RENEWABLE ENERGY IN REGIONAL PLANNING AND DEVELOPMENT: AN EVALUATION OF DEVELOPMENT AGENCIES IN TURKEY

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submitted by **DEVRİM ERSANLI** in partial fulfillment of the requirements for the degree of **Master of Science in City and Regional Planning Department, Middle East Technical University** by,

Prof. Dr. Canan Özgen _____
Dean, Graduate School of **Natural and Applied Sciences**

Prof. Dr. Melih Ersoy _____
Head of Department, **City and Regional Planning**

Assoc. Prof. Dr. Bahar Gedikli _____
Supervisor, **City and Regional Planning Dept., METU**

Examining Committee Members:

Assoc. Prof. Dr. Serap Kayasü _____
City and Regional Planning Dept., METU

Assoc. Prof. Dr. Bahar Gedikli _____
City and Regional Planning Dept., METU

Assoc. Prof. Dr. Ela Babalık Sutcliffe _____
City and Regional Planning Dept., METU

Assist. Prof. Dr. Osman Balaban _____
City and Regional Planning Dept., METU

Instr. Dr. Burcu Çıngı Özüduru _____
City and Regional Planning Dept., Gazi University

Date: September 2nd, 2013

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Last name: Devrim Ersanlı

Signature:

ABSTRACT

RENEWABLE ENERGY IN REGIONAL PLANNING AND DEVELOPMENT: AN EVALUATION OF DEVELOPMENT AGENCIES IN TURKEY

Ersanlı, Devrim
M.Sc. in Regional Planning, Department of City and Regional Planning, METU
Supervisor: Assoc. Prof. Dr. Bahar Gedikli

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This thesis studies the renewable energy concept in regional planning. A comprehensive study is made about the renewable energy in Turkey, in a regional planning aspect. A profound analysis about the renewable energy related activities of the regional development agencies is made. The examples of successful regional and national planning policies in the world, for the increase in renewable energy utilization and sustainable energy generation are studied. The Turkish legal legislation about the renewable energy is discussed. Development agencies established in Turkey are studied in detail, including the legal framework, macro, and micro planning relations. The renewable energy related decisions in NUTS2 level regional plans, and renewable energy related activities of the development agencies are evaluated. The study concludes with a general evaluation of more effective renewable energy policy recommendations for Turkey.

Keywords: Regional Planning, Renewable Energy, Sustainable Development, Development Agencies

ÖZ

BÖLGE PLANLAMA VE KALKINMADA YENİLENEBİLİR ENERJİ: TÜRKİYE KALKINMA AJANSLARI ÜZERİNE BİR DEĞERLENDİRME

Ersanlı, Devrim
Yüksek Lisans, Bölge Planlama, Şehir ve Bölge Planlama Bölümü, ODTÜ
Tez Yöneticisi: Doç. Dr. Bahar Gedikli

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Bu çalışma, bölge planlamada yenilenebilir enerji kavramını araştırmaktadır. Türkiye'de yenilenebilir enerji konusunun bölgesel anlamda ne durumda olduğu derinlemesine incelenmiş ve kalkınma ajanslarının son yıllardaki yenilenebilir enerji faaliyetleri ele alınmıştır. Dünya'da yenilenebilir enerji kullanımını arttırmak ve sürdürülebilir enerji üretimi sağlanmak konularında başarılı olmuş ulusal ve bölgesel planlama politikaları incelenmiştir. Türkiye'nin yenilenebilir enerji konusundaki mevcut mevzuatı irdelenmiş ve kalkınma ajanslarının kendi mevzuatları, üst ve alt ölçek planlama ilişkileri çerçevesinde ayrıntılı olarak çalışılmıştır. İBBS2 ölçeğinde kalkınma ajansları tarafından hazırlanan bölge planlarının yenilenebilir enerji ile ilgili kararlarına ve kalkınma ajanslarının yenilenebilir enerji konusundaki faaliyetlerine de yer verilmiştir. Tezin sonucunda ise Türkiye için daha etkin yenilenebilir enerji politikaları konusundaki tavsiyeler derlenmiştir.

Anahtar Kelimeler: Bölgesel Planlama, Yenilenebilir Enerji, Sürdürülebilir Kalkınma, Kalkınma Ajansları

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CHAPTER 1

INTRODUCTION

1.1 General

Energy is the force and backbone of all of a society's development and generation of wealth. In the future, we must have a sustainable, affordable and climate friendly energy supply. Conventional fossil energy sources must be (and will be) replaced by renewable sources, gradually.

Since the late 1980s, there is a growing interest on the energy generation technologies from renewable sources. This concept has its roots in the energy crisis of the 1970s and the increase of environmental awareness in the early 1980s. The disturbance of import dependence of the energy resources led to the energy supply security threat concept, and renewable sources were designated as the remedy for this threat, since they are far more equally distributed over the global surface than the fossil fuels. There is an obvious need for a transition from the existing fossil fuel related energy generation approach to a more sustainable and renewable energy generation methodology.

In this transition context, city and regional planners face a new and comprehensive challenge. Starting from the last century, an increasing amount of the global population began to live in cities. The building and construction sector represents nearly half of all energy consumption and related emissions; transportation is another important source of pollution. But urban areas do not only produce the highest density of energy demands, they also dispose of the highest density of energy resources like the industries producing waste heat. (UP-RES 2010)

Planning, design and accomplishment of projects for eco-cities, eco-districts, zero-energy buildings and energy efficiency prove that city and regional planning does positively influence the application, generalization and publication of renewable energies and energy efficiency measures. It is the key to a socially, economically and ecologically more sustainable future renewable energy and planning concepts. Many practical examples across the world show that economic benefits can be achieved through planning that incorporates sustainability and energy efficiency related aspects.

There is a need for change in our behaviors and thoughts for the future, in order to accomplish the "energy transition". The transition can only be achieved when all the actors in the value chain have enough understanding for the need of change and knowledge of the technology of the renewable energy systems. Therefore in all levels of

planning, expertise and competency in climate and renewable energy is needed. Whereas the traditional approach perceives the energy supply and urban planning activities as separate areas of expertise, with the introduction of the responsibilities for creating smarter and more sustainable communities, and new skills and tools to planners; these activities can be connected and mutually enhanced. (UP-RES 2010)

Seeing the useful aspects of renewable energy, starting from the late 1980s, many countries have integrated the sustainable and renewable energy generation concept into their national and regional policies. In this study, German and Chinese experience will be discussed in order to assess the importance of regional planning in the field of renewable energy.

It is obvious that the spatial structures of the future urban cityscapes and rural landscapes will be shaped by the renewable energy technologies as well as the growth patterns and land use trends and tendencies. One of the actors in the generalization of renewable energies through the economical and spatial plans is the strategic planning tools, support programs and policies. The Regional Development Agencies are the responsible institutions for creating and executing these policies by the regional plans. Utilization of renewable energy is an important development issue among other planning subjects.

This study discusses the current situation of the support programs of the Regional Development Agencies in the renewable energy field, originating from the world experience in renewable energy planning, Turkey's renewable energy potential, historical development of the sustainability related concepts in macro level plans and current renewable energy related legislation of Turkey.

1.2 Background

Economic development concept is different from economic growth, in which the main parameters include monetary indicators. Economic development concept extends the economic growth concept by adding environmental, sustainability related and social and qualitative notions. Sustainability should be incorporated to the economic development for long-term stability and continuity of the economic, social and regional activities. United Nations World Commission on Environment and Development, in 1987, accepts any development as sustainable if it *"meets the need of present without comprising the ability of future generation to meet their own needs."* The social equity of the present day cannot be achieved if the economic activities of some groups jeopardize the well-being of other people living in other parts of the world. Then, it would not be possible to achieve the "intergenerational" equity. (WorldBank 2013)

The natural environment is in continuum, is not being shaped by the administrative borders of the countries. Therefore, it is among the important subjects of the international

law. The environmental problems have gained international dimensions, with the increase in quantity and complexity of the human activities. (Gedikli 2008)

“Sustainable” development could be restated as “equitable and balanced,” meaning that, in order for development to continue indefinitely, it should balance the interests of different groups of people, within the same generation and among generations, and do so simultaneously in three major interrelated areas: economic, social, and environmental.

A sustainable policy should pay attention to the achievement of policy goals while trying to find optimal tools for the prevention of social and economic inequalities. At the same time, the policy goals should be achieved in a sustainable manner, without depleting the limited reserves of all kinds of resources, including energy.

Renewable energy generalization and utilization policies are gaining wider applications in national and regional planning studies. There are miscellaneous barriers in implementing renewable energy related policies. These include cost-related difficulties like increased prices of equipment, high interest of credits and financing difficulties. Although there are considerable decreases in costs of renewable energy equipment, the first installation costs of renewable energy systems are higher than the same for other conventional systems. It is almost impossible for renewable energy investments to compete with other energy generation techniques without incentive mechanisms. Moreover the return of investment time for renewable energy systems is longer. Because of this, financial instruments are harder to find or more expensive, although the operation and fuel costs are almost zero (Çiçek, Öztürk and Özek 2009).

In order to overcome the cost based problems, renewable energy support policies are the main instrument that a regional planner possesses. Long term price guarantees and buying guarantees help investors to convince financial institutions. Besides economical efforts, non-economic factors like removal of legal and administrative barriers are needed for the success of policies. The availability of land resources and public lands are among other support systems for renewable energy related investments (Klessman and Held 2011).

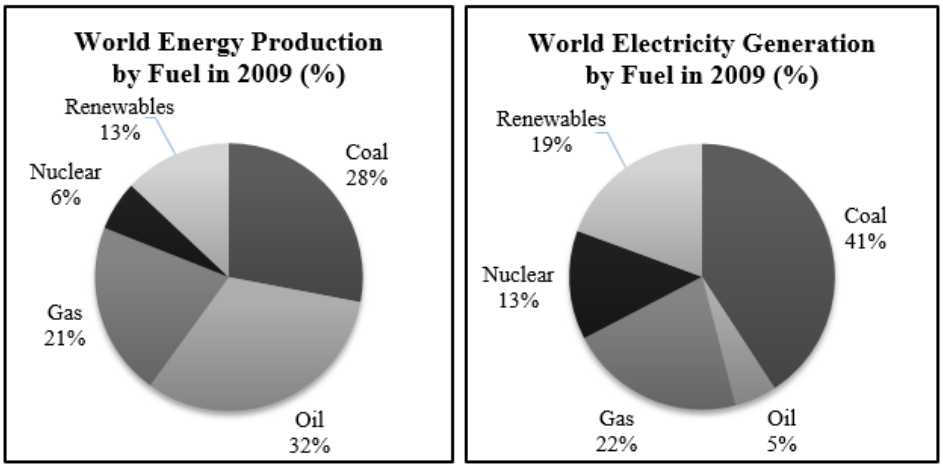


Figure 1 – Renewables have 13% share in World Energy Production, and 19% share in World Electricity Generation. Source: (European Commission 2012)

In spite of cost barriers and other problems, the ratio of energy generation from renewable resources will increase inevitably in the following years. Today, energy generation process (including transportation, urban and rural accommodation, heating and electricity) is still based on fossil fuels (Figure 1), but both the technology and generalization of renewable energy is becoming more important and valuable every day, because a sustainable energy policy can only be achieved by renewable resources. The import independency and security of energy resource supplies can be achieved by renewable and sustainable energy policies. The usage of renewable energy usage decreases the greenhouse gases (GHG) emission levels. As a result, renewable energy can be considered as the most sustainable and environmental friendly energy technology. It is predicted that the renewable energy usage will increase in geometric scale in the following years (Figure 2). Especially, solar energy is going to be a major resource for urban and industrial electrification.

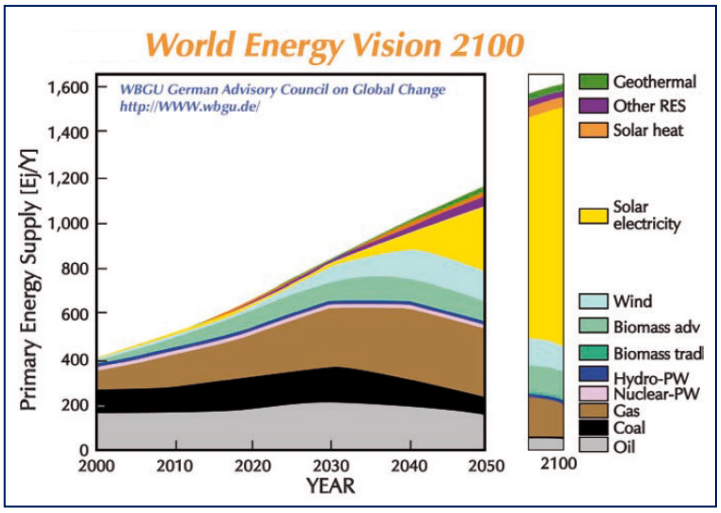


Figure 2 – World Primary Energy Supply, Projection (Source: German Advisory Council on Global Change)

Having seen these benefits and future advantages, many countries have started research and development activities regarding the energy generation from renewable sources, starting from 1980s. United States of America and Germany are the leading technology developers in the renewable energy field. Countries like Denmark, Portugal and Spain adopted and generalized the renewable energy utilization technologies. The last decade has seen other countries like China, India and Brazil increase their efforts in renewable energy technology and implementation fields (REN21 2012). Turkey is in an introductory stage to the renewable energy technologies.

The Types of Renewable Energy Sources

International Energy Agency (IEA) defines the renewable energy as the *"energy that is derived from natural processes (e.g. sunlight and wind) that are replenished at a higher rate than they are consumed"*. (International Energy Agency 2013)

The following section summarizes the types of renewable energy sources. (Renewable Energy Association 2013)

a. **Solar Energy:** Solar radiation emitted from the sun is used for generating electricity through a photovoltaic (PV) system. The important benefit of PV technology is that it delivers electricity at the point of installation and use. Solar PV cells can be utilized in large variety of applications, individual houses and buildings. It is also common to use PV arrays in large grid-connected solar farms. PV systems can also be installed in remote rural areas where grid connection is too expensive or not feasible. Additionally, in urban areas, it can be cheaper to

power street lights or other equipment with solar energy than with power from the grid.

Solar hot water systems or solar thermal systems are a well-proven and simple technology producing low-carbon energy. Solar water heating systems use roof mounted solar collectors to capture the energy released by the sun. This energy is then used to heat water for domestic and industrial uses. A small amount of electrical energy is consumed to pump this hot water to the utility. This energy can also be generated by a solar PV panel. (Renewable Energy Association 2013)

The solar energy systems generate no hazardous gases nor cause environmental pollution. Only during the manufacturing process, correct industrial environmental conditions shall be ensured. (Rao, et al. 2012)

b. **Wind Energy:** Wind is a renewable, free and indigenous energy source that has few environmental impacts and generates no pollution. Wind technology is being used around the world as an excellent means of electricity generation for serving growing energy needs.

   A wind turbine rotor (usually consisting of three blades) converts the wind's kinetic energy into mechanical energy and a generator is used for the generation of the electricity for productive use. Wind electric turbines provide electricity for residential or business use or for use by grid electric utility companies.

   A complete computer hardware and software controls the wind turbine, allowing the equipment to turn to the direction of the wind. In extreme weather conditions, the turbine is safely shut down in order to avoid unwanted situations. There are criticisms about wind energy turbines for damaging the birds in migration, generating noise, generating interference with electronic signals and claiming large amounts of lands in wind farm projects. In fact, all of these side effects can be mitigated by correct planning activities and choices in location and size of the wind farm projects. (Armstrong and Hamrin 2000)

c. **Hydro Energy:** Hydropower systems capture the energy in the moving (falling) water by hydro turbines. The rotating mechanical energy is then converted to electricity in order to meet the market demand, safely, cheaply and efficiently.

   Hydropower plants are configured in one of two ways. "River Type" projects use the natural flow of a river by diverting it into canals that lead into a power plant. In the second configuration, water is stored in a reservoir (dam) and sent to the power generation turbines as needed. Less than 10 percent of the world's technically usable hydropower potential is being utilized today. Small-scale hydropower plants are proving to be very cost-effective for strengthening grid-

connected systems and for rural electrification. However these plants can sometimes cause issues like: manipulating and changing the course of the local streams (riverbed derivation), covering of large natural or historic protection areas, disturbance of local ecosystems and decrease the bio diversity, or sometimes the displacement of the local population (Rao, et al. 2012). The location of the hydroelectric power plants should be carefully planned in order to avoid possible threats to wildlife and plants; historical sites; agricultural areas; protection areas and similar locations of importance. Complete river basin management studies should be prepared and taken into consideration, instead of just rerouting water to the power turbines by collector pipes. The riverbed derivation (completely altering the course of a riverbed or combining with another riverbed) must be strictly controlled. (TMMOB 2012)

d. **Geothermal Energy:** It is calculated that 99.9% of earth's mass is over 100 degrees centigrade and continuously generates hot water resources. Geothermal technology utilizes recent developments in drilling technology and it is possible to establish systems at depths of up to 5km. In such systems, water is injected into the hot rock via one well, it is then superheated by the rock before being abstracted via another well. These projects have early capital requirements and high initial exploration risks however, such systems are expected to provide energy for up to 50 years making them a cost effective and very reliable source of on-demand power, as well as heat and cooling (Renewable Energy Association 2013). Improper location of power stations and improper drilling of hot steam wells might lead to release of hazardous materials like boron, arsenic, mercury and noble gases. There is a risk of liquid depletion if the water is not pumped back to the well after usage. However geothermal energy shows increasing number of applications around the world. (Rao, et al. 2012)

e. **Biomass Energy: A**ny organic material such as agricultural residues, municipal waste, wood, wood wastes, and animal waste is the oldest source of energy known to humanity. Bioenergy is generated from biofuels - organic materials such as trees, agricultural residues, animal wastes, grass, aquatic plants, and municipal waste. These fuels store energy captured from the sun during photosynthesis. Bioenergy technology extracts the energy stored in biofuels through direct combustion or by converting the fuel into charcoal, liquid, or gas (Armstrong and Hamrin 2000). In biofuel case, most of the biomass fuel is gathered from fast-growing plants that are harvested specifically for energy production. Ideally, energy crops can grow on a marginal amount of land, grow without fertilizers or extensive maintenance, and protect the soil from erosion. However, there are examples of land-grabbing, where large amounts of agricultural lands are used for biofuel crops, decreasing the food output and fertility of soil. (Renewable Energy Association 2013).

Bioenergy systems can increase economic development and job creation. In addition, bioenergy has a strong role in the mitigation of the environmental concerns such as acid rain, waste disposal and global climate change.

All types of renewable energy sources mentioned above have their respective characteristics, technology and features. There are additional types of renewable energy sources like tidal energy and additional types of renewable energy are being researched. The scope, capacity and location for renewable energy projects should be carefully planned and selected in order to prevent the negative outcomes. This principle is valid for almost all type of urban and industrial activities.

1.3 The Aim and Scope of the Thesis

This thesis discusses the renewable energy concept in relation to the general planning perspective and specifically the regional planning perspective. Starting from the global developments in sustainability and renewable energy concepts, a research on the international policies is made. How the regional planning and regional development policies in Turkey considered energy and renewable energy subjects is discussed in detail.

The main research subject of the thesis is the establishment of NUTS2 level Development Agencies (DAs) in Turkey and the outlook and actions of these Development Agencies in relation with the renewable energy concept.

Research Methodology

The study mainly follows a literature review, content analysis and evaluation based research approach. The literature review study concentrates on:

a. The evaluation of the global context regarding the need for renewable energy sources
b. A comprehensive research of the worldwide national and regional renewable energy policies, with an emphasis on regional planning and spatial aspects
c. A chronological literature study about the planning and legal documents about regional planning and renewable energy
d. In order to include counter arguments, a review is made among the NGO and press reviews and releases about renewable energy

For this study, several data sources are used from different disciplines, such as:

a. Planning Documents: 5 year development plans and regional plans
b. Legal Texts: Laws, regulations, decree laws, policy documents and tariffs
c. Energy Statistics: Historical and categorized energy (electrical and gross) supply, consumption and projection figures including fossil fuels and renewable energy sources from Turkish and global sources
d. Conference proceedings, global declarations about renewable energy, environmental and sustainability issues
e. Interview with regional plan specialists

After establishing an objective framework describing the situation of renewable energy in Turkey's regional planning efforts, a selection of recommendations is presented. This information includes both the renewable energy experts' and the author's experiences from actual renewable energy projects and global lessons learnt from regional energy policies and applications.

Since the renewable energy applications in Turkey have a rather recent history (starting from late 1990s), the overall local literature and planning experience is currently in a development phase. This situation might be considered as an obstacle, especially the lack of reviews of legal texts from the renewable energy related point of view. The literature about the actual economic and planning related outcomes of renewable energy legislation and real life experiences is again limited, as of today. The thesis tries to combine renewable energy and regional planning efforts, which are different disciplines. From this point of view, the study has an innovative character, consequently including subjective reviews and evaluations.

Scope

The Introduction Chapter provides background information about sustainability, environmental problems, energy and renewable energy concepts.

In the second chapter, "Integration of Renewable Energy into National and Regional Policy: A Historical Evaluation", the global context about renewable energy utilization is discussed. The efforts for the development of renewable energy related sectors through strategic planning decisions and international treaties are explained. The renewable energy policies of two successful countries, Germany and China, are discussed in detail. Germany is a successful country in designing and administering national and regional policies about the renewable energies. This country is also an exemplary country for the research and development of machinery and equipment for renewable energy electricity plants. As another example, China is selected because of the acceleration achieved in renewable energy utilization capacity through successful regional planning decisions. This country has completed the transformation from being the importer for renewable energy equipment to being the manufacturer and exporter of machinery and equipment. A

case-study research is made for each country. The important policy decisions and regional planning examples are indicated which might be useful to Turkish case.

The "Evolution of Energy (and Renewable Energy) Policies in the Regional Planning Efforts and Policies in Turkey" is the third chapter of the thesis. This chapter discusses Turkey's current situation within the renewable energy concept. Initially, the renewable energy resource potential of Turkey is studied in order to see the national and regional potentials. The increasing demand for energy and the status of import dependence are among important arguments in this chapter. After assessing the importance of renewable energy resource assessment studies, the current situation of renewable energy projects in Turkey is summarized. In order to discuss the historical development of national and regional energy and renewable energy policies, the 5 Year Development Plans (5YDPs) are studied within energy and renewable energy focused scope. In each 5YDP period, a summary is made considering the national and global context. The section concludes with a comparative summary. The study continues with the detailed study of the Turkey's current legal and administrative structure about renewable energy. The Renewable Energy Law and Its Regulations are summarized and discussed within a regional planning scope. Some examples are included about the application of these laws and regulations.

The fourth chapter, which is about the Development Agencies (DAs) and their renewable energy related works, is the main focus of the study. As the DAs are responsible for preparing the regional plan documents under the guidance of the Ministry of Development, it is essential to study the planning decisions related with the renewable energies. An introduction to the DA discussion includes a summary about the NUTS2 classification methodology and the legal framework of the DAs. The macro and micro scale planning relations of the regional plans are discussed. The detailed overview of each regional plan document is made within the energy and renewable energy scope. The activities of each DA about the generalization and popularization of the renewable energy technologies are studied. The chapter also includes information about the support and grant programs, originating from EU. The Ankara Development Agency case has more detailed information as the result of an interview with a regional planning expert. Another interview with an expert of BEBKA Development Agency is made about the renewable energy support programs. All of these DA studies are combined in a comparative map, discussing the current situation of the agencies.

In the Conclusion chapter, a recommendations section is compiled in order to emphasize the best practices of renewable energy policies in both regional and national scales. This section includes further experience from local institutions and the author himself, having a background of renewable energy applications within Turkey and other countries.

CHAPTER 2

INTEGRATION OF RENEWABLE ENERGY INTO NATIONAL AND REGIONAL POLICY: A HISTORICAL EVALUATION

2.1 Introduction

From the strategic planning and policy design point of view, the introduction of the "energy production from renewable sources" concept dates back to the 1980s. The need for energy has been a major concern of the western central governments since the energy demand had been increasing in exponential terms. In order to minimize the import dependency for depleting energy sources like oil coal, natural gas; the governments focused on two strategic areas:

a. Conservation of energy, using less energy, being more efficient
b. Using renewable and sustainable energy resources, increasing the technology and the production of renewable energy plants

There are also political and socioeconomic factors that prepared a basis for government intervention. Some of these factors are: Oil Crises, the Chernobyl Nuclear incident and the increase in environmental public awareness.

As a result of global developments, The United Nations Conference on Environment and Development (RIO Earth Summit) was held in Rio de Janeiro on 3-14 June 1992. 172 governments were represented at the summit, of which 108 of them were represented by heads of state or government. With the participation of around 2400 representatives from worldwide NGOs, the following issues were addressed:

a. Patterns of production: Particularly the production of toxic components, such as lead in gasoline, or poisonous waste — will be inspected in a systematic manner by the UN and the participating Governments

b. In order to replace the use of fossil fuels, alternative sources of clean and renewable energy will be researched in order to prevent the global climate change

c. Increased usage of public transportation systems is emphasized in order to reduce private motor vehicle emissions, traffic jams and congestion in cities and the health problems caused by polluted air and smog

d. There is much greater awareness of and concern over the growing scarcity of water (United Nations 1992)

The two-week Earth Summit was the outcome of a process that began in December 1989. The education, planning and negotiations among all Member States of the United Nations had led to the acceptance of Agenda 21; an Agenda for the 21st Century that includes wide-ranging action guidelines to achieve worldwide sustainable development. *"Agenda 21 is a comprehensive plan of action to be taken globally, nationally and locally by organizations of the United Nations System, Governments, and Major Groups in every area in which human impacts on the environment"*. It is a non-binding, voluntarily implemented action plan. Many countries have published their local versions of Agenda21. (UN 2012)

The Rio Earth Summit influenced all the following UN and other environmental conferences, which have studied the relationship between human rights, population, social development, women and human settlements — and the need for environmentally sustainable development.

Among other outputs, two important legally binding agreements were opened for signature: the Convention on Biological Diversity and the Framework Convention on Climate Change (UNFCCC). The (United Nations) Framework Convention on Climate Change is the regulatory organization that supports the governments to cooperatively consider what they could do to limit average global temperature increases and the resulting climate change (UNFCCC 2013). Turkey has also participated in the Rio Summit and signed the declaration document (Çevre ve Orman Bakanlığı 2010). The Local Agenda 21 project was initiated in 1997. The National Environmental Strategy and Action Plan[1] has completed in 1998. Turkey did not sign the Framework Convention on Climate Change document in Rio, attended the convention as a participating country in 2004. (Gedikli 2008, 92)

By 1995, countries realized that the provisions in the Convention for the reductions in emissions were not enough. In order to strengthen these provisions, after two years of negotiations, they adopted the Kyoto Protocol.

The Kyoto Protocol legally binds developed countries to their emission reduction targets. The first commitment period of the protocol had started in 2008 and ended in 2012. The second commitment period began on 1 January 2013 and will end in 2020 (UNFCCC 2013).

There are now 195 Parties to the Convention and 191 Parties to the Kyoto Protocol. The UNFCCC secretariat supports all institutions that have taken part in the international climate change negotiations.

[1] Ulusal Çevre Stratejisi ve Eylem Planı (UÇEP)

The signatory bodies of the Kyoto Protocol (countries, regional economic organizations etc.) set their own legally binding targets regarding the decrease percentage in greenhouse gases (GHG) emissions. Turkey did not set a target, so although it has signed the protocol on February 2009, Turkey is not a part of the global efforts in decreasing the GHG emissions (EU Emission Database for Global Atmospheric Research 2013).

In parallel with these developments, the European Union has published two directives regarding the "gross national electricity production from renewable sources" in 2001 and 2009 respectively:

a. The directive 2001/77/EC, which took effect in October 2001, sets national indicative targets for the production of renewable energy from each of the member states. These targets are not mandatory; however the European Commission will monitor the progress of the member states and if necessary, will be able to propose mandatory targets for the countries which have missed their goals. The objectives contribute toward achieving the overall indicative EU targets, which may be summarized to a 12% share of gross renewable domestic energy consumption by 2010 – and a 20% share by 2020. There were 15 member states at the time this directive was legalized, and "national indicative targets on 2010" was met by only 4 of them, including Germany (European Commission 2012, 102-103).

b. The latest directive 2009/28/EC that took effect on April 2009 re-states the former EU Directive's indicative targets, which is a 20% renewables share by 2020. This directive adds interim targets for each two year period until 2020, in order to ensure smooth increase in renewable energy production (European Union 2009, 46-47).

The latest Renewable Energy (RE) Directive of the European Union covers electricity, heat, and transport. This new Directive replaces two older Directives, one for electricity and one for biofuels.

The RE Directive is part of the legislation to decrease the greenhouse gases across Europe by 20%. The RE Directive also includes a 10% binding minimum target for biofuel consumption to be achieved, in addition to the mandatory overall target of 20% renewable energy by 2020.

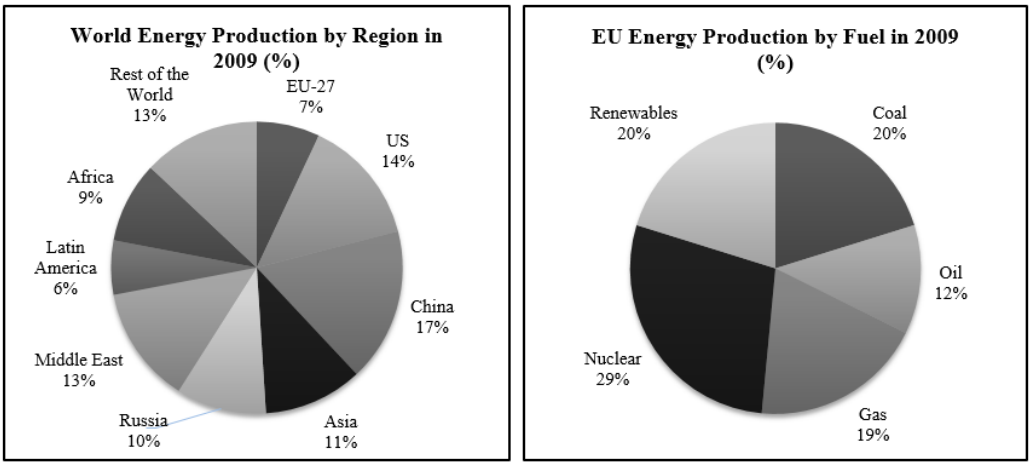


Figure 3 – EU Produces 7% of World's Energy and 20% of this portion is generated from Renewable Sources – Source (European Commission 2012)

The planning leading up to the RE Directive proposal included an impact assessment process with numerous consultations and stakeholders. In the planning process, these documents were important, because they have provided cost and benefit estimates and outlined approaches for allocating targets. These key principles were used in the assessment: cost-effectiveness, internal market and fair competition, flexibility, competitiveness, and innovation.

Under the new RE Directive, member states submitted National Allocation Plans (NAP) that outlines policies and measures to meet their targets. If a member state could not meet its target, there is a penalty, but its details are not included in the RE Directive (Wiser, et al. 2008, 30-34).

Like the EU countries, other countries, too, aim to increase their Renewable Energy sources utilizations. This is achieved via feed-in-tariff mechanisms combined with R&D activities and increase in investments regarding the renewable energy power plant technologies. Global investment in renewable power and fuels increased 17% to a new record of total 257 billion USD in 2011. China and Germany were among the leading countries (Figure 4).

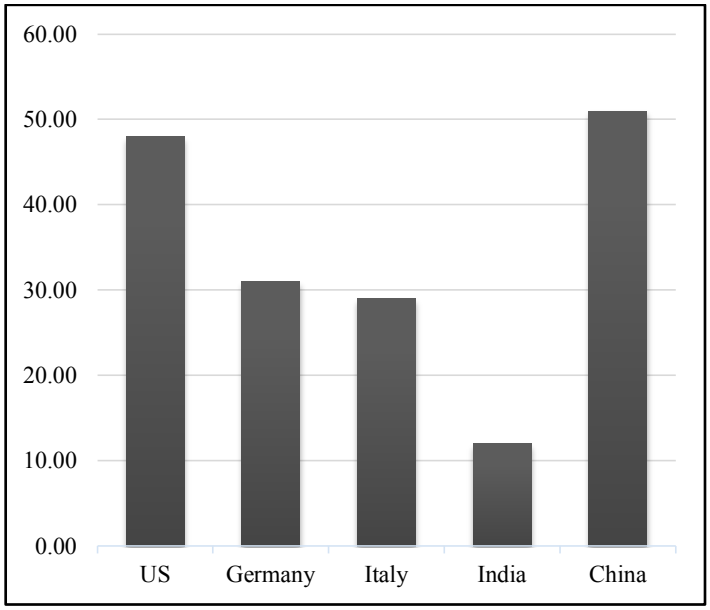


Figure 4 – Renewable Energy Investments in 2011, Billion USD, (REN21 2012)

Within this context, especially the wind energy sector is increasing the global installed wind turbines since 2000. The below figure summarizes the increase in wind energy projects worldwide. China, in 2010, became the wind energy capacity global leader. And China is increasing the gap onwards, as the leader in wind energy capacity. (Figure 5)

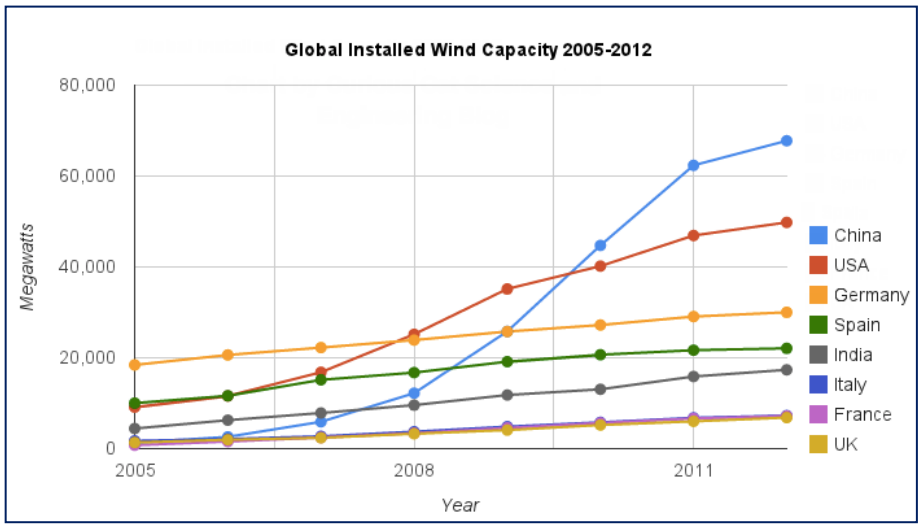


Figure 5 – Global Installed Wind Capacity. Chart source: CC Science and Engineering, data source: Wind Energy Association

It is important to evaluate other countries' renewable energy related central and regional planning policies and their impacts on total economic growth and minimization of environmental damages. It is also necessary to assess Turkey's efforts in the renewable energy policy design. Among many types of incentives and policies, Turkey uses limited support measures (Table 1).

Table 1 – Renewable Energy Support Policies, Selected Countries

	Regulatory Policies				**Fiscal Incentives**				**Public Finances**			
	Feed in Tariff	Electric Utility Quota Obligation	Net Metering	Biofuels Obligation	Heat Obligation	Tradable REC	Capital Subsidy or Grant	Investment or Production Tax Credits	Reduction in Other Taxes	Energy Production Payment	Public Investment Loans or Grants	Competitive Public Bidding
United States	o	o	o	x	o	x	x	x	x	x	x	x
China	x	x		x	x		x			x	x	x
Germany	x			x	x		x	x	x		x	
Turkey	x			x								

o: some regions
x: whole country

source: Renewables 2011, Global Status Report

After the acceptance of NUTS criteria in 2002, regional development agencies have been established and these agencies are financing the renewable energy projects with EU grants and other financial mechanisms. Along with the national support policies, Table 1, the regional policies are of great importance. In order to analyze the regional renewable energy policies, the renewable energy resource potential of Turkey must be taken into consideration. A brief look at the existing plants is necessary while assessing the potential projects and distribution of the investments by regions. These issues will be discussed in 4.1.

2.2 Renewable Energy being Strategically Planned and Implemented as a "National Policy" in Many Countries since the 1980s.

In the past 30 years, in order to increase the investments in renewable energy, many countries have created and undertook support programs, incentives and subsidies. These programs have produced wide positive outcomes. In more countries, citizens demand the introduction of similar renewable energy support programs.

This chapter focuses on deployment of subsidies and support programs in two countries: Germany, a developed economy, which made important investments in the wind industry; and China, an emerging economy, and a relatively new player in the renewable energy industry, which has completed large numbers of projects in the global market. The achievements in these examples could be used as benchmarks or transfer of experiences when discussing Turkish case. This does not mean the exact application of these countries' policies, but the gaining of inferences from the adoptable successful examples.

2.2.1 Germany Example

Germany has been an important country that has shown more than satisfactory advancements in the promotion, technology and the usage of energy generated from renewable sources. Among the large industrial countries, Germany is one of the leading countries in terms of installed wind energy capacity and solar energy installations. This capacity is due to the regional and central renewable energy policies, not because of an exceptional resource base. All these efforts led to a remarkable expansion of this sector. (Mez 2004, 599)

Renewable energy caught the attention of German policy makers around the 1973 oil crisis. Germany's government increased R&D spending for domestic energy sources, including renewable energy, although the large amount of the spending was made to nuclear and fossil energy sources. Between 1974 and 1982, annual financial supports for renewable energy research and development increased from 10 million USD to over 150 million USD. This increase in R&D spending gave way to the increase of several functions for successive developments in the renewable energy sector. The spending attracted the attention of universities, private research institutes, and smaller start-up companies. In time, they created research networks and thereby a collection of technical knowledge. Furthermore, renewable energy experts were able to work on several publicly financed wind power and solar projects. They proved that the renewable energy had indeed the potential to become a significant source of clean and sustainable energy (Laird and Christoph 2009, 2619).

As a result of the renewable energy research and development efforts, the earliest German Renewable Energy Law (Stromeinspeisungsgesetz - Feed-In Law) became effective in January 1991. The Feed-In Law required electric utilities to connect energy generators from renewable sources to the national interconnected electricity grid. The electricity companies were obliged to buy the energy generated from renewable sources at the rates of 65 to 90 percent of the average tariff for final customers. Moreover, the overhead sums for this subsidy were divided equally between the customers in the nation. That resulted in negligible additional cost per customer for the financing of the tariff subsidy. Investors in renewable energy were not required to negotiate contracts or engage in much bureaucratic activity (Mez 2004, 600).

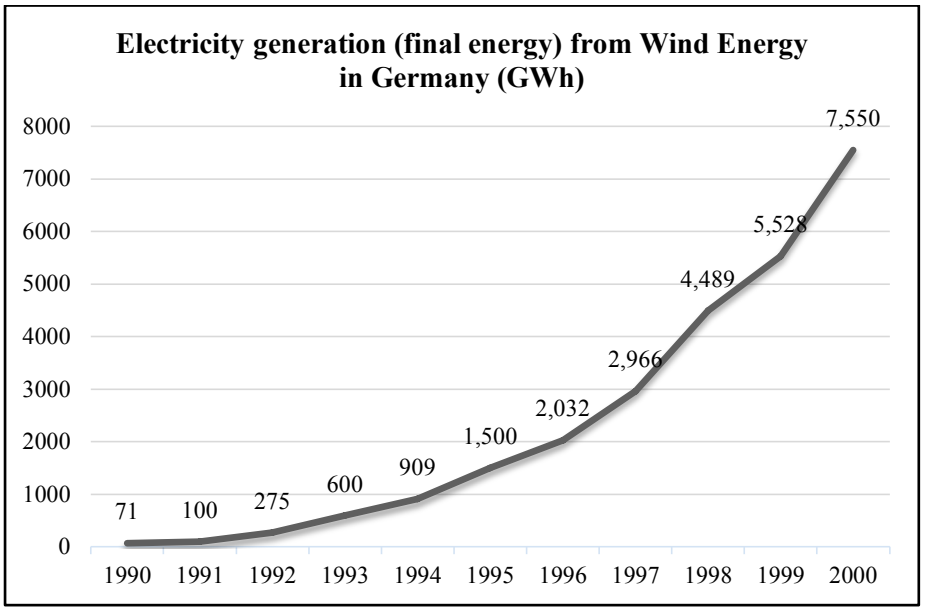


Figure 6 – Electricity Generation from Wind Energy, Germany, (1990 - 2000), (source: (Federal ministry for the Environment 2011), 16)

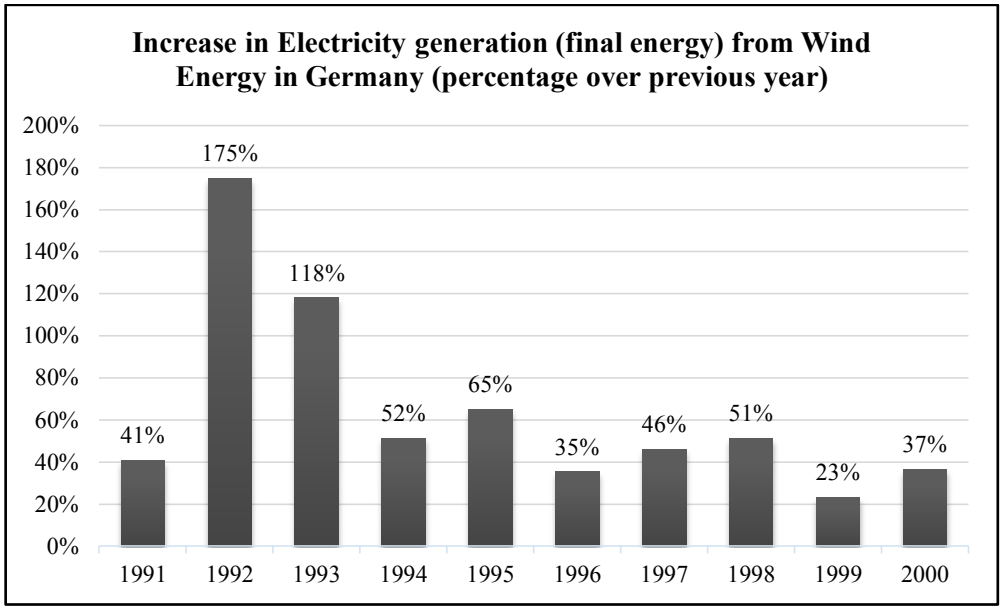


Figure 7 – Increase in Electricity Generation from Wind Energy in Germany, (1990-2000), (source: Figure 6)

This legislation has made an incredible increase in renewable energy projects all over the country. It is possible to see the effects of the Feed-In Tariff Law in Figure 6 and in Figure 7. Especially in 1992 and 1993, there is over a hundred percent increase in previous years' figures meaning that the investors and renewable energy project developers have decided to increase their investments in the electricity generation projects from renewable energy sources (Figure 7). Moreover, individuals were attracted from these beneficiary policies and responded with increasing numbers of renewable energy source plant installations.

Although the high tariff (electricity buying) rate encouraged wind power projects that were located in good spatial locations, it was not high enough for the Photovoltaic (PV) solar power plants to be operated profitably. Also, the Feed-In Law did not include guaranteed tariffs for other renewable sources, such as for biomass. (Mendonça and Corre 2008, 2)

The newly booming German Renewable Energy Industry needed more specific and to the point legislations including the effects of technological developments. The investors were continuing to increase the size and number of renewable energy projects, and the Feed-In Law was not answering all of the industry's needs. There was a policy flaw reflecting the technological advancements' added values to the tariff scheme. Because of this policy issue, investors could not enjoy the positive outcome of the new designs, advanced and more efficient renewable energy plants.

As the result of these needs, another legislation called "German Renewable Energy Act – EEG" was approved in 2000 which is still in regulation today with a number of amendments. Being the successor of the previous Feed-In Law, it is the most effective policy tool that made Germany in top three renewable energy generating countries. It has been influential in other countries' (including Turkey) renewable energy tariff policies and legislations. In parallel to Feed-In Law, the EEG law had price oriented principles. These are:

a. Every kilowatt-hour of electric energy that is generated from renewable energy facilities receives a fixed feed-in tariff. The wholesale companies (grid operators) must feed this electricity into the grid preferentially to the electricity generated by conventional sources (coal, natural gas and even nuclear power). Renewable energy plant operators and investors receive a 20 year, technology specific (wind, solar, biogas, etc.) guaranteed payment for their produced electricity. By this financial guarantee, SME's and private owners are encouraged to invest in renewable energy projects, which they did in exponential increments.

b. A country wide equalization scheme was put into practice for the costs that grid operators incur as the result of the different amount of renewable energy each region feeds into power grid. This regulation leads to an even distribution of the renewable energy power amounts and extends remuneration to all energy supply companies and ultimately to all end customers.

c. Technological innovation by falling feed-in-tariffs: periodically lowering rates of remuneration for new plants (decrements of 1% per year) exerts cost pressure over manufacturers. By this method, technologies are becoming more efficient and less costly.

One of the goals of the EEG is to speed up the market launch of technologies for electricity production from wind power, solar radiation, biomass, geothermal power and hydropower, as well as mine gas. One of the legislation's important elements is the obligation of the grid operators to give priority to electricity from renewable energy sources, and to pay for it according to fixed tariffs (Federal Ministry for the Environment 2007, 2).

The EEG introduced a fundamental change in energy supply: every citizen can now become an energy producer. The electricity operators have promised to accept this electricity, and to pay fixed fees for the renewable electricity. After just a few years this has created an independent, successful and developing industry which is initiated by the businessmen, the know-how of numerous small and medium-sized enterprises and the enthusiasm of solar energy institutions, environmental groups and agenda groups.

The direct economic benefits of the EEG to the German Industry and Economy can be summarized as:

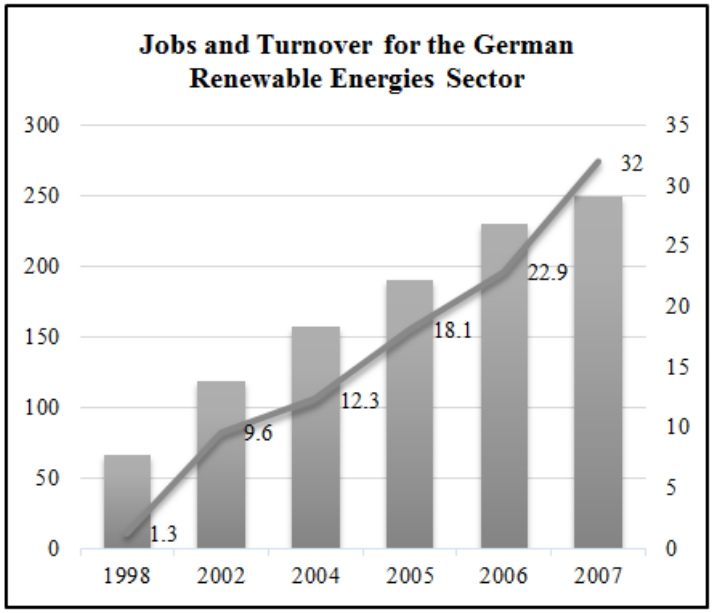
a. **New employment opportunities:** In 2006, the number of people employed in the renewable energy sector - including foreign trade and other value added industries – increased to more than 230,000 (Figure 7). Within these new employment opportunities, 130,000 can be directly attributed to the EEG. The increment in employment generally occurs in industrial zones. New manufacturing plants and factories are established creating components and equipment for renewable energy plants. Since a renewable energy plant is a multi-disciplinary production, this type of manufacturing creates employment for different types of professionals. Specialization occurs; like a factory only producing standardized components for many wind turbine vendors.

   The renewable energy plant locations are often remote areas with limited access and/or habitable conditions. Mountain-tops, cliffs, valleys (for increased solar radiation) or even deserts and oceans are common places for renewable energy plant locations. Utilizing most technological control system software and sensor driven operating and emergency systems; these plants minimize the need for human intervention and operation. During the regular maintenance periods, a short visit to plant sites is enough for uninterrupted operation. All of these high-tech requirements gave way to an enlargement in the industrial electronic control sector, as well.

b. **Increase in the Industry and Manufacturing of Renewable Energy Plants:** German renewable energy related businesses had a global market share of 15% in 2006. Investments in electricity-generating equipment from Germany are projected to increase from 9 billion euros (2005) to an estimated 20 billion euros in 2020. (Figure 7)

c. **CO2 reduction:** The EEG is the most effective instrument for reducing CO2 emissions. By 2006, 45 million tons of CO2 had already been saved. The legislations in the EEG have avoided external costs of around 3.4 billion euros which would have arisen if the electricity had been generated by fossil fuel power stations from coal, gas or oil.

d. **Increased share of renewable energy in the total energy consumption**: The share of renewable energies of gross energy consumption amounted to 12% in 2006 (2000: 6.3%). Germany will be able to increase this percentage to 27% by 2020. By 2030 this share is to rise to 45% (Federal Ministry for the Environment 2007, 4).



Left axis and columns: jobs generated (thousands)
Right axis and trend line: Annual turnover (billion Euros)

Figure 8 – Jobs (Generated) and Turnover for the German Renewable Energy Sector, (1998 – 2007), (source: BMU)

After its approval in 1 April 2000, the EEG has received amendments and revisions in order to reflect the recent changes in both technology and the energy market rules and regulations. A special mention should be made of the 2003 Interim Photovoltaic Act, which introduced appreciably higher fees for photovoltaic, and the comprehensive law amending the EEG of 2004.

Table 2 – Cost and Benefit Effects of the German Renewable Energy Law (EEG), (source: Engineering Agency for New Energy Sources)

Cost Effects of German Renewables Act			**Benefit Effects of German Renewables Act**	
Additional costs as compared with conventional electricity generation	3.2 billion Euros		5.0 billion Euros	Reduction in the electricity wholesale price
Additional costs, energy regulation and grid transmission	0.1 billion Euros		3.4 billion Euros	Avoided external costs from climate change and air pollutants
Additional transaction costs, personnel costs	0.002 billion Euros		1.0 billion Euros	Savings in energy imports, hard coal and natural gas
= 3.3 billion Euros			**= 9.4 billion Euros**	

With the help of the EEG, by 2010, Germany uses 12.5% of its total energy consumption by electricity generated from renewable resources. The benefits of the EEG for the economy are already considerably higher than the costs that have incurred by the investments, (Table 2). This cost was estimated at 3.3 billion euros for 2006. By contrast, the benefits of this policy amount to 9.4 billion euros. The reduction of the wholesale price for electricity with 5.0 billion euros was the most tangible benefit that corresponds to a price cut of around 15%. Furthermore, the EEG has contributed to a saving of 45 million tons of CO2 emissions (2006), which avoid damage to the climate and environment amounting to 3.4 billion euros. Lastly, the saving of around 1 billion euros against energy imports of coal and natural gas can be credited to the EEG. (Federal Ministry for the Environment 2007, 15)

Under the terms of the EU Renewable Energy Directive (Directive 2009/28/EC), Germany has committed to a legally binding target of using 18 percent of its energy consumption from renewable energy sources. Under this directive, each EU member state (including Turkey, as a candidate country) is obliged to adopt a National Action Plan (NAP) which sets out the steps required to reach its target and its progress in reaching such target to date. The NAP for Germany was adopted in August 2010. The overall share of energy (electricity, heat and transport) from RES was 10.9 percent in 2010 and the last German progress report under the EU Renewable Energy Directive (covering 2009 and 2010) confirms that it is on target to meet its EU obligations by 2020.

It should be noted that the decrease in German CO2 emission levels include the closedowns of several Soviet factories during the merging of West Germany with East Germany. These events positively affected the decrease in CO2 emissions although limited mitigations were implemented other than simply ending the Soviet factories' activities in East Germany (O'Ronain 2013).

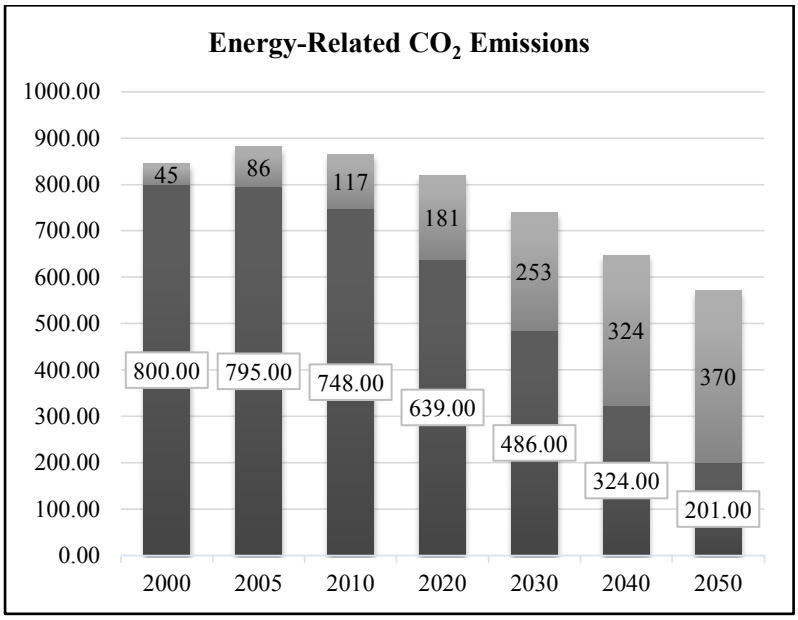


Figure 9 – Savings in Energy Related CO_2 Emissions (million tons), Germany, Forecast, 2000-2050, (source: BMU)

By the decisions taken in the Kyoto Protocol, the industrial nations committed themselves to reducing their CO2 emissions between 2008 and 2012 by 5% as against 1990 levels. Germany is going beyond that in its National Climate Change Program and has set itself this clear goal: Between 2008 and 2012 greenhouse gas emissions are to be reduced by 21% compared to 1990 levels. By 2003, an 18.5% reduction had already been achieved. The target reduction will be achievable by expanding renewable energy utilization levels and better efficiency measures. For this purpose, concrete targets are being set for the private household, transport, industry, trade and services, farming and forestry, and waste management sectors. The private sector is integrated into the climate strategy through carbon emissions trading. (Figure 9)

Since the beginning of the first legislation in 1991, Germany is constantly increasing its use of renewable energy sources. When these legislations are put into practice, the regional entities in Germany are the most active regulators and enforcers of these policies. In order to give a comprehensive example, the Hannover Region is examined. This region is a renewable energy region in the northern part of Germany, having regional

renewable energy sources utilization programs; there are several 100% renewable energy sub-regions around this region.

2.2.2 Hannover Region Case Study

In 2001, the Hannover Region emerged as an administrative entity consisting of the City of Hannover and the surrounding 20 municipalities. The City of Hannover is the capital of Lower Saxony State and the administrative center of the Hannover Region.

The Hannover Region extends for about 60 km from east to west and 55 km north to south; except for the southeast, most of the Region lies within a 25-km radius of Hannover city center. Around 1.1 million people live within 2,290 km²: around 518,000 of them at the center, the City of Hannover, and 612,000 in the surrounding communities (Landesbetrieb für Statistik und Kommunikationstechnologie Niedersachsen LSKN, 2007).

The Hannover Region is responsible for numerous tasks such as regional planning and addresses the multiple issues of an integrated urbanized region. Most local government responsibilities that go beyond the town and city borders are now met by Hannover Region administration. This is an innovative regulation to the challenges presented by the multiple and diverse relationships between a major city and its hinterland.

The Region Hannover statute passed by the State Parliament created the foundation for regional policymaking by a single body. Hannover Region is, among other things, the competent body for regional planning, environmental protection, regional economic and employment promotion, local public transport, waste management, health services, and social and youth welfare. The Development Agencies in Turkish case are, by legislation, not as active as the Hannover Region's broad authority and study areas. Our version of regional planning bodies is more of a supporting and organizing character. The Turkish DAs within the renewable energy scope is discussed in section 4.1.

The main concerns of regional planning are to guide and shape spatial development processes in accordance with a vision statement and to resolve conflicts on land use on a macro scale. Like many regional planning authorities within Europe, the Hannover Region is constantly dealing with the following issues:

a. New housing developments or transport routes.
b. The areas where nature conservation have overriding priority.
c. Protecting and securing the basic natural renewable resources i.e., water, soil and air; as these are the essential needs of human beings, flora and fauna.
d. Devise action plans and policies to meet the increasing demands in energy, residential and commercial land and all kinds of urban and municipal services.

In brief, Regional Plan is the linking instrument between state spatial planning and municipal land-use planning. Within the Hannover Region's Regional Planning activities, particularly important or sensitive uses such as settlement development, nature, passenger airports and wind parks, 'priority areas' or 'priority locations' are designated. This classification is associated with a higher degree of protection, pre-eminence over other uses. These designations have the authority of overriding objectives in the Regional Plan and must be observed and obeyed by the various planning authorities and especially by local authorities.

Electricity generation from Renewable Energies in Hannover Region

The City of Hannover is a major urban center while the other municipalities are small towns having a rural character. Due to its natural environment, wind energy is the most economically viable renewable energy source. In the region, geothermal, bio and solar energy sources play limited roles.

Compared to nationwide average values for power generation from renewable energies in Germany, the proportion of wind energy is comparably high. While the share of wind in electricity production from renewable energies in Germany is 52%, in the Hannover Region it is 82%. The use of hydroelectricity is significantly behind the average values for Germany (Germany: 26%; Hannover Region: 3%). The share of biogas and photovoltaic in the mix of renewable energies deviates only slightly from the nationwide average (Biogas: Germany 14 %, Hannover 10 %; Photovoltaic: Germany 8 %, Hannover 5 %) (Table 3) (The Federal Institute for Research on Building 2013).

Table 3 – Renewable Energy profile of the region Hannover, 2010
(The Federal Institute for Research on Building 2013)

Type of Renewable Energy Source	Quantity (No. of Plants)	Installed Power (kW)	Electricity (MWh)	Energy Percentage	
				In Region	In Germany
Photovoltaic	2459	26018	23545	5	8
Wind Power	237	288070	403828	82	52
Hydropower	9	3428	15073	3	26
Biogas	25	8936	50354	10	14

The Hannover Region Planners are aware of the fact that the wind power protects the climate, and the German Renewable Energy Sources Act and Federal Building Code (Baugesetzbuch) promote its expansion. The task of regional planning is to designate suitable locations for wind power plants and to prevent wind power development at

inappropriate locations, thus concentrating wind farms at specific sites that have adequate wind energy resources, preferably around the perimeters of the region. The aim is the prevention of the scattering of the wind turbines over large areas of urban countryside.

Planning of locations for wind turbines is made within the framework of the overall spatial plan: suitable sites are identified by working from a list of exclusion criteria such as nature conservation areas and sufficient distance from settlements and forests. Further consideration of effects on the landscape´s appearance and economic factors such as wind probability and grid connection leads to the final designation of possible sites.

As the result of these regional planning studies, the 2005 Hannover Region Regional Plan designates more than 40 "priority sites for wind power", which today have a total generating potential of over 300 MW (this potential is enough to meet the electricity demand of 30.000 houses – if 10 kW / house is accepted as the nominal average consumption). Upgrading wind plants – replacing weaker turbines with more technically advanced and efficient ones – can raise this capacity in the long term to an estimated 400 MW. Going beyond the location criteria in the Regional Plan, the locational and environmental compatibility of wind power sites can be ensured through further stipulations in land-use planning and technical approval for more quality wind turbine plants. Possible disturbance factors such as noise and shadow flicker can be minimized by imposing operating conditions and taking appropriate technical and spatial precautions.

As a spatial design instrument, Hannover Regional Plan has enough flexibility and update capacity e.g., through procedures to deviate from planning aims or planning supplements. This is particularly important if the strategy is to respond to sudden developments or new planning proposals that require regional planning consultation.

The practical actions that the Hannover City and Region have imposed are distributed to very diverse areas in sustainable development. Some tangible and re-usable mitigation efforts including the ones that lead to decrease in carbon dioxide emissions and increase in RE usage are sampled below:

a. Establishment of an Energy Agency as the result of a close cooperation between the public utilities,
b. Improvisation in public transport (new railway station and tramlines),
c. An extensive heat loss prevention and building insulation program,
d. Development of small co-generation plants (generating electricity and heat at the same time, within the same process),
e. Development of the NEH house (Niedrig Energie Haus = Low Energy House) and making this house available to public and supporting the people to benefit from the renewable energy technologies and efficiency ideas used in the making of this prototype house.

The following milestones can be summarized in the period 1992-2002:

1992: As a response to the objectives set out at the Rio Earth Summit, Hannover City Council committed that in 2005, CO2 emissions will be reduced by 25% compared to 1990. It is decided that energy saving is the main objective, support for rational use of energy and usage of renewable energy sources, and a reduction of the electricity from nuclear power.

1994: Within its environmental division, the City Council established a section for the protection of energy and climate. Its duty is to set up CO2 auditing and climate protection programs and carry out municipal climate protection projects. This section had completed successful projects on energy saving in kindergartens, schools (from 1998), and building of city administration (from 2000). This saves both CO2 emissions and money – over 400,000 Euro a year, from which the institutions receive 30 percent. 40 percent is used on further energy and water saving measures, and the remaining part sent back to the municipal budget. The section supports the inclusion of renewable energy related clauses in contracts for the sale of developable land e.g. requiring low energy houses and distributed cogeneration plants and again supports the development plans in which energy efficiency is emphasized.

Within the European Union THERMIE project, between 1994 and 1997 Hannover Municipality subsidized and supervised thermal insulation measures in 26 multiple-occupancy houses with a total of 300 apartments. The project showed that an average 50% saving on heating energy is possible through economically viable measures.

Small scale combined heat and power stations (CHP) use their fuel with efficiencies of around 90 percent. Hannover is therefore trying to increase the contribution of such distributed CHP plants; the number of such CHP plants has risen to 53.

1998: The City Council of Hannover, five municipalities around Hannover and partners from private enterprise and the community set up the proKlima climate protection fund that supports energy-efficient retrofitting of older buildings, innovative designs for new construction, popularization of carbon dioxide emission saving and the use of renewable energy sources. An average of 5M Euro per year is made available for around 1,500 grant applications. As a result approximately 16.000 tons of annual reduction in carbon dioxide emissions is reached.

The new suburb of Kronsberg has been taking shape since 1997, which is a model of city planning, social and ecological practice. A low energy standard was set for housing throughout the entire development. A district heating by-law was imposed requiring compulsory connection and use. In this new residential area, the City of Hannover has succeeded in reducing carbon dioxide emissions by 60% compared to conventional new construction. Around 1,350 m^2 of solar collectors are used to heat 104 social housing apartments in Solarcity at Kronsberg. These also feed a thermal storage tank, sunk six meters into the ground, with a total volume of 2,750 m^3. This means that solar energy can

be used from spring to December, covering around 40% of total heating needs, with the remainder coming from the district heating network.

The Kronsberg development also features a passive house development of 32 terrace houses. These houses require almost 90% less heating energy than conventional terraced houses, due to 40-cm thick thermal insulation, extremely airtight structures; while solar panels on the roofs provide hot water almost all year round. The remaining minimal energy needs are compensated for by the owners' shares in a wind turbine generator on Kronsberg Hill bringing overall carbon dioxide emission savings up to 100%.

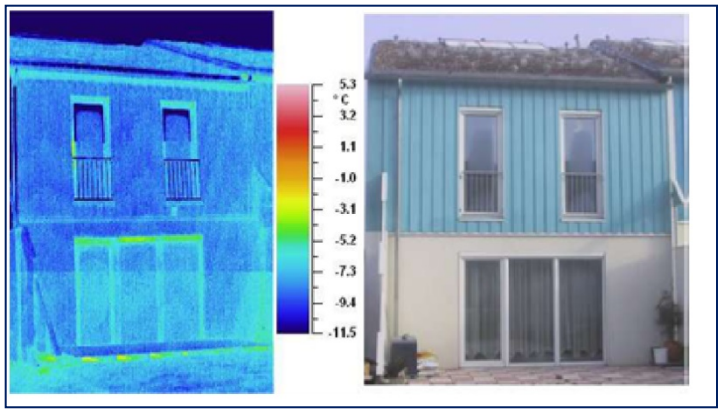


Figure 10 – Heat losses are kept minimum at the Kronsberg Passive Houses, (source: Passiv Haus Institut)

2001: The city administration offers investors the chance to install and run photovoltaic units on the roofs of municipal buildings. To encourage the use of solar energy, Hannover City Council has made the roofs of municipal buildings available to private investors for the installation of photovoltaic cells. Schools too have made their idle roof areas for photovoltaic installations by private firms.

Two of the latest model wind turbines that were erected on Kronsberg Hill rated at 1.5 MW and 1.8 MW. Together with an existing 300 kW turbine, they meet the electricity needs of roughly 3,000 dwellings in the new district.

The Hannover example demonstrates that all sorts of initiatives and funding in the field of renewable energy, climate protection and energy saving can be introduced at local level. However, in order for the local players to be involved, supporting legal legislations and a certain private market must exist at the local level, too.

2.2.3 China Example

China is constantly increasing its electricity consumption especially for the last decade (Figure 11). Among many factors that lead to this increase are the seriously ascending amounts of industrial and technological manufacturing of virtually every commodity. In order to meet this increasing demand for electricity, China has increased its electricity production in parallel.

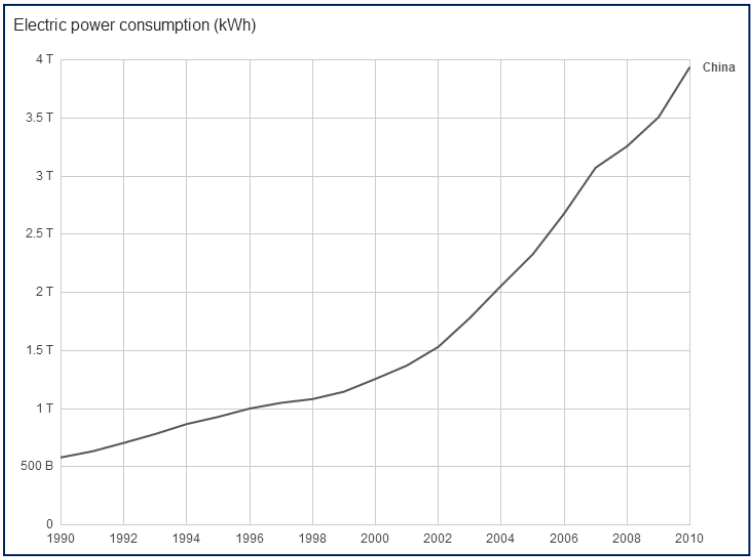


Figure 11 – China's Electric Power Consumption, (source: WorldBank)

The natural energy resources of China were enough for meeting this energy demand. For this reason, China kept its energy imports at minimum, around an average of 5%.

Within the local energy sources, China has been using conventional fossil energy sources as a primary source (coal, oil, natural gas) (Figure 12). The percentage of conventional sources to total electricity production was 83.3% in 2011 (Table 4). The high ratio of fossil fuel dependent electricity generation profile has driven Chinese Government to enact subsidy policies in order to increase investments in the electricity generation projects using renewable sources.

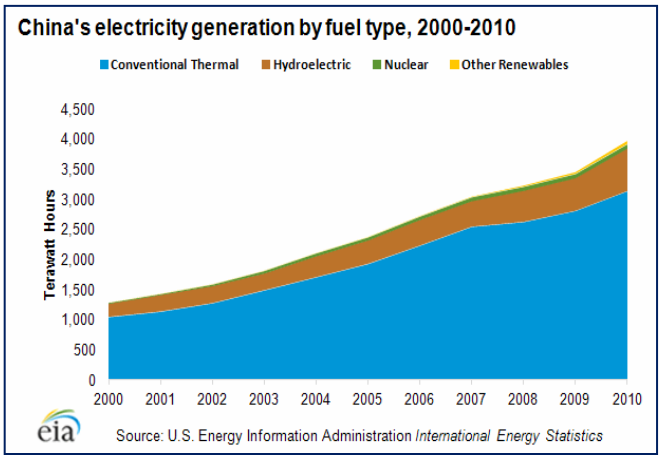


Figure 12 – Chinese Electricity Generation by Type (Source**: US EIA, International Energy Statistics)**

In 2011, 16.7% of China's electricity generation was made by the renewable sources. This amount is 785.9 GWh (Table 4). That corresponds to 17.5% of the World's Electricity production from renewable sources for the same year. If the hydroelectric sources (river plants and water dams) are excluded from this, China's production ratio becomes 10% to the world's electricity generation from renewable sources without hydropower (wind, solar, biomass etc.) (Table 4).

The increase in electricity production from different renewable energy sources gives important information about the increase in investments in China. In 2011, China has invested 51 billion USD and has achieved the 20% of world's total renewable energy investments (Figure 4).

China Renewable Energy Law in 2005 has established Policy frameworks for electricity generation from renewable energy. In 2009, China set a target to increase the share of non-fossil energy (nuclear and renewables) in the power sector to 15% by 2020. By 2011, this target is already met by 7%.

Table 4 – China and Global Electricity Production by Source (TWh), (source: Observatory of Renewable Energy, France, 2012)

	2001	2008	2009	2010	2011	Between 2001 – 2011	Between 2010 – 2011
Wind	0.664	13.4	27.8	55.0	88.6	63.1 %	61.2 %
	37.9	*219.6*	*276.4*	*351.5*	*459.9*	*28.3 %*	*30.9 %*
Solar	-	0.123	0.223	0.550	1.900	173.9 %	245.5 %
	1.4	*12.8*	*21.0*	*33.5*	*61.6*	*45.8 %*	*84 %*
Hydro	277.4	585.2	615.6	720.9	692.8	9.6 %	-3.9 %
	2636.8	*3282.3*	*3335.2*	*3501.1*	*3579.5*	*3.1 %*	*2.2 %*
Geothermal	-	0.144	0.153	0.160	0.167	6.4 %	4.6 %
	51.7	*65.3*	*67.3*	*68.5*	*69.9*	*3.1 %*	*2.0 %*
Biomass	2.4	2.4	2.4	2.4	2.4	-0.2 %	0.7 %
	134.1	*232.0*	*250.8*	*270.1*	*276.0*	*7.5 %*	*2.2 %*
Nuclear	17.5	68.4	70.1	73.9	86.3	17.3 %	16.9 %
	2637.7	*2730.8*	*2696.4*	*2755.1*	*2568.2*	*-0.3 %*	*-6.8 %*
Fossil	1174.3	2787.7	2980.4	3342.1	3837.0	12.6 %	14.8 %
	10010.6	*13637.5*	*13409.6*	*14340.4*	*14908.1*	*4.1 %*	*4.0 %*
Total Renewable	**280.5**	**601.2**	**646.2**	**779.0**	**785.9**	**10.9 %**	**0.9 %**
	2862.4	***3812.5***	***3951.1***	***4225.2***	***4447.5***	***4.5 %***	***5.3 %***
Total Conventional	**1191.8**	**2856.1**	**3050.6**	**3415.9**	**3923.4**	**12.7 %**	**14.9 %**
	12687.6	***16406.9***	***16146.0***	***17138.6***	***17516.6***	***3.3 %***	***2.2 %***
Total Production	**1472.3**	**3457.3**	**3696.8**	**4194.9**	**4709.2**	**12.3 %**	**12.3 %**
	15550.1	***20219.5***	***20097.1***	***21363.8***	***21964.0***	***3.5 %***	***2.8 %***
Renewables Share	*19.1 %*	*17.4 %*	*17.5 %*	*18.6 %*	*16.7 %*		
	18.4 %	*18.9 %*	*19.7 %*	*19.8 %*	*20.2 %*		

Note: The gray cells represent China, where the italicized cells represent Global figures.

China has made these advancements in approximately ten years. The country has achieved a successful shift from renewable energy parts producer for the western companies, to a complete energy plant developer and manufacturer for its own use in rural and urban areas, feeding its own grid.

The 12th Five-Year Plan, covering the period 2011-2015, calls for 70 GW of additional wind capacity, 120 GW of additional hydropower and 5 GW of additional solar capacity

by 2015. An update to the 12th Five-Year Plan, released in July 2012, calls for wind and solar capacity to reach 200 GW and 50 GW respectively by 2020 (WEO 2012, 213-214).

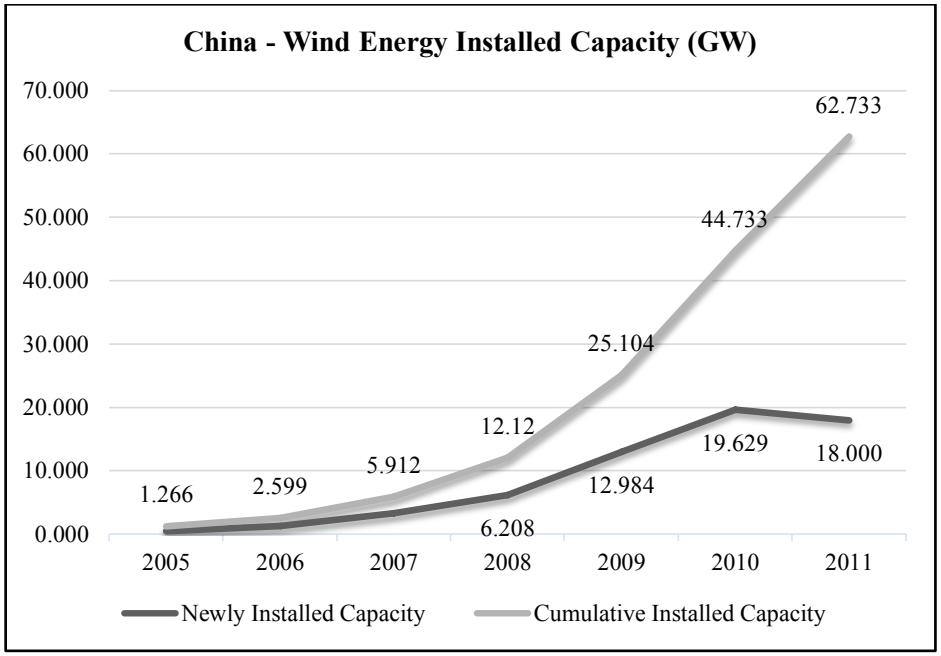


Figure 13 – China Wind Energy Installed Capacity (GW) (2005 – 2011), (source: Global Wind Energy Council)

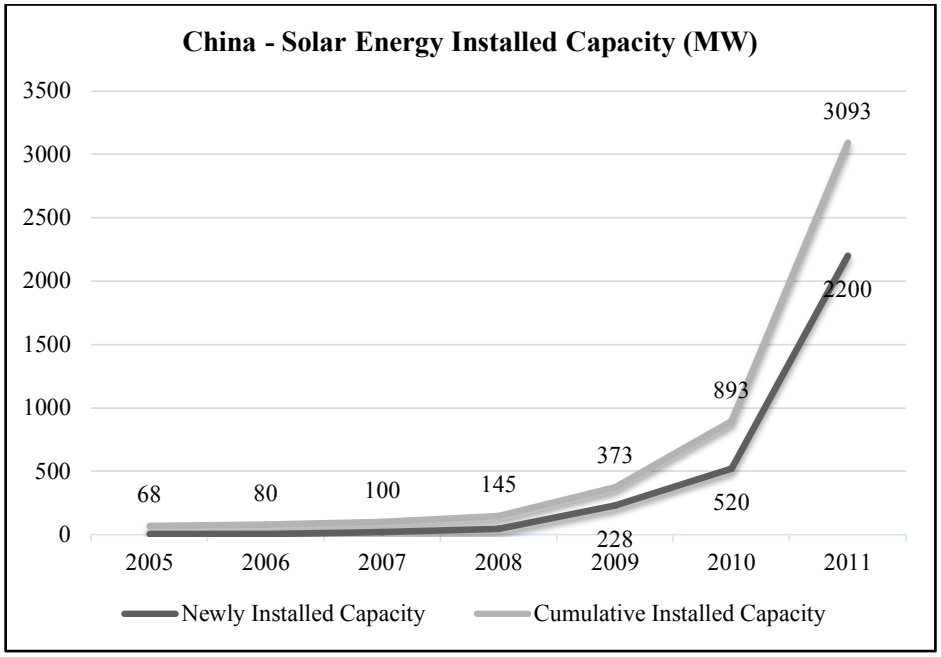


Figure 14 – China Solar Energy Installed Capacity (MW) (2005 – 2011), (source: EPIA Global Market Outlook for Photovoltaics)

Since the renewable energy law was first passed in early 2005, wind power capacity grew 49-fold by the end of 2011 (Figure 13). The increase in wind energy capacities has put China to the first place globally. Similarly the solar energy capacity has increased by 45 times (Figure 14). In order to reach these high capacities, with abundant natural renewable resources, China has put many legal regulations in practice.

Examples of China's Renewable Energy Policies (all of them are in force):

a. **Brightness Program (1996)** (Earliest Legal Regulation): This program included 20 MW of solar PV and wind, and 200 MW of small hydro to provide electricity for more than 1000 towns (the official statistic is 1 million people in total). The central government has invested 240 million USD to provide hardware. It is designed to allow development of rural communities as well as reducing poverty.

b. **Renewable Energy Law (2005)** (The main legislation of China): It is a framework policy which lays out the general conditions for renewable energy to make it a more important energy source. Renewable energy becomes the preferred source for energy development under this law. Research and development and the industrial development of renewable energy are listed as the preferential area for hi-tech industrial development in the national program. It sets middle and long term targets for the total volume of renewable energy development, and, on the basis of this, will prepare national plans for the implementation of these targets. In drawing up these targets and plans, it will cooperate with the regional and local administrations to reflect regional differences in the final regional plans.

c. **Golden Sun Program (April 2012)** (The Latest Notice): It is a 1709 MW solar demonstration project consisting of approximately 175 locations. (current solar capacity in China is 3093 MW) (Figure 14) Central government strictly backs up this project, giving considerable financial subsidies. (IRENA 2013)

Similar to Germany, the benefits for the renewable energy policies include increase in employment, decrease in carbon emissions, decrease in fossil fuel usage and an overall advancement in total level of technology and an obvious increase in the quality and quantity of research & development programs. Achieving these objectives needs an extensive planning study from the national level to the regional levels and to more micro levels, hierarchically.

In order to give an innovative example about China's renewable energy policies, the "renewable energy regions project" is discussed as a case study. This project has a centrally controlled planning character and introduces a renewable energy generation regions concept in the national level. The project identifies renewable energy regions based on the resource assessment studies. These regions are in the remote locations

having a rural characteristic. The clean energy generated within these regions is consumed in more developed and urbanized locations.

2.2.4 China Case Study – Renewable Energy Regions

From the 1980's, China Meteorological Administration conducted three national wind energy measurement census studies. These studies are enhanced with numerical simulations in order to assess the renewable energy potential of the entire country. As of 2005, it has been measured and simulated that China's theoretically available and technically exploitable (physically and spatially available) wind energy potential is around 2,100 GW. This potential can employ 1,400,000 wind turbines of 1.5MW each. If a typical wind farm consists of 50 wind turbines, this means there is a potential for 28,000 new wind farm zones – Turkey has approximately 2GW installed capacity and a total of 56 wind farms of smaller sizes.

With the studies done by the renewable energy resource assessment system, whole country has been simulated in a 5 x 5 km resolution grid and selected resource abundant areas are re-simulated by 1 x 1 km resolution. Suitable and unsuitable areas for wind turbine operation are assessed. Examples for unsuitable area types are: physical terrain conditions, slope, road availability, land usage, urban areas, military and governmentally prohibited areas (Chinese Renewable Energy Industries Association 2010, 12-15).

As the main result of these extensive potential assessment studies, seven areas were selected as the "renewable energy bases (renewable energy generation regions)". These areas are mainly located at the northern side of the country (Figure 15) and the "energy consuming" regions are located at the southwestern parts. As a start-up target, a 10GW capacity objective is set for each region. This capacity is enough for powering 2 million homes by each zone.

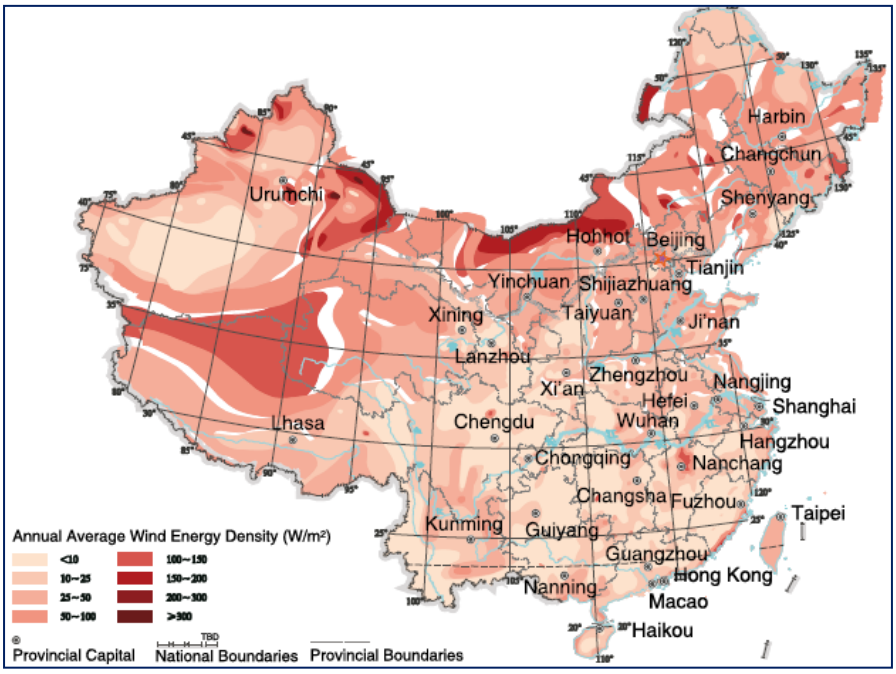


Figure 15 – Distribution Map of China's Average Wind Density, Source: CMA, the Third National Wind Energy Resources Census

Within the selection criteria for these regions, the seasonal distribution of the wind power resources are observed with respect to the hydro-energy (rivers mainly) resources. These regions have high wind energy regimes between the months August and March. The hydro-energy resources (dams) have higher rainfall values between March and August. These two renewable resources are selected as complementary for each other, working cooperatively to overcome a possible electric shortage.

Along with these positive criteria, there are numerous negative issues about the geographical distribution of the renewable energy regions. The locations that are rich in renewable energy resources are located at rural areas of the country. There is a notable distance between the renewable energy generation region (most northern parts) and energy consumption areas (south eastern parts) of China. This issue is handled like a typical urban or regional transportation problem. The possible solutions are capacity increase in the existing main arteries, construction of new arteries and introduction of smart transient systems to equally (or optimally) distribute the traffic loads. These solutions are being successfully implemented in Europe, China and other countries.

This case study is particularly worth mentioning because it introduces the "renewable energy region" concept to energy and planning disciplines. Like other successful planning decisions, there are indirect positive outcomes of the studies made within these projects, like:

a. **Increase in qualified employment:** The import dependency for the renewable energy power plants (wind turbines, solar panels, micro-hydro turbines etc.) is being decreased at a notable rate. This positive effect is mainly observed with the development of a national power plant design and manufacture sector that employs high qualified local manpower. In order to meet the increasing demand in renewable power plants (in order to accomplish the assertive regional renewable energy objectives), and the gap created from the decrease in imported energy plants, Chinese manufacturing sector is working very hard. This effort might be observed in Figure 13, where Chinese wind power installed capacity is increasing at a notable rate.

b. **Political restitution:** Chinese government officials began to take active role in international environmental summits and meetings. Especially within the renewable energy scope China has begun to give voluntary targets and commitments. During the Copenhagen meeting in 2009, China has declared that non-fossil energy would satisfy 15% of total energy production. This commitment is a binding target for short-term and middle-term planning decisions. Another voluntary commitment is a 40-45% decrease in carbon dioxide emissions per capita is also announced by Chinese officials (Chinese Renewable Energy Industries Association 2010, 22). As the result of these positive attitude changes, China government is regarded as a more internationally integrated and more sustainable development oriented administration among other industrialized nations.

c. **Industrial acceptation:** Within the efforts minimizing the common belief about the "quality" of Chinese products, the national planning, administration and governance bodies are giving increasing importance to the standardization and quality control concepts when developing a service, a product or an entire renewable energy power plant. The breakdowns, maintenance problems and efficiency of machinery are closely monitored by multi control systems, and failures are solved in a short time. Increasingly large numbers of renewable energy power plants are exported to industrialized countries which were main exporters of the same, only a few years ago.

The intensive studies in renewable energy resource assessment made by Chinese Meteorological Administration is used in a national renewable energy regional planning study leading to a number of direct and indirect positive outcomes. It is important that correct geographical data is essential for a regional plan; especially the renewable energy resource assessment needs long observation periods in order to understand the annual cycles of resources like rainfall, solar radiation and wind regimes.

2.2.5 Inferences from Successful Policies and an Overall Evaluation

With successful policy implementations China and Germany increased both their know-how in renewable energy technologies and experiences in designing and implementing successful national and regional policies for the generalization of renewable energy utilization. Some of the inferences from these policy implementations are:

a. The establishment of research centers in Germany led to an increase in the technology regarding the renewable energy related machinery. New companies are established, additional employment opportunities are created.
b. The feed-in-tariff prices in Germany and China are supported by clean electricity buying obligation for the customers. Every electricity customer is obliged to use certain amount of renewable energy. This led to an enlargement in industry, followed by an increase in equipment and machinery production. Energy imports decreased and equipment exports increased.
c. The completion of renewable energy resource assessment studies in these countries led to the definition of renewable energy regions. This information enabled the planners to reserve and utilize these areas for renewable energy related activities.
d. In Turkey's situation, as a developing country, the local manufacturing of the renewable energy plants (wind turbines, solar panels, etc.) is important in order to decrease the importation. China has similar subsidies for local manufacturing.

Within the light of the inferences from other countries' renewable energy laws, Turkey's current renewable energy legislation is discussed in Chapter 3.

CHAPTER 3

EVOLUTION OF ENERGY (AND RENEWABLE ENERGY) POLICIES IN THE REGIONAL PLANNING EFFORTS AND POLICIES OF TURKEY

3.1 Introduction and Turkey's Current Situation in RE Usage and Installed Capacity

Turkey is beginning to understand the need for the transition from the fossil energy sources to the renewables, observing the EU and world experiences. The value of these experiences is of great importance, because learning from these examples saves time to implement and make the conversion to the renewable energy sources.

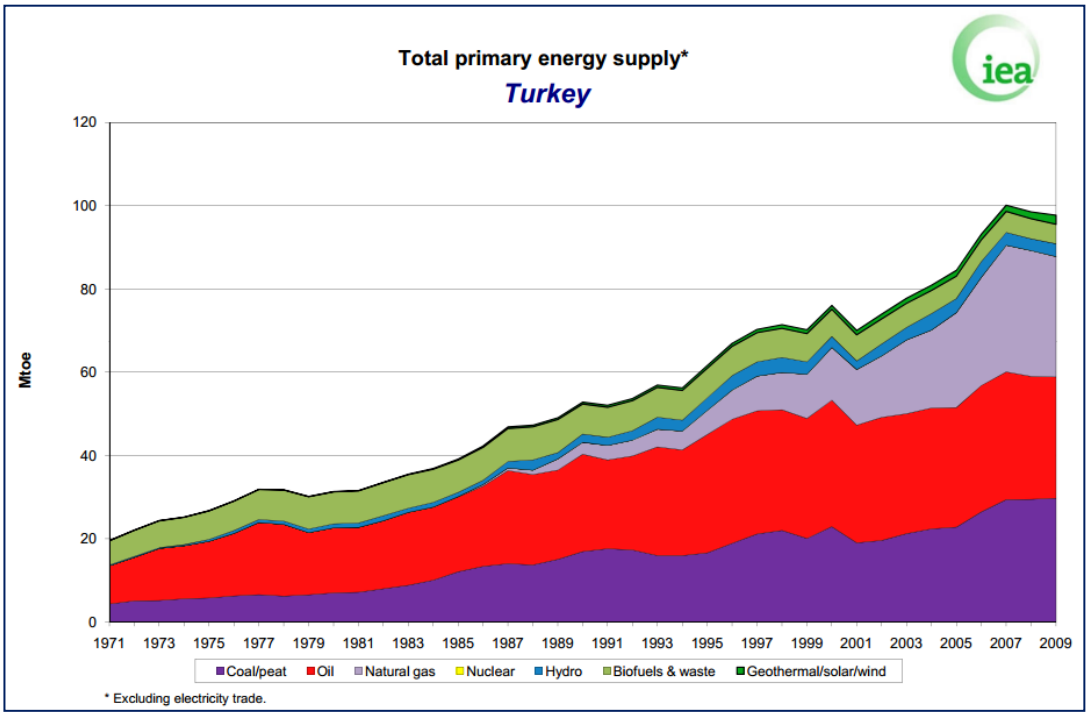


Figure 16 – Turkey's Total energy supply by sources, source: IEA

Since the fossil fuel resources are limited in Turkey, since 1960s, the hydroelectric power plant projects (dams) had been of great importance. Many individual dams have been constructed during the planning periods of 2nd and 3rd Five Year Development Plans

(5YDP). In addition to this capacity, during the 4th 5YDP (1979 – 1983), Turkey has planned and started the construction of Southeastern Anatolia Project[2], in order to meet the increasing energy demand for increasing urban and industrial activities. The hydroelectricity is an important branch of renewable energy sources, more predictable than wind energy, but should be carefully implemented to the spatial location. The natural habitat and micro geography around the dam lakes should be carefully studied and alternative locations should be prepared in case of environmental risks. There are many faulty implementations of hydroelectric electricity generation projects which harm the surrounding historical sites that, in return, received many criticisms from the experts and community.

Along with the hydroelectric power plant projects, with the continuous increasing demand for energy, like other countries, Turkey began to benefit from other energy sources like coal, oil and natural gas (Figure 16). These types of energy sources were imported from abroad and creates additional budgetary costs and import dependencies. Turkey has become an energy importing country, supplying more than 50% of its energy demand from imported energy sources. Oil and Natural Gas have the largest share in importation. Natural Gas has been introduced to Turkey's energy generation in order to distribute the imported source types. As a local fossil fuel source, Turkey has large reserves of lignite coal. The accredited lignite reserves are evaluated to be around 8.0 billion tons. The estimated total possible reserves are 30 billion tons. These reserves are of high ash and high moisture types of coal, yielding inefficient burning and calorie producing capacities. High calorie coal is being imported since 1996 (Kaygusuz and Kaygusuz 2002).

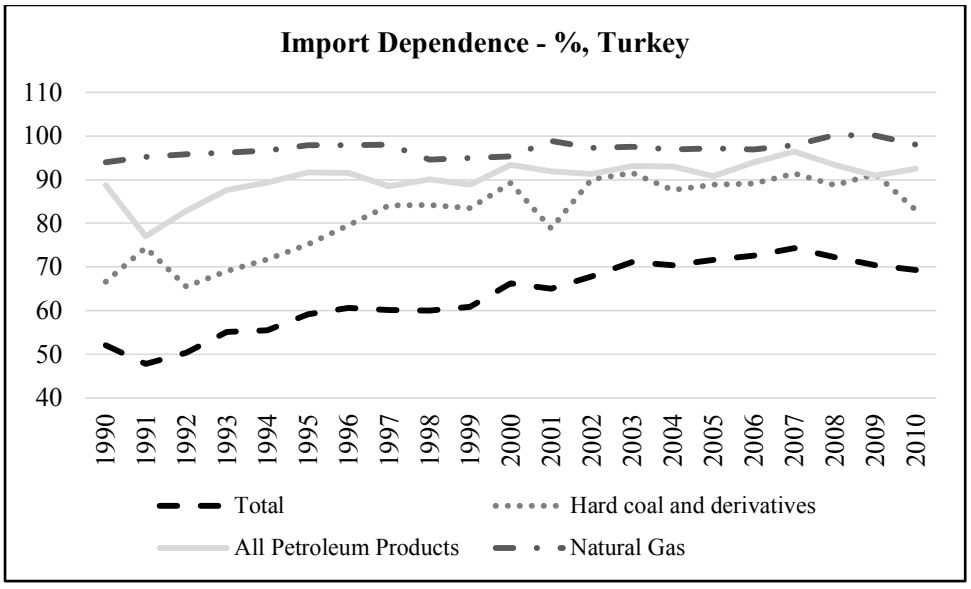


Figure 17 – Turkey's Import Dependency Percentage by source and years, source: Eurostat

[2] GAP, Güneydoğu Anadolu Projesi

The import dependency of Turkey in the main fossil fuel types combined (petroleum, coal and natural gas) was never under 50% since 1991 (Figure 17). From 2004, the import dependence of Turkey is over 70%. From 2009, Turkey's import dependence for coal is decreasing from 90% and petroleum products import dependence is increasing over 90% as a result of the increase in the number of petroleum powered vehicles and airplanes. In terms of electricity supply, 73.5% of Turkey's electricity generation is made via fossil fuels (Figure 18).

Especially by the policies stated in the 8th and 9th 5YDPs (from 2001), Turkey's only fossil fuel energy source, coal, has been promoted. By these policies, the renewable sources (hydro) had a decreasing trend, where the fossil fuels had increasing percentages (Barış and Küçükali 2012, 378).

Specifically, the use of natural gas has been remarkably increasing since the 1980s. At first, this consumption was in the form of household utility power (in ovens etc.). By the introduction of the new technology gas turbines, the natural gas became the major source of national electricity generation (Figure 16). The 98% of the natural gas consumption is met by importation (Figure 17). This situation not only increases the amount spent on the imported fossil fuels, but also greenhouse gases (mostly carbon dioxide) emissions of Turkey. This is important, because the Energy Sector is the largest greenhouse gas producing/emitting sector. Turkey has 0.84% share of world total in global greenhouse gas emissions (where EU27 has 10% and China has 22% share as of 2010) (UNEP 2012, 15-18).

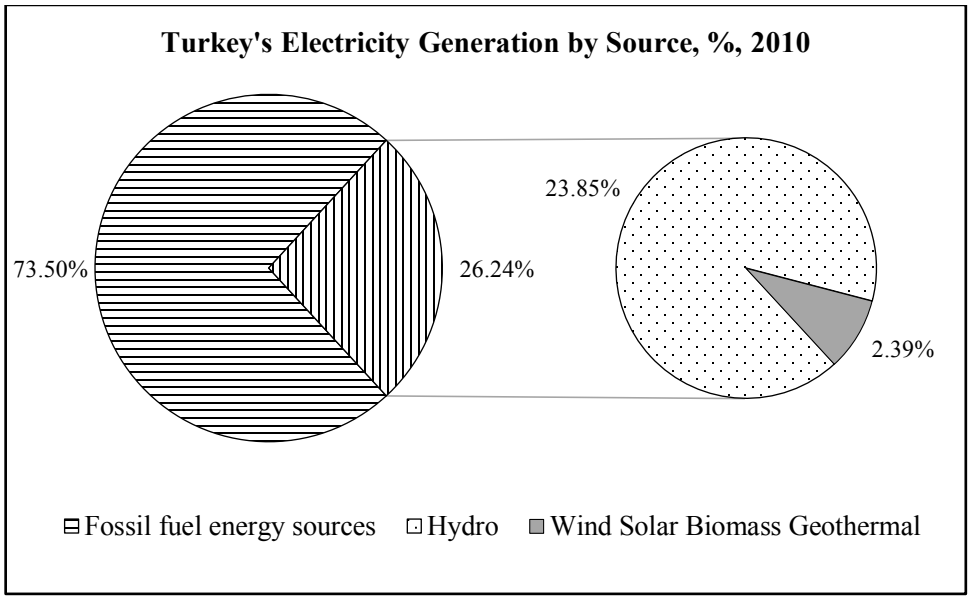


Figure 18 – Turkey's Electricity Generation by Source, Percentage, 2010, Source: IEA

Approximately 27% of the electricity demand is met by renewable energy sources, but above 90% of this renewable energy generation is made by hydro power. The remaining 10% of electricity generation (2.39% of total generation) is covered by wind, solar, geothermal and biomass resources (Figure 18).

Turkey's usage of renewable energy sources are at very low levels compared with other equivalent countries sometimes having less renewable resources. Turkey has to improve its renewable sources utilization in order to minimize the high import dependency for the fossil fuels. As seen in the hydro-electric projects, water related sources are being used in electricity generation since the 1950s. However; solar, wind, biogas, biomass and geothermal energy sources did not achieve the resource utilization that they deserve. The next section discusses the resource potential.

3.1.1 Turkey's Potential of Renewable Energy Sources

Turkey has satisfactory resource potential in renewable energy. Germany has lesser renewable energy resources but renewable energy production of Germany is a lot more than Turkey. Besides, Germany increases its net gains by exporting the technology for energy production plants from renewable sources. (IRENA 2013)

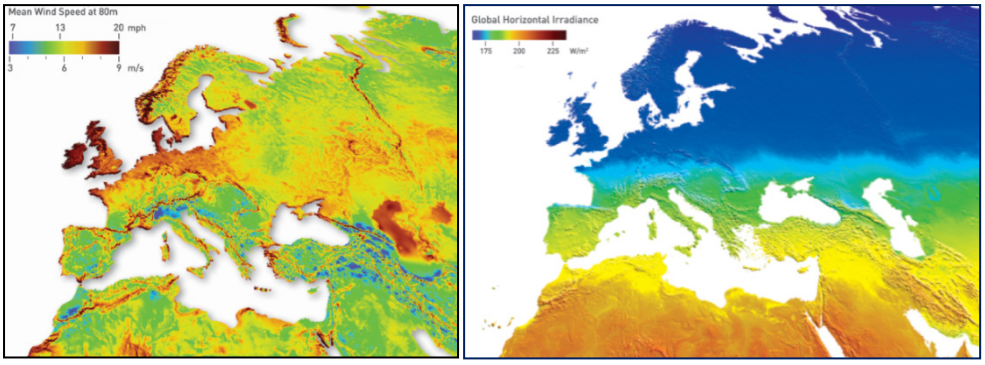


Figure 19 – Wind and Solar Energy Potential Maps of Europe, (source: 3TIER)

The renewable energy resource assessment studies are closely related with meteorological sensor data collection and combining this data with the existing topographic and terrain information. The meteorological sensors are points in space, so the data has to be interpolated in order to obtain quantifiable resource spaces or regions. Usually computer programs and/or simulations are used to distribute and transform the point values into area values. The resource maps presented in this study are obtained by using the preceding methodology (Figure 19).

The Directorate of Renewable Energy of Turkey[3] has published renewable energy atlases making assessments in two types of renewable energy sources: wind and solar. An overview for energy potential is given within these atlases based on cities. As an example for the wind energy resource assessment for a city, Balıkesir (a high potential area for wind energy) is sampled in Figure 20:

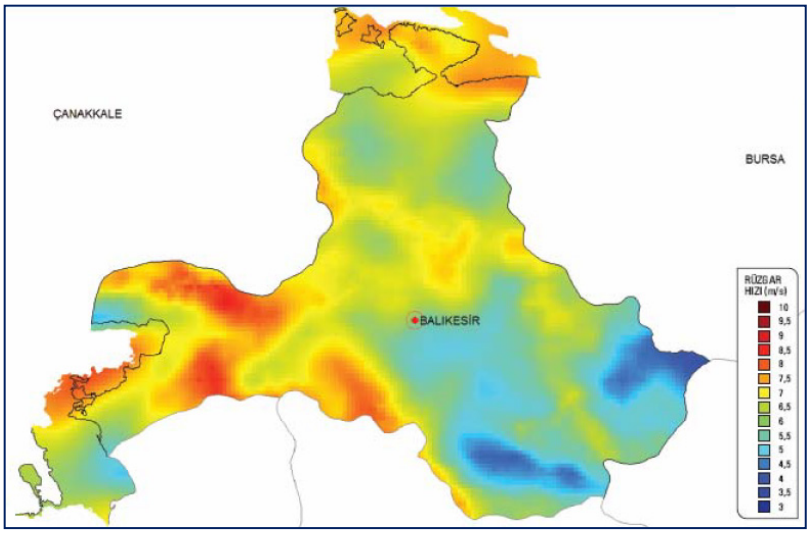


Figure 20 – The Wind Energy Potential of Balıkesir, (source: REPA, YEGM)

It is possible to recognize the economically feasible (candidate) regions from yellow to red color gradient areas. Generally, these regions are the regions having greater or equal to 7 m/s wind speed at 50m above the ground. The high resource potential areas (orange and red regions on the left) are mountainous and marine areas, but this statement cannot go further than an assumption, since this resource map does not have any elevation or terrain information. Since the transportation and installation of the wind turbines is a difficult task in mountainous areas, this information has to be merged with a terrain information (using GIS tools) when actually planning for renewable energy regions.

[3] Yenilenebilir Enerji Genel Müdürlüğü

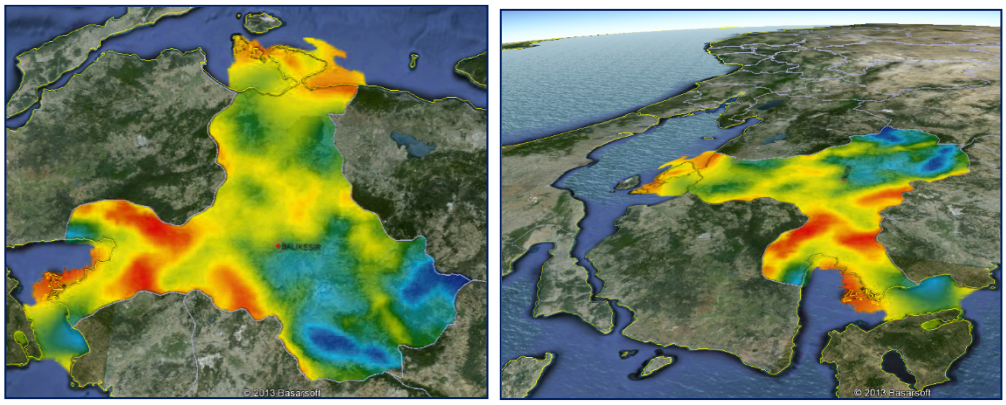


Figure 21 – The Resource Map laid over Terrain Information, (drawn by author using the information in Figure 20)

From Figure 21, it can be assessed that:

a. The wind resources on off-shore (sea) areas have greater potential
b. The high elevation areas (mountains, terraces, shoulders and plateaus) have greater potential
c. The adverse sides according to the main wind direction have lower potential
d. Low altitude and surrounded areas (valleys, bowls, trenches) have generally lower potential
e. Because of the temperature differences the wind has tendencies to travel from seaside to the inner lands using natural valleys and straits

The resource assessment study becomes more complete when the topographical information is included in the study. The renewable energy atlases studies published by Directorate of Renewable Energy include two more important information sets, these are:

a. Non-suitable areas for renewable energy plant installations. These areas are determined due to the following criteria:
    i. The zones over 1500m sea level and more than 20% inclination
    ii. Urbanized and settlement areas
    iii. Roads, highways, railways, airports and seaports
    iv. Irrigated areas and qualified forest lands
    v. Protection Zones (Natural Parks, Special Environmental Protection Areas, etc.)
    vi. Energy Power Plants
    vii. Security Areas, Radar Zones, Security Bands
    viii. Sea Zones with more than 50m depth

b. Capacity factor map for the locations. This value is the percentage ratio for the plant's actual production. For wind energy, this value is around 20-50%. If this ratio is 50%, which is a very high ratio, it means that the wind will blow and the plant will produce electricity in 180 days (half of the year).

Every renewable energy resource type has its own characteristics, but since the electricity consumption of the city is an ongoing and endless process, it is essential to evaluate the continuity of the energy resource for a given energy generation plant. Although the average values or the momentarily values of energy potential is high, the resource region can become economically unfeasible when it is not possible to harvest energy during most of the year.

The following table presents a comparative chart for Turkey's and selected countries' renewable energy potential.

Table 5 – Renewable Energy resource potentials of selected countries, 10^9 kWh

	Wind (onshore)	Solar	Hydropower	Biomass	Geothermal
Turkey[4]	60	102	124	>100	23
China[5]	24700	6480	2474	7812	278
Germany[6]	262	24	26	87	29

The table gives the annual production values if all the resources were utilized by renewable power plants. 10^9 kWh is equivalent to TWh and roughly corresponds to 20.000 houses' all year non-stop electric consumption. Computer simulations are used when predicting these values. In 2010, Turkey's total primary electricity consumption was around 250 TWh, and theoretically all of the consumption can be met by renewable sources.

As for the comparison, China has very high wind energy resource potential, and the other renewable resources are considerably higher than other countries because of the higher amounts of land. Turkey has 12 times more solar energy potential than Germany, yet Germany is the world leader in electricity production from solar resources. (REN21 - Renewable Energy Policy Network for the 21st Century 2013)

[4] Source: Ministry of Energy and Natural Resources, Turkish State Meteorological Service (TSMS)
[5] Source: (Liu, et al. 2010)
[6] Source: (Renewable Energy Information 2008)

Table 6 – Renewable Energy capacity potential in Turkey and installed capacity as of 2009, (source: Ministry of Energy and Natural Resources, 2010) (Barış and Küçükali 2012)

Type of Energy	Technical Potential (MW)	Economic Potential (MW)	Installed Capacity (MW)
Hydropower	54000	42000	14533
Wind	80000	20000	1700
Geothermal	1500	600	77
Biogas + Biomass	-	-	81
Solar	56000	-	1

From the above information, it can be inferred that Turkey's hydropower potential is comparably high, but exploitable areas should be carefully studied. The high mountainous valleys and very slow streaming rivers are considered as non-feasible areas for hydro power. After the completion of Keban Dam and GAP Project, Turkey's hydro installed capacity percentage has increased to 98% of its renewable electricity production and 26% of its total electricity production (Global Energy Network Institute 2011, 10). From the Table 6, it is seen that Turkey is only using 23-30% of its hydro renewable energy resources.

The biomass renewable energy resource is different from other sources. Unlike natural resources like wind and solar, the biomass energy resource can be increased by central, regional and local planning decisions and positive interventions. It is possible to generate very large amounts of energy, if agricultural and husbandry areas are arranged and upgraded in order to produce biomass resources. The technology, equipment and experience in Turkey are limited, but these disadvantages can be solved in short periods.

Geothermal resources have a critical risk regarding the usage of hot water. If the hot water is not pumped into the artesian well, the renewable resource depletes. This hot water is often used as a heating resource, pumped into the residential areas. The return of the water is expected by natural ways, which is indirect and time consuming. Regarding the potential, Turkey is in an advantageous position, although all of the resource assessment studies are not completed yet.

In summary, Turkey has abundant renewable energy resources. Compared with the EU countries, in many areas, Turkey's capacity exceeds the EU countries (Global Energy Network Institute 2011).

Figure 22 – The operational Wind Turbine Farms in Turkey, 2012
(Data source: EPDK, drawn by author)

In Turkey, the available wind energy power was 433.35 MW by the end of the year 2008; and it became 1503.35 MW at the end of 2010. The wind energy investments in Turkey are in an accelerating trend.

The majority of wind energy investments are made in western Turkey, where the wind energy potential is feasible (Figure 19). The southern mountains in Mersin and Hatay areas are used for wind energy, as well. Turkey has 1.7 GW installed capacity of wind energy and utilizes only a small portion of its potential (48 GW). (Turkish Wind Energy Association 2011).

As supplementary information; the solar energy (electricity production – PV) has a similar situation. The installed capacity is 1 MW (0.001 GW) whereas the country has a solar energy capacity potential of minimum 450 GW. (Okdik 2013). Geothermal and Biomass utilization ratios are similar, closer to 1%. Especially the solar energy investments have to be supported and increased, because of the high potential and the availability of affordable technologies.

Renewable energy investments can be grouped into two investment methods in Turkey:

a. The renewable energy investments that are due to the electricity production license permitted from Energy Market Regulatory Authority (EPDK). These projects have commercial characteristics having financial, technical and operational companies involved.

b. The same investments that do not require license from EPDK. These investments have a capacity limitation of 500kW, which is approximately equal to the

consumption of 50-75 houses. These projects have a private or household, cooperative driven characteristics.

The unlicensed (b.) type of projects is very limited in Turkey, because of the local and domestic supplier problems. Although the Turkish authorities try to encourage local electricity power plants production, like wind turbines or solar panels; these efforts are limited and require technical competencies, know-how and experience. Importation is unfeasible in wind energy because 500kW is relatively a lower capacity, therefore the unit costs increase dramatically.

Generally Turkish large commercial companies group together with foreign financial and technical groups to accomplish licensed (a.) type of wind farm projects. These kinds of investments logically choose the most feasible and accessible locations which is western Anatolia, as seen in (Figure 22).

As an economical model, the financial body (creditor) finances the project with its own selection of wind turbine brands. These turbines are supplied from foreign countries (mainly Europe) as unused or mostly refurbished second-hand machines (EPDK). The location of the renewable energy investment is made according to resource measurement and assessment studies. These studies are made in long term, not less than a year. The selection of the location is made with the help of GIS tools and the Renewable Energy Potential Atlas, published by the EPDK.

In order to overcome the importation of second-hand foreign wind turbine issue and to instate an attraction to the local production, The Regulation of Renewable Energy Law No.4346 increases the electricity buying price, which is produced by locally manufactured wind turbines. This feed-in-tariff subsidy is valid for both types of investments (Law No.4346).

These (economical) planning decisions will have more concrete effects if they are combined with the spatial planning decisions. Since the wind potential areas are identified in Turkey, these subsidies should be customized to the resource availability. The advantageous regions in the developing areas of Turkey (or locations in the regions) should benefit from subsidized prices.

Starting from 1950s, Turkish authorities are emphasizing the need for local, renewable, alternative and less costly energy sources within a number of programs, laws and planning documents. In order to understand the progress, it is important to evaluate these policy documents and legal documents within the scope of “energy generation from renewable sources”. The following chapter discusses this issue historically.

3.2 Energy Policies in Turkey's 5 Year Development Plans

The 5 Year Development Plans (5YDP) are the main policy instrumentations as an umbrella combining all types of macro planning decisions and strategies. These plans were prepared by the State Planning Organization (SPO)[7] between 1960 and 2010. After SPO was reorganized as the Ministry of Development in June 2011 with Decree Law No. 641, the preparation of the 5YDPs are done by this ministry. In this section, the 5YDPs are discussed from the renewable energy, sustainable development, environmental awareness, regional planning and regional development points of views. How the energy subject is handled and what types of energy related encouragements have been made by the governments are the main focus points of this chapter.

From the 1st 5YDP, Energy has been an important chapter in the plans. The strategies about popular energy generation sources (coal, oil, hydro, nuclear, natural gas and renewables) can be followed in a chronological order. The global concepts like environmental awareness, natural preservation, energy efficiency, protection of the nature and environment are also mentioned in these plans when they have been a part of the global agenda.

In the following section; each 5YDP is discussed, focusing on energy, renewable energy and sustainability concepts.

3.2.1 The 5 Year Development Plan Statements and Renewable Energy Related Outcomes

During the evaluation of 5YDPs, the italicized text is the paraphrased statements from the plan documents, followed by an evaluation by the author having a renewable energy and sustainability oriented scope.

a. *1st 5YDP (1963-1968): Energy demand and supply concepts are explained and comparisons with other countries are made. The need for an increase in energy supply is emphasized, completion of Keban Dam and utilization of more coal mines are set as an objective. The public economic investments (KIT[8] in its Turkish abbreviation) shall be organized within the energy area. An 83% development in energy supply is planned. With the 30% of the population have access to electricity, energy efficiency is mentioned and use of efficient devices is encouraged. The usage of wood and animal manure (tezek) is planned to be*

[7] Devlet Planlama Teşkilatı, DPT
[8] Kamu İktisadi Teşekkülü, KİT

decreased, using state interventions if necessary. The biogas plants will be installed (trial) near the state farms. (DPT 1963)

Within this planning period, the environmental consciousness related issues are not in the major interests of the nations and governments in the global context. The main development targets are industry, agriculture and development related. But the biogas and geothermal energy generation activities are encouraged within those early years. Our first 5YDP has goals towards the usage of renewables. The importance of renewable hydro electricity generation from dams is emphasized. The foundation of today's 25% of hydroelectricity generation percentage (which is a high percentage) was planned starting from the first 5YDP.

As in the regional planning strategies, Keban Dam has been identified as a project that will increase the development efforts in the East and Southeast Anatolia Regions. The centralization risks of East Marmara (namely Istanbul) Region have been discussed. The Zonguldak and Ereğli Region (industrial coal reserves) have been regarded as prosperous industrial activities regions. These regions are identified due to proximity to the energy resources, namely coal in this case.

b. *2nd 5YDP (1968 – 1972): Cheap electrical energy is planned to be used as an incentive for the private sector to invest in underdeveloped regions. Petroleum energy sources are foreseen to be utilized more in this planning term. Natural gas is seen as a new and prosperous energy resource and importation from neighboring countries is planned to be evaluated. The electricity grid of the country is planned to be developed and enhanced. The hydro (renewable) energy resource will be more utilized. Nuclear energy will be researched.* (DPT 1967)

In parallel with the global agenda of those times, it is not possible to find a reference to sustainability and environmental issues in this plan. The increase in the urbanization and industrialization, country's energy demand started to increase more than the supply capabilities. The "energy bottleneck" problem addressing the increasing gap between the energy demand and supply is pronounced first time in this plan. In order to minimize the gap, resource importation has been seen as an imminent remedy. Oil, in this planning period, has been introduced as the resource to close the energy gap. Not only oil, but also oil refinery machinery and oil power plant machinery (all were imported) were the main import items that put extra costs on the budget of the state. Natural gas was planned to be used in households, in cooking mostly.

The regional development section of the plan has the statements about the minimization of development differences between the regions. There are statements and strategies about the industrialization and housing efforts. These efforts have indirect references to the increase in energy (and electricity) production.

c. *3rd 5YDP (1973 – 1977): In this plan, the increasing demand of domestic energy is mentioned. In order to meet this demand, within the technical context of the planning period, coal and petroleum are indicated as primary fossil energy sources. The hydro potential of the country is being used in an increasing trend (+13% increase from previous planning period). Approximately 32% of electricity supply of the country is met by hydro sources. Today, this percentage is 24% (Figure 18). The balance between thermic (fossil fuel) and hydro energy resources will be monitored in the favor of hydro (renewable) resources. Nuclear energy is again regarded as a promising energy source and research and prototype studies are planned. In this planning period, the defects of the existing electricity grid have taken the priority. Because the generated electricity means nothing unless it is efficiently transmitted and utilized.* (DPT 1972)

Within this planning period, the increasing trend in hydro power plant investments is noteworthy, regarding the renewable energy and sustainability. Since this increase is not adequate to meet the increase in energy demand, coal and oil power plants are built as energy investments utilizing fossil fuels.

The increase in urbanization rate and the need for additional housing stock is mentioned in this plan. The energy need for these new urbanized areas will be met by the increase in power plants and energy imports.

The effects of the 1972 Stockholm Conference (United Nations Conference on Human Environment) was beginning to reach more countries and people in this planning period. This conference is the first declaration that discusses the effects of the industrialization (including energy generation) to the environment and sustainability. The reflections of this conference will be seen in the next 5YDP.

d. *4th 5YDP (1979 – 1983): The environmental issues like water pollution, air pollution, noise and the deterioration of the ecological balance is mentioned. As these concepts are newly being discussed and emerged, examples and sample figures are given, but no solid planning decisions are taken at that time. The energy discussion starts with a declaration that states the inadequacy and failure of the capacity increase efforts in energy generation. This situation led to an energy crisis throughout the country. The coal and hydro reserves were not utilized enough. As a result, the oil crisis had a negative effect on meeting the energy demand. The (electricity) energy importation was seen as the only (and mandatory) solution for this problem. The localization of the production of energy related industrial materials is among the planning decisions of this period.* (DPT 1978)

It is the first time that energy efficiency and energy savings concepts are mentioned in the development plans. Also the environmental issues like air, sea and land pollution and urbanization risks on agricultural lands are discussed. The environmental consciousness is recognized first time. The negative relation between

the conventional industrialization (urbanization) and the environmental quality is mentioned. Current problems (Ankara's air pollution is given as an example) shall be primarily treated. One important planning decision is the authorization of the local authorities to create land reservations to preserve the environmentally valuable areas like lakesides, riverbeds, valleys etc.

e. *5th 5YDP (1985 – 1989): The coal energy (electricity) source is seen as the imminent primary source for a remedy in electricity supply problems. The lignite resources will be exploited and utilized more efficiently. The hydro resource is to be taken into consideration in the middle and long terms. The energy efficiency and environmental sensitivity will be maintained. The technologies and possibilities of electricity generation from solar, geothermal and biogas sources will be encouraged. The subsidies shall be introduced in order to increase the local production of renewable energy related machinery and equipment. The distributed research and development studies scattered within the country shall be unified with an Energy Master (Development) Plan.* (DPT 1984)

This plan is the first plan that uses renewable and alternative energy sources concept. The emphasis is given to solar, biomass and geothermal renewable energy sources. These sources are selected due to the technological capacity of these times. Environmental problems are discussed in a separate chapter. The environmental pollution problems are seen as generated from urbanization and industrialization efforts.

The regional development section does not have a direct reference to energy issues, but there are decisions in order to decrease the gap between developed and underdeveloped regions by increasing the industrial activities.

The Southeastern Anatolia Project[9] was introduced within this planning period, after 10 years of economic succession. This project is a good example about the regional planning efforts related with the energy, irrigation and renewable energy concepts. There are more than 10 hydroelectric power plants within the project; all are generating electric energy from renewable sources (DPT 1984). This project is a multi-sectorial and integrated regional development movement within the sustainable development context. It started as an integrated project of multiple hydroelectric power plants and dams along the Euphrates and Tigris rivers in 1970s. It has become a socioeconomic development program in 1980s and gained sustainable values in 1990s rather than gaining only financial income. The main objective is the creation of an environment that can be used and further developed by the next generations. (Göymen 2005, 3-4)

[9] Güneydoğu Anadolu Projesi (GAP)

f. *6th 5YDP (1990 – 1994): The energy related objective statements in this plan have been more general and abstract rather than solid and quantifiable objectives. Due to the fact that the limited energy quality of coal (lignite) resource, the priority of this source has been degraded within this planning period. The importance is given to imported resources, natural gas primarily. The importation of (high energy quality) coal is taken as a decision. As for the renewable energy resources, it is said that "required measures will be taken for the larger utilization of the renewable resources, such as primarily hydro, geothermal, solar and the like". (Need for the) Conformity to EU (energy) policies is mentioned generally, without a planning decision.* (DPT 1989)

As of 1987, with the Our Common Future report from the United Nations, the "sustainability" concept is introduced to the global agenda for the first time. The need for unlimited energy could only be met by establishing a sustainable supply-demand relationship with the natural resources. The effects of this concept will be noticed through the next decade.

This plan is the first plan that establishes a direct relationship between the conventional energy generation activities and environmental pollution. The environmental awareness will be a key factor within energy generation, conversion and transmission activities. The research & development and technology transfer studies will be made within the renovation or construction activities of the power plants. Additional research & development and support programs will be introduced regarding the renewable energy projects in order to the utilization of existing resources.

g. *7th 5YDP (1996 – 2000): Within the energy scope, this development plan emphasizes the increase in energy demands as a result of the technological improvements. The problem in electricity supply is still continuing. It is evident that the plan wants the privatization of the existing state owned power plants. The generalization of the usage of renewable energy sources and transition to the nuclear energy source are taken as planning decisions. The legislation problems in terms of geothermal energy production will be solved.* (DPT 1995)

The plan has references to 1992 Rio Conference and 1995 Copenhagen Summit. The sustainability concept is recognized and shall be integrated to every economic and social activity. A distinction was made between the pollution removal efforts and sustainable and preventive activities that do not create pollution problems, this includes energy generation activities. The plan does not have a recommendation regarding the types of renewable energy sources (solar, wind, geothermal etc.).

h. *8th 5YDP (2001 – 2005): The need for complete reevaluation and restructure of the Energy sector is emphasized. The production of electricity is defined as a resource oriented, environmentally polluting and costly type of activity. The private sector's hesitation in investing to energy sector can be cleared with a new*

legislation. The development of the alternative energy projects is mentioned when discussing the importance of natural protection. (DPT 2000) *The Renewable Energy Law No.5346 has come into force within this planning period. This law has been discussed in 3.3.1.*

The regional development section includes planning decisions about the minimization of development differences between the regions. Metropolitan areas, together with their surrounding zones, will be studied in regional plans. These plans will be aiming to decrease the problems in energy, environmental issues and corrupt urbanization.
The Southeastern Anatolia Project was in progress in the planning period. There are 10 hydroelectric plants completed up to the plan date, including the Atatürk and Karakaya Dams. Eastern Anatolia Project[10] and Eastern Black Sea Project[11] Regional Plans are prepared within this period. The plan states that these efforts will be done under the sustainable development principles.

i. *9th Development Plan (2007 – 2013): The improvement of energy infrastructure is a part of the main competencies along with the sustainability and environmental protection. Within the improvement of energy infrastructure, the share of renewable energy will be increased. Natural gas and hydro are pointed out as primary sources of electricity generation. In order to maintain the diversity in energy supply, nuclear energy plants will be commissioned. The privatization of the state owned power plants is again within the planning decisions of this 5YDP.* (DPT 2006)

The Development Agencies (DAs) have become operational within this period and the preparation of regional plans is now made by DAs. The State Planning Organization is transformed into Ministry of Development and is responsible for the macro scale coordination of the DAs and approval of the regional plans.

As seen from the above research, the energy resource recommendations started with coal and hydro resources in 1st plan. Then oil (petroleum) was added to this energy mix. The renewable hydro resources were recommended intensely from the 2nd plan onwards. All these resources was not enough for the increasing energy demand, so natural gas was recommended from the 5th plan, and the usage of imported natural gas is widely recommended starting from the 6th plan.

Within the 5YDPs, the energy generation natural resources are recommended in parallel with these aspects:

a. Current technological advancements of the planning period: The types of turbines and power plant technologies are definitive in selecting energy resource. In the

[10] Doğu Anadolu Projesi, DAP
[11] Doğu Karadeniz Projesi, DOKAP

first plans, coal is recommended because the coal thermal power plant technology was common.

b. Current status of the national energy resource assessments: There are resource assessment studies in almost all types of energy resources including geothermal, coal, natural gas, petroleum and biomass. During the 7th 5YDP period, solar and wind potentials were assessed. Moreover, Turkey's advantageous position in hydro resources led the construction of many dams by the state and private sector. Decision makers tried to benefit from the local resources primarily.

c. Current status of the environmental and sustainability related global context: The natural energy resources having environmental pollution risks (coal, oil, nuclear etc.) are slowly being replaced by more sustainable and renewable counterparts. The beginning of this transformation is discussed in the regional development and environmental awareness related chapters of the 5YDPs.

d. Current political and economic global context: The energy raw material recommendations have political and economic causes among other factors. The relations of Turkey with Russia, Turk Republics and Middle Eastern countries affect the natural gas or petroleum procurement process. The pipeline joint projects are built with these countries including provisions for energy resources.

The environmental awareness and sustainability issues regarding the energy production is first discussed in 6th 5YDP. This included the protection of the environment from energy generation activities. These type of activities included coal and oil power plants.

The energy efficiency has been introduced in the 1st plan as the "efficient usage of equipment". It meant the less energy you spend, the less you will have to generate. The following two plans did not mention energy efficiency, but after 4th plan, this issue is encouraged.

3.2.2 A Comparative Summary of the Energy Policies in the 5 Year Development Plans

The energy subject has been a major discussion within all 5YDPs. Since the energy is the main driving force for both the industrial and urban activities; the generation, supply and sustainability of energy, natural resources potential, the need for energy resource importation has been discussed in all of the Development Plans. The following table displays principles, objectives and planning tools in each 5YDP. Additionally, renewable energy, sustainability and environment related statements, decisions and activities are summarized comparatively.

Table 7 - The Principles, Objectives, Tools and Renewable Energy related Decisions in the Development Plans

	Principles	Objectives	Tools	RE, Sustainability and Environment Related
1st Plan 1963 – 1968	▪ The introduction of economic development to the regions. ▪ Regional economic integration.	▪ Balanced urbanization ▪ Balance between regions ▪ The investment effectiveness	▪ Financial incentives ▪ The investment based precautionary alternatives towards the less developed regions	▪ Encouraged energy sources: H, C, B[a], G[a]
2nd Plan 1968 – 1972	▪ The focus on the population related issues generated from the fast urbanization	▪ Balanced inter-regional development ▪ Balanced distribution between the regions in the social equality aspects ▪ The investment effectiveness	▪ Decreased taxation ▪ Financial incentives towards private sector investments ▪ Pilot projects ▪ Keban Project	▪ Encouraged energy sources: H, O, N, Nu[a]
3rd Plan 1973 – 1978	▪ The minimization of the regional differences ▪ The development of identified less developed regions	▪ Same with the 2nd Plan	▪ Financial incentives ▪ Industrialization programs for the less developed regions ▪ Inventory studies ▪ City planning ▪ Sectorial planning ▪ Integrated packet projects ▪ Priority cities for development	▪ Encouraged energy sources: O, C, H, B, G, Nu[a] ▪ The effects of industrialization to the environment
4th Plan 1979 – 1983	▪ The mobilization (allocation) of the resources towards the regional problems	▪ The development of the less developed cities ▪ Sectorial and regional mutual dependence ▪ Spatial organization	▪ Decrease in interest rates for the investments ▪ Financial supports ▪ Integrated packet projects ▪ Investments in city and regional scale ▪ Çukurova Urban Development Project ▪ GAP (DPT – JICA)	▪ Encouraged energy sources: O, C, importation of electricity ▪ Energy saving and energy efficiency concepts are mentioned ▪ Urbanization in agricultural lands ▪ Environmental consciousness ▪ Local administrations are allowed to decide natural or environmental land reservation areas

Table 7 (continued)

5th Plan 1985 – 1989	▪ Speeding the development by rationalizing the resource utilization in the regions that are less developed and having sectorial potentials	▪ The balanced regional development respecting the social equality	▪ The preparation of regional programs in order to the assessment of the potential resources ▪ Selection of the related investments in the direction of these programs ▪ The improvement of the substructure for the industrial projects in the priority regions and sectors ▪ Financial aids for the investments in the priority cities for development	▪ Encouraged energy sources: C, H, S, G, B ▪ Renewable and alternative energy sources are mentioned first time ▪ Environmental problems are identified as a result of urbanization and industrialization ▪ The need for environmental protection is mentioned
6th Plan 1990 – 1994	▪ Consideration of social, administrative and financial aspects as a whole for the application ▪ The adaptation of the statistical system to the compatible with the international standards	▪ Balanced development in the regions ▪ Supporting of the counties in order for the prevention of the migration from villages to cities	▪ The increasing of the financial resources to the priority cities for development ▪ Incentives for the priority cities for development and creation of a special fund for this objective ▪ Industrial zones	▪ Encouraged energy sources: N, H, S, G ▪ Emphasizing of the direct relationship between the energy generation activities and environmental pollution ▪ Renovation of power plants ▪ Additional research activities for the technologies of renewable energy
7th Plan 1996 – 2000	▪ The integration of sectorial and spatial studies ▪ The sectorial specialization of the cities ▪ City Planning ▪ Minimization of regional differences ▪ Maximization of the competitive power	▪ Rationalization of migration and demographic changes ▪ The separate handling of metropolitan area issues ▪ Policy development studies for the housing problems ▪ Regional differences	▪ Continuation of the priority cities for development policy ▪ Immediate support program for East and Southeast Anatolia ▪ GAP (southeast Anatolia project) ▪ Legal organizations ▪ Housing projects ▪ The supporting of SME's in the priority cities for development ▪ ZBK, DOKAP, GAP	▪ Encouraged energy sources: N, G ▪ Generalization and popularization of the usage of renewable energy sources ▪ Sustainable and preventive industrial and energy generation activities

Table 7 (continued)

8th Plan 2001 – 2005	▪ Participatory Planning ▪ Sustainability ▪ Increasing of the effectiveness of the resource usage ▪ Adaptation for the EU Regional Policies	▪ Increasing the competencies ▪ Mobilization of the local entrepreneurship and local resources ▪ Regional differences	▪ SME Supports ▪ EU Funds ▪ First comprehensive regional plans ▪ Human capital ▪ Yeşilırmak basin development project ▪ Regional operational programs	▪ Encouraged energy sources: N, H, W, S, G ▪ Renewable Energy Law ▪ Sustainable Development
9th Plan 2007 – 2013	▪ The central level effectiveness of the regional development policy ▪ The increase in the institutional capacity in the regional level ▪ Development based on the local dynamics ▪ Development in the rural areas	▪ The increasing of the efficiency of the region ▪ The decreasing of the development differences between the rural and urban areas ▪ Supplement for the competitive power and employment	▪ Collaboration with the DAs ▪ Collaboration with the local dynamics ▪ SME policies ▪ Research and development infrastructure studies ▪ National rural development strategies ▪ Venture capital, micro finance credits, differentiated input costs	▪ Encouraged energy sources: N, H, W, S, G ▪ Renewable energy regulations ▪ Energy efficiency programs ▪ Grants through Development Agencies

[a] Introductory and for R&D purposes

Types of energy sources:	
C	Coal
O	Oil
N	Natural Gas
Nu	Nuclear
H	Hydro
W	Wind
S	Solar
B	Biogas - Biomass
G	Geothermal
Green items are renewable	

The 5YDPs are important instruments for the governments to establish macro scale goals and strategies. Within the 5YDPs, the energy issue was discussed under the headings of development, industrialization, urbanization, pollution, sustainability and renewability. The energy strategy of Turkey is affected and being shaped all together with those concepts.

In this section, the most macro-scale plans of Turkey were examined from renewable energy, sustainability and environment related overview. These plans do emphasize the importance of these subjects in parallel with the global awareness, starting from 1980s. It is not always possible to assess that these plans have a direct positive intervention or policy implementations; in fact the statements related with renewable energy and sustainability in 5YDPs are more complementary, indirect and intentional.

By the implementation of the 5YDPs and with many internal and external factors, a series of legal texts have been put into practice or being legislated. These laws include "renewable energy law", "building code", "environmental law", etc.

3.3 Turkey's Existing Legal and Administrative Structure about Renewable Energy

From the renewable energy oriented point of view, the most directly related law is the Renewable Energy Law. The law, legislated in 2005, aims at achieving the generalization of electricity production oriented usage of renewable sources. The main objective is to increase the electricity generation (rather than heating or transportation), by using renewable energy sources. The Law has extensive technical details regarding electrical and electronic connections and specifications. Within this study, the relation between regional and/or national policies and the spatial context is focused.

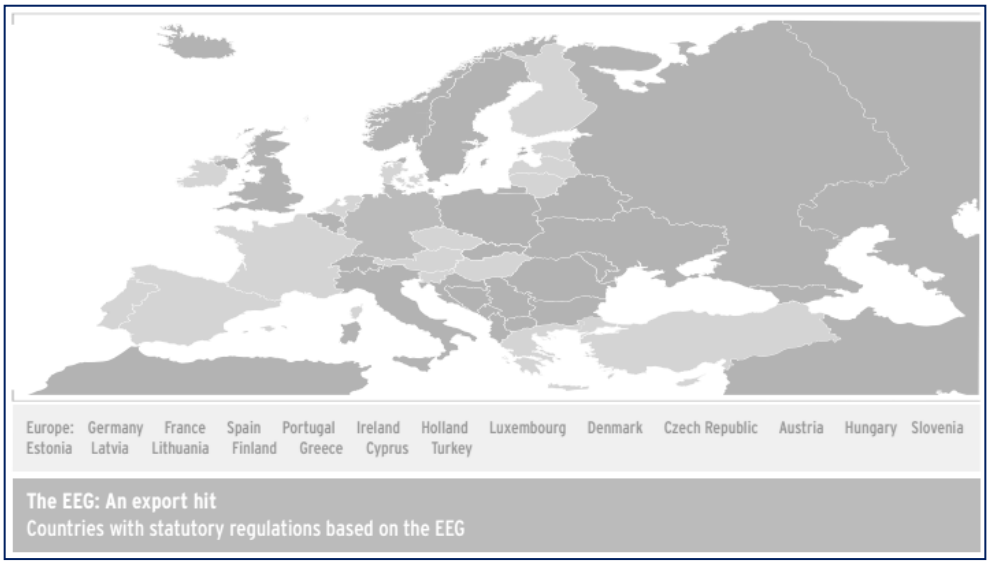


Figure 23 – Turkish RE Law is based on German RE Law (EEG)
(Source: (Federal Ministry for the Environment 2007))

According to international sources, Turkey's Renewable Energy Law is based on German Renewable Energy Law, which was discussed starting at 2.2.1 (Figure 23). This law is a Feed in Tariff (FIT) driven type of law, which grants economic advantages to the price of electricity generated from renewable sources.

3.3.1 The Renewable Energy Law, No. 4346, Date: 2005

The Renewable Energy Law was legislated on May 2005. The Law's objective is the generalization of electricity generation utilizing the renewable energy sources. The Law includes multiple support and incentive mechanisms for this purpose. Some of these policy tools are on a conceptual basis, leaving the details of execution to the regulations and authorized institutions. In the following section, the italicized parts are paraphrased from the original legal text. The following parts are comments and statements within a renewable energy oriented focus.

1. *This Law's objectives are:*
    a. *The generalization of electricity production oriented usage of renewable energy sources*
    b. *The economization of these sources in a safe and high quality manner*
    c. *Increase in the supply diversity (not to be dependent upon only one energy source)*
    d. *Decrease in the greenhouse gas emissions*
    e. *Processing of the waste material*
    f. *Protection of the environment*
    g. *The development of the (local) manufacturing industry in realization of these objectives*

The introduction part contains almost all concerns for the need and generalization of renewable energy, like the need for electricity generation, safety, supply diversity (import minimization), environmental concerns and the growth of local renewable energy related (manufacturing) industries.

2. *The renewable energy sources are identified as: Wind, solar, geothermal, biomass, biogas, and wave, water current and hydro sources in the form of channel, river or lake that is less than 15 km^2.*

3. *The city planning (zoning) that affects the utilization and efficiency of renewable energy sources is prohibited in the public or treasury lands. The renewable energy resource areas and locations are assessed by related institutions. These areas are recorded into city plans by the responsible institutions, with the directives from the ministry.*

This article is about the controlling of the city planning activities in the favor of the protection of renewable energy sources. What kind of city planning activities affects renewable energy sources is not clearly explained. Although the designation of the renewable energy resource areas is left to the related institutions, these institutions were not listed or identified in the text. These ambiguities might create problems in the future execution of the law.

4. *The tariff for electricity from renewable energy resources are certified with Renewable Energy Certificate*[12] *and have advantageous (subsidized) buying prices.*

5. *The hydro energy plants require permissions from State Water Works.*

6. *The electricity buying prices from renewable sources are higher (subsidized) where the production plants (solar panels, wind turbines, micro hydro turbines and such) are manufactured locally in Turkey. This is called "Addition of Local (industrial) Contribution".*

These three price-related articles describe the two generalized principles of renewable energy subsidy. The first one is the declaration of increased buying prices for electricity generated from renewable sources. There is no enforcement for buying renewable sources generated electricity instead of conventional generated electricity, which is a must in the German Law. The second one is the advantage granted to the local (Turkish) renewable energy plant manufacturers. These manufacturers include industrial institutions and companies designing and producing wind turbine, solar panel, micro hydro turbine, biogas, biomass, geothermal power plants or parts.

7. *The following investments are entitled to have additional subsidies, grants and/or incentives by the Council of Ministers' decisions:*
    a. *Energy production plants*
    b. *Local procurement of electro mechanical systems manufactured in Turkey*
    c. *R&D and manufacturing activities of solar cells and solar focusing apparatus*
    d. *R&D and plant investments for electricity and fuel production from biomass*

The renewable energy power plant designers (mostly a research & development based activity) and producers (mostly a manufacturing and systems integration type of activity) will receive additional benefits.

8. *The forest land and public land are available for rental to be used in renewable energy projects. These lands are rented by the Ministry of Forestry or Ministry of*

[12] YEK Belgesi

Finance. There will be an 85% discount for the electricity transmission rents accrued by Electricity Authority for ten years.

9. *The renewable energy plant investments are allowed in the natural parks, nature parks, natural monuments, nature preservation areas, protected forestry and wild life development areas with the permission of the related Ministry. The same is valid for the natural site zones with the Environmental Protection Council[13]'s permissions.*

These articles are of spatial type, regulating locational and land use related aspects of renewable energy resource usage. The article 8 states that the electricity transmission fee for the clean electricity generated by renewable sources and within public lands is reduced by 85%. The article 9 enforces permission requirements from related institutions regarding the usage of natural and historical preservation areas within renewable energy projects. With the availability of the required permissions, renewable energy investments are possible within these protection areas (Republic of Turkey 2005).

10. *The different types of renewable energy resources will receive different amounts of feed-in-tariff prices. The tariff prices will increase depending on the percentage of the local manufactured energy plant components. (A comprehensive table for the determination of the local percentage is published.)*

This article draws a detailed framework for electricity buying prices generated from renewable sources. These prices are determined for renewable energy types (wind, solar, biomass, geothermal, etc.) and there is additional price increase for different weights of domestic manufacturing. For example, a wind turbine continues to receive additional prices if only (for example) its tower is manufactured in Turkey. If blades are also manufactured in Turkey, the amount continues to increase according to a price schedule. From personal experiences, this approach is generally considered as a positive and useful policy in order to create additional employment and provide sectorial expansion in Turkey including supporting industries and maintenance operations.

This Law's objectives are to increase the utilization of renewable energy sources and to decrease the importation of foreign energy sources in the long term. Additional objective is to increase the investments in the renewable energy sector either foreign or domestic, by providing a positive margin towards the local manufacturers. The Law also provides articles to integrate national energy policy of Turkey to the policies of EU during the accession phase.

In parallel with the renewable energy policy developments in the world, the laws have direct or indirect incentive or subsidy mechanisms that target the increase in renewable energy sources utilization. As a general approach the mechanisms and incentives regarding the renewable energies are presented in Table 8.

[13] Çevre Koruma Kurulu

Table 8 - An overview of renewable energy incentives in Turkey, Source: (Yılmaz 2008)

Mechanism	Incentives
Licensing	Individuals and corporate entities granting an exemption from licensing and setting up a company with a capacity less than 500 kW for building electricity generation facilities out of renewable energy sources.
	Corporate entities applying for a license only will pay 1% of the licensing cost. Furthermore, they do not pay licensing costs for the first 8 years.
	Priority is given for system connection.
Land Appropriation	Real properties, which are either regarded as forest or the private property of Treasury, are leased or right of easement or usage permits are given to such properties.
	Forest Villagers Development Revenue, Forestation and Erosion Control Revenues are not demanded during the first 10 years: 85% discount is granted for rent, right of easement and usage permits.
Purchase Guarantee	The Turkish government guarantees, via a feed-in tariff, to buy electricity out of renewable energy plants, built or to be built between 18.05.2005 and 31.12.2015, for 10 years for a fixed price depending on the used renewable energy.
	The government also promotes domestic manufacturing of the equipment to be used in power plants through additional feed-in tariff.
	Feed-in-tariff amounts and duration for renewable power plants to be built after 31.12.2015 will be decided by Turkish Council of Ministers.

The energy production activities from most renewable resources are location specific, i.e. high wind or solar potential areas are selected for renewable energy projects. These types of resources are not transportable like petroleum, coal or biomass sources; as well as hydro sources to some extent. In parallel to this fact, the planning activities or zoning procedures should include and protect the locations for renewable energy resources. The Renewable Energy Law includes protective articles about the renewable energy resource sites. The city and regional planning activities are advised to protect those sites from other non-energy related activities. These sites are often located at mountainous and non-habitable areas, usually in lands that belong to Treasury with lower speculative land values, which were discussed at 3.1.1.

Other than city planning activities, many comments are made about the renewable energy law by Non-Governmental Organizations and, Energy and Renewable Energy related

institutions. The Union of Chambers of Turkish Engineers and Architects[14] compiled these comments and published a declaration. Within these comments, the following items are related with regional planning and strategic energy planning areas: (TMMOB 2011).

a. The law lacks serious support towards renewable energy. Only price mechanism is used.

b. The law lacks reasonable and measurable objectives for each type of renewable energy sources for the years 2020, 2030, and 2050.

c. The local and domestic manufacturing of power generation equipment (turbines, power cells, control systems, batteries, spare parts and such) must be more actively subsidized.

d. There is a risk that the law will lead to improper usage of naturally rich, environmentally viable and agricultural arable lands. The law does not include protective articles regarding the forests, historical sites, protection areas and valuable arable lands. Especially the improper location of micro hydro (HES in its Turkish abbreviation) type of renewable energy power plants possess serious risks to the natural water regimes, as well as the rivers and lakes. There should be an inventory of renewable energy plant installation zones prepared by planners and related electric authorities.

e. The electrical energy transmission related articles within this law are often criticized for being against the decision of the State Council (Danıştay). The transmission activities are public activities that cannot be privatized.

f. The solar renewable energy resource is not enough subsided. The feed in tariff price is comparably low, that in return, does not attract enough investors to solar power. The solar term here is used for electricity generation panels, not water heating systems.

g. From the national security point of view, the electricity generation shall be jointly made by public and private sectors. Complete privatization of electricity generation activities (the law does not set a limit, so it is limitless) endangers the supply security of energy.

In spite of the criticisms for the Renewable Energy Law, the renewable energy projects, especially in the wind energy sector, have shown an increasing trend after the enactment of the law (Figure 24). From personal experiences, since the wind energy investments have the shortest return, the wind energy projects are preferred by the investors. The solar and other renewable energy projects are also increasing.

[14] Türk Mühendis ve Mimar Odaları Birliği, TMMOB

The Law had positive effects on the development of renewable energy projects in Turkey. Some amendments have been made in order to clarify and elaborate the subsidy mechanisms within the Renewable Energy Law.

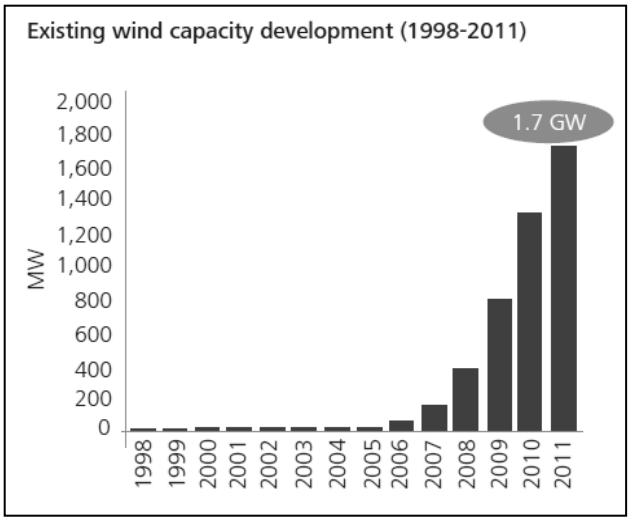


Figure 24 – After 2005, installed wind turbine capacity grows in exponential terms, (source: Wind Business in Turkey, (TUREB 2011))

3.3.2 The Regulation of Renewable Energy Law No.4346, year: 2011

The italicized texts are paraphrased from the original Turkish Regulation articles. The following are the comments and opinions by the author about the articles.

1. *In a more detailed approach, this regulation further draws the framework of energy generation process from renewable sources.*

2. *For up to 500kW capacity (a household uses about 10kW of energy in the peak consumption), people and/or companies are not obliged to take "electric production license from wind energy".*

This article limits the unlicensed wind turbine power capacity to a comparably smaller amount of 500kW. By this regulation, any person or company can install a wind turbine up to 500kW size without any electric production license. However, there are other permissions required for the installation like transmission permits and military approvals. The reason behind this limitation is the poor condition of electrical infrastructure of Turkish electricity grid and the lack of experience of operation (EPDK 2013). Since the wind farms are newly being constructed and operated in Turkey, the law starts with

smaller machines for taking smaller risks. However 500kW wind turbines are not currently being manufactured in the world and the minimum commercial wind turbine size has reached to 2.0 MW (Nordex Inc. 2013). This regulation may bring over-aged and old technology wind turbine generators to Turkey.

Although the governing Law (no.5346) dictated a joint determination of renewable energy resource locations with related institutions, this regulation lacks required procedures for the determination of these locations. This activity is left to the entrepreneur and the law only requires the ownership of rental records of the project area. If an entrepreneur manages to get required records, all types of renewable energy projects can be built to theoretically all types of lands (TMMOB 2011).

The Renewable Energy Law and its regulation create a framework for renewable energy applications in Turkey. Application of these policies to actual space and socioeconomic system experiences different interactions in each project, either positive or negative.

As an example for the application of the Renewable Energy Law, Hatay – Samandağ Wind Farm project is selected. This project is one of the clean electricity generation projects from renewable sources. The electric generation capacity of the project is 25MW and consists of multiple wind turbines. The turbines are imported from abroad either brand new or second hand refurbished machines. There is electricity production license requirement for this type of wind farm project (EPDK, 2011). Current distribution of licensed wind farm projects over Turkey can be seen at (Figure 22).

Hatay area has feasible wind energy resources, therefore it is attracting wind farm investments from both local and foreign investors (REPA). Samandağ Wind Farm Project is a local renewable energy project. It has 9 units of turbines each having a 2.5MW power capacity. The investor determined the wind turbine locations, and the electricity authority had approved the locations of each wind turbine (TMMOB 2009).

There was no planning or zoning activity involved in turbine siting process, as the law did not require any. These types of regulatory or preventive activities took place *after* the completion of license process. Such as:

a. The Museum Management of Hatay noticed that the tower foundation area of 1st wind turbine sits on 3rd degree protection area. After negotiations, the turbine location has changed by the investor.

b. There is no Environmental Impact Assessment study required by the Governorship.

c. The foundation areas of all nine wind turbines were placed on qualified agricultural lands. The Agricultural Ministry has conditionally agreed on the establishment of wind turbines.

d. Environmental and Forestry Directorate has given positive comments to the change request to the city and surroundings plan of Hatay. (TMMOB 2009)

During the initialization of Samandağ Wind Farm project, there were some irregularities between the legal structure and the application to the actual location. The local residents' responses are generally positive but they are complaining about the lack of communication between the wind farm investors and the local people. They say that they are willing to help to the investors in selecting better locations for the turbines, since they know the area for many years. Additional investigations showed that the wind farm site was placed on an earthquake fault area. The access roads for the wind turbine transportation and installation blocked the agricultural lands and some parts of the Asi River. (TMMOB 2009)

This example shows that additional studies, communications and interactions should be made when translating the legal structure to the physical structure.

3.3.3 Other Laws Containing Renewable Energy Related Statements

As from the renewable energy related legal structure in Turkey, additional headings can be summarized from different laws:

a. Environmental Law No.5491, year: 2006 states that *"the Ministry of Environment takes necessary measures to develop and support subsidy and incentive mechanisms, regarding the use of renewable energy and other (environment related) activities."*

b. The Law about the organization and duties of the Ministry of Energy and Natural Resources[15] No.KHK662, year:2011 declares:
   i. *The General Directorate of Renewable Energy[16] (replaces the Assessment Authority of Electrical Works[17]) is responsible for the determination and measurement of the resource capacity for all types of renewable energies including wind, solar, geothermal and biomass.*
   ii. *The same organization is also responsible for the monitoring and evaluation of the (technical and administrative) developments about the energy generation processes from renewable energy sources. Decide national priorities and objectives in order to increase the renewable energy production and energy efficiency.*

[15] Enerji ve Tabi Kaynaklar Bakanlığı
[16] Yenilenebilir Enerji Genel Müdürlüğü
[17] Elektrik İşleri Etüt İdaresi, EİEİ

c. The Law (KHK) establishing the Ministry of Environment and Urbanism[18] No.644, date: 2011 declares that: "*Among the duties of the "General Directorate of Environment Management[19]", the generalization and encouraging of usage of clean energy sources in which the renewable sources have priority."*

   The same law authorizes the Ministry of Environment and Urbanism for the preparation, have them prepared and authorize the following plans:

   a. Macro scale spatial strategy plans (national and regional physical plans)
   b. Environmental arrangement plans in the basin or regional scales
   c. The provincial environmental arrangement plans that have not been prepared within the period given by the Ministry

   These authorities granted to the Ministry of Environment and Urbanism indicate the maximum level of centralization in planning processes, seriously damaging the locality and local contribution to the planning activities. (Ersoy 2013)

These excerpts from legal texts have an introductory nature to the renewable energy concept. The common point of these regulations is the generalization, popularization and utilization of renewable energy sources.

Since the laws and regulations define macro scale policies, the execution of the principles are made by related organizations. The next section discusses the Development Agencies, which are responsible for preparing and executing the Regional Plans.

[18] Çevre ve Şehircilik Bakanlığı
[19] Çevre Yönetimi Genel Müdürlüğü

CHAPTER 4

DEVELOPMENT AGENCIES (DAs), REGIONAL PLANNING AND RENEWABLE ENERGY

4.1 Introduction – Regional Planning in Turkey

It is widely accepted that almost all developed and developing countries are experiencing regional inequalities. Especially after the World War II, the regional equalities have been a major issue in political and economic agenda.

The regional development and regional planning concepts are used together in Turkey. The regional planning efforts had started in 1960, as the Regional Planning Directorate[20], under the Ministry of Development and Housing[21]. It is seen that this directorate had completed several regional planning projects during 1960s and in 1970s focused on the metropolitan planning. In 1985, the regional planning duties had been given to State Planning Organization (DPT). (Ildırar 2004)

Within this period, the regional development related policies and decisions have been realized by central governmental institutions, in a national scale. In this governmental structure, the first stage consists of the parliament and the government, the second stage includes SPO and related public institutions, the third stage consists of public financial bodies (banks), cooperatives, confederations and local administrations. In the local scale, the local units of the central government (provincial and district administrations) have been actively administering the regional development related policies. Unfortunately, the local NGOs and professional organizations did not have the chance to contribute and participate in these policies. (Tamer 2008)

As a result of experienced policy failures, it was necessary to build institutional mechanism at the regional level. With the establishment of Development Agencies, a more decentralized and regionalized institutional model has entered into the political agenda of Turkey. It is an important step towards a multi-level governance model from a centralized regional planning approach. (Kayasü and Eldeniz, Institutional Performance of Izmir Development Agency 2013)

[20] Bölge Planlama Dairesi Başkanlığı
[21] İmar ve İskân Bakanlığı

4.2 Development Agencies in Turkey

Up to this section, in order to construct a framework, the macro scale plans (5YDPs), policies and legal texts of Turkey is discussed from the sustainability and renewable energy point of view. It is essential to focus on Development Agencies that are responsible for the planning activities in the regional scale.

In today's global context, the policy decisions that aim increasing the economic development with the system of the Development Agencies, points out the deportation from the traditional policies which are centrally managed and sector oriented. With these organizations, a European Development Model has been adopted and the sub-national zones are emphasized as the main driving force of the economy. In parallel, a portion of the economic development related jurisdiction power has been delegated to local institutions, that enables the involvement of the civil community into the political decision making process. (Young-Hyman 2008)

EU's main issue, in introducing the Regional Development Agencies, was the minimization of the intra-regional inequalities, more than increasing the regional growth and development. The term "region" is used for the state-nations that form the EU. Turkey, on the other hand, has two alternatives in using the DAs. One is, using them as tools within a narrow framework for utilizing EU support funds. The other is the harnessing of the broad potentials that regional decision units (DAs) hold. These potentials include the organization and fulfillment of the (technical) innovation functionalities in the region. In order to perform these functionalities, the development of the projects that transfer the technical knowledge and undertake the necessary research activities is needed. (Tekeli 2008)

Regional Development Agencies have differences in both their scales and the roles that they undertake. Some of them are established in city scale, whereas the others have regional or national scales. Turkey has adapted the EU based classification, where city scale and regional scale DAs are possible.

4.3 NUTS2 Classification

In order to obtain a single, compatible system for dividing the EU's geographical territory into economic entities; Eurostat (the statistics office of the European Union) has introduced the NUTS classification in the early 1980s. Nomenclature of Territorial Units for Statistics (NUTS) is a hierarchical system for the following purposes:

a. The collection, development and harmonization of EU regional statistics

b. Socio-economic analysis of the regions
    i. NUTS 1: major socio-economic regions
    ii. NUTS 2: basic regions for the application of regional policies
    iii. NUTS 3: small regions for specific diagnoses

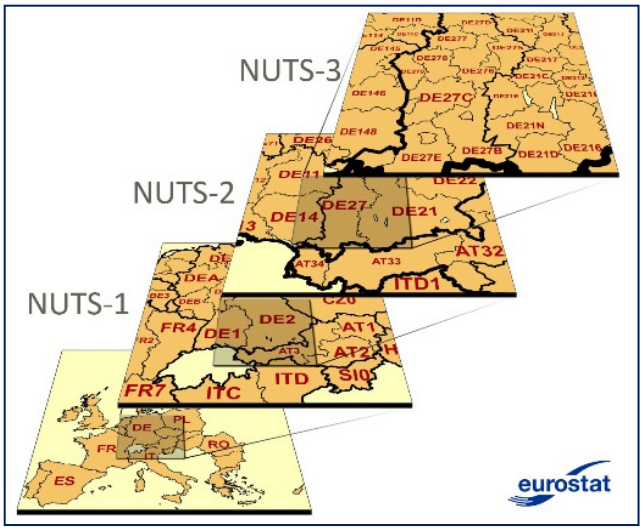


Figure 25 – Hierarchical structure of NUTS system; source (Eurostat)

c. Framing of EU regional policies

Turkey has been a part in the territorial statistical units study since 2002. Being an accession country for the EU, Turkey has adopted NUTS system along with other accession countries like Montenegro, Croatia, the Former Yugoslav Republic of Macedonia (FYROM), Serbia and Iceland (European Commission 2013).

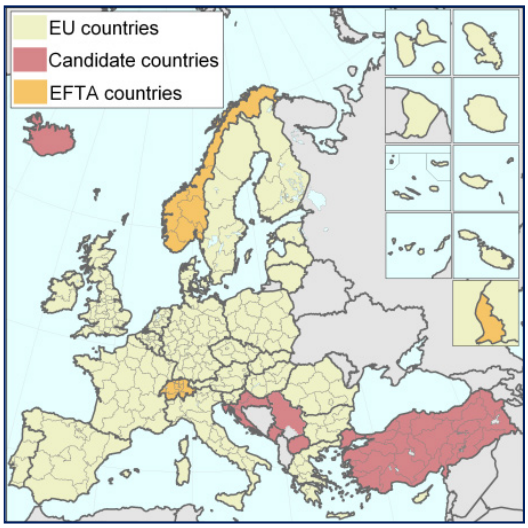


Figure 26 – Countries that use NUTS System; source (Eurostat)

In Turkey's implementation of NUTS system, NUTS 1 level covers 12 greater-regions, the NUTS 2 level corresponds to 26 sub-regions having 1-3 cities and the NUTS 3 level corresponds to the 81 provincial administrations.

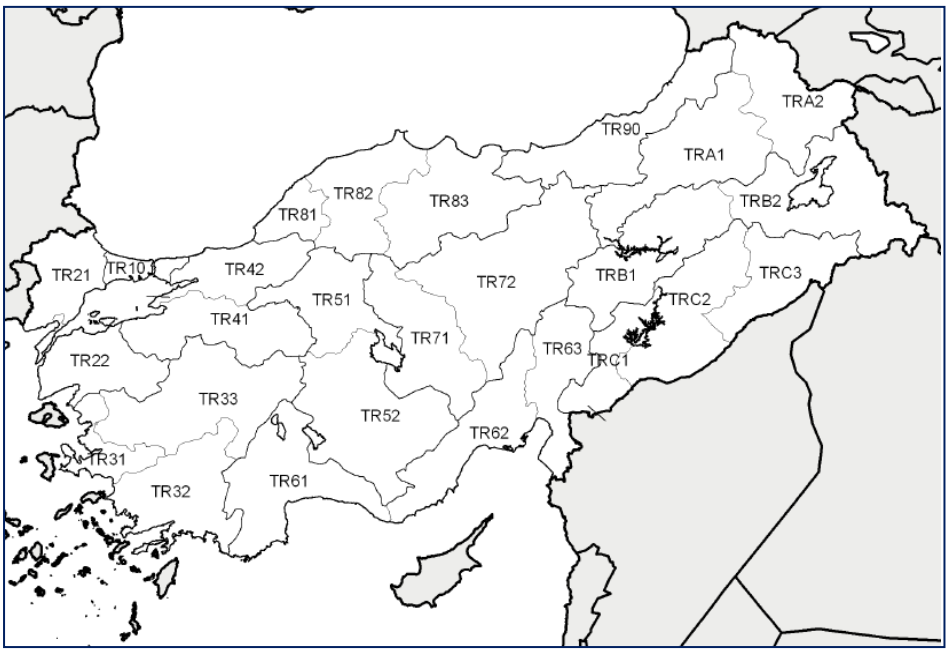


Figure 27 – NUTS 2 Regions of Turkey, source (EU)

Following the adoption of the NUTS classification, Development Agencies (DAs) have been established in NUTS 2 level regions. There are 26 agencies in Turkey. The Law on Development Agencies (Law no. 5449, date of acceptance 25.01.2006) defines the objectives of DAs as follows:

a. Improve the cooperation between public sector, private sector and non-governmental organizations
b. Achieve the utilization of the resources locally and efficiently
c. Activate the local potential
d. Speed-up and create sustainable regional development in parallel with the principles and policies foreseen in the national development plans and programs
e. Decrease the inter-regional and intra-regional development differences

4.4 The Establishment of the DAs and Legal Framework

The establishment of the Development Agencies is evaluated as an important change in Turkey's regional development. In the past, the state had a tendency for the central preparation and execution of the regional development strategies and plans. The DAs are seen as an important refraction from the central planning approach started in 1960s (Aydemir ve Karakoyun 2011).

Starting with the Accession Partnership Document, Turkey commits the need for the preparation of the regional plans by the Development Agencies, in order to:

a. Develop a national economic and social accordance (with the EU) policy that aims to decrease the regional differences
b. Acceptance of the legal framework that eases the execution of the regulations
c. Determination of multiyear budgeting methodologies enforcing the priority criteria related to the public expenditures to the (NUTS 2) regions
d. Strengthening of the administrative bodies that will implement the regional development
e. Establishing of Development Agencies in NUTS 2 level, that will design, create and implement the regional plans

By the establishment of DAs, these important objectives are aimed: local and affective usage of the resources, acquiring decreases in the development differences between the cities and the regions, strengthening of the local administrations; while taking NUTS2 classification into account. DAs primary functions include: planning, coordination, execution, monitoring and evaluation in the regional level. (Aydemir ve Karakoyun 2011)

When Regional Development Agencies Law was put into legislation, the State Planning Organization (SPO) was responsible for the national coordination with the assignments below:

a. Takes measures minimizing the inter-regional and intra-regional development differences, guides and consults the DAs within the studies of planning, programming and developing projects; monitors and evaluates the execution of plans and the programs
b. Determines the criteria for evaluating the performances for DAs and their programs; makes or have other parties to make the actual evaluations
c. Designates the internal or external origin financial funds aimed for regional development to the DAs and determines the procedures for the usage of these funds
d. Facilitates the inter DA cooperation and supports the creation of joint project development

e. In order for the Agencies to fulfill their functions effectively and efficiently, facilitates collaboration and coordination with the related institutions and corporations in the central level
f. Approves the annual programs of the DAs
g. Approves the general secretaries for the DAs who are selected among the suitable qualified persons and proposed by the Agency Boards of Directors
h. Determines the modes of assessment regarding monitoring and evaluation of the plans and programs, aids and funds transfers, employment of personnel, proper execution of budget and accounting standards, annual reports (Republic of Turkey 2006)

From 2011 onwards, the State Planning Organization was reorganized as the Ministry of Development, implementing the aforementioned assignments about the DAs.

Within the Ministry of Development, the General Directorate of Regional Development and Structural Adjustment[22] is responsible for coordination and approval of the activities of the Development Agencies. These activities include: preparing and executing regional plans, achieving regional development, and executing EU supported regional programs, grants and incentives. Higher level regional plans are prepared by the General Directorate of Regional Development and Structural Adjustment, and NUTS 2 level regional plans will be prepared by DAs, under close cooperation with various organizations, in accordance with national plan policies. By this way, it will be possible to harmonize the policies and decisions within the NUTS 2 level regional plans with broader macro objectives, national development plans and policies, resource assignments and policy sharing between priority development regions and cities (Republic of Turkey, Ministry of Development 2006, 12).

4.5 Regional Plans, Macro - Micro Scale Plan Interactions and Criticisms

Along with the elaboration of literature and printed material like articles, reports, publications etc., an interview by e-mail was conducted with a regional plan specialist from Ankara Development Agency (ANKARAKA). The aim of the interview is to better position the DA's regional plan within the planning system and take the views of a practitioner. He summarizes the relation between the DAs and the Ministry of Development regarding the preparation of the Regional Plans:

> "Regional Plans are defined with this statement in Building Code No.3194: '*the regional plans shall be prepared in order to determine the tendencies of socio-economic development, the development potentials of the settlements, sectorial*

[22] Bölgesel Gelişme ve Yapısal Uyum Genel Müdürlüğü

objectives and the distribution of the infra-structure. ... When needed, the (former) State Planning Organization prepares or makes the regional plans prepared.' Currently, The Ministry of Development (former SPO) is responsible for this. With an official statement, the Ministry of Development has entitled DAs for the preparation of regional plans and the coordination duties. Within the current legal context, the real "owner" of the regional plans is the Ministry; however they are prepared by the DAs and within the assignment of the Ministry, they coordinate the regional plan preparations. The Ministry makes necessary guidance during these activities and the content of the plans.

The Strategy and Policy Development Department of the Regional Development and Structural Adjustment General Directorate in the Ministry of Development has published a document named "New Regional Plans: Scope, Format and Content" in 20 May 2013. In the first section "General Criteria", there are articles defining the relations of the regional plans with the macro and micro scaled related planning documents. Article 1 states that "*the preparation of the regional plans should be consistent with the development plans, regional development national strategy documents and other sectorial and thematic strategies and national level documents*". Article 2 states that "*the inclusion of the spatial decisions for the region in the regional plan is determined by the national plan, program and strategies*". This article defines one of the properties of the regional plan as the construction of the relation between the policy, plan and strategies in the national level and the activities to be undertaken in the regional and local level.

The Article 3 of the same section states: "*the consideration of the compatibility and interaction with the regional plans that are in the perimeter of the regional plan in preparation*". This article defines the relations with the same level plans.

The Article 7 requires the examination of the lower scale plans especially the Territorial Development Plans[23] in the region.

By these statements, the Ministry of Development requires the harmonization of the regional plans with the macro and micro scale plans and planning documents. In practice, the realization of this task is made by the agency specialists. Since the preparation of a regional plan is a comprehensive task and a group organization, the relations with the other plan documents are being carried out carefully. Although sometimes there are accession problems for the related planning documents, their planning decisions are being reflected in the regional plans." (ANKARAKA 2013)

[23] Çevre Düzeni Planı

At this point, with multiple institutions having the authority to prepare macro plans like Territorial Development Plans or the Provincial Territorial Plans, there is an uncertainty about the execution of the regional plans.

The ambiguities about the following issues are present:

a. Which institutions will execute these plans and the actors participating in this process
b. How will the establishment of planning-execution coexistence be achieved
c. What will the plan contents be
d. How will the economic and social decisions and spatial decision be unified (Eraydın 2008)

In addition to preparation of the regional plans, the development agencies have other social and economic objectives and duties. The relations between DAs and the Ministry of Development had received a number of criticisms as well (Dedeoğlu ve Sertesen 2011):

a. The DAs are very much in the guidance of Ministry of Development. MoD has excessive control over DAs from the appointment of Secretary General to the approval of the financial budgets. It is currently not possible to say that the DAs have enough autonomy to fulfill the local duties expected from them.

b. The scope of duties of DAs is very broad. On the other hand, the resources allocated to DAs are inadequate. The solution of regional inequalities issue cannot be achieved only through DAs. Within this limited sources, the DAs should mainly focus on economic development and development of the private sector; leaving the social development dimension temporarily out of scope.

c. All of the decisions that affect the economic and social development are determined in city level, since all the administrative, legal and political system is organized in city scale. It is not possible for the formerly created NUTS2 level region DAs to affect this decision mechanism and create a brand new thinking and conception habit.

However, with the effect of globalization and the economic and social changes, in the present times, the multi-actor governance approach is replacing the classical central and hierarchical administration methods. With this new approach, along with the local bodies, international administrations (EU), regions and cities come into practice as different governance agents. This situation decreases the definitive roles of the central authorities (The Ministry of Development) in the allocation of resources and final decision making. More participatory mechanisms having more horizontal relations replace this central hierarchy. As a result of these, the need for redesigning of the process of carrying out the public services emerges. (Halkier 2006)

In order to carry out their duties, DAs need financial resources and other sources of income. The sources of finance for DAs are determined as follows:

a. A share for each DA determined by the Higher Planning Committee[24] from the sources received from 0.5% of the general taxation revenues.
b. The income received from EU and other international funds
c. Operation revenues
d. The 1% of incomes of Special Provincial Administrations[25] and Municipalities
e. The 1% of incomes of Industry and Commerce Chambers
f. The grants and charities donated by national and international institutions
g. The excess sources from previous year

The DA uses this budget in performing its duties, carrying out daily operations and providing technical support to the region. In many areas, including renewable energy and sustainability, the agency initiates call for projects in order to support the successful applications, in parallel with the regional plans and higher level plans.

Since the DAs are responsible for the preparation of regional plans, the regional policies or approaches about the renewable energy utilization in a given region (NUTS 2 region in this case) will be discussed according to these regional plans.

Each of the 26 Development Agencies has prepared a regional plan and submitted it to the Ministry of Development's approval. These plans cover the period between 2010 and 2013, and have macro (5 year development plan, national plan, EU policies, etc.) and micro planning relations.

The macro (higher scale) plans, programs or documents that are related with the DA regional plans are:

a. 9th Development Plan (2007 – 2013)
b. National Earthquake Strategy and Action Plan (2012 – 2023)
c. National Environmental Integration Strategy (UÇES) (2007 – 2023)
d. Information Society Strategy (2006 – 2010)
e. Instrument for Pre-Accession Assistance – Rural Development (IPA)(2007 – 2013)
f. KENTGES – Integrated Urban Development Strategy and Action Plan (2010 – 2023)
g. The Industrial Strategy Document of Turkey (2011 – 2014)
h. Turkey Tourism Strategy Document (2013 – 2023)
i. National Rural Development Strategy Document (2001 – 2023)

[24] Yüksek Planlama Kurulu
[25] İl Özel İdaresi

Almost all of these plans and documents have mentioned renewable energy utilization within the analysis or recommendations sections. Similarly the abundance of the renewable energy resources potential is emphasized in these documents. In the Industrial Strategy document, the Low Carbon Economies (clean and renewable energy generation related industrial activities) has been identified as one of the largest growing economies in the near future, creating new employment and market opportunities. It is stated that the companies creating new products and services in this sector should be supported and backed up with new markets, opportunities and creation of "green employment" education centers. (TC Sanayi ve Ticaret Bakanlığı 2010)

The Integrated Urban Development Strategy and Action Plan 2010 – 2013 (KENTGES in its Turkish abbreviation) document sets the action 6.2.4 as the research, inventory and resource assessment studies will be made regarding the supply of energy demands by urban areas by renewable sources. There is a need for the energy studies, energy plans and projections for energy demands and consumptions of the settlements. Legal structure arrangements will be done for the generalization of renewable energy usage in the urban areas. Suitable support and subsidy mechanisms shall be identified. The sustainable and renewable energy technologies will also be supported and used for transportation solutions in the cities. (TC Çevre ve Şehircilik Bakanlığı 2010)

Other than the development agencies, Greater City Municipalities have been granted to prepare macro scale plans. Regarding the scope and borders for the regional planning activities, responsibilities and authority; the publication of the Law No.6360, which is about the "Establishment of 13 Greater Municipalities and 26 District Municipalities"[26] has made radical changes. As its name states, it has permitted 13 more municipalities (in addition to the existing 16) as City of Greater Municipality. Moreover, the effective planning borders of the greater municipality cities have been extended to their administrative borders. Before, the planning border limits were between 20 and 50 km, with respect to the cities' population. As another major decision, the presence of the "special provincial administrations" is ended in the all 26 City of Greater Municipality. And all the town municipalities[27] are closed (1022 in total) and their planning authorities are transferred to the Greater Municipalities. As a result the Greater Municipality has become a planning entity responsible for the whole city. (Ersoy 2013)

The Ministry of Environment and Urbanism has the authority of preparing Territorial Development Plans in the "regional" level, where the determination of the region is made by the Ministry. This regulation has been done by the Decree Law[28] No 644.

It is evident that there are three institutions that have the authority to prepare regional plans over a city: DAs, Greater City Municipalities and Ministry of Environment and

[26] 6360 sayılı "On Üç İlde Büyükşehir Belediyesi ve Yirmi Altı İlçe Kurulması İle Bazı Kanun ve Kanun Hükmünde Kararnamelerde Değişiklik Yapılmasına Dair Kanun" (6.12.2012)
[27] Belde Belediyesi
[28] Kanun hükmünde kararname, KHK

Urbanism. There is a risk for the planning decisions taken from separate regional plans prepared by different institutions to conflict and interfere with each other. And the following micro scaled plans might be negatively influenced by this confusable situation. (Ersoy 2013)

Figure 28 – An overview of Development Agencies, (source: Ministry of Development)

4.6 Renewable Energy and Regional Plans

Following is a summary about the renewable energy related planning decisions and statements from the Regional Plans prepared by the Development Agencies:

1. TR10: Istanbul Development Agency (ISTKA – Istanbul):
    a. Renewable energy is mentioned in the "Strategic Goals and Objectives" section of the axis of "Environmental and Cultural Sustainability". "The encouraging of the usage of renewable energy sources" statement is used in various locations when detailing the importance of the protection of the environment and pollution mitigation.
    b. The rich renewable energy resources potential of Turkey and the region is emphasized in the "Energy" chapter of the "Existing Situation Analysis" section. An entire sub-chapter is reserved for the renewable energy concept, with capacity tables and supporting figures. Two renewable energy resource maps are presented with very high scale (approx. 1:1000000) taken from General Directorate of Renewable Energy (EIEI). Unfortunately, both the most common renewable energy resources (solar and wind) are declared as poor and non-economical for the region.

c. In the SWOT (GZFT) analysis section, renewable energy related arguments are used in many places as supporting and complementary propositions.
d. In the determination of region's strategic priorities, renewable energy, energy efficiency and environmental pollution mitigation concepts are used, without any clear objectives and policies.

2. TR21: Trakya Development Agency (TRAKYAKA – Tekirdağ, Edirne, Kırklareli):
    a. Renewable energy is mentioned in the "Existing Situation Analysis" section as a future for the energy sector. There is a separate sub-section about the renewable energy, giving initial information and addressing the need for improvement of activities within this area. Wind energy and biogas (related to the husbandry activities) are regarded as potential renewable energy sources within this region. A sample wind resource map (national scale) is provided.
    b. In the SWOT (GZFT) analysis section, renewable energy potential is regarded as a *strong* notion and information about the renewable energy electricity feed in tariff opportunities are given as supporting arguments.
    c. One of the "strategic objectives" of TR21 regional plan is designated as "spreading of environmental friendly energy systems and increasing the energy efficiency". Among the supporting commitments for this objective, research and technical activities about the renewable energy were mentioned as well as expressing of the intentions for constructing new wind farms within the region.

3. TR22: Güney Marmara Development Agency (GMKA – Balıkesir, Çanakkale): This region has the largest installed capacity of wind turbines in Turkey.
    a. In the "Existing Situation Analysis" section, renewable energy and energy efficiency are discussed as the "factors" of the region's sustainable development vision. Satisfactory information about region's renewable energy potential (with wind resource maps) and, completed and in-progress wind farms are presented. Investors are encouraged to increase investments in this region. Geo-thermal and biomass types of renewable energy are being summarized within this section.
    b. In the SWOT (GZFT) analysis section, renewable energy potential is regarded as a *strong* notion. In the *opportunities* section, the renewable energy "EU support" is mentioned.
    c. There is an "objective statement (strategy)" in the 3rd objective of "Achievement of Environmental Sustainability" goal, within the "Vision, Goals, Objectives and strategies" section. As its name suggests (The Spreading of the Utilization of Renewable Energy Sources), this strategy can be summarized as the holding of informational meetings and educational seminars about the utilization of renewable energy sources for electric energy, thermal energy and organic fertilizer production. In

order for these resources to be realized safely, affordably and environmentally; R&D studies and application projects will be made. Within this region, the success of this strategy is planned to be evaluated by these three criteria: electricity generated by renewable energy sources, the number of industries and houses using electricity from renewable sources and the number of research and projects related to the renewable energy sources.

4. TR31: İzmir Development Agency (IZKA – İzmir): This region has increasing amounts of renewable energy projects in Turkey.
    a. Renewable energy is one of the five "key sectors" assessed in this regional plan. Other key sectors are tourism, logistics, agriculture and manufacturing of advanced technological products.
    b. Among all of the four "development axes", renewable energy is mentioned as a prosperous and promising source of energy.
    c. There are "strategic priorities" within each development axis. And objectives are listed regarding each strategic priority. Renewable energy is mentioned in many objective definitions. The R&D related and educational objectives are examples.
    d. Within Izmir regional plan, the most contextually responsive objective is mentioned under 6th strategic priority (the realization of efficiency and economic diversity in sectorial basis)'s 4th objective (priority investment areas (spatially) will be determined and utilized regarding the renewable energy sources). This objective expands the benefits of renewable energy related technology investments, and emphasized that combined with the region's renewable energy potential; these efforts will be positively returned to the region's economy.
    e. The measures for renewable energy related objectives' evaluation are: the ratio if wind energy installed capacity to wind energy potential capacity, the same ratio regarding the geothermal energy sources and the amount of energy generated from renewable sources.

5. TR32: Güney Ege Development Agency (GEKA – Aydın, Denizli, Muğla):
    a. In the "Existing Situation Analysis" section, there is a renewable energy heading in the energy sub-section. Within this chapter, the existing situation and renewable energy potential of the region is summarized with supporting figures. Solar, wind and geothermal resource maps are presented and the region's renewable energy resource abundance is emphasized.
    b. The need for Renewable Energy Workshops is stated in miscellaneous sections.
    c. In the SWOT (GZFT) analysis section under the "Energy and Mining" heading, renewable energy potential is regarded as a *strong* notion. In the *opportunities* section, the increasing public interest in energy generation from renewable resources is mentioned. However the resource

assessment studies, lack of education and R&D activities about the renewable energy are listed under the *weakness* section of the SWOT analysis.

d. The GEKA regional plan has five development axes declarations. Under the "healthy and livable environment" development axis, the first objective is the "generalization of the utilization of renewable energy". This objective is backed up by a number of aims, and strategies. In summary, it is planned that the education activities will be increased; the resource assessment activities will be detailed and local production of the renewable energy power plants will be subsidized about this objective.
e. The locations that have priority in renewable energy resource assessment are clearly determined and marked on a regional map.
f. The only criteria for renewable energy related objective evaluation is the number of "Renewable Energy R&D Centers". It is foreseen that the number of these centers will reach 3 by the end of 2013.

6. TR33: Zafer Development Agency (ZAFER – Afyonkarahisar, Kütahya, Manisa, Uşak):
    a. Under the "Energy and Mining" chapter of the regional overview section, the geothermal energy potential of the region is explained. The hydro, wind and geothermal potential of the region are presented with charts. Exiting plants are also listed.
    b. The energy production capacity increase is among the strategic objectives. The 5YDP macro plan decision of increase in the renewable energy utilization is repeated under this section.
    c. One of the objectives in the regional plan is the generalization of wind and geothermal energy in the region. No quantifiable objectives exist.

7. TR41: Bursa Eskişehir Bilecik Development Agency (BEBKA – Bursa, Eskişehir, Bilecik):
    a. Under the "Energy and Natural Resources" chapter, the geothermal energy potential of the region is stated as the major renewable energy resource. The resource maps regarding solar and wind potentials are presented.
    b. In the SWOT (GZFT) analysis section, the "failure of utilizing the renewable energy potential of the region" is listed under the *weakness* section. The national policies emphasizing the local and renewable energy production is listed under the *opportunities* section.
    c. The "sustainable environment and energy" axis of the six development axes sets six objectives. "Increasing the consistency and awareness for the international treaties (Kyoto, UN, EU etc.)" and "Assessment and utilization of the renewable energy potential of the region" objectives have targets about the training, resource potentials assessment and the increase in local industry regarding renewable energy.

8. TR42: Doğu Marmara Development Agency (MARKA – Kocaeli, Sakarya, Düzce, Bolu, Yalova):
    a. Under the "Provision of Environmental Sustainability and Strengthening of the Technical Infrastructure" objective, the supporting of energy efficiency and decreasing of the energy costs by energy generation from renewable resources is mentioned. These efforts will be supported by financial and educational subsidy activities.
    b. In the spatial situation analysis section, the energy potential of the region is discussed. The renewable energy sub-section explains the different types of renewable energy sources with resource maps and national figures.

9. TR51: Ankara Development Agency (ANKARAKA – Ankara):
    a. Ankara regional plan has four main objectives. One of these objectives, "Environment and Space in Ankara: Ankara that respects the environmental sustainability and has a higher locational and life quality", has declarations about renewable energy. These can be summarized as increasing the consciousness about the importance of energy efficiency and energy generation from renewable sources, the renewable energy resource assessment studies and utilization in the region, and the increase in machinery and equipment production related to the energy production from renewable sources.
    b. In the regional plan, it is stated that the major renewable resources like wind and solar is limited in the region. As an alternative, geothermal and biomass energies are suggested as advantageous renewable energy sources. The region is the center of government, so energy policy design is an important activity made in the region. Moreover, the technological zones (of the universities) are important R&D bases. Important renewable energy research projects are carried out in the region. This region has a more central/national character.

10. TR52: Mevlana Development Agency (MEVKA – Konya, Karaman):
    a. In the "Existing Situation Analysis" section, there are renewable energy headings like solar, wind and electrical energy, in the energy and natural resources sub-section. The existing situation and renewable energy potential of the region is summarized with supporting figures. There are intentions and wishes about the increase in renewable energy utilization in the region.
    b. In the SWOT (GZFT) analysis section, the "high costs of renewable energy plant installation and maintenance activities" is mentioned in the *threat* zone. Similarly, "the lack of scientific researches in the renewable energy field" is seen as *weakness* in the region. "The inadequacy of energy infrastructure, the costliness and fluctuation in energy prices, and the slowness of transition to the utilization of renewable energy sources" are mentioned in the *threat* zone.

c. Among the thematic axes, the "provision of the sustainability of natural resources" axis has declarations and actions about the renewable energy. The increase in utilization of renewable energy resources has been set as an objective. The solar energy potential has been identified as the maximum advantageous renewable energy source. The locations that have satisfactory solar energy potential are clearly announced in the regional plan.
d. There is a statement about the construction of a "Solar Energy Organized Industry Region". The renewable energy sectorial development axes (location) are assessed in a regional map.

11. TR61: Batı Akdeniz Development Agency (BAKA – Antalya, Burdur, Isparta):
    a. In the "Existing Situation Analysis, A General Overview to Western Mediterranean Region" section, under the "Sectorial Analysis", there are information emphasizing the region's renewable energy resource potential. The existing situation and renewable energy potential of the region is explained with solar resource maps (Antalya has the most solar efficient hours in the country). Wind energy locations are located and offered verbally. A reference to the biogas potential is given. The renewable energy sector has been listed among promising industrial sectors within the region.
    b. In the SWOT (GZFT) analysis section, the "solar, wind, hydro, biogas and ethanol from sea moss" renewable energy production possibilities are seen among *strong* values of the region. The increase in the demand for the renewable energy in the world is seen within the opportunities. However, the costliness for the renewable energy installation is seen as a *threat*.
    c. Within "development of the potential promising sectors" section, the strategy for developing renewable energy is the intention for the increase in activities, researches and projects.

12. TR62: Çukurova Development Agency (CKA – Adana, Mersin):
    a. Like the other regions, this region has determined the "renewable energy sector" among the promising sectors. It is planned that this sector will be developed in the supply scope.
    b. It is stated that the following types of renewable energy is abundant in the region: solar, hydro, biomass, and wind energy. The following actions shall be taken in order to strengthen the renewable energy sector: The realization of feasibility studies for the (potential) investments in the sector, development of the human resources, development of the R&D activities and increase in the amount of energy generated with the renewable energy resources. A broad location has been advised for wind energy utilization.

13. TR63: Doğu Akdeniz Development Agency (DOGAKA – Hatay, Kahramanmaraş, Osmaniye):
    a. In the "Existing Situation" section, under the "Sectorial Analysis - Electricity" chapter, electricity generation from renewable resources is discussed. The solar energy is the most promising type of renewable energy source.
    b. The solar energy potential of the region is detailed with resource map and radiance (sunny hours) tables.
    c. The region plan contains additional intentions about the supporting of the feasibility studies about renewable energy.

14. TR71: Ahiler Development Agency (AHIKA – Aksaray, Kırıkkale, Kırşehir, Niğde, Nevşehir):
    a. In the "Existing Situation" section, under the "Situation Analysis – Natural Resources, Energy" chapter; solar, wind and geothermal renewable energy resources are discussed. The region's solar and wind energy potential has been declared as inadequate. The geothermal energy potential is regarded as promising, but suitable for heating only, not for electricity generation.
    b. The need for reassessment of the renewable energy resources is noted, because there is a foreign wind farm investment in the region proving that there are feasible locations in the region.

15. TR72: Orta Anadolu Development Agency (ORANKA – Kayseri, Sivas, Yozgat):
    a. In the "Existing Situation" section, under the "Energy" chapter; solar, wind and geothermal renewable energy resources are discussed. The geothermal energy potential is suitable for heating only, not for electricity generation. As a result, geothermal resources are advised to be used in tourism activities.
    b. Two locations in the region are recommended as wind energy possible investment sites. A joint solar energy project has been explained in detail. There are no more planning decisions.

16. TR81: Batı Karadeniz Development Agency (BAKKA – Bartın, Karabük, Zonguldak):
    a. In the "Primary Objectives" section, under the "Development of Prosperous Sectors", renewable energy is mentioned within the "Supporting of new innovators and SMEs, Application of Clustering and Branding Policies" discussion with intentions to increase R&D activities and usage of renewable energy sources.

17. TR82: Kuzey Anadolu Development Agency (KUZKA – Kastamonu, Çankırı, Sinop):
    a. Under the "Environment and Energy" chapter, renewable energy is discussed with detailed information. Hydro potential is identified as the most abundant renewable energy source in the region. Solar energy is another promising renewable energy source although the region's average is slightly lower than the national average. It is justified that, Germany's average potential is lower than region, but it is having the maximum benefit.
    b. Similarly, the region's wind energy potential was in medium scale, but it is advised that there are feasible areas within the region. There are no locations indicated, though.
    c. In the SWOT (GZFT) analysis section, the "existence of the renewable energy sources" is seen among *strong* values of the region.

18. TR83: Orta Karadeniz Development Agency (OKA – Amasya, Çorum, Samsun, Tokat):
    a. The regional plan for this region is not published, yet. The "Existing Situation" document has some content about the renewable energy. The hydro and bioenergy potential of the region is indicated. The region's corn, maize and wheat potential are regarded as bioenergy resource.
    b. Wind energy is declared as a medium scale renewable potential. The in-progress construction of wind farms in the region is explained. There is also a wind resource map. Solar energy is not advised since the region's potential is limited.

19. TR90: Doğu Karadeniz Development Agency (DOKA – Artvin, Giresun, Gümüşhane, Ordu, Rize, Trabzon):
    a. Within the popular hydroelectric power plant debate within the region, the regional plan states the abundance of the hydro resources.
    b. Other sources of renewable energy are cursory explained with general information. The need for increasing the usage of renewable energy sources is repeated like in every regional plan.

20. TRA1: Kuzey Doğu Anadolu Development Agency (KUDAKA – Bayburt, Erzincan, Erzurum):
    a. The hydro potential of the region is emphasized. It is stated that the wind, solar and geothermal resources are in need of resource assessment and feasibility studies.
    b. Under the "Increasing the Environmental Sustainability and Strengthening the Industrial Infrastructure" objective, "increasing the environmentally sensitive renewable energy production" is declared as a strategy.

21. TRA2: Serhat Development Agency (SERKA – Ağrı, Ardahan, Iğdır, Kars):
    a. In the SWOT (GZFT) analysis section, the "existence of renewable energy interested firms" is seen among *opportunities* for the region.

22. TRB1: Fırat Development Agency (FKA – Bingöl, Elazığ, Malatya, Tunceli):
    a. A wind energy potential information chart is presented including the available surface (km^2) and potential installed capacity (MW) within the region.
    b. Solar energy potential is presented with a chart, as well. Sunny times within a year and the intention of solar power is summarized.
    c. In the SWOT (GZFT) analysis section, the "the solar and wind energy potential of the region" is seen as a *strong* notion for the region. A target of 10% is set for the renewable energy production until 2013.

23. TRB2: Doğu Anadolu Development Agency (DOKA – Bitlis, Hakkari, Muş, Van):
    a. In the "Urban and Rural Infrastructure Analysis", region's solar, wind and hydro energy potential is summarized. Some locations in the region have the most advantageous solar energy potential within the country.
    b. In the SWOT (GZFT) analysis section, the "the solar and hydro energy potential of the region" is seen as a *strong* notion for the region.
    c. The R&D and investment projects are planned to be subsidized within the region.
    d. The locations having renewable energy potential are marked on a region map.

24. TRC1: İpekyolu Development Agency (IKA – Adıyaman, Gaziantep, Kilis):
    a. Solar energy potential of the region is given in detailed monthly and annual capacity charts.
    b. The wind energy studies in this regional plan are satisfactory. There are locations set forth in the plan, taking the wind energy resource maps and spatial information into account.
    c. In the SWOT (GZFT) analysis section, the "the solar and wind energy potential of the region" is seen as a *strong* notion for the region.

25. TRC2: Karacadağ Development Agency (KARACADAG – Diyarbakır, Şanlıurfa):
    a. It is declared that the renewable energy resources need assessment and feasibility studies.
    b. The renewable energy R&D activities are planned to be supported. Additional research activities shall be made regarding the increase in renewable energy utilization percentage. Financial advices are presented for the possible investors.
    c. There are targets set like the increase in installed capacity and increase in the number of education institutions.

26. TRC3: Dicle Development Agency (DIKA – Batman, Mardin, Şırnak, Siirt):
    a. Solar, wind and biogas potential of the region is emphasized. The resource assessment studies are planned to be increased.
    b. The renewable energy investments will be increased and integrated with city plans. The latest renewable energy legislation that permits the individuals to establish renewable energy plants up to 1 MW will be used as a policy tool.

All of the DA Regional Plan Documents mention renewable energy as a prosperous and necessary form of energy resource and agrees on the need for generalization, popularization and supporting of the utilization of the renewable energy resources.

4.7 Renewable Energy Related Activities of the Development Agencies

It is necessary to assess the studies and activities that are made within these policies defined in the regional plans. Some of the DAs have published reports or statistics related with the renewable energy activities. The following is a compilation of these studies:

1. TR10 ISTKA: In 2012, the agency has reserved 2.500.000 TL to support activities in different areas including sustainable and renewable energy technologies, in parallel with the regional plan decisions. The program's name is "Direct Activity Support"[29] and grants 80% - 100% financial support between 25.000 and 75.000 TL per successful application. This call was open for both public and private entities and its aim was the quick initialization of research and development, sustainability and competency related regional plan decisions. (İstanbul Kalkınma Ajansı 2012)

2. TR21 TRAKYAKA: For 2012 and 2013, the agency has started "Economic Development Financial Support Program" with 11.000.000 TL budget. The renewable energy related industrial activities are supported with priority.

3. TR22 GMKA: At the end of 2012, the agency has announced Financial Support Program. This program includes renewable energy related support mechanisms within agriculture and tourism sectors. A total of 11 million TL budget is reserved for the whole program.

4. TR31 IZKA: In parallel with the regional plan decisions, Izmir Development Agency has initiated a "Renewable Energy and Environmental Technologies

[29] Doğrudan Faaliyet Desteği

Financial Support Program". This program is particularly important because it is directly targeted to renewable energy and environmental technologies. This program attracted 107 different applications, in which 24 of them was non-profit organizations. A total of 30 million TL budget was reserved for the program and 51 project applications were found successful. There will be an increase in employment, research, development and economic activities within the region by this program.

5. TR32 GEKA: Agency has published a Renewable Energy in Southern Aegean report giving information about the potentials of the region to the investors. There are also support programs regarding the use of renewable energy in the agricultural activities, with a maximum budget of 450.000 TL per application.

6. TR33 ZAFER: The agency has appointed Dumlupınar University to prepare a "The determination of renewable energy potential and strategic sub regions in TR33 region" document under a direct activity support program. This study is an exemplary study, giving information and locational resource maps regarding the renewable energy resource types. The financial support programs are being continued by the agency within the region.

7. TR41 BEBKA: Eskişehir – Tepebaşı Municipality has constructed a solar powered municipality building with a rainwater collection and reuse system. This project has been used as an example of best practice for the local community.

8. TR42 MARKA: Agency is working jointly with Turkey Sustainable Energy Financing Facility[30] for the supporting of medium and large scaled renewable energy projects.

9. TR51 ANKARAKA: Within the "Direct Activity Support Program", in 2012, the budget of 906.000 TL has reserved for exemplary project types including the renewable energy and energy efficiency projects. The highest amount of 75.000 TL was allocated per successful project within 3 months of project duration. Another support program is the "Environmental Aware Innovative Applications Financial Support Program" that allocates 12 million TL within 9-12 months to the commercial institutions. With this program, a financial support between 100.000 and 750.000 TL has been provided for the projects about environment, sustainability and renewable energy related subjects.

10. TR52 MEVKA: The agency has organized a "Green Economies" conference in November 2011. The necessary public information and education activities are done within the renewable energy and energy efficiency subjects. Within the "Guided Project Support" system, preparations for a Regional Innovation Center

[30] Türkiye Sürdürülebilir Enerji Finansman Programı, TurSEFF

have started including a center for renewable energies. One of the projected outcomes of this center is the increase in the clustering of industrial activities related to renewable energies in the region. (MEVKA 2013)

11. TR61 BAKA: In parallel with the higher solar energy resource potential of the region, the agency has published a "Solar Energy Sector Report". The report emphasizes the resource potential, gives introductory information about the solar energy equipment and makes recommendations about the roof panel and solar cluster applications in the houses. There is also a renewable energy research center at the Süleyman Demirel University in the region.

12. TR62 CKA: The agency has organized renewable energy sectorial meeting in order to increase the public awareness.

13. TR63 DOGAKA: In May 2012, the agency has hosted a 100% renewable energy conference. A budget of 5 million TL has been allocated for the renewable energy resource utilization grant program. This program has 50% support for commercial institutions, 700.000 TL maximum per project.

14. TR71 AHIKA: Within the support programs 6 solar and 1 wind energy project are supported. Another supported project is a 4.2 million TL biogas and electricity plant from biomass in Kırşehir.

15. TR72 ORANKA: There were no activities recorded regarding the renewable energy related issues.

16. TR81 BAKKA: The agency continues support programs but no information was found.

17. TR82 KUZKA: In March 2012, the agency has hosted a 100% renewable energy conference.

18. TR83 OKA: On February 2012, the Commerce and Industrial Chamber of Çorum has organized a "Renewable Energy Resources in TR83 Region Seminar" through a direct activity support program from the agency.

19. TR90 DOKA: The agency has initiated several exemplary solar energy projects in schools and public buildings. On November 2012 a Renewable Energy Symposium had been organized.
20. TRA1 KUDAKA: The agency has opened calls for projects regarding the promotion of renewable energies (symposiums, conferences etc.) for public institutions through direct activity support program.

21. TRA2 SERKA: The agency continues support programs but no information was found.

22. TRB1 FKA: The agency continues support programs but no information was found.

23. TRB2 DOKA: The agency continues support programs but no information was found.

24. TRC1 IKA: On May 2010, the renewable energy commission of the agency had organized an informational meeting regarding the renewable energy potential of the region. On December 2012, in collaboration with UNDP, the agency had organized an Energy Summit. An energy efficiency center and laboratory was planned to be built in Gaziantep.

25. TRC2 KARACADAG: The agency has published a Renewable Energy Report in 2010. This report is a comprehensive report giving information about the technology and support programs related with the renewable energy types and equipment. In Şanlıurfa, the agency has initiated a renewable energy and energy efficiency research and development center within the Harran University.

26. TRC3 DIKA: Agency is supporting solar panel efficiency test projects within Batman University. In 2010, the agency had published an Energy Report, including renewable energy potential information of the region. These activities are in parallel with the regional plan document of the Regional Development Agency.

4.8 A Detailed Study of the Ankara DA Case

In order to have information about the renewable energy related activities of a development agency, an interview with e-mail was made with a regional plan specialist from Ankara Development Agency (ANKARAKA). The main subject of this interview is the activities carried out by the agency in renewable energy. The regional plan specialist provided details about the activities that are supported by the agency in the field of Renewable Energy:

Within the scope of Direct Activity Support program:

a. The Clustering Analysis in Renewable Energy in Ankara (Ankara Chamber of Industry, 2010)
b. The Feasibility Report of Ostim Ekopark (Ostim Foundation, 2011)
c. The Inventory Studies for Solar Energy (Ankara Chamber of Industry, 2011)
d. The Sectorial Analysis Project of Wind Energy Technologies (RÜZTEK) (METU, 2012)

The expert further emphasizes that renewable energy is taken into the scope of the Direct Activity Support Program, because in the Ankara Regional Plan, it had been designated and announced as a priority area. They believe that in the upcoming periods, the Direct Activity Support Program will evaluate and accept increasingly number of renewable energy related projects.

Another support program of ANKARAKA, the Call for Proposals for "Environmentally Aware Innovative Applications Financial Support Program"[31], had evaluated and started the renewable energy related projects. The priority areas for the support program were:

a. The realization of innovative product, process, marketing and organization strategies within the enterprises that produces material and equipment for the renewable energy sector.

b. The development of environmentally friendly products, the transition to the clean manufacturing processes and/or the increasing of the energy efficiency within the production processes in the health technologies and industrial/construction machinery sectors.

c. The development of innovative information and communication technology products aimed to the realization of strategy, methodology and technologies which serves for the environmental sustainability in the information sector.

Although these efforts are not enough for the generalization of renewable energy in the region, the new regional plan gives more emphasis to the renewable energy concept. The support of the agency will continue in both the development of renewable energy related technologies and the popularization of renewable energy utilization.

About the **vision** of the Ankara Development Agency in the renewable energy and sustainability fields, he states that the 2011-2013 plan had identified four main objectives for four parts of the regional plan. The objective for "Environment and Space in Ankara" part was stated as "Ankara, the high quality of life and space, that respects the environmental sustainability".

The 2014-2023 Regional Plan has been prepared in a more concise format and has three main objectives for three axes. The "Environmentally aware Ankara, that uses natural resources while protecting them" statement was identified as the main objective for "Environment in Ankara" axis. The Plan has further statements and directives in the respective related chapters and sections. (ANKARAKA 2013)

[31] Çevreye Duyarlı Yenilikçi Uygulamalar Mali Destek Programı

4.9 Inferences on the Renewable Energy Related Activities of the DAs

After summarizing the DAs' renewable energy activities, an analysis is made in order to make a comparison. Although almost all development agencies have renewable energy related statements in their regional plans, the actual activities of the DAs differ from each other. The following study elaborates this comparison.

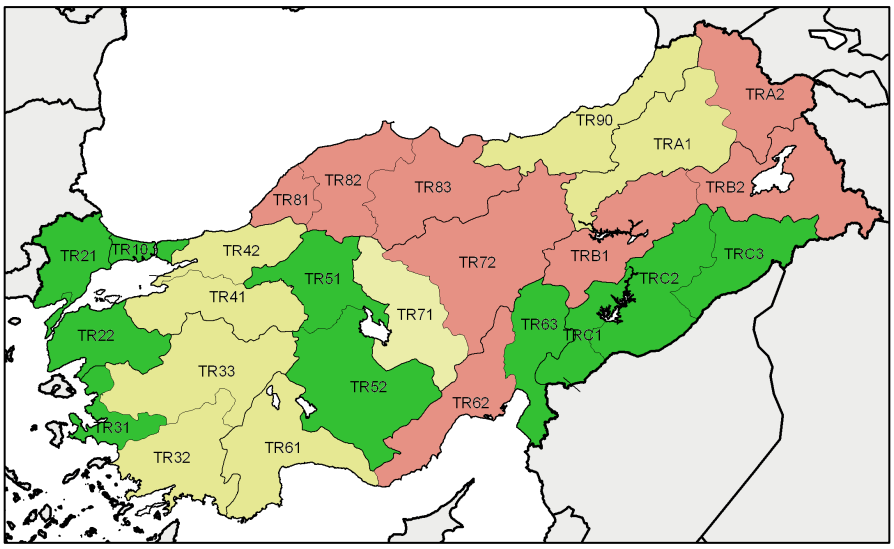


Figure 29 – Renewable Energy Activities Indicated for DAs, (developed by author)

The activities of the Development Agencies regarding the Renewable Energy and Energy Efficiency concepts are grouped into following three categories (Figure 29):

a. (Green Regions) Agencies that are actively supporting renewable energy projects in their regions with quantifiable financial and technical support programs.

b. (Yellow Regions) Agencies that are in the process of public awareness and informational activities regarding renewable energies and energy efficiency. These activities include the assessment studies for renewable resources.

c. (Red Regions) Agencies that are continuing their other support programs and indirectly or minimally supporting the renewable energy projects.

From the Figure 29, it can be inferred that:

a. The green regions are generally in parallel with the abundance of the renewable energy resources distribution over the country. The only exception is the Ankara and Konya region (TR51 and TR52), where Ankara region is the central

government region shaping the renewable energy policies and Konya region has both higher industrial capacity and need for rural energy (Mevlana Kalkınma Ajansı 2011).

b. The supporting of renewable energy related activities are in parallel with the region's level of economic development, higher levels of activities are observed in the western regions. However, the Southern-Anatolian regions (TR63, TRC1, TRC2 and TRC3), from Hatay to Hakkari are active and supporting the renewable energy related activities and projects.

c. In Central Anatolia macro region, from north to south, there is a red group of regions, then extending to east, covering the eastern borders. The central regions state that there are limited renewable energy resource potentials in their regions, or other activities are in their higher level priorities. The eastern regions, again, have higher level economic and social based priorities, since their development indices are lower. The TRB1 region is a different region, since the region has a number of hydro projects including the Keban Dam, the need for additional renewable energy activities might not be felt yet.

d. The yellow area in the central-western Anatolia region has higher renewable energy resource potential. Form their Regional Plan documents and activities, it can be summarized that they are in a transitional phase, making preparations and increasing the public awareness for the renewable energy projects.

   Within this area in central-western Anatolia, an interview with e-mail was made with an expert from the BEBKA Development Agency (TR41) about the renewable energy related activities of the agency. The expert stated that there were total of 5 renewable energy projects that received support in 2012. Four of these projects were solar PV electric generation projects having a total of 296 kW (roughly meeting the electric energy demands of 30 houses). One of the supported projects was a wind energy project, having a minimal power capacity of 50 kW (5 houses). The expert emphasized that these supports are not enough and will be continued increasingly in the future. (BEBKA Development Agency 2013)

In general, since the DAs were recently established and developing institutions, the overall progress of the regional renewable energy support in Turkey is improving. There are symposiums, conferences held about the subject and comprehensive reports and studies are published. In their 7 years of activities (the DA law was accepted in 2006), the DAs are trying to perform their best in many diversified areas.

The DAs create the technical and economic framework of the support programs, in parallel with the decisions in the higher level plans and Ministry of Development's regulations. It is the investors' or "entrepreneurs'" responsibility to prepare, apply and realize the renewable energy related activities that are stated in the support programs.

This is why these support programs take the common name of invitation. The yellow regions in Figure 29 are the regions trying to increase the grant and support program applications by informing and encouraging the related private (and public) bodies.

During these early establishment years, DAs are using the financial support programs as a main instrument in fulfilling the objectives stated in the respective regional plans that they have prepared.

4.10 Conclusion – DAs

Local economic development has been one of the basic issues for international arena and accepted as a priority objective in the regional policies (D'Arcy and Giussani 1996). In the process of regional economic development, the inadequacy of the legal framework and regulations could be a major obstacle in achieving the objectives. It is a fact that, whatever structure and ruling methods does a state have, the possibility of local regional development can be achieved by the effective distribution of resources and the quality of the coordination activities (Reese and Ohren 1999).

For Turkey, regionalization concept includes challenges and dilemmas. From the early years, the country has been governed by 81 provinces, lacking a regional form of governance. The provinces implemented centrally orchestrated policies. Expecting the DAs to solve all the regional problems would not be realistic. But the DAs can act as intermediate agents, inducing change and making contributions. The key issue is the achieving of an effective legitimization of DAs in their regions. (Kayasü, Yaşar and Lagendijk 2009)

The DAs have to respect the internal dynamics, economic policies, financial, political and social structures of the country. A project that has been successfully implemented in a region or a country may fail at another location. This situation is especially important in renewable energy technologies, because the subject includes technological advances. The technologically advanced country and a client country should have different subsidy mechanisms, objectives and support programs. With the creation of correct facilities for the local investors, the generation of new employment opportunities for the local regional workforce will be possible (Jones 2008).

It is clear that all of Turkey's regional development issues could not be solved or remedied by the projects that are supported by the DAs. But the contributions of the DAs to Turkey's regional development efforts are increasing in time. For a more solid and durable contribution, besides the local attendees, the procedures for these projects should be re-designed for the foreign attendees to join the support projects with the presence of local partners (Cankorkmaz 2011). This policy instrument can increase the level of technology transfer and know-how sharing between the joint attendees. Especially in

renewable energy related projects, the level of technology is one of the main parameters for the project to be successful. Since the technology is available in the EU countries, joint projects will be very useful given that efficient support mechanisms are available from the DAs, under the consistent Regional Plan decisions.

CHAPTER 5

CONCLUSION

The sustainable and renewable energy related public awareness is getting stronger every day. Increasing number of countries and regions are implementing renewable energy projects and renewable energy related policies and planning decisions. One of the most valid objectives in regional support programs is "the increase in the utilization of renewable energy resources".

Because of the growing demand for energy and the increased concerns about the extinction of the fossil energy resources, the sustainability and renewability of the energy sources are the future of the energy generation and energy related planning.

One of the prerequisite for the efficient and healthy regional renewable energy planning is the renewable energy potential assessment study. These studies are critical, because most of the renewable energy sources cannot be stored or transported. The location, protection and accessibility of the resource become very important. Within the past decade, Turkey has continued the national energy resources inventory with the introduction of renewable energy resources. These studies are ongoing and their outcomes will be an important input for the planning studies. The summary of these studies is the high availability and high quality of Turkey's renewable energy sources.

Since the initial investment costs are higher and return of investment times are longer than the conventional energy plant investments, the renewable energy plant investments are entitled to receive extra supports from the central and/or regional institutions, in order to protect the environment, minimize the import dependency and achieve sustainable energy supply. There are many forms of supports like increased buying prices for electricity generated from renewable sources, public land rental easements and subsidies towards the local renewable energy equipment manufacturers.

The Development Agencies have been established in order to minimize the inter-regional development differences. They have authority to develop and prepare support mechanisms in a number of development axes, including the generalization of the utilization renewable energy resources. Renewable energy and sustainability are among the priorities of the successful project selection criteria.

Within this study, it has been noticed that, within the situation summarized above, the majority of the responsibility is not on the DAs, but on the private and public entrepreneurs, regarding the increase in renewable energy investments. But the public

awareness and informational activities done by the DAs and other institutions should be increased in order to attract more entrepreneurs.

Another important activity is the generalization and increasing of the research and development activities related to the production of energy, utilizing renewable resources. The public and semi-public institutions (like universities, research centers and technology development zones) should cooperate with the DAs in order to perform technical research and development activities. The information and innovations should be spread to the private sector, under support programs.

All of these activities should be coordinated along with the regional plan decisions, by the DAs, or DA designated actors. Several government institutions are part of the renewable energy related regional and national structure. These include ministries (Energy, Natural Resources, Forestry, Environment, and Development), municipalities, directorates and other national and local institutions. Like many other areas, DAs should be in an organizing position between all these public and private actors.

5.1 Recommendations from Sectorial Experiences

The renewable energy investments, especially in wind energy, are increasing in the current period (Figure 24). The accomplishment of the investments by locally produced machinery and equipment has important economic and social positive outcomes. The laws supporting the domestic manufacturing are indirect policies that are in practice towards the increase in energy production from renewable sources. There is a need for more direct support policies like:

a. The tax exemptions for the local workforce
b. Tax exemptions in income and VAT taxes for local buyers and sellers in the renewable energy related industrial activities
c. Direct research & development financial supports
d. Additional supports for the international certification and approval processes for the domestic equipment producers

The regulatory and supervisory role of the public is important in the renewable energy investment projects. The micro hydroelectric dam projects in Northern Turkey; that violate the regional people's rights and benefits, endangers the natural environment and destroys the agricultural lands, historical sites and forestry; are poor examples of unplanned or unmonitored renewable energy applications. Together with all forms of renewable energy applications the opinions and demands of the public should be incorporated to the decision process, monitored by local authorities and DAs.

There is an urgent need for a national renewable energy strategy document and activity plan that considers the global technologic innovations. Turkey has to move away from the import oriented energy policies, not by privatization of the existing power plants. The public energy planning and public power generation should be a prior objective for strategic reasons, decreasing the costs of energy for the efficient growth of private sector.

The following statements are recommendations from the author's sectorial experiences and miscellaneous declarations from TMMOB and other non-governmental organizations.

a. Every human being has the right to consume cheap energy. The supply of adequate, high quality, continual, low cost and sustainable energy must be the basic energy policy.

b. Up to now, the increasingly additional imported-resource based energy supply method has been selected to meet the national energy demand. The electricity grid losses and the importance of energy efficiency have been neglected. But by decreasing the losses and illegal consumption, and increasing the regional energy efficiency values, a considerable amount of energy savings will be possible.

c. The electricity generation license system makes all new energy investments are the result of free market conditions and in the initiatives of entirely private and mostly foreign players. In order to establish sustainable, renewable and secure power policy, all the steps for energy generation should be planned and monitored by public institutions. These include ministries, development agencies and local authorities. The spatial distribution and efficiency of the power plants should be closely monitored. Then the private sector should continue to make investments within the planned framework.

d. Within the "Ten Year Generation Capacity Projection Study for Turkey Electrical Energy 2012-2021" document prepared by the Ministry of Energy and Natural Resources (MENR)[32] declares that if the energy demand becomes greater than the energy supply, then the renewable sources will be used for closing this gap (p.2). This approach is inadequate and under expectations. The electricity and fuel generation targets utilizing local and renewable resources must be determined in short, middle and long terms. These targets must be in consistency with all official planning, strategy and policy documents.

e. The inventory of renewable energy plant locations for all kinds of renewable resources must be completed by using the support programs of DAs in this area. The identified locations should not interfere or obstruct the agricultural lands, potential settlement and urbanization areas, and all kinds of environmentally,

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forestry and historical valuable spaces. The EIA studies must be carried out in a manner that incorporates the actual views of the local residents of the investment locations.

f. The environmental damages originated from energy generation activities should be minimized. The Environmental Impact Assessment studies for all types of energy generation projects must be mandatory.

g. The water-basin management studies in the hydroelectric power plant projects must be carefully carried-out. The drying out or changing the path of river type water sources should be avoided. The public nature of using water sources should be protected; water sources should not be commercialized.

h. Renewable Energy Strategic Plan studies should be made for each of the renewable energy resources. These plans should include locational, technical and financial recommendations and be part of national renewable energy strategic plan.

i. The utilization capacity of solar energy should be increased. Along with electricity production from solar energy, passive heating and building design studies should be increased. Architectural design principles passively utilizing renewable energies must be spread in new building designs. The usage of solar energy powered lighting in roads and public areas should be increased.

The renewable energy subject in Turkey is still in the developing phase. There are lessons that can be learnt from other countries experiences. It is important to achieve a renewable and sustainable energy supply to the developing urban and industrial activities. In the regional planning and development concept, the role of the development agencies regarding the generalization of renewable energy utilization is very important. In order for the development agencies to successfully promote and support the renewable energy subject in their regions, a renewable energy general policy planning document is needed. By the guidance of this planning document, the development agencies will be able to determine and execute the correct actions in their regions. The contribution of industrial and academic institutions, as well as the private companies is important in transforming these support mechanisms into valuable knowledge and products.

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