

## The Experience of Germany and Denmark in Using Alternative Energy Sources

*Nishonov Abdulloh Ubaydulloh ugli*

*Lecturer at the Department of Environmental Law, Tashkent State University of Law, Doctor of Philosophy (PhD) in Legal Sciences  
abdullahnishonov007@mail.ru*

**Annotation:** In this article, we have explained the methods, means and useful aspects of using alternative energy sources. The experiences of Germany and Denmark in the use of alternative energy sources, their similarities and differences, advantages and disadvantages have been studied. The scientific views of national and foreign scientists who conducted research in this field are highlighted. Also, the prospects of implementation of the beneficial aspects obtained from these foreign countries in our country were studied and the prospects of implementation of the policies carried out in the way of efficiency in our country were studied.

**Key words:** alternative energy, energy sources, wind energy, solar energy, atomic energy, offshore wind energy.

In today's rapidly developing age, attention to every field is increasing. As in all fields, the development in the field of electricity is rapidly advancing. Countries around the world are switching from fossil fuels to alternative energy sources. Through this article, we will try to show its useful aspects through the experience of Germany and Denmark.

Alternative energy is electricity from a renewable or green source (such as heat or electricity). The term "alternative energy" is usually derived from energy sources such as solar energy, wind energy, and hydropower. The term "alternative energy" is used interchangeably with terms such as "renewable energy" and "clean energy". While fossil fuels take hundreds of millions of years to replenish once burned, sources such as wind, hydropower, and the sun are generated daily in nature.

Today, most of the electricity and thermal energy produced in Uzbekistan is taken from the burning of organic fuels, i.e. gas, oil, coal, and the like. But these underground resources are non-renewable and their quantity is limited. Humanity is increasing year by year. This makes it necessary to study the practices of countries with advanced experience in the use of renewable energy sources.

Renewable energy in Germany is mainly based on wind and biomass, as well as solar and hydropower. Germany had the world's largest installed capacity of photovoltaics until 2014, and by 2021 it will have more than 58 GW. It also ranks third in the world in total installed wind power capacity by 2021 and second in offshore wind with over 7 GW. Germany has been called "the world's first major renewable energy economy."

Germany and Denmark, as countries that have achieved high results in the field of alternative energy and at the same time with different financial capabilities, are of undoubted interest for scientific analysis and comparisons.[1]

Russian scientist A. Sumin in his scientific views states that subsidizing the production of electricity based on alternative energy sources, as well as state regulation of investments in the construction of new electricity infrastructure, will lead to an increase in research in this direction.[2]

N.V. Supyan, one of the German energy scientists, wrote in 2011 about the inconsistency of the German government's energy policy[3]. N.K. Meden continues the research of N.V. Supyan and says that the German government will adopt a new law on the support of renewable energy sources to encourage the development of the alternative energy sector[4]. **A.V. Zimakov** Germaniya iqtisodiyotini “yashil energiya” ga almashtirish kerak degan xulosaga keldi[5]. The monograph of S.V.Sedykh and S.E.Zaritsky is dedicated to the periodicity of the energy policy of the German government. They emphasize that the current energy policy of Germany is primarily aimed at ensuring the energy security of the country[6].

Also, in the studies of O.V.Shuvalova, I.A.Rodionova and N.V.Toganova, there are opinions that the development of alternative energy is closely related to the processes of liberalization of the German electricity market.

The enterprises of the fuel and energy complex cause the greatest damage to the environment, so the world community has implemented a number of measures to reduce these emissions. In particular, in 1992, the United Nations Framework Convention on Climate Change was developed. After that, the Kyoto Protocol was developed in 1997 and the Paris Protocol in 2015, and these international documents included indicators for reducing carbon dioxide emissions that each country can emit into the atmosphere[7]. On the one hand, the adoption of the above international documents obliges the countries to produce energy with low emissions of carbon dioxide into the atmosphere.

Implementation of energy policy in the field of alternative energy is different in each country. They differ from others in that they need reliable, continuous supply of energy sources to citizens and business entities. The Danish government was the first among the European countries to correctly use the possibilities of alternative energy and began to develop it. Denmark is the first country in Europe to use wind energy to generate electricity. In 1991, the first offshore wind power plant in Europe appeared in Denmark.

Denmark has set a target of generating 30 percent of all energy needs from renewable energy sources by 2020, a significant increase from the 17 percent achieved in 2005; In 2017, this target was reached, with 32.7% of the observed energy consumption coming from renewable energy sources. The country has ambitious renewable energy targets for the future, including plans to meet 100% of its energy needs from renewable sources in all sectors by 2050[8].

Germany started building wind energy bases in 2008. Nevertheless, today Germany ranks among the top three world leaders in terms of wind energy capacity, along with China and the United States, and has also become one of the world leaders in total installed capacity of solar panels.

The share of renewable electricity increased from just 3.4 percent of gross electricity provided by conventional hydropower in 1990 to over 10 percent by 2005, thanks to additional biomass and wind, and accounted for 42.1 percent of consumption in 2019. As in many countries, the transition to renewable energy in transport and heating and cooling has been much slower in Germany[9].

Germany's economy is several times larger than Denmark's. Therefore, Germany will not be able to refuel its economy as quickly as Denmark.

According to official data, in 2010, about 370,000 people were employed in the field of renewable energy, particularly in small and medium-sized companies[10]. This is more than double the number of jobs in 2004 (160,500). Two-thirds of these cases relate to the Renewable Energy Sources Act. The German federal government is working to increase the commercialization of renewable energy, with a particular focus on offshore wind farms.

In Germany, it is planned that the share of renewable energy in energy consumption will be 60% in 2050. Germany, unlike Denmark, initially relied on the development of nuclear power rather than on

the development of alternative energy. However, due to its consistent energy policy, it has become a world leader in the use of alternative energy.

Both Denmark and Germany are investing heavily in low-carbon innovations in wind energy. This investment in wind energy is one of the twin goals of reducing carbon emissions and increasing international competitive advantage. Support for wind energy dates back to the 1970s, but in recent years it has gained special attention, opening up new avenues of innovation.

What are the main characteristics, similarities and differences of innovation paths in Denmark and Germany?

The use of alternative energy sources is the best option for mankind. Because it does not produce harmful substances, it does not produce global problems. Denmark and Germany have a lot in common when it comes to innovation paths in terms of technological and organizational innovation.

Similarities in turbine technology are the constant increase in turbine size and quality. The main difference to be found is in the relative importance of the various turbine designs. Today, the international "Danish Design" has long been a global standard in practice[11]. Therefore, we can enrich our research by comparing the experience of two countries.

Denmark has been a world leader in turbine technology for over three decades. Danish companies account for 25% of the total world turnover in this field. Denmark is also a prime location for investments in wind energy development activities, such as research and development, testing and high-quality manufacturing. This situation was achieved as a result of the strong support of the existing state policy. Today, wind energy accounts for more than 30% of the electricity consumed in Denmark. The 2012 agreement provides for 50 percent of the electricity generated by all the main parties in parliament.

The main factors behind Denmark's success in using alternative energy are government policies, conditions, geography, value chains and strategies implemented by firms. The roots of the innovation paths common to these two countries indicate a combination of determinants, mainly related to social and political priorities, preferences and decisions at the national level. However, the subtrajectories that make the difference between Denmark and Germany differ in this respect. They are mainly based on "certain" geographical conditions and company-level technology choices. In other words, many of the similarities in innovation paths between Denmark and Germany have common national causes, while company-specific strategies also significantly influence innovation paths. This raises important questions about the national identity of innovation paths in wind energy development.

The experience of Germany and Denmark showed that alternative energy development programs did not exist by themselves. It is only one part of several other related programs. Among them, programs to reject the use of nuclear energy (in relation to Germany), measures to increase the energy efficiency of economies, construction of infrastructure, changes in the organizational structure of the energy sector, etc. can be included.

In conclusion, the use of alternative energy sources in the energy sector of Germany and Denmark is important in preventing the depletion of non-renewable fuel products. This is to prevent poisoning that can endanger the whole world.

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