target of 22.1[6] per cent share of RES-E in the EU energy mix, resources other than

[6] The Green Paper considered a target of 24 per cent for the stipulated time period but was recalibrated to 22.1 per cent for the EU15. Later, the figure was readjusted to 21 per cent in view of the expansion of the EU15 to EU 25.

hydro would have to provide the growth needed. The potential of large scale hydro had been almost fully harnessed in the EU and developing new sites for small scale hydropower plants met with stiff resistance from the locals. Biomass, the Green Paper proclaimed could play a substantial role in securing energy supply as it had a great potential in the EU and could be used for heating as well as power generation. It also identified biofuels as a potential energy source which could boost energy security by substituting the ever increasing use of oil in the transport sector. Hence, the Commission advocated a growing presence of biofuels despite their high prices compared to corresponding fossil fuels. It set a longer term objective of 20 per cent substitution of fuels by biofuels by 2020. (ibid: 43)

Table 2.2: Indicative Figures for Member State targets for contribution of RES-E to gross electricity consumption by 2010

	RES-E TWh 1997	RES-E% 1997	RES-E TWh 2010	RES-E % 2010
Austria	39.05	70.0	55.3	78.1
Belgium	0.86	1.1	6.3	6.0
Denmark	3.21	8.7	12.9	29.0
Finland	19.03	24.7	33.7	35.0
France	66.0	15.0	112.9	21.0
Germany	24.91	4.5	76.4	12.5
Greece	3.94	8.6	14.5	20.1
Ireland	0.84	3.6	4.5	13.2
Italy	46.46	16.0	89.6	25.0
Luxembourg	0.14	2.1	0.5	5.7
Netherland	3.45	3.5	15.9	12.0
Portugal	14.3	38.5	28.3	45.6
Spain	37.15	19.9	76.6	29.4
Sweden	72.03	49.1	97.5	60.0
United Kingdom	7.04	1.7	50.0	10.0
Community	338.41	13.9	674.9	22.1

Source: Commission of the European Communities 2000a: 27; European Communities 2001: 39

In 2003, the European Parliament and the Council adopted the *Directive on the promotion of the use of biofuels or other renewable fuels for transport.* It reiterated the importance of biofuels as clean fuels in achievement of the EU's emission reduction targets under the Kyoto protocol. Article 3 of the Directive required Member States to set indicative targets for themselves, whereby it set a reference value for the year 2010 at 5.75 per cent of the total fuel consumption based on the energy content of the fuel. It also set an intermediate target of 2 per cent for 2005. In 2005, the Commission proposed a 31 point *Biomass Action Plan,* which built on the previous biofuels Directive of 2003. It considered biofuels as a sub-head of biomass and proposed to double the contribution of biomass from the erstwhile 4 per cent to 8 per cent by 2010. This was likely to reduce the share of fossil fuels in the EU's energy mix 5 per cent to 75 per cent and result in an 8 per cent cut in import of oil. It estimated that promotion of biomass to stipulated levels would reduce greenhouse gas emissions by 209 million tons of carbon dioxide equivalents per annum and create up to 250.000 to 300.000 jobs in the agriculture and forestry sector. (Commission of the European Communities 2005)

An important issue besides policy support for expansion of renewable energy was infrastructure development to make greater penetration of renewable energy sources in the centralised energy system technically feasible. It was a prerequisite for the expansion of RES-E as greater penetration of RES-E could not be realised without facilitating electricity trade at the Union level. Power generation from most renewable sources is intermittent in nature and this phenomenon can be overcome by importing electricity from other regions or Member States, where climatic conditions permit power generation at that particular time. For this purpose, it is imperative to have a well interconnected Union wide grid in place. The interconnecting of national grids had already been addressed by the Community earlier as well, although in context of liberalisation of energy sector and creation of the Internal Energy Market in the Community. In 1990, the Commission in its Communication, *Towards Trans-European Networks: For a*

Community Action Programme, called for interconnecting various networks viz. transport, telecom, and gas and power grids. (Commission of the European Communities 1990)

In 1993, the Commission tabled a Communication exclusively concerning energy grids, *On Community Guidelines on trans-European Energy Networks*, whereby it called for grid access for peripheral regions and islands in many Member States. By now grid inter-connections were already being built but network development plans were governed by national objectives of self-sufficiency in energy and not by the cause of development of an Internal Energy Market. In this view, it called for bridging of remaining interfaces in the national grids and increasing the capacity of interconnections between electricity grids. The broad line of action entailed identification of projects of common interest and creation of conducive environment for completion of these projects. These projects were mostly high voltage i.e. 220 kV or more transmission lines. The Communication enlisted 37 projects of common interest in the field of electricity transmission. The Commission also strengthened its position in the energy sector as it assumed the role of the regulator monitoring the implementation of guidelines, formulating and updating the list of projects of common interest and administering financial grants for these projects. (Commission of the European Communities 1993b)

In 2006, the Commission followed up the previous Communication with a *Priority Interconnection Plan.* However, this time the prime objective of installing new energy infrastructure and interconnections was cited as the integration of electricity produced from renewable energy sources. Competitiveness and security of supplies remained other objectives under the purview of realisation of the internal energy market in the Community. The Communication complained that the EU so far had not been able to ensure non-discriminatory network access and that the necessary degree of coordination between national energy grids concerning technical standards, information exchange and congestion management regime. It warned that the EU had not invested optimally in new energy infrastructure and if it continued on the same lines, achieving the targets set for integration of RES-E would be difficult. Therefore, to speed up the creation of new

infrastructure projects it proposed an action plan, whereby most important infrastructure projects encountering difficulties were identified and European coordinators were appointed to supervise the speedy completion of the same. It also advocated coordinated planning of infrastructure at the regional level corresponding to the needs of the consumers in the region. It also proposed to streamline the authorisation procedure to accelerate the development of infrastructure projects. Lastly, it also declared to examine whether funding for the TEN-E networks was necessary. (Commission of the European Communities 2006a: 8-14)

By now renewable energy had set a firm foot in the EU and was acknowledged as an important prospective tool in the Union's strategy to tackle with the threefold issue of energy security, climate change and sustainability. The time was ripe to reassess the Community's renewable energy strategy and set bigger targets. The Commission opened a wide-ranging debate on a future European energy policy with the publication of a Green Paper in March 2006. Titled, *Renewable Energy Roadmap Renewable energies in the 21st century: building a more sustainable future,* the paper was in line with the compelling reasons to promote the new energy sources and the EU's aspiration of becoming the leader in renewable energy. On ground though, the development of renewable energy sources was uneven across the Member States. The Commission accrued this drawback to the lack of binding targets for renewable energies at EU level, relatively weak regulatory framework in the transport sector and the complete absence of a legal framework in the heating and cooling sector. To overcome this drawback, it proposed a legally binding target of 20 per cent contribution of renewable energy sources in the gross energy consumption. It also set sectoral targets for specific renewable energy technologies. The binding targets for renewable energy were to reflect in the national targets as well. For this purpose, the Member States were required to lay down their specific sectoral targets in line with the Community targets in their National Action Plans. (Commission of the European Communities 2006b: 4-9)

The Green Paper was followed up by the 'energy and climate change package' titled, *20 20 by 2020: Europe's Climate Change Opportunity* in 2007. The package claimed to

mark a turning point in the European Union's climate change and energy policy as Europe after the adoption of this package would be able to lead the world on tackling climate change, providing for secure, sustainable and competitive energy as well as establishing the European economy as the model for sustainable development. It endorsed the demand for binding targets put up in the Green Paper. It stipulated a reduction of at least 20 per cent in greenhouse gases emissions by 2020, which could be raised to 30 per cent if there is an international agreement committing other developed countries to comparable emission reductions. The other binding targets stipulated a 20 per cent share of renewable energy in the gross energy consumption by 2020 as well as 20 per cent higher energy efficiency. The package was adopted by the Parliament in December 2008. During the course of negotiations prior to the adoption of the package various important clauses were included, among them a mandatory target of 10 per cent share of biofuels in the transport sector by the year 2020. (Commission of the European Communities 2008a)

The 'energy and climate change package' is among the most important policy documents on renewable energy. It sets the medium term targets for the year 2020 but realization of these targets requires that proper infrastructure be laid down alongside support mechanisms. The package was supported by the energy strategy, *Energy 2020* proposed by the Commission in November 2010. The new energy strategy laid down a rather general action plan to beef up (Commission of the European Communities 2010a) Another action plan on infrastructure, *Energy Infrastructure Priorities for 2020 and Beyond – A Blueprint for an integrated European energy network* aimed to accelerate infrastructure development in the EU. The energy scenario of the Community was changing fast. Specifically, in case of electricity from renewable energy sources were located away from the centres of consumption and to transport electricity from one point to other, better electricity grids are a prerequisite. For this purpose, it proposed to focus on the priority projects launched under the first 10-year network development plan (TYNDP). It also proposed to provide the necessary framework for initial incentives for the roll out of smart grids. (Commission of the European Communities 2010b)

At present, the Community has provided for ample policy support to achieve the 20 per cent target by 2020, however, the major hindrance is absence of suitable infrastructure. In such a case, there might be an absurd situation where renewable energy capacity is being built but there is no adequate grid capacity to transport the electricity produced. After 2020 as well, lack of infrastructure will hinder any growth of renewables within the Community or projects such as Desertec and Mediterranean Solar Plan eyeing import of RES-E from adjacent regions viz. Middle East and North Africa. Hence, it is imperative for the EU to beef up its efforts to install adequate infrastructure. (Belin 2010)

Chapter 3

Case Studies of Renewable Energy Sources in the European Union

Renewable energy sources have matured from their childhood and become cornerstones of the energy policy of the European Union as well as the Member States. They are the surest measures of tackling climate change and enhancing energy security. Being a basket of technologies aimed at energy production, they also help in diversifying energy supply. The new energy sources also have a huge potential of boosting the economic output and creating jobs in the region adding to the charm of the new resources. They have made substantial inroads into the European energy systems, policy and even mindsets. The movement which effectively started a decade ago will snowball into the overhauling of the European energy system. At present, the EU is meandering into the pivotal years regarding its renewable energy strategy. Renewable energy is technically capable and promising enough to attract capital investments and register significant growth rates. It is important to prepare further ground for their expansion. To ensure mass deployment of renewable energy in both short and long term, the EU needs to build on the measures it has already undertaken. It requires more planning, training of work force, regulatory reforms and building of new infrastructure to maintain the growth rates in renewable energy penetration registered in the past.

Renewable energy sources have shown tremendous growth in the past decade and are still growing at a great pace. However, despite this progress, the renewable energy's contribution in the EU's gross inland energy consumption in the year 2009 stood at 9.4 per cent[7] and was likely to miss the target of 12 per cent laid down by the White Paper of 1997 for 2010. Virigine Schwarz, Executive Programme Director, ADEME argues that the main reason behind renewables not contributing the stipulated share in the gross energy consumption is that energy consumption levels have not sunk as expected and efforts to reduce consumption have not matched the efforts to develop renewable energies. Thus, renewables have grown in absolute terms but it does not reflect in

[7] Eurobserver Projection

percentage terms because of higher base figures of energy consumption. She adds that it is now important to focus on the target of 20 per cent contribution by renewable energy sources to the gross energy consumption by 2020. (Eurobserver Report 2010: 7) Before moving on to the discussion about short, medium and long term targets for renewables in the region, it is important to take stock of the break-up of the major technologies viz. wind, solar, biomass and biofuels in the renewable energy mix of the EU.

Renewable energy resources are multi faceted. Wind and hydro are exclusively meant for producing electricity, biomass, solar energy and geothermal energy can be used for heating and cooling purposes as well as power generation and biofuels can be used in the transportation sector. In 2008, renewable energy sources contributed 567 TWh in the total 3374 TWh in the total electricity produced in the EU 27 accounting for 16.8 per cent of the gross electricity production in the region.

Table 3.1: Contribution of renewables to total electricity production in the EU in 2008

Wind	20.9%
Solar (photovolatic & thermal)	1.3%
Biomass	19%
Hydro	57.7%
Geothermal	1%

Source: DG Energy EU 2010: 6

Heating and cooling account for a large portion of energy consumption across domestic, commercial and industrial sectors in the EU. Renewable energy sources have a great potential of replacing conventional sources of energy in this sector but its potential has been marginally utilised so far. Presently, renewables contribute only 67.5 Mtoe to the 564.7 Mtoe energy used for heating and cooling purposes accounting for only 12 per cent of the total. Following is the break-up of the contribution of various renewable energy sources. In 2009, 12 Mtoe of biofuels were consumed in the transportation sector accounting for nearly 4 per cent of gross energy consumption in the sector. The EU was unlikely to meet its target of 5.75 per cent for the year 2010 but despite slow growth rates

promotion of biofuels is considered important as they are key to offsetting demand for fossil fuels. (DG Energy EU 2010: 6-7)

Table 3.2: Contribution of renewables to total heating and cooling needs in the EU in 2008 (Mtoe)

Biomass	63.5
Solar thermal	1.1
Geothermal	0.7
Heat Pumps	2.2
Total	67.5

Source: DG Energy EU 2010: 7

In 2008, renewable energy sources contributed 10.3 per cent to the gross energy consumption of the EU with a target of 20 per cent by the year 2020. Member States have varying degrees of penetration level of renewables in their national energy mix and corresponding targets. Following is the status of renewable energy penetration in the final energy consumption of the EU Member States.

Denmark, France, Germany, and the United Kingdom are the leading Member States in the renewable energy sector which have established effective policy framework and hence provided a conducive environment for the new energy technologies to flourish. Before moving onto the analyses of the individual technologies, it is important to first look into the general support framework established by some leading countries to facilitate the expansion of renewable energy.

Denmark

Denmark has witnessed a successful turnaround in its energy sector on the basis of effective policy making. In 1990, it was a net energy importer, importing 25% of its electricity consumption from Norway and Sweden and by 2003 it was a net exporter of energy. Denmark's fossil fuel consumption has reduced by 10 per cent since 1980 although GDP has recorded a growth of 65 per cent in the same period. Adjusted gross energy consumption only grew by 0.5 per cent from 1990 to 2009. Over the same period GDP grew by 36.1 per cent. This means that there has been a drop in the energy intensity

Table 3.3: Renewable energy penetration in the final energy consumption in the EU

	2006	2007	2008	Target 2020
Sweden	42.7%	44.2%	44.4%	49%
Finland	29.2%	28.9%	30.5%	38%
Latvia	31.3%	29.7%	29.8%	40%
Austria	24.8%	26.6%	28.3%	34%
Portugal	20.5%	22.2%	23%	31%
Romania	17.5%	18.7%	20.3%	24%
Estonia	16.1%	17.1%	18.9%	25%
Denmark	16.8%	18.1%	18.7%	30%
Slovenia	15.5%	15.6%	15.1%	25%
Lithuania	14.7%	14.2%	14.9%	23%
France	9.6%	10.2%	11%	23%
Spain	9.1%	9.5%	10.7%	20%
Bulgaria	9.3%	9.1%	9.3%	16%
Germany	6.9%	9%	8.9%	18%
Slovakia	6.2%	7.4%	8.3%	14%
Greece	7.2%	8.1%	7.9%	18%
Poland	7.4%	7.3%	7.8%	15%
Czech republic	6.4%	7.3%	7.2%	13%
Italy	5.3%	5.2%	6.6%	17%
Hungary	5.1%	6%	6.6%	13%
Cyprus	2.5%	3.1%	4.1%	13%
Ireland	3.1%	3.4%	3.8%	16%
Belgium	2.7%	3%	3.3%	13%
Netherlands	2.5%	3%	3.2%	14%
U.K	1.5 %	1.8%	2.2%	15%
Luxembourg	0.9%	2%	2.1%	11%
Malta	0.1%	0.2%	0.2%	10%
Total EU 27	8.8%	9.7%	10.3%	20%

Source: EU Energy Portal 2011

since 1990 of 27 percent. (Danish Energy Agency Portal 2010) The rise of renewable energy technologies are to be credited for this turnaround with wind, biomass, and waste management taking charge. After 1980, the government aggressively supported cogeneration despite stiff resistance by the thermal power generators. By 2003, wind and cogeneration based power projects produced 70 per cent of the total electricity and have along with natural gas powered plants have totally replaced thermal power. Thus, there has been a major shift from centralized coal based power generation to decentralized wind and cogeneration based plants. Wind energy and biomass based cogeneration plants now form the backbone of decentralised district heating and power generation units. The share of power generation from cogeneration has increased from 18 per cent in 1980 to 54 per cent in 2003 and by now cogeneration potential has been fully utilised. Wind energy too has witnessed a steep and sustained rise. In 1980, wind energy contributed 1 per cent of the total power consumption, which grew to 16 per cent in 2003. Renewable energy industry has also been a major contributor to the remarkable turnaround of the Danish economy. The export of new energy technologies rose from € 530 million in 1992 to € 4000 million in 2003 out of which € 2400 million came from exports by wind turbine manufacturers. (Hvelplund: 2005: 83-86)

Important Actors

Major propagators in this success story are civil society groups supporting RES and small and medium enterprises which implemented the renewable technologies in hostile conditions too. They formed interest groups and lobbied at the parliament level for institutional reforms to promote cleaner technologies. Successive parliaments were supportive of their actions as renewable technologies held the key for a bail out from energy imports and rapid economic development. NGOs such as the Organization for Renewable (OVE) energy merit a mention as they in collaboration with environment-protection groups initiated a discourse in favor of RES. They received political attention and were forceful enough to lobby for the new technologies trying to make ground.

Another major reason for the success of RES in was the adoption of a feed-in-tariff model. For promoting electricity from renewable energy sources, the governments

followed feed-in-tariff model. In this model, utility companies are obliged to buy electricity generated from renewable energy sources at premium rates for a stipulated period of time, which in this case was pegged at 7.9 € cts for a period of 6-8 years. This secured the investments for a long period of time and built investor confidence in the new technologies as safe instruments for investment. The combination of local ownership and the feed-in-tariff model secured a stable support for clean technologies. Until 1999, it was funded by the state budget and thereafter the burden was passed on to electricity utility companies. The scheme applied to RES-E from wind, solar and biomass alike. However, decentralized cogeneration systems were granted a surplus of 1.3 €cts per KWh. (Hvelplund: 2005: 86-92)

The government has also used taxation effectively to dissuade the use of oil and for the purpose of heating. Soft loans were availed for community district heating systems; decentralized cogeneration plants received extra support for per unit electricity produced. The government has also introduced tendering system, where firms bid for long term projects supplying at a fixed rate. (Hvelplund: 2005: 93)

In February 2008, the Danish government laid down new energy policy for 2008-2011, which meets or surpasses EU environmental goals in several areas. It makes Denmark the first country in the world to commit itself to reducing overall energy consumption; it aims to achieve a 2% reduction by 2011 with 2006 as base year. (Danish Official Portal 2010)

The new energy policy projects the renewable energy output at 20% of the country's total energy needs. It also calls for setting up new offshore wind farms generating a further 400 MW of RES-E. It earmarks twenty seven renewable energy initiatives promoting the use of more biomass/waste and lesser fossil fuels in central combined heat and power stations, and programs to increase the deployment of wind turbines both onshore and offshore. Regarding the latter, the government plans to invite tenders for two offshore wind farms each of 200 MW capacities, poised to be integrated into the mainstream by 2012.

On the basis of these simple but effective measures, Denmark has been able to induce a remarkable shift in its energy system which also translates into a business opportunity.

France

In the years after the oil crisis of 1973, France started a programme for self reliant national energy production, consequently a vibrant electricity sector largely reliant on nuclear energy propped up. Presently, nuclear energy contributes over 70 per cent of the gross electricity produced but renewable energy sources too are gaining importance. In 2008, their share was pegged at 11 per cent and expected to step up to 23 per cent by 2020. France has fairly developed hydro power sector and has huge potential for wind, biomass and geothermal energy.

Important actors

France has a complex system for supporting renewable energy with many actors and a multitude of schemes. Ministry of Economics, Finance and Industry handles the charge of energy policy, thus is responsible for the formulation and implementation of policy on matters concerning renewable energy. Ministry of Research administers technological research and development in the field. Ministry of Equipment, Transport, Housing, Tourism and Sea advices the Ministry of Economy on matters of planning and implementation of policies in this sector. , Ministry of Ecology and Sustainable Development also influences policy making on renewable energy matters. ADEME, the French agency for environment and energy management the promotion of renewables helps regional and local bodies to implement national plans. *Syndicat des Energies Renouvelables* (SER) represents the interests of renewable energy industry and organises conferences and funds studies to provide inputs for favourable policy making. (Grotz 2005a: 123-125)

A mix of direct investment aid, tax reductions feed in tariffs and tenders are used for promoting the penetration of renewables. Feed in tariffs are the mainstay of support mechanisms for smaller installations however tender system has been introduced for bigger projects such as large wind and solar farms.

Table 3.4: Feed-in tariffs for electricity from renewable energy sources

Source	Duration of Contract	Tariff
Biomass	15	4.9 €cts/ KWh
Biogas (methanisation)	15	4.6 €cts/KWh
Biogas (wastes)	15	4.5-5.72 €cts/KWh
Geothermal	15	7.62 €cts/KWh
Photovoltaic	20	15.25 €cts/KWh
Animal wastes	15	4.5-5.0 €cts/KWh
Projects<36 kVA	15	7.87-9.6 €cts/KWh
Household wastes	15	4.5-5.0 €cts/KWh
Wind	15	8.38 €cts/KWh

Source: Grotz 2005a: 132

France also has a threefold mechanism to promote the penetration of renewable energy sources in the heating sector. Tax credits of up to 50 per cent can be availed on the produce of the installations. Residential heating equipment using renewables for fuels can avail a 5.5 per cent reduction in value added tax (VAT), and under the Financial Law 2005, a concession of up to 40 per cent of the cost of the biomass heating equipments can be availed.

Policy incentives to ensure purchase of electricity from biomass installations of less than 12 MW capacity have also been introduced. Private individuals purchasing renewable energy products for use at homes can benefit from tax credits. For biofuels, targets have been set at 7 and 10 per cent of the total fuel consumption in the transportation sector respectively for 2010 and 2015. Vendors not meeting these targets will be subject to penalties, whereas biofuels enjoy partial tax exemption. (EU Renewable Energy Portal 2011)

France, being a major and advanced country in the EU has been awarded a considerable target to achieve by 2020. Renewable energy is gaining ground in France in the past decade. Particularly wind, biofuels and biomass are likely to take the lead in coming years as well.

Germany

Germany is the EU leader in wind utilisation, solar photovoltaic and thermal installations and biofuel production. It accounts for nearly 50 per cent of the total installed onshore wind capacity in the EU.

Important Actors

Energy policy at the national level is lies in the portfolio of Federal Ministry of Economics and Labour (BMWA). Since 2002, renewable energy at the national level is looked after by the Ministry of Environment, Nature Conservation and Nuclear Safety (BMU). Another important actor related to the renewable portfolio is the Ministry of Economic Cooperation and Development (BMZ), which is responsible for development policies. As Germany has a strong federal structure, federal states or the *Länder* play a substantial role in policy making. Many federal states have their own support schemes for RES in addition to the national ones. Research and Development is supported by primarily three central ministries namely the Ministry of Environment, Nature Conservation and Nuclear Safety (BMU), Ministry of Consumer Protection, Food and Agriculture (BMVEL), and Ministry of Education and Research (BMBF). A section on bio-fuels falls under the Ministry of Transport, Building and Housing (BMVBW). The German Federal Energy Agency (DENA) promotes energy efficiency and renewable energy by running information campaigns, offering consultation and cooperating with similar institutions worldwide. Other interests groups such as German Electricity Association (VDEW), which encompasses most of the electricity suppliers, Federal Renewable Energy Association (BEE), which is the umbrella organization of the major renewable energy associations and Federal Association of new energy suppliers (BNE) too, play an important role in policy formulation. (DENA Portal 2011; Grotz 2005b: 143-146)

The prime instrument for supporting renewable energy in Germany has been the Renewable Energy Sources Act (*EEG*) adopted in 2000. It was a continuation of the electricity feed-in law, 1990 with which Germany paved the way for feed-in tariffs in Europe. It guaranteed free access to the grid for renewable energy for the first time and

the amount of support was determined as a percentage of the average price paid by the end consumers. RES-E producers putting solar and wind technologies to use enjoyed a selling price of 90 per cent of the retail price, while rates for biomass and hydro ranged from 65 to 80 per cent. The feed-in law was revamped with the 2000 Renewable Energy Sources Act (EEG), which transformed the feed-in tariff structure; instead of percentages of end-user tariffs, the new rates were pegged at a fixed sum of money per unit of electricity for 20 years. Compensation rates for different energy sources varied. The EEG, 2000 prioritized grid access for RES-E; it also obliged the grid operators to prioritize the purchase and transmission of RES-E. In 2004, the EEG was amended; the new law sought to equalize the incurred costs for grid operators, which varied regionally. To allow technological progress and enhance competitiveness of the renewable technologies, compensation rates are reduced nominally each year. The EEG has been arguably the most successful scheme for promoting RES. Germany does not enjoy very conducive environmental conditions for solar or wind energy but the EEG has set pace for the development of renewables at a meteoric pace. Today, feed-in tariffs are considered a benchmark scheme on the pan union level. (EU Energy Portal 2011; Grotz 2005b: 146-152)

Other than EEG, direct invest support for RES, soft loans and tax allowances for renewable energy units are also used as support instruments. The most important scheme under the direct support initiative is the Market incentive program for an increased use of renewable energy (*Marktanreizprogramm, MAP*). It was started in 1998 under the aegis of Ministry of Economics and Technology but in 2002 it was shifted to the Ministry of Environment (BMU). It is the central support program renewable heating sector primarily supporting biomass although it has support provisions for solar thermal as well as photovoltaic installations as well. (Grotz 2005b: 151)

A myriad of soft loan schemes are initiated for promoting investment in and utilization of renewable energy. *Kreditanstalt für Wiederaufbau* (KfW) and the *Deutsche Ausgleichsbank* in partnership with smaller local banks provide low interest rate loans and up to 100% credit for setting up biomass, biogas plants, small hydropower stations and geo-thermal utilities. These programs aim to promote small and medium enterprises

and public-private partnership. The *100,000 Roofs Photovoltaic Program* (1999-2003) provided €500 million and was to be categorized under this format. Biofuels also receive full tax exemption since 2004, a move which helped Germany to achieve a 5.75 per cent quota stipulated for 2010 in 2006. RES-E is subject to taxation and there is no tendency to give it benefits through this route. (Grotz 2005b: 151)

Table 3.5: Feed-in tariffs for electricity from renewable energy sources

Source	Duration of Contract	Tariff
Biomass	20-30	3.9-17.5 €cts/ KWh
Hydro	15-30	3.7-9.67 €cts/KWh
Sewage Gas	20	6.65-9.67 €cts/KWh
Geothermal	20	7.16-15 €cts/KWh
Photovoltaic	20	45.7-62.4 €cts/KWh
Onshore wind	20	5.5-8.7 €cts/KWh
Offshore wind	20	6.19-9.1 €cts/KWh

Source: Grotz 2005b: 148

A stable policy framework has created favourable conditions for increased penetrationof renewable energy in Germany. Feed-in tariffs for RES-E, market incentives for RES-H, and tax exemptions for biofuels besides other information campaigns run by the government have helped in creating a throbbing renewable energy market in the country.

United Kingdom

Renewable energy is perceived as an important resource for tackling climate change in the UK. It has a strong support system for renewables based on tradable green certificates along with an obligation on utility companies to accommodate a certain percentage of electricity from renewable energy sources. Hydro-power was the only major renewable energy source put to use till the 1990s. In the 1990s, National Non Fossil Fuel Obligation (NFFO) was adopted to promote renewable and other clean technologies. (Dinica 2005: 297)

In 2000, UK introduced a threefold system to support the commercial viability of the RES. The first one being the Renewables Obligation (RO), the second being Climate Change Levy (CCL) and the third element being government subsidies for renewable technologies to enable them to participate in the RO system. In April 2002, the Renewables Obligation (RO) took over from the NFFO and speeded up the process considerably; it is presently the mainstay of support schemes for renewable energy in the UK. It obliges electricity suppliers in UK to increase the proportion of RES-E in their electricity supplies. Renewables Obligation Certificate (ROC) is issued for each unit of eligible renewable electricity produced supplied to customers i.e. 1 megawatt hour (MWh). Suppliers meet their obligations by presenting sufficient ROCs; if suppliers do not have sufficient ROCs to meet their obligations, they pay an equivalent amount into a fund, from where money is paid back to those suppliers that have presented ROCs.

The Climate Change Levy (CCL) was adopted in April 2001 and imposed a levy on all but domestic consumers using electricity generated from conventional sources. RES-E was exempt of the levy set at 62 € cts/kWh. The CCL acted as an incentive to buy RES-E and take into account the external costs related to the conventional sources of energy. Apart from these the government runs schemes to provide direct subsidies to renewable technologies such as the clear skies schemes.

Important Actors

Main actors involved in the process of policy making are Department of Trade and Industry (DTI), which has the general competence for renewable policy, the office of Gas and Electricity Markets (Ofgem). The main task of the Ofgem is ensuring competitive pricing of gas and electricity; it is also responsible for the implementation of renewable policies. It acts as the regulator making sure that the quota for RES-E is met. A Renewables Advisory Board subordinated to the DTI holds dialog with the stakeholders, i.e. consumer groups, industry and advices the government on ways to improve the implementation of policies. Sustainable Energy Policy Network (SEPN) and Renewables UK are relatively newer public agencies aiming at harmonizing the actions of related public offices and industry. (Dinica 2005: 299; Ofgem Portal 2010a)

In the year 2002, when the scheme was initiated the quota of RES-E in the electricity supplies was set at 3 per cent, which presently stands at 10.4 per cent. It is set to rise to 15.4 per cent by 2015 and then remain stable until 2027, when the obligation is poised to end. The Government intends that suppliers will be subject to a renewables obligation until 31 March 2027. (Ofgem Portal 2010b)

Budget 2010 earmarked the government's plan to create a Green Investment Bank, which will support investment in low-carbon infrastructure projects. It will bring together public and private sector capital, and operate on a commercial basis. The government will put in an investment of up to £1 billion an equal private sector investment.

A new scheme namely 'UK Finance for Growth' has been announced; its purpose is to streamline £4 billion of existing financial support for small and medium-sized businesses, focusing on encouraging businesses to commercialize low-carbon technologies. The government has also announced £60 million for the development of offshore regions to attract offshore wind turbine manufacturers in the UK. The government committed to reduce government departments' carbon emissions by at least 30 per cent by 2020. It also committed to reforming the energy market further, a task it has pioneered so far. It also announced a 50 per cent tax reduction for ultra-low carbon cars. (UK Government Portal 2010)

The UK relies on quotas and issuing green certificates to support renewables. This strategy is complex and has not been as efficient in securing investor confidence as the feed-in model. As a result UK, which enjoys good natural conditions, has not been able to harness the potential of renewables to the fullest. However, growth has picked up in the past decade and the government is aggressively bidding for more institutional reforms to ensure an even speedier growth in the sector. The government's proactive response is a key confidence building measure for investors and is likely to yield results.

It is suggested that each renewable energy technology mentioned above be dealt with in greater detail to assess their present status as well as their future projections in the region.

Wind Energy

The European Union is a world leader in terms of manufacturing and development of wind farms. Wind currently provides more than 5 per cent of Europe's electricity. It, particularly onshore wind, is the most competitive form of renewable energy and is likely to be the largest contributor in meeting the target of 34 per cent share of renewable electricity by 2020 envisaged by the energy and climate package. In 2010, a total of 9,301.3 MW of wind power capacity was installed in the EU taking the total wind power capacity to 84,339 MW. 68.7 MW of wind power capacity was also decommissioned in the same year. Being home to 44.3 per cent of the global wind energy capacity, the EU maintains a comfortable lead over other regions in the sector. However, the EU failed to achieve its target of 10 GW fresh installations in 2010. The main reason behind this failure has been sluggish growth in the traditionally leading Member States viz. Spain, Germany, France and UK. But new avenues have opened up with eastern European countries embracing wind energy and offshore wind projects gaining currency in favourable regions. (Wind Barometer 2011: 59-63)

Offshore wind energy has a great potential in the EU given the long coastlines many Member States possess. The EU is the global leader in offshore wind capacity as well, but has not been able to realise its potential in past. Offshore wind is likely to be a significant contributor in achieving the target of 20 per cent share of renewable energy by 2020. Progress in this sector gained momentum in the year 2009 after the Commission tabled its Communication, *Offshore Wind Energy: Action needed to deliver on the Energy Policy Objectives for 2020 and beyond,* easing financing of projects and enhancing cross-border planning. Consequently, in 2010, the new technology has registered a remarkable turnaround. It added 1140.3 MW offshore wind power capacity over a base of 1910.9 MW raising the total capacity to 3050.2 MW. (Commission of the European Union 2008b; Wind Barometer 2011: 59-63)

Presently, Germany, Spain, Italy are the leading Member States in terms of total installed capacity followed by France, the UK, Portugal, and Denmark. However, in terms of installed capacity per 1000 inhabitants Denmark lead the way with 686.6 MW

followed by Spain (449.6), Portugal (366.4), Germany (332.7), Ireland (319.6) and Sweden (231.6). (Wind Barometer 2010: 62) The differentiated penetration levels of wind energy in the Member States are rooted in their policy framework. Following is the assessment of the wind energy sector in the leading member states.

Offshore wind energy systems gathered momentum this year after the In 2010, however, new capacity additions came from only five EU Member States, which added a total of 1139.3 MW of new offshore power generation capacity raising the share of offshore wind to 12.2 per cent of the total wind power market. Among the five Member states the United Kingdom brought maximum capacity on stream connecting 653 MW thereby raising the installed total offshore power generation capacity to 1341.2 MW. The UK commissioned four new offshore wind farms, namely the Thanet (300 MW), Gunfleet Sands I and II (108 and 64.8 MW) and Robin Rigg wind farm (180 MW). Denmark follows in next. It added 211 MW of offshore wind capacity in 2010, commissioning Rodsand II (207 MW) and the Avedore farm. Its offshore wind energy capacity is pegged at 872 MW. Belgium stood third by commissioning new capacity of 165 MW at the Belwind wind farm off the Zeebrugge coast. Total Belgian offshore wind power capacity is now pegged at 195MW. Germany too added a total of 108.3 MW of new capacity to bring accumulated capacity up to 180.3 MW. It commissioned the Baltic 1 and Bard 1 wind farm projects. Finland was the last country to add new capacity last year. It commissioned a single wind turbine of 2.3 MW) at the Pori 1 wind farm, raising the country's offshore wind power capacity to 26 MW. (Wind Barometer 2011: 63)

In 2010, European Wind Energy Association (EWEA) launched the European Wind Initiative. With a budget of € 6 billion, it aims to maintain Europe's lead in offshore and onshore wind energy, to make onshore and offshore wind the most competitive energy technology by 2020 and 2030 respectively and to supply 20, 33 and 50 per cent of the total electricity consumption in the EU. These targets translate into 230 GW of wind energy capacity by 2020 out of which 40 GW is going to be offshore. By 2030, total installed capacity should be raised to 400 GW, with 20

Table 3.6: Installed wind power capacities at the end of 2010 (in MW)

	2009	2010	Capacity installed in 2010	Capacity decommissione
Germany	25,719.4	27214.7	1551.1	55.8
Spain	19601.1	20676.0	1515.9	0.0
Italy	4897.9	5797.0	899.1	0.0
France	4626.0	5660.0	1034.0	0.0
U.K	4424.0	5203.8	779.8	0.0
Portugal	3326.0	3897.8	571.8	0.0
Denmark	3482.0	3800.0	318.0	0.0
Netherlands	2222.0	2245.0	32.3	9.3
Sweden	1560.0	2163.0	603.5	0.5
Ireland	1260.0	1428.0	168.0	0.0
Greece	1087.0	1208.0	121.0	0.0
Poland	724.7	1185.0	460.3	0.0
Austria	994.6	1010.6	16.0	0.0
Belgium	606.1	888.0	283.1	1.2
Romania	18.0	418.0	400.0	0.0
Bulgaria	177.0	375.0	198.0	0.0
Hungary	203.0	293.0	90.0	0.0
Czech republic	193.3	215	21.7	0.0
Finland	147.0	197.0	52.0	2.0
Lithuania	98.0	154.0	56.0	0.0
Estonia	104.0	148.8	44.8	0.0
Cyprus	0	82.0	82.0	0.0
Luxembourg	43.3	43.3	0.0	0.0
Latvia	28.0	31.0	3.0	0.0
Slovakia	5.5	5.5	0.0	0.0
Slovenia	0.0	0.0	0.0	0.0
Malta	0.0	0.0	0.0	0.0
EU Total	75106.4	84339.0	9301.3	68.7

Source: Wind Barometer 2011: 61

GW of new capacity being added each year. Out of this 10 GW will come from offshore wind. It is technically feasible to create this capacity but the challenge of incorporating it into the grid remains. (EWEA 2010a: 2-4)

The capacity of the European power systems to absorb wind power relies more on the regulatory framework than on technical and implementation constraints of the technology. Large scale penetration of wind power is hindered more by barriers such as inadequate infrastructure, lack of interconnections coupling them with electricity grids and lack of competition than by the intermittent nature of the new source of energy. Wind energy can already meet up to 20 per cent of electricity demand in the EU without threatening the stability and reliability of the power system, whereas it supplies nearly 5 per cent of the total power generated. For higher penetration levels, the EU needs to reconsider the way its power systems managed and operated. (EWEA 2010b: 6-7)

Solar energy

Solar energy is utilised in largely two forms: solar thermal and photovoltaic. Photovoltaics are used fro power generation whereas solar thermal collectors are used for space heating and heating water. Solar thermal market in the EU enjoyed a high growth rate in 2008 when 4.6 million m^2 of new collector surface area was added to the existing capacity. However, growth slowed down due to economic recession in the next year and it added 9.1 per cent lesser collector surface area with only about 4.17 m^2 new capacity being added. Due to credit crunch, investors have postponed investment decisions in the sector and a sharp rise in photovoltaic installations could also have impacted growth of solar thermal installations. (Solar Thermal Barometer 2010)

The EU is the global leader in solar photovoltaics with over 80 per cent of the total global installed capacity. In 2010, photovoltaics added more capacity than any other renewable energy source, bringing 13023.2 MWp of modules onstream. This addition accounted for a 120.1 per cent increase over the previous year, when merely 5918.2 MWp of capacity was added. The cumulative photovoltaic capacity in the EU now stands at 29327.7 MWp.Solar Photovoltaics generated a total of 22.5 TWh of power in 2010. 88.7 per cent of which came from the three leading member States of Germany, Spain

Table 3.7: Installed collector area and equivalent power in 2008 and 2009

	2008 (m^2)	2009 (m^2)	Cumulative Capacity (m^2)	Equivalent power
Germany	1920000	1619800	12899800	9029.9
Austria	362923	365000	4330000	3031.0
Greece	300000	206000	4076200	2853.3
Italy	421000	400000	2014875	1410.4
France	374252	316956	1994772	1396.3
Spain	466000	402000	1865036	1305.5
Netherlands	51521	70713	774345	542.0
Cyprus	40552	34963	700715	490.5
Czech republic	90000	90000	513750	359.6
Poland	129632	144308	509836	356.9
Denmark	33000	54500	484080	338.9
U.K	81000	89100	476260	333.4
Portugal	86620	140000	445000	311.5
Sweden	55461	46302	422000	295.4
Belgium	91000	55000	335013	234.5
Slovenia	10100	23890	157902	110.5
Ireland	43610	42514	120967	84.7
Romania	10000	20000	114300	80
Slovakia	10250	12600	104520	73.2
Hungary	10000	10000	66700	46.7
Malta	6999	8508	44867	31.4
Bulgaria	6000	5000	36600	25.6
Finland	3300	3000	28463	19.9
Luxembourg	3994	3352	20161	14.1
Latvia	1500	1500	8350	5.8
Lithuania	700	700	4850	3.4
Estonia	350	350	2170	1.5
EU Total	4609764	4166056	32551532	22786.1

Source: Solar Thermal Barometer 2010: 87-88, 98

Table 3.8: Installed photovoltaic capacity in 2009 and 2010 (MWp)

	2009	2010	Cumulative Capacity
Germany	3940.0	7411.00	17370.0
Spain	17.010	370.00	3808.081
Italy	698.8	2321.1	3478.5
Czech republic	408.646	1489.78	1953.10
France	221.200	719.146	1054.346
Belgium	503.109	213.425	787.457
Greece	36.500	150.40	205.4
Slovakia	0.216	143.617	143.809
Portugal	34.253	28.645	130.839
Austria	20.209	50.00	102.596
Netherlands	10.669	29.393	96.900
U.K	7.077	45.255	74.845
Slovenia	6.858	27.332	36.336
Luxembourg	1.795	0.916	27.273
Bulgaria	4.293	11.540	17.240
Sweden	0.854	1.3	10.064
Finland	2.0	2.0	9.649
Denmark	1.3	2.5	7.065
Cyprus	1.142	2.918	6.246
Romania	0.190	1.3	1.940
Poland	0.369	0.370	1.750
Hungary	0.200	1.1	1.750
Malta	1.289	0.143	1.670
Ireland	0.210	0.0	0.610
Lithuania	0.015	0.030	0.1
Latvia	0.004	0.0	0.08
Estonia	0.038	0.030	0.08
EU Total	5918.2	13023.2	29327.7

Source: Solar Photovoltaic Barometer 2011: 147-148

and Italy. Apart from the market leaders, photovoltaics showed substantial growth in Czech Republic, which climbed up to the third slot among the fastest growing solar photovoltaic markets and France in the previous year. If this rate continues, photovoltaics could contribute more than 6 per cent of total electricity demand by 2020. It is important to note that southern countries such as Italy, Greece and Spain, which enjoy more solar radiation have better energy productivity in terms of power generated per MWp of installed capacity. (Solar Photovoltaic Barometer 2011; EPIA 2011b: 25-27)

The reason for this unprecedented growth even in times of recession has been plummetting costs of installation for photovoltaics. German Solar Industry Association reported that the cost of installation for roof top modules under 100 KWp have fallen to € 2546/KWp in early 2011 from € 4000/KWp in 2009 and the trend is likely to continue. Taking into account the sinking installation costs, leading Member States such as Germany and Spain have introduced scaled down feed-in tariffs to peg them with costs and prevent distortion of competition. Czech Republic too has introduced measures to tax photovoltaic electricity production to prevent execessive expansion. Despite falling costs, there are roadblock in installing photovoltaic projects, namely lack of efficient grid connectivity. Because of an expansive grid system in Europe, the prospects for offgrid photovoltaics is not great. The European Photovoltaic Industry Agency (EPIA) calls for reassessment of the grid connection process to make it more transparent and nimble. Grid connectivity should be ensured for the entire lifetime of the installation. It also maintains that small rooftop installations or building integrated plants could prove to be the drivers for photovoltaics market as falling installation costs might attract individual investors and cover the largely untapped market. (Solar Photovoltaic Barometer 2011: 147-163; EPIA 2011a: 7; EPIA 2011b: 25-27)

Biomass

Biomass is arguably the renewable energy source with greatest potential in the EU. Biomass is broadly defined in the EU to provide for the Member States to accommodate their resources such as forest, agricultural and municipal waste under it aegis. Thus, biomass energy may include energy from solid biomass, municipal waste and biogas.

Solid biomass includes wood, wood wastes and other solid plant or animal matter. As as most member states have this resource in relative abundance, they aim to develop considerable capacities in this sector. In 2009, primary energy output from biomass combustion amounted to 72.8 Mtoe registering a 3.6 per cent growth over the previous year. Germany led in this sector with 11.22 Mtoe primary energy output followed by France (9.975 Mtoe), Sweden (8.608 Mtoe), Finland (6.469 Mtoe) and Poland (5.191 Mtoe). Austria does not rank high in terms of absolute numbers for primary energy output because of the small size of the country but ranks fifth in terms of per capita primary energy production behind Finland, Sweden, Latvia and Estonia indicating that biomass is highly developed in the region. (Solid Biomass Barometer 2010: 123-124)

Biomass can be used for both power generation and heating purposes. Since 2001, power generation from biomass has experienced a steady growth rate of 14.7 per cent per annum growing from 20.8 to 62.2 TWh. It is estimated that about 800 solid biomass units are functional in Europe with an electricity output of 7.1 GW which is expected to grow to 10 GW by 2013. Germany is the leader in power generation from solid biomass closely followed by Sweden and Finland. It is estimated that power generation will rise to nearly 131 TWh by 2020. (ibid: 127)

The use of biomass for heating purposes also registered growth due to boom in the biomass cogeneration and biomass boiler markets. The estimated contribution of solid biomass in the heating sector for 2008 stands at 58 Mtoe, which includes heat sales in industrial and transport sector as well. Solid biomass heat sales to district heating sector are pegged at 5.473 Mtoe a miniscule above 5.434 Mtoe in the previous year. The reason behind this sluggish growth is slow down in market leaders because of recession. Finland's timber and paper industry which largely produces raw material for biomass sector was hit by recession. This was reflected in the primary energy production which recorded a drop of 11.7 per cent over the previous year. In Sweden, although primary energy demand picked up by 3.6 per cent due to commissioning of new cogeneration plants, it benefitted power generation more, which registered a 12.6 per cent rise compared to heating sector which could only pick up by 5 per cent. However, Germany

and France maintained good growth rates. Eastern European countries also remained buoyant. (ibid: 128-133)

Table 3.9: Gross electricity production from solid biomass in the EU in 2009 (TWh)

	Power only Plants	Cogeneration Plants	Total Electricity
Germany	7.882	3.474	11.356
Sweden	0.00	10.057	10.057
Finland	0.870	7.517	8.387
Poland	0.00	4.907	4.907
Netherlands	1.764	1.786	3.550
U.K	3.535	0.00	3.535
Austria	1.256	2.065	3.321
Italy	2.105	0.723	2.828
Belgium	1.899	0.760	2.659
Hungary	2.043	0.195	2.238
Spain	0.631	1.508	2.139
Denmark	0.00	1.963	1.963
Portugal	0.349	1.364	1.713
Czech republic	0.522	0.874	1.396
France	0.384	0.895	1.279
Slovakia	0.00	0.493	0.493
Slovenia	0.007	0.112	0.120
Lithuania	0.00	0.087	0.087
Ireland	0.048	0.017	0.065
Romania	0.00	0.060	0.060
Estonia	0.004	0.023	0.028
Latvia	0.00	0.004	0.004
EU Total	23.3	38.886	62.186

Source: Solid Biomass Barometer 2010: 125

Table 3.10: Heat sales to the district heating networks in the EU in 2009 (Mtoe)

	Heat Plants only	Cogeneration Plants	Total Heat
Sweden	0.774	1.328	2.102
Finland	0.191	0.942	1.133
Denmark	0.337	0.269	0.606
Austria	0.228	0.292	0.521
Germany	0.140	0.196	0.336
Lithuania	0.145	0.036	0.181
Latvia	0.087	0.009	0.096
Poland	0.037	0.180	0.216
Italy	0.00	0.061	0.061
Slovakia	0.023	0.028	0.051
Netherlands	0.00	0.039	0.039
Hungary	0.003	0.056	0.059
Slovenia	0.004	0.012	0.016
Luxembourg	0.001	0.00	0.001
Belgium	0.00	0.006	0.006
Czech Republic	0.020	0.030	0.050
EU Total	1.1991	3.3483	5.473

(Solid Biomass Barometer 2010: 126)

Another component of biomass energy sector is energy generation from municipal waste. It includes biodegradable garden, kitchen and food wastes and can be used for both power and generation. Energy can be extracted from organic waste through incineration and methanisation. The following section deals with incineration and methanisation is discussed under the head biogas. In 2009, primary energy and electricity production from municipal waste stood at 7.7 Mtoe and 15.4 TWh respectively registering an increase of 3.3 per cent over the previous year. Extracting energy from organic wastes is also a much environment friendlier option compared to dumping and burying wastes, which releases methane, a much stronger greenhouse gas compared to carbon dioxide. (Municipal Waste Biometer 2010: 95)

In absolute terms, Germany leads the pack in both power and heat generation. In the Heating sector it is followed by Sweden, Denmark, France and the Netherlands and in the power generation sector, it is followed by France, Italy, the Netherlands and Sweden. However, Denmark is the European Leader followed by Sweden, the Netherlands, Finland and Luxembourg in terms of per capita primary energy production. All the leading experienced growth in 2009. As France was one of the earliest countries in Europe to employ municipal waste incineration, many of its plants are ageing and are less efficient. Although, four new plants are under construction, the sector needs modernisation. (ibid: 96-101)

Table 3.11: Heat production from renewable municipal waste in the EU in 2009 (ktoe)

	Heat only plants	Cogeneration Plants	Total Heat
Germany	169.1	355.8	525.0
Sweden	110.0	380.1	490.1
Denmark	35.8	316.9	352.7
France	58.4	195.1	253.5
Netherlands	81.5	38.1	119.6
Italy	0.0	55.9	55.9
Finland	11.2	42.5	53.6
Austria	13.1	33.1	46.2
Czech Republic	24.4	10.0	34.4
Hungary	0.0	12.6	12.6
Slovakia	2.4	0.5	3.0
Belgium	0.0	2.7	2.7
EU Total	505.8	1443.4	1949.2

Source: Municipal Waste Biometer 2010: 95

The prospects for this sector are good in the EU. A number of European companies are working in this field and creating value out of eco-friendly waste management. The estimated output for 2010 is pegged at 8 Mtoe. Power generation is expected to pick up from present levels contributing about 67 TWh to the total power consumption in the EU

by 2020. (ibid: 103) Biomass energy technologies also include extraction of energy from organic wastes through methanisation. In 2009, primary energy production from biogas in the EU stood at 8.3 Mtoe. Electricity output in the same year was pegged at 25.2 TWh. The prime factor contributing to the growth in previous years has been a rise in agricultural biogas recovery, which uses purpose-designed methanisation plants. It relies on energy crops, mainly maize and provides for 52 per cent energy output of this sector. Landfill plants and waste water treatment plants contribute 36 and 12 per cent respectively. In absolute terms, Germany is the leader in biogas sector as well followed by Spain, Italy, France and the UK. In per capita terms as well Germany is the EU leader followed by the UK, Luxembourg, Austria and Denmark. (Biogas Barometer 2010: 105-111)

Table 3.12: Power generation from renewable municipal waste in the EU in 2009 (GW)

	Power only plants	Cogeneration Plants	Total Power
Germany	3083.0	1083.0	4166.0
France	1277.0	703.0	1980.0
Italy	799.7	816.5	1616.2
Netherlands	404.0	1169.0	1573.0
Sweden	0.0	1241.0	1241.0
United Kingdom	1240.7	269.9	1510.6
Denmark	0.0	1019.9	1019.9
Spain	761.0	0.0	761.0
Belgium	309.6	147.0	456.6
Austria	253.0	48.0	301.0
Finland	65.0	226.0	291.0
Hungary	29.0	84.0	113.0
Luxembourg	24.3	0.0	24.3
Slovakia	0.0	22.0	22.0
Czech Republic	0.0	10.9	10.9
EU Total	8536.3	6840.2	15376.6

Source: Municipal Waste Biometer 2010: 94

Table 3.13: Primary Biogas energy output in 2009 in the EU (in ktoe)

	Landfill Gas	Sewage Gas	Other Biogas	Total
Germany	265.5	386.7	3 561.2	4 213.4
U.K	1 474.4	249.5	0	1 723.9
France	442.3	45.2	38.7	526.2
Italy	361.8	5.0	77.5	444.3
Netherlands	39.2	48.9	179.8	267.9
Spain	140.9	10.0	32.9	183.7
Austria	4.9	18.9	141.2	165.1
Czech republic	29.2	33.7	67.0	129.9
Belgium	44.3	2.1	78.2	124.7
Sweden	34.5	60.0	14.7	109.2
Denmark	6.2	20.0	73.4	99.6
Poland	35.5	58.0	4.5	98.0
Greece	46.3	12.2	0.2	58.7
Finland	30.6	10.7	0.0	41.4
Ireland	23.6	8.1	4.1	35.8
Hungary	2.8	10.3	17.5	30.7
Portugal	0.0	0.0	23.8	23.8
Slovenia	8.3	3.0	11.0	22.4
Slovakia	0.8	14.8	0.7	16.3
Luxembourg	0.0	0.0	12.3	12.3
Latvia	7.0	2.7	0.0	9.7
Lithuania	1.3	2.1	1.2	4.7
Estonia	2.0	0.9	0.0	2.8
Romania	0.1	0.7	0.5	1.3
Cyprus	0.0	0.0	0.2	0.2
EU Total	3 001.6	1 003.7	4 340.7	8346.0

Source: Biogas Barometer 2010: 107

Table3.14: Gross Biogas power output in the EU in 2009 (in GWh)

	Power Only	Cogeneration Plants	Total
Germany	11325.0	1237.0	12562.0
U.K	5064.7	526.8	5591.5
France	671.4	175.0	846.4
Italy	1374.1	365.5	1739.6
Netherlands	82.0	833.0	915.0
Spain	479.0	48.0	527.0
Austria	602.0	36.0	638.0
Czech republic	241.6	199.6	441.3
Belgium	175.2	286.7	461.8
Sweden	0.0	34.0	34.0
Denmark	1.3	323.5	324.7
Poland	0.0	319.2	319.2
Greece	183.5	34.0	217.5
Finland	0.0	31.0	31.0
Ireland	100.0	17.0	117.0
Hungary	0.0	95.2	95.2
Portugal	73.0	10.0	83.0
Slovenia	9.7	59.2	68.8
Slovakia	1.0	20.0	21.0
Luxembourg	0.0	53.4	53.4
Latvia	3.0	42.0	45.0
Lithuania	0.0	15.0	15.0
Estonia	10.0	0.0	10.0
Romania	1.0	0.0	1.0
Cyprus	0.0	12.0	12.0
EU Total	20397.4	4773.0	25170.4

Source: Biogas Barometer 2010: 108

Biofuels

Biofuels in the EU mainly refer to bioetanol and biodiesel. Bioethanol is an alcohol derived from the fermentation of derivates of sugar and starch crops, which can also be used as food. Biodiesel is produced from transesterification of vegetable oils, animal fats and grease. Biofuels are also classified as first or second generation biofuels. First generation biofuels are derived from sugars, starch and vegetable oils. The production of second generation biofuels does not have any impact on the food stock supplies, land use and biodiversity. Thus, they are derived from non edible crops or non edible wastes of food crops.

The 2003 Directive of the European Council and Parliament required the use of biofuels in the transport sector in each Member State to rise to 5.75 per cent by 2010. Total biofuels usage in 2008 according the most recent data available was 12 Mtoe up by 1.9 Mtoe over the previous year. It amounted to 4 per cent of the total fuel consumption in the EU and was likely to miss the target for 2010. Growth in this sector has been on a downward spiral. In 2006-07, it grew at 41.8 per cent and in 2008-09 it grew at a mere 18.7 per cent. Therefore, to accelerate growth, the EU in the energy and climate package raised the bar to a binding target of 10 per cent contribution of renewable energy to the total energy consumed in the transport sector in each Member State by 2020. The package also requires the production of biofuels at home as well as in exporting countries to be sustainable and hence presses on the need to promote second generation fuels. (Commission of the European Union 2008a; Biofuels Barometer 2010: 75)

Biodiesel makes up for majority share of 79.5 per cent in the total biofuels use in the EU followed by bioethanols, vegetable oils and biogas contributing 19.3, 0.9 and 0.3 per cent respectively. Bioethanol and biodiesel posted respective increase of 31.9 and 19.9 per cent over 2008. Vegetable oil consumption decreased in the by 72.9 per cent in the same year, however, use of biogas in Sweden also increased by 23.2 per cent. Germany is the market leader followed by France, Italy, Spain and the UK. Germany however experienced stunted growth in 2009 as the quota for the year was downgraded from 6.25 to 5.25 per cent. The 6.25 per cent now holds valid

Table 3.15: Biofuels consumption in the transport sector in the EU in 2009 (in toe)

	Bioethanol	Biodiesel	Other Biofuels[8]	Total
Germany	581 686	2 224 349	354 376	2 894 407
France	455 933	2 055 556	--	2 511 490
Italy	118 014	1 048 988	--	1 167 002
Spain	152 193	894 335	--	1 046 528
U.K	159 000	822 872	--	981 872
Poland	136 043	568 997	--	705 040
Austria	64 249	424 901	13 369	502 519
Sweden	199 440	159 776	35 015	394 231
Netherlands	138 650	228 886	--	367 536
Belgium	37 577	221 252	--	258 828
Portugal	0	241 468	--	241 468
Romania	53 274	131 328	--	184 601
Hungary	64 488	119 303	--	183 791
Czech republic	51 097	119 809	--	170 906
Finland	79 321	66 280	--	145 601
Ireland	19 733	54 261	--	73 994
Slovakia	6 820	55 041	--	61 861
Greece	0	57 442	--	57 442
Lithuania	14 091	37 770	--	51 861
Luxembourg	740	39 915	498	41 154
Slovenia	1 859	27 993	--	29 852
Cyprus	0	15 024	--	15 024
Latvia	1 120	3 570	--	4 690
Denmark	3 913	243	--	4 156
Estonia	Not available	Not available	--	Not available
EU Total	2 339 241	9 616 129	137 255	12 092 625

Source: Biofuels Barometer 2010: 76

[8] Other Biofuels refers to the use of vegetable in its pure form, except Sweden where biogas is used in transport sector

for the period 2010 to 2014. This caused a drop in the use of pure vegetable oils with other biofuels not fully able to fill the gap. France experienced a 10.4 per cent growth over 2008 and is expected to achieve its incorporation target of 6.25 per cent for 2009. In 2005, France introduced a new tax (TGAP) applicable on the total sales of fuels and payable by the distributors. If the distributors meet the yearly incorporation target set by the authorities, they enjoy full tax exemption. The tax rates are incremented annually for example tax rates for 2009 and 2010 were pegged at 6.25 and 7 per cent respectively. Italy experienced massive growth of 62.9 per cent over 2008. Incorporation rate stood at 3 per cent in 2009, up from 2.4 per cent in 2008. Bioethanol consumption grew by 103.3 per cent and biodiesel too registered a growth of 59.3 per cent over the previous year. First trends indicate that biofuel consumption in 2010 stands at 1.2 Mtoe, amounting to 3.2 per cent incorporation rate thereby missing the 5.75 per cent target. (Biofuels Barometer 2010: 75-79)

The EU is estimated to have incorporated only 4.8 per cent biofuels by energy content by 2010 against the target of 5.75 per cent. The countries which missed their targets for the year 2010 are required to meet them by 2010. Thereafter, it will be replaced by the new goal of 10 per cent share of renewable energy in total energy consumption in the transport sector in the EU. European industry is already getting ready for the opportunity that these targets put on offer as well as the challenge that stringent sustainability criteria will pose. (ibid: 95)

Renewable energy sources are now established in the EU and are looked up to take up greater role in the European energy mix. Technologically, they are advanced enough to shoulder greater burden and replace conventional fuels. Moreover, additional technology exists to incorporate the new energy resources in the centralised energy system in spite of the intermittent nature of many energy technologies. In fact, industrial associations concerning renewable energy technologies are drawing up longer term plans of 100 per cent power generation from renewable energy sources up to 2050. Also, there are plans to import RES-E from Middle East and North African regions to assist these scenarios.

Renewable energy has the promise and potential of reviving the European energy system, what it needs now is better policy making to help it achieve that stage.

Chapter 4

Conclusion

The European energy mix has already come a long a way from being solely constituted by coal to the present day mix of coal, oil, gas, nuclear and renewable energy. So far, the proactive policymaking in the field of renewable energy has stemmed from the need to tackle the twofold challenge of climate change and security of energy supply. Despite the actions, the two goals have not been achieved yet. The European Union like other regions of the world predominantly relies on fossil fuels, which it has to import from oil and gas producing region. Moreover, the EU is also bound by its international commitments under the Kyoto Protocol to reduce greenhouse gases emissions. Although, it is likely to meet its Kyoto targets, it has also taken the lead by setting an aggressive target of 20 per cent reduction in greenhouse gases emissions by 2020. With the oil prices heading north, global oil scenario getting choppier and the pressure to cut emissions, the EU needs to take some tough decisions regarding its energy future. It is mandatory for the EU to reshuffle its energy system and switch to fuels which are low-carbon, abundant and resultantly, more secure.

The EU is among the leading actors on climate matters. Its pioneering decision to set a binding target beyond 2012 comes in this light. It has also inserted the clause of extending 20 per cent target to 30 per cent to catalyse global action on climate mitigation. This clause has not been able to mobilise countries to take action earnestly and the EU might have to take bigger targets in the future. Moreover, the EU can not rely on circumventing on the emissions issue by financing clean development mechanisms and buying carbon credits from developing countries. Nor can it rely on outsourcing emissions to other countries in the longer term. These are facelift measures when observed from a global perspective; the developing countries are no longer ready to curb emissions at the cost of their development when the developed countries continue to emit greenhouse gases at an unchanged rate. They want legally binding and substantive commitment from developed countries for equitable distribution of the remaining 'carbon space'. Moreover, developing countries have been demanding technology transfer to

facilitate emission reduction in their territory. This stance of the developing countries, primarily China, India, Brazil and South Africa has already been on show in the climate change talks. Thus, substantial cuts in its greenhouse gas emissions are inevitable in the future and the issue will become more prominent once the EU sails past its 20 or 30 per cent emission reduction targets by the help of trade in carbon credits. Therefore, the EU needs to pad up for some more stringent measures devoted to climate change mitigation. Energy is the sector where a reshuffle can have a sizeable and long lasting effect on the overall emissions in the region. (Jayaraman 2009a, Jayaraman 2009b)

Renewable energy provides a viable alternative. It has made inroads into the European energy mix. Today, it is a significant contributor to the total energy consumed in the region and is poised to strengthen its position in future as well. An additional and correlated aim has been to overhaul the present development model to embark upon the path of sustainable development. The EU has, to this end, invested in the research and development of the upcoming technologies and laid plans for their market entry. It provided for a legal framework, various policy instruments and support schemes to promote renewable energy to set foot in the competitive market with the eventual goal of providing a comprehensive solution to the energy needs by becoming the mainstay of the energy mix. The EU has had considerable success in its goal of promoting renewable energy. It is the global forerunner in the field of renewable energy and has a very progressive renewable energy policy. Renewables are hailed as future energy sources globally as well as in the EU, wherein all energy will be sourced from them. Although renewable energy sources have shown tremendous growth and promise, the prospects of a 100 per cent renewable energy scenario in the near future are debatable and will likely take some time. However, with climate change as the other pressing issue, the EU might not have enough time to wait for renewables to revolutionise its energy system to an ultra low emissions energy system.

Europe stands at an unprecedented crossroads regarding energy policymaking, an area which will have far reaching consequences for its economic, social, political and environmental sectors. Europe seems to have decided that renewables are the future of its

energy system but carving out a plan to reach there is yet to be done. The EU is yet to decide on the energy technology which should act as a bridge between its predominantly fossil fuels based present and renewable energy oriented green future. The three plausible options at its disposal are nuclear energy, which is disputed after the developments in Fukushima earlier this year, gas and renewable energy. The EU is drawn back to the drawing table to sketch its short and medium term energy policy employing any or all of the above three low emission energy sources.

The case of nuclear energy in the EU has considerably weakened in the aftermath of the earthquake and tsunami in Japan on 11th March 2011. The mishap triggered fears of a nuclear meltdown in the nuclear reactors in Fukushima and mobilised public opinion against the harnessing of nuclear energy in the EU. In addition to the nuclear opponents, Germany and Spain, countries which were rather supportive of the technology, bowed to the strong public opinion and asserted that any of 143 reactors functioning in the EU territory should be shut down if they fail to survive the stress test. Germany first suspended operations at seven of its ageing nuclear plants and later shut down eight of its nuclear power plants in the aftermath of the nuclear disaster in Fukushima, Italy has postponed plans to re-launch nuclear power and Bulgaria has also put stricter measures for the upcoming Belene nuclear power plant. France, a leading member State in nuclear energy, also supported highest safety standards and declared to shut down plants which do not pass the stress test. It hopes to use the showdown in the nuclear sector at home to its benefit and sell technology oversees. In the meantime, Germany also rolled out the pioneering decision of a nuclear phase-out by 2022. (Euractive 2011a; Euractive 2011b)

As prospects for nuclear energy are fading, the EU is left with largely gas and renewable energy as its substantial options in the medium term. Gas usage is likely to experience a surge in the EU after the German decision of a nuclear phase-out stated the EU's energy commissioner, Günther Oettinger. (Reuters 2011) In this context, the EU's gas industry truly stands at the threshold of a breakthrough. The gas sector is also, presently, witness to the conflicting interests. Some Member States such as Germany and Austria which enjoy amicable relations with Russia support gas pipelines; the

controversial Nabucco Pipeline is an attempt to lower reliance on Russian gas imports and is not out of doldrums yet. Others like Poland, which do not share a good rapport with Russia, are betting big on exploiting indigenous shale gas resources. Shale gas faces stiff resistance from various Member States because of its impact on environment. Some Member States, primarily Italy, are also bullish on the prospects of liquefied natural gas (LNG) and have invested in re-gasification terminals. All the above ventures are promising but overall there is no clarity on the Union level as to what is going to be the role gas is to play in the energy strategy and more specifically, what would be the role assigned to the different sources of gas within the gas sector. (Dreyer 2011) Another option for the EU is to take a giant leap and fill the gap created by phasing out nuclear energy and coal with renewable energy. This is a very ambitious scenario which invites immense investments in the renewable energy sector.

The manifestation of Internal Energy Market throughout the EU will deliver a more coordinated approach in energy matters. However, progress on this front has been slow due to varying interests of the Member States. The UK advocated and practiced liberlisation of the energy sector at home. Although, the UK was vehemently opposed to the Commission's intervention in its energy sector, though the measures undertaken at the domestic front overlapped with those proposed by the Commission France selectively supported the concept of the IEM as it perceived it as an opportunity to boost its electricity exports. It therefore supported all aspects of the IEM except third party access to the electricity grids, which would have diluted the stake of the state electricity monopoly, *Electricite de France*. Germany gave a mixed response to the IEM. Although, it was dedicated to the general principle of a common market at the European level, it was against the third party access clause. Moreover, the energy sector in Germany was largely governed by market forces with the exception of nuclear and coal. In Germany, coal industry was not perceived solely as an energy source. It was rather an important component of the German social and employment policy as well. Therefore, the sector was heavily subsidised and regulated and the IEM sought to deregulate the sacrosanct policy area. The third party access clause also caused the private sector gas and electricity utilities to lobby against the IEM as major pipelines in Germany transiting Russian gas lie

in private hands. Thus varying interests of the European heavyweights have hampered the progress on the IEM agenda. (Matlary 1997: 30-32; 79-85)

The EU has recognised the potential of renewable energy resources and has worked proactively to put in place conducive conditions for promotion and integration of the new resources and acknowledges renewables as an important constituent of the energy mix, there is still fair bit of uncertainty about its energy future. Despite, much hype about climate change and a green development model based on renewable energy, it still may needs to compete with other energy technologies for a greater share in the energy mix in the medium to longer term. Although, nuclear promise has ended abruptly after the catastrophe in Japan, there is still no clarity over the role natural gas, more specifically shale gas will play in the near future. This uncertainty about the future energy mix hinders massive investments needed in the renewable energy sector.

However, the renewable energy lobby in the EU is hopeful that renewables can carry the burden of transformation of European energy system in the short to medium term. Electricity will remain the most convenient energy vector derived from renewable energy sources. Moreover, despite energy conservation measures, electricity demand will increase sharply between 2030 and 2050 as electricity will replace conventional fuels for heating purposes and in transport sector. This should also translate into a greater role for electricity from renewable energy sources (RES-E). However, the European power sector presently finds itself in doldrums and looks up to the policymakers to take lead and deliver on the promise of integrated and liberalised European energy market. This will clear the air and invite badly needed investments in the ageing power infrastructure of Europe. The EU has set ambitious climate change policies targeting massive decarbonisation of its economy, which requires massive investments in primarily the power sector. Therefore, power sector in the EU is expected to undergo massive change in the short, medium and long term. (Beckmann 2011)

The European Renewable Energy Council (EREC) also concludes in its feasibility study focusing on a 100 per cent renewable energy scenario in the EU by 2050, *Rethinking 2050* that Europe's ageing power infrastructure needs upgrading. Investments

in new power generation capacity, transmission lines and electricity grids are inevitable for a reliable and renewable energy compliant electricity system. Nearly 330 GW of new power generation capacity, which equals 42 per cent of the current EU capacity needs to be built by 2020. The EU is presented with opportunity in the form of necessity of upgrading its old infrastructure. The new infrastructure must correspond to the requirements of a well functioning internal electricity market as well as a futuristic power scenario of 100 per cent renewable energy based power system. The intermediate goals of RES-E contribution of 39 per cent in 2020 and 65-67 per cent contribution in 2030 need urgent action in the form of better access to technically superior transmission networks. (EREC 2010: 23, 26)

This is a challenging task as electricity grids are very expensive assets whose planning and implementation need to consider various issues such as security of electricity supply, efficiency of the system as well as environmental and social issues. In the present context, European grid planners have to accommodate the demand for infrastructure conducive for an internal electricity market as well as integration of RES-E. Additionally, economic efficiency of the transmission system can not be overlooked either. (ENTSO-E 2010: 43) Therefore, future European power transmission grids will be required to combine the two concepts of smart and super grids. Smart grids are futuristic electricity transmission infrastructure which can accommodate higher end-user participation enhancing compliance of the power infrastructure with power generation from renewable energy sources. Super grid refers to a well interconnected electricity grid which connects different national grids and enables transport of electricity from one to the other end of the continent. The EREC proposed speedy development of super grids primarily in three circles, namely North Sea offshore grid, the Mediterranean energy ring and the Baltic interconnection plan. (EREC 2010: 46-49)

The integration of the internal electricity market requires increased exchange capacities between the Member States in the North Sea Region. Therefore, seven interconnection projects are being planned in the region in the mid-term. Ireland and the United Kingdom will have two interconnections between them and other couplings, namely the United

Kingdom and the Netherlands, Germany and the Netherlands, Luxembourg and Belgium, France and Belgium and Norway and Denmark will have one interconnection between them. Projects eyeing reinforcement of the ageing internal grids are also being planned in the Member States in the region. The North Sea region is peculiarly suited to offshore wind energy and upgraded grids in the region shall facilitate better integration of offshore wind farms in the long term. The new grids will employ sub sea High Voltage Direct Current (HVDC) cables enhancing interconnections between Ireland, the UK, France, Belgium, the Netherlands, Denmark and Norway.

Long terms projects in the Baltic region are expected to bolster the grid capacity in the Nordic electricity system as well as connect the Nordic electricity market to the continental grids. These projects will add 1400-2800 MW additional capacity between the Nordic and continental power system. It will boost cross border capacity between Poland and Lithuania to 1000 MW of which 400 MW will qualify as spare capacity with possible exchange in both directions. The creation of an interconnected grid in the Baltic region will also enhance the system security in the Baltic system. Owing to the long term projects, the interconnection between Baltic and continental power transmission systems will have 400 MW additional capacity. Another interconnector of 500-700 MW capacity between Estonia and Latvia will provide for efficient exploitation of wind power in both the countries. The provision of interconnections between different national grids will improve both the RES-E and market integration between the systems. The long term projects marked as new projects will employ HVDC cables to minimise transmission losses over long distances.

The Mediterranean Energy Ring network proposed by the EREC coincides with the projected mid and long-term plans laid down by European Network of Transmission System Operators for Electricity (ENTSO-E) for continental south-west and central-south regions. In the mid-term, besides reinforcing internal grids, it is planned to create new interconnections between Spain and France and Spain and Portugal. Some projects solely aim at RES-E integration, namely the North axis projects from Galicia to the French border, the new Cantabrian Sea-Mediterranean Sea axis, the Trás-os-Montes 220 kV

network, the new 400 kV lines from Covilhã to Pego in the inland middle region of Portugal and two 400 kV lines between Batalha-Lavos and Lavos-Paraimo also in Portugal. Besides, many 220 kV networks are in pipeline in Spain to accommodate RES-E. Morocco, Algeria and Tunisia are already synchronously connected to Spain via subsea cables in the Straits of Gibraltar. In the central-south region, the completion of the 1000 MW HVDC line between Sardinia and mainland Italy, the double circuit 2000 MW AC link between Sicily and Mainland and the interconnection between Italy and South-East Europe are preliminary steps for the realization of the Mediterranean subsea grid. The upgrading of the existing power lines from 220 kV to 400 kV, namely Westtirol-ZellZiller and S.Peter-Ernsthofen in Austria, Calenzano-Colunga and Avise-Villeneuve-Chatillon in Italy, Feuillane-Realtor and Neoules-Broc Carros in France will reinforce the internal grids in the region. The consolidation and upgrading of the transmission network in this region is a precondition for the development of an electricity corridor between the EU and North Africa. (ENTSO-E 2010: 95-100)

In the long-term, state of the art electricity transmission networks in the region seek greater integration of the Southern European and North African energy markets by completing the Mediterranean electricity ring. This electricity corridor also enjoys considerable political support in the EU given the prospects of exploiting conducive climatic conditions for generation of RES-E and importing the surplus into the European continent. The Mediterranean Solar Plan and the Desertec initiative aim to install multi-megawatt of RES-E generation capacity in the Maghreb countries that could supply the increasing demand in these countries and export the surplus to Europe.

A substantial upgrading of the power transmission infrastructure is challenging task for many reasons. It requires massive capital investments. Moreover, maintaining the reliability of the grids will remain a top priority. At present, there is not much clarity over the upcoming renewable or conventional energy based power plants, which would determine the direction of the current flows. In the absence of crucial data, mid and long term planning of grids is a considerably difficult task. The upgrading and extension of the power transmission should enhance secure operation and quality of electricity delivery.

Alongside the technical aspects of grid planning other aspects such as market structure, environmental issues and the society's response towards large scale projects in different Member States as well as non-EU countries will also impact the implementation of these tentative projects. (ENTSO-E 2010: 150-152) In this context, inviting large investments for infrastructure in the power sector is a difficult task.

Hence, policy and regulatory frameworks at local, regional, national and the Union level will determine the course of investments in favour of a renewable energy based energy system. The EU stands at the crossroads where it has to take decisions about the future of its energy mix and energy system. It has to decide whether to effectively continue on the conventional path whose drawbacks are already visible or to innovate to a 100 per cent renewable energy scenario as seen by the EREC. (EREC 2010: 46) The potential of the new energy technologies has been proved and their penetration levels are headed northwards. The challenge will be to not just maintain the growth rate but accelerate it further. Presently, the greatest concerns around renewable energy sector are that of securing investments for the sector as well as compliant infrastructure.

However, state-of-the-art infrastructure alone will not result into an overhaul of the energy system. A more comprehensive policy framework is needed to realise the aim of an energy future totally based on renewable energy. The policy framework needs to be inclusive encompassing various sectors like energy, climate, research and development, industry, regional development and international cooperation, which in one way or other impact the development and penetration of renewable energy resources. The EU should continue with its strategy of energy efficiency and energy conservation. Moreover, the EU must ensure effective implementation of the other targets set for the year 2020. In its study *Rethinking 2050,* the EREC also urges the EU to set binding targets for 2030 at the earliest possible, a step which should reinforce the EU's commitment towards renewable energy and promote long term investment into the new energy technologies. Besides, it also calls for an EU wide carbon-tax. The aim is to internalise the external costs related to conventional fuels such as expenditure on healthcare and costs of environmental degradation. Such a move would also dissuade the use of fossil fuels and renewable

energy sources could fill up the void. Although, renewable energy sources now enjoy considerable public acceptance in many European countries, the EU will do well in stepping up efforts to create further awareness and acceptance. (EREC 2010: 47-48)

Renewable energy sources can provide a comprehensive long term solution to the twofold challenge of energy security and climate change. Energy security, climate change and climate protection are inevitably linked with global energy policies, leading to an energy-climate nexus with far-reaching foreign and security implications for regional and global stability, and human security. Lack of energy security and climate change will adversely affect the growth patterns. Policymakers need to address the twofold interrelated challenges of energy security and climate change to put the world on a path of sustainable development. Security of the global energy system and greenhouse gas emissions reductions are preconditions for sustainable development. There is a strong need to mitigate these factors and find a plausible long term solution. Mitigating climate change and securing energy supply requires a radical change in production, transformation and the use of energy globally. Present energy trends are not sustainable. Renewables can provide an alternative to the fossil fuels and bring about a restructuring of the global energy system. In the European context, renewables can provide a new dimension to the European development model, which will duly reflect in the EU's competitive edge in the business sector. The penetration of renewable energy sources represents a necessity, a challenge as well as an opportunity. They have proved their mettle as reliable energy contributors.

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