Black Sea Journal of Engineering and Science
doi: 10.34248/bsengineering.1505551

Open Access Journal
e-ISSN: 2619 – 8991

Research Article
Volume 7 - Issue 6: 1109-1117 / November 2024

EXAMINATION OF THE PEACEFUL USES OF NUCLEAR ENERGY IN TURKISH LEGISLATION

Nimet VELİOĞLU[1]*

[1]*Istanbul University- Cerrahpaşa, Faculty of Forestry, Department of Environmental and Forest Law, 34473, Istanbul, Türkiye*

Abstract: Population growth, industrialization and technological advances increase the demand for energy. Due to problems such as global warming, environmental pollution and destruction, the trend towards alternative energy sources continues on a global scale. For this reason, the use of nuclear energy, one of the secondary energy sources, has tended to increase in recent years. Reasons such as the geographically uneven geographical distribution of resources that are raw materials for energy among countries and their exhaustibility, fluctuations in energy prices and the economical production of nuclear energy are among the reasons why countries in the world turn to nuclear energy. A number of accidents at nuclear power plants have had a negative impact on the perception of nuclear power plants, but for different reasons, nuclear energy is gaining popularity again. Nuclear power plants are the first thing that comes to mind when it comes to nuclear power, but it is also used effectively in medical treatments and applications of various branches of science as well as energy production. In global energy production; the fact that it aims to reduce carbon emissions by providing more energy production within the scope of sustainability, the continuous and uninterrupted continuation of electricity production using nuclear, the production of electricity at more affordable costs in nuclear power plants compared to other power plants (thermal, renewable, etc.), the fact that greenhouse gas emissions are almost negligible, and the use of nuclear technology in many fields such as physics, medicine, transportation, agriculture as well as energy production have made nuclear energy back on the agenda of countries in recent years. In nuclear energy, nuclear waste and their storage processes continue to be discussed as a problem in this process. For these reasons, the possibility of peaceful use of nuclear power has been questioned in academic platforms and various criteria have been determined. This article examines Türkiye's compliance with the criteria for the peaceful use of nuclear energy and clarifies the development process in this regard. Türkiye's legislation on nuclear energy, international conventions, nuclear safety, radiation control criteria and compliance with national legislation will be examined.

Keywords: Nuclear, Energy, Peaceful use, Legislation

***Corresponding author:** Istanbul University- Cerrahpaşa, Faculty of Forestry, Department of Environmental and Forest Law, 34473, Istanbul, Türkiye
E mail: nimet@istanbul.edu.tr (N. VELIOĞLU)
Nimet VELİOĞLU https://orcid.org/0000-0003-0031-5697

Received: June 26, 2024
Accepted: September 17, 2024
Published: November 15, 2024

Cite as: Velioğlu N. 2024. Examination of the peaceful uses of nuclear energy in Turkish legislation. BSJ Eng Sci, 7(6): 1109-1118.

1. Introduction

Global final energy consumption is expected to increase by around 30 percent by 2050 and electricity generation is expected to double (Yıldırım, 2019). The share of coal in electricity generation remains the dominant energy source worldwide, currently around 36% (Gizlenci et al., 2012). The share of nuclear, renewables and natural gas has increased over the last 40 years (IAEA, 2015). Today, nuclear energy contributes about 10% of global electricity generation (IAEA, 2015).

Electricity generation from fossil fuels negatively affects CO2 gas emissions, which have a significant share in global warming (Demirgil and Birol, 2018). For this reason, nuclear energy is on the world agenda because of its low cost and environmentally acceptable energy needs (Çanka, 2011).

The economic crisis that accompanied the pandemic, the decrease in natural gas and oil resources and the increase in fossil fuel prices have been effective in reshaping energy markets and reviving interest in nuclear energy.

The first countries to produce energy from nuclear energy sources were the United States and the former Soviet Union in late 1955 (Tüylüoğlu and Türkan, 2023). After the devastating effects of two nuclear weapons containing uranium and plutonium, which were used for the first time, the need for an international, impartial institution started to be felt due to nuclear technological discoveries (Muray and Holbert, 2020) and the fears and concerns caused by the use of these technologies (Koltukçu, 2010).

Despite the use of the first nuclear bomb, the then US President Dwight D. Eisenhower made a speech titled "Atoms for Peace" at the United Nations (UN) General Assembly on December 8, 1953, which marked the first step in the establishment of the Agency that would determine the content and details of the use of the atom for peaceful purposes. Following Eisenhower's initiative, the charter of the International Atomic Energy Agency (IAEA) was unanimously approved by 81 countries on October 23, 1956 and entered into force on July 29, 1957, and started its activities as an autonomous organization within the UN (Kavaz, 2021).

In the second article of the Agency's statute, the Agency's two main missions are stated: "The Agency shall aim to accelerate and expand the contribution of nuclear energy to peace, health and prosperity throughout the world." It is also emphasized that efforts will be made to ensure that any nuclear activities controlled or supported by the Agency do not serve military purposes (Kara and Türkan, 2022). The Organization is headquartered in Vienna and has offices in Toronto, Tokyo, New York and Geneva.

The Agency's board of 34 members, which changes every two years, convenes quarterly to discuss the work of the organization and issues related to global nuclear security (Kara and Türkan, 2022).Türkiye has been a member of the board of directors since September 2022.

A general assembly meeting is held once a year with the participation of all members, and member countries provide information about their work in the nuclear field and the projects they carry out in cooperation with the Agency (Kocaoğlu, 2010).

The IAEA has signed two binding agreements with its member states for nuclear safety and security: the Comprehensive Safeguards Inspection and the Additional Protocol. These agreements allow the Agency to inspect the nuclear activities of member states, in which case the Agency can determine whether nuclear material is being used for peaceful purposes (Özdemir, 2020).

Pursuant to the aforementioned agreements, countries are obliged to regulate their legislation in a way to include the topics of nuclear and radiation safety, radiation protection, nuclear liability and nuclear security.

Today, 440 nuclear reactors are in operation and 54 nuclear reactors are under construction in the world. The electricity generated in nuclear power plants corresponds to approximately 10% of the world's electricity supply (Ministry of Energy and Natural Resources, 2023).

The country with the most nuclear power plants in the world is the United States of America with 100 plants. The country that uses nuclear energy the most in electricity generation is France with 75%. Ukraine meets 51% of its energy needs from nuclear energy, Sweden about 30%, Belgium about 40%, the European Union 26%, South Korea about 30% and the USA 20%. The countries with the least nuclear energy capacity are Armenia, Belarus, Iran, the Netherlands and Slovenia with 1 nuclear reactor each (Miden and Verplanken, 1990).

Historically, nuclear reactor accidents corresponding to level 6 (serious accident) and level 7 (major accident) have occurred. One of the most important of these accidents was the thermal explosion at the Mayak Nuclear Plant in Russia in 1957, which was the first. The 1986 Chernobyl accident is also one of the largest nuclear technology accidents in history (Özdemir, 2020). Another major nuclear power plant accident in history occurred in 2011 at the Fukushima Daiichi Nuclear Power Plant due to the tsunami that occurred after the Japanese earthquake (Katsuya, 2001).

Along with the energy production from nuclear power plants, there are ongoing debates about its environmental impacts (Akleyev et al., 2017). There are various ideas about the positive and negative aspects of nuclear energy. While reasons such as nuclear energy being an alternative to fossil energy sources, being economical and nuclear energy being a beneficial technology for humanity are the positive aspects of nuclear energy, reasons such as nuclear accidents in the past and the high initial investment cost are considered as the negative aspects of nuclear energy. Therefore, it is important to examine the positive and negative aspects of nuclear power plants in economic and environmental terms.

The high potential reserves of nuclear power, the fact that they do not cause greenhouse gas emissions that cause climate change, the recycling of nuclear waste, the separation of fossil materials (uranium, plutonium) from fission products remaining in the burnt fuel with reprocessing in advanced technologies and their reuse in fuel production (Çetinkaya, 2019) and the fact that they do not adversely affect air quality are included in the literature as positive aspects.

On the negative side, radioactivit poses a danger due to pre-production, production phase and post-production wastes (Muray and Holbert, 2020), and although studies have shown that the risk of accidents in nuclear power plants is low, the destruction it will cause in huge areas in the event of an accident negatively affects people and nature (Uyar, 2017).

Despite all these negativities, it is important to obtain electricity from Nuclear Power Plants and to produce energy in this way today when energy costs are high. Studies in many fields such as the fight against cancer, the development of X-ray devices, the protection of water resources with isotopic technique, the application of drip system in regions with water shortage using nuclear technology, the measurement of pollution in the seas and the determination of its causes are carried out with nuclear energy. In order to catch up with this technology in the world and considering the high amounts paid for energy imports in our country, nuclear energy is recommended as a necessary alternative.

The peaceful use of nuclear energy, taking into account its positive and negative aspects, aims to eliminate the danger dimension.

1.2. Nuclear Energy in Türkiye

The need for energy is constantly increasing in Türkiye (Kavaz, 2021). Evaluating Türkiye's energy policies and investments in energy production, it is stated that the steps towards alternative energy sources are insufficient and the efficient production, consumption and capacity of energy are weak (Erkök, 2022). This situation brings with it concerns that the country may face an energy crisis (Eş and Mercan, 2016). As a result, it is seen that nuclear energy is an important issue in terms of its economic growth, symptoms, technological

developments and energy policies (Furuncu, 2016).

Efforts to obtain nuclear energy in Türkiye started in 1956 and the Atomic Energy Commission was established under the Prime Ministry in the same year. Subsequently, in 1961, the Nuclear Research and Training Center research reactor was put into operation in Büyükçekmece (Gizlenci et al., 2012).

The establishment of the first nuclear power plant in Türkiye was planned in 1967, and the necessary studies for this purpose were commissioned to a Swiss consortium, but the plant, which was planned to be completed in 1977, could not be established due to the economic and political conditions of 1970-71 (Pamir, 2003).

The Department of Nuclear Power Plants was established within TEK, work to build the plant resumed in 1970, site selection for the plant was completed in 1976, and a license was obtained for Akkuyu. However, due to the failure to make payments and the coup d'état, the result could not be reached.

The Atomic Energy Commission and the Atomic Energy Authority were reorganized in 1982 with Law No. 2690. The purpose of the Authority is to generate electricity from nuclear energy, to encourage and regulate studies, to license and inspect nuclear facilities.

In 1983, with the Decree Law No. 166, the Nuclear Power Plants Corporation was established to meet a portion of the country's electrical energy needs; however, the Law No. 3743 enacted in 1991 was annulled because the conditions of the establishment decree were not fulfilled.

During the reorganization of TEK, the Nuclear Power Plants Department was closed in 1988.

In 1995, work accelerated again, and the Nuclear Project Group was given the status of a directorate and then a presidency.

In 1997, an international tender for nuclear power plants was launched and bids were received in October 1997 (Temurçin and Aliağaoğlu, 2003). NPI (France-Germany), AECL (Canada-Japan), WESTINGHOUSE (USA-Japan) consortiums participated in the tender (Kaya, 2012). In 2000, the government announced that it was abandoning the finalization of the project and the establishment of a nuclear power plant in Türkiye.

In 2004, the then Minister of Energy and Natural Resources brought the issue of nuclear power plants back to the agenda. He announced that technical examinations on nuclear power plants were underway, that the specifications for their establishment had reached the specification stage and that negotiations would be held in the near future. He stated that the operation of the plants would be in the private sector and that research on the location of the plants was ongoing, and that the Akkuyu region in Mersin, which had previously been identified as the site for the plant but was opposed by environmental groups, was on the agenda as one of the alternatives.

Subsequently, 7 million TL was allocated to the investment budget of the Electricity Generation Co. and the Turkish Atomic Energy Authority for the power plants, which were included in the 2005 investment program.

In January 2007, the "Nuclear Energy Law" was enacted, aiming to build three 5,000 megawatt nuclear power plants between 2010 and 2020.

In May 2010, the Russian Federation and the Republic of Türkiye signed a Cooperation Agreement for the construction of the Akkuyu Nuclear Power Plant. On December 13, 2010, in accordance with the terms of the agreement, the Russian side established the Akkuyu Nuclear Joint Stock Company project company in the Republic of Türkiye (Ağır et al., 2020).

In 2013, after a visit to Türkiye by Japan, an international agreement was signed to build a nuclear power plant. The other nuclear power plant project in Türkiye is the Sinop Nuclear Power Plant. On June 27, 2019, Turkish President Erdoğan announced in an interview that the Sinop project was halted due to rising costs.

In October 2015, the Minister of Energy and Natural Resources announced plans to build the third nuclear power plant in İğneada.

In March 2022, the Nuclear Regulation Law entered into force.

1.3. Turkish Nuclear Energy Legislation

1.3.1. Constitution of 1982

The legal framework regulating nuclear energy is structured in accordance with the normative hierarchy of the Turkish national legal system. The 1982 Constitution does not contain provisions directly addressing nuclear energy or nuclear activities. Instead, the importance of nuclear energy is recognized indirectly through various constitutional provisions. These include the right to life under Article 17, the right to live in a healthy and balanced environment under Article 56/1, and the state's obligation to protect the environment and natural heritage under Article 56/2. . While these constitutional provisions do not explicitly prohibit nuclear activities in Türkiye, they impose strict obligations on the State. They require the State to exercise the utmost care at every stage of nuclear activities.

Furthermore, the Constitution contains specific provisions that indirectly affect the siting and development of nuclear energy facilities. Article 169, which focuses on the protection of forests, and Article 43, which addresses the protection of coastlines, are particularly relevant in this context. These articles impose certain limitations on the establishment of nuclear power facilities in forested areas and coastlines, as in the case of the Akkuyu NPP. According to these provisions, the State is obliged to take into account the public interest and the protection of these natural assets during the development of nuclear projects. Plans that do not comply with these considerations, particularly in terms of public interest and protection of forests, face legal obstacles.

Similarly, the process of expropriation of private property for nuclear projects is subject to constitutional

provisions on property rights (Article 35) and expropriation limits (Article 46)

1.3.2. International conventions to which Türkiye is a party

Türkiye is a signatory to some of the key international nuclear texts, highlighted by its membership of the IAEA and its adherence to the 1957 Charter of the Nuclear Energy Agency (NEA, originally established as the OEEC European Nuclear Energy Agency).

The Paris Convention of 1960 on Third Party Liability in the Field of Nuclear Energy; was opened for signature in 1960 in order to determine the insurance and legal liability against radioactive leakages that may be encountered while using nuclear energy among the member countries of the Nuclear Energy Agency, which was established within the Organization for Economic Cooperation in Europe, with a common legislation among all member countries and to ensure that this legislation works in harmony. Today, only member countries of the Organization for Economic Cooperation and Development (OECD) can become a party to this convention. Our country is among the drafting countries of the Convention. One of the objectives of the Convention is to determine legal liability against third parties in the aftermath of possible nuclear incidents and to ensure that this does not hinder the peaceful use of nuclear energy. The Convention limits the scope of action of the parties by including clear provisions in terms of location and subject matter. In this way, the operator of nuclear facilities, the transporter and transporter of nuclear material are held legally responsible. The content of the Convention has been expanded and regulated by the subsequent joint protocols. The 1964 Protocol Amending the Paris Convention was adopted on February 12, 1964 and entered into force on April 5, 1968. The Convention was amended by an additional protocol in 1982. The Protocol was adopted in Paris on November 16, 1982 and entered into force on January 21, 1986. 1964 Additional Protocol and 1982 Protocol

The Treaty on the Non-Proliferation of Nuclear Weapons is an international treaty whose purpose is to prevent the spread of nuclear weapons and weapons technology, promote cooperation in the peaceful uses of nuclear energy and advance the goal of nuclear disarmament. Designed to advance the goal of non-proliferation and as a confidence-building measure between States parties, the Treaty establishes a system of safeguards under the responsibility of the International Atomic Energy Agency (IAEA). The Treaty was opened for signature in 1968 and entered into force in 1970. It is an international treaty whose purpose is to prevent the spread of nuclear weapons and weapons technology, to promote cooperation in the peaceful uses of nuclear energy and to advance the goal of nuclear disarmament.

The Convention on the Physical Protection of Nuclear Material, as amended in 2005, is the principal international legal instrument in the field of nuclear safety adopted under the auspices of the International Atomic Energy Agency (IAEA). It was signed in Vienna on 26 October 1979 and entered into force on 8 February 1987. The Convention imposes a legal obligation on the parties to ensure the physical protection of nuclear material during international transportation. It also established a general framework for inter-state cooperation in the protection, recovery and return of stolen nuclear material. The 9/11 attacks and heightened security concerns sought to broaden the scope of the Convention, and the amended Convention was adopted on 8 July 2005 and entered into force on 8 May 2016. The Convention is currently signed by 164 countries.

The Convention on Nuclear Safety was opened for signature by countries on September 20, 1994. Its purpose is to set out the basic safety principles for ensuring and maintaining a high level of safety in onshore nuclear power plants. The activities carried out by the Contracting Parties regarding the improvement of nuclear safety are discussed at the NPP Review Meetings held every three years, and the countries prepare their national reports on whether they are in compliance with the provisions of the Convention before these meetings and submit them to the International Atomic Energy Agency. The national contact point for the Convention is the Nuclear Regulatory Authority. Türkiye signed the Convention on September 20, 1994 and made it a part of its domestic legislation on October 24, 1996.

The Convention on Early Notification of a Nuclear Accident, adopted in 1986 following the Chernobyl Nuclear Power Plant accident, establishes a notification system for nuclear accidents in which a release of radioactive material has occurred or is likely to occur and which has resulted or may result in a transboundary release that may be of radiological safety significance to another State. The Convention requires states to report the time, place and nature of the accident and other data necessary to assess the circumstances of the accident. According to the provisions of the convention, notification to states affected by a nuclear accident is mandatory. Türkiye signed the convention in 1986 and made it part of its domestic law in 1991.

"The Convention on Assistance in the Event of a Nuclear Accident or Radiological Emergency was adopted on November 18, 1986 following the Chernobyl Nuclear Power Plant accident. It establishes an international framework for cooperation between States Parties and with the International Atomic Energy Agency (IAEA) to facilitate emergency assistance and support in the event of a nuclear accident or radiological emergency. The Convention requires states to notify the IAEA of their available experts, equipment and supplies to provide assistance. In the event of a request, each state party has the right to decide whether it can provide the requested assistance, its scope and conditions. Türkiye signed the convention in 1986 and it entered into force in 1991.

The Joint Protocol was adopted in 1988 to establish treaty relations between the Contracting Parties to the Vienna Convention and the Contracting Parties to the

Paris Convention and to eliminate conflicts that may arise from the simultaneous application of both Conventions to the same nuclear incident.

The International Convention for the Suppression of Acts of Nuclear Terrorism covers a wide range of acts and possible targets, including nuclear power plants and reactors, threats and attempts to commit or participate in such crimes as accomplices, extradition or prosecution. It encourages States to cooperate in preventing terrorist attacks by sharing information and assisting each other in connection with criminal investigations and extradition, and deals with crisis situations by helping States resolve post-crisis situations by securing nuclear material through the International Atomic Energy Agency. Türkiye signed the Convention in 2005 and it entered into force in 2012.

The Joint Convention on the Safety of Spent Fuel Management and Radioactive Fuel Management is the first legal instrument to address the safety of spent fuel and radioactive waste management on a global scale, and does so by establishing basic safety principles and through "peer review" similar to the Convention on Nuclear Safety. The Convention applies to spent fuel from the operation of civil nuclear reactors and radioactive waste from civil applications. It also covers planned and controlled releases of liquid or gaseous radioactive materials from regulated nuclear facilities into the environment. Türkiye signed the Unified Convention on 6 October 2021 and it entered into force on 21 May 2023.

1.3.3. Situation in Turkish laws

The 'Nuclear Regulation Law' No. 7282, which came into force on March 8, 2022, came into force during the period when the first reactor of Akkuyu NPP was about to be completed. This Law, which is the most comprehensive law in the history of Turkish nuclear regulation, defines their roles and powers regarding the use of nuclear energy and ionizing radiation. Again, in accordance with the international agreements signed by Türkiye, it requires compliance with international nuclear safety measures that require nuclear activities to benefit society or individuals (Kahraman, 2019), reduce radiation to the lowest possible level and keep exposure below thresholds. The law in question also oversees nuclear safety and safeguards.

The Nuclear Regulatory Law establishes a regulatory framework for nuclear activities by distinguishing between activities that require permits, licenses or permits, and activities that simply need to report. The law requires licenses for a wide range of nuclear power plant operations, from site preparation to decommissioning, as well as the import, export and transit of nuclear material.

The Nuclear Regulatory Law sets out detailed rules on radioactive liability and makes reference to the Paris Convention on Nuclear Liability in areas not covered by the Law. It establishes absolute liability for damages on nuclear operators, regardless of errors, personnel actions or technology defects, with liability caps in Euros of 700 million for nuclear power plants and 70 million for smaller plants. It requires operators to compulsorily insure their activities or to provide adequate coverage. The law allows the creation of a nuclear insurance pool financed by operators to cover nuclear-related damages, and the pool and the responsible operator to jointly compensate accidents.

Post-nuclear incident damage assessments are carried out by the 'Nuclear Damage Assessment Commission', appointed by the President, which compensates damages and requests reimbursement from operators and insurers. The law imposes criminal and administrative sanctions, including imprisonment for up to eight years and fines for unlicensed activity.

Regulations regarding nuclear energy and radioactive activities contain scattered provisions. Some provisions of previous nuclear laws have not been repealed. Among these, there are articles in the Law No. 5710 on the 'Construction, Operation and Energy Sales of Nuclear Power Plants'. According to the mentioned articles, the possibility of competitive tendering by TETAŞ (now EÜAŞ) is summarized in Article 3. In addition, Law No. 5710 stipulates that nuclear power plants built through competitive tendering can receive state aid. Finally, article 6/10 of the 'Electricity Market Law No. 6446' obliges nuclear power plant operators to apply to EMRA for an electricity generation license. This application must include preliminary permits from other authorities such as NDK for site development and reactor construction.

The regulatory disorganization of Türkiye's nuclear activities indicates that a regulatory framework is still in the formation stage. Monitoring the development of this regulatory area and ensuring compliance with constitutional and international laws are important for maintaining the legality and effectiveness of nuclear governance in Türkiye.

Due to the recent development of nuclear laws and the specific nature of projects such as the Akkuyu NPP, which are based on an international agreement and potentially exceed Article 90/Article 90, no significant cases of conflicts between national and international nuclear regulations have arisen in Türkiye. To date, many lawsuits have been filed against the Akkuyu NPP project and have been heard in the administration, regional administration and the Council of State. The arguments presented in these cases include allegations of fundamental constitutional violations, such as violation of the right to a healthy environment, and allegations of invalid environmental impact assessments or noncompliance with the Zoning Code. Despite this legal procedure, no nuclear project has been stopped or interrupted in Türkiye.

In light of all these scattered regulations and discussions, it can be suggested that Nuclear Law should emerge as a separate field of legal expertise and academic discussion. It is important to examine international law, specific demands of the energy private sector and environmental

risk issues. It is also necessary to expect the development of jurisprudence and administrative practices regarding nuclear activities in Türkiye through legal disputes in the long term.

2. Material and Method

Nuclear energy has become an important technology for scientific research, industry, agriculture, medicine and electrical energy production. However, in this regard, the peaceful use of nuclear energy has also strengthened the perception that it could lead to the spread of nuclear weapons and possible nuclear war. Therefore, the use and development of nuclear energy for peaceful purposes has become the focus of the international community. For these reasons, the International Atomic Energy Agency (IAEA) has begun to act as an important factor.

The most important goal of the Agency is to ensure that nuclear energy is used for peace, health and world welfare. At this stage, states that do not have any nuclear energy programs should be informed about the benefits and costs of this energy; It is very important that states with advanced nuclear energy programs should use nuclear energy in line with the rules of international law - especially safety and responsibility - with sustainable business management and technological developments based on international experience.

In order to measure Türkiye's compliance with the use of nuclear energy for peaceful purposes, the headings in international regulations are first examined as criteria:

A. Radiation protection

B. Nuclear and radiation safety

C. Nuclear liability

D. Nuclear security

To briefly explain the principles;

Radiation protection; radiation protection is the activities carried out to minimize the risk of radiation exposure to the public and the environment. These activities must prevent radiation from causing negative consequences. In order to be protected from radiation emitted as a result of a nuclear accident or in an uncontrolled manner, states that use nuclear energy must first take the necessary precautions in their domestic law. In other words, regulations regarding radiation protection must be foreseen in the domestic law of the country operating in this field. These regulations may include provisions such as determining any activity or facility that requires a license, authorizing the operator and determining the conditions for obtaining a license. Early Notification Convention in Case of Nuclear Accident and Assistance Convention in Case of Nuclear Accident or Radiological Emergency can be cited as examples of international regulations made in this field. In the aforementioned Conventions, it was emphasized that an international framework should be established to prevent nuclear accidents, minimize the consequences of nuclear accidents, and facilitate the rapid provision of assistance in the event of a nuclear accident or radiological emergency.

Nuclear and radiation safety; many of the expert opinions emphasized that the use of nuclear energy and ionizing radiation applications are the primary conditions for safety. According to the definition of the International Atomic Energy Agency, “nuclear and radiation safety means protecting workers, the public and the environment from the danger of unnecessary radiation, and providing appropriate working conditions to prevent accidents or mitigate the consequences of accidents.” (IAEA Safety Standards, 2015).

Nuclear liability; nuclear liability envisages compensation for damages arising from such accidents by developing regional and international legal regimes. Today, many regional and international agreements regulate nuclear liability.

Nuclear security; nuclear security is the most important factor regulating the legal framework of peaceful nuclear energy. The most important goal of nuclear security is to control the spread of sensitive nuclear technologies. The first and most important step to be taken to achieve this goal is to envisage legal regulations and mechanisms that will prevent the transfer of sensitive technologies in question.

Determining how much Türkiye includes these principles in its current laws will also determine how ready it is. In the evaluation, a five-point scoring table, which is a technique previously used in various articles in international publications, was used. [Aydın Coşkun and Gençay 2011), (Elvan and Türker 2014), (Elvan and Birben 2021)] peaceful use criteria were evaluated in order to evaluate its compatibility in Türkiye's legal system and management practices.

For this purpose, in the study, for each principle determined by the International Atomic Energy Agency for the peaceful use of nuclear in Turkish legislation, laws directly related to that principle in Türkiye, primarily the Constitution, were determined and the extent to which they were included in these laws was investigated. The following scoring system was used for this.

Scoring is made on a scale from 0 to 4:

0 = no provision or application;

1 = contains too narrow provisions or is impractical and inadequate;

2 = Contains an indirect provision or application but is not sufficient;

3 = Positive, indirect content is provided or applied and is sufficient;

4 = Positive, contains a direct provision or application and is sufficient

Each principle has been evaluated separately within the framework of the principles determined above. It will be determined that Turkish Legislation is sufficient in terms of principles with an average score above "2". The evaluation is made by taking into account the purpose and content of the constitution and relevant laws.

3. Results

The four criteria determined for the peaceful use of

Nuclear Energy are the Constitution and the Nuclear Regulation Law, as well as the Law No. 5710 on the Construction, Operation and Energy Sales of Nuclear Power Plants, which is still in force, the Law on Exemptions of the Turkish Atomic Energy Authority and Making Some Regulations, the Electricity Market Law, Law on Preventing the Financing of the Proliferation of Weapons of Mass Destruction, Law on Preventing the Financing of Terrorism, Law on the Supervision of Industrial Establishments Producing War Equipment and Equipment, Weapons, Ammunition and Explosives, Law on the Principles Applicable to Explosives and Suspicious Objects Seen in the Seas and on the Surface of the Country.

Law on Military Restricted Zones and Security Zones, Law on the Operation of Boron Salts, Trona and Asphaltite Mines and Nuclear Energy Raw Materials, Return of Some Lignite and Iron Fields, Law on the Establishment and Operation of Electrical Energy Production Facilities with Build-Operate Model and Regulation of Energy Sales, Investments No separate evaluation will be made for Project-Based Support and the Law on Amendments to Certain Laws and Decree Laws, the Turkish Civil Aviation Law, the Turkish Penal Code, the Turkish Commercial Code, the Insurance Law, the Mining Law, as well as the relevant regulations and circulars.

Scoring is done by taking into account the purpose of the law and the articles in its content.

Table 1. Place of criteria for peaceful use of nuclear energy in Turkish legislation

	A	B	C	D
1982 Constitution	1	1	1	1
Nuclear Regulatory Law	4	4	4	4
Law on the Construction, Operation and Energy Sales of Nuclear Power Plants	2	2	2	2
Law on Exemptions and Certain Regulations of the Turkish Atomic Energy Authority	2	2	2	2
Electricity Market Law	2	2	2	2

Table 1. Place of criteria for peaceful use of nuclear energy in Turkish legislation (continuing)

	A	B	C	D
Law on Preventing the Financing of the Proliferation of Weapons of Mass Destruction	2	2	2	2
Law on Prevention of Financing of Terrorism	1	1	2	3
Law on the Inspection of Industrial Establishments Producing War Vehicles and Equipment, Weapons, Ammunition and Explosives	1	1	2	4
Law Concerning the Principles Applicable to Explosive Substances and Suspicious Objects Seen in the Seas and on the Surface of the Country	2	4	2	4
Law on Military Restricted Zones and Security Zones	1	1	1	4
Law Regulating the Exploitation of Boron Salts, Trona and Asphaltite Mines and Nuclear Energy Raw Materials, and the Return of Some of the Lignite and Iron Fields	2	2	2	2
Law on the Establishment and Operation of Electrical Energy Production Facilities with the Build-Operate Model and the Regulation of Energy Sales	2	1	1	1

Table 1. Place of criteria for peaceful use of nuclear energy in Turkish legislation (continuing)

	A	B	C	D
Law on Supporting Investments on a Project Basis and Amending Certain Laws and Decree Laws	0	0	1	0
Turkish Civil Aviation Law	2	2	1	2
Turkish Penal Code	0	0	4	1
Turkish Commercial Code	1	0	3	0
Insurance Law	1	1	3	1
Mining Law	1	1	1	1

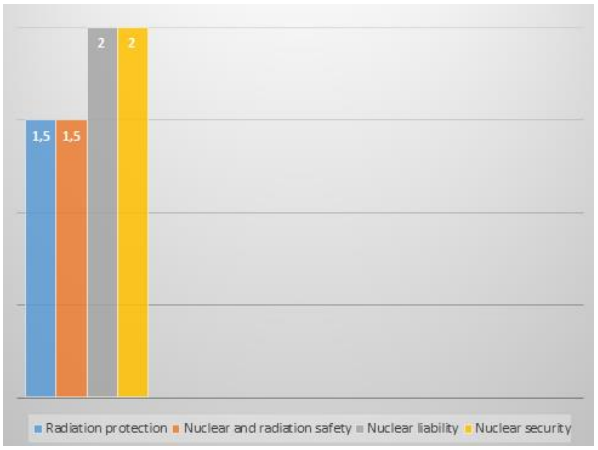

Figure 1. Legislation compliance chart for the peaceful use of nuclear energy in Türkiye.

According to Figure 1, it would be appropriate to consider those with an average score of 2 and above as adequate. When all laws related to the use of nuclear energy in force are examined, it is seen that the principles of Nuclear Liability and Nuclear Safety are sufficient.

Changes and developments should be made in the legislation for Radiation Protection and Nuclear Radiation Safety.

Regardless of all these evaluations, the Nuclear Regulation Law, which is our general law on nuclear energy, received 4 points on the basis of all principles and is positive, covers direct provisions, includes implementation and is sufficient. The Nuclear Regulation Law, which is a special law regarding the peaceful use of nuclear energy, fully carries the principles in question. The purpose of this law is, essentially, the principle of peaceful use, the principles and principles that should be aimed at protecting employees, the public, the environment and future generations from the possible harmful effects of ionizing radiation during the distribution of nuclear energy and ionizing radiation, and the responsibilities of the Nuclear Regulatory Authority, which has constant control over these activities. to determine the authorities and responsibilities and the legal liability for nuclear damage resulting from nuclear incidents. Therefore, it is possible to conclude that Turkish legislation is sufficient based on the general law regarding the peaceful use of nuclear energy.

4. Discussion and Conclusion

The use of nuclear energy in medicine, agriculture, consumer products, military vehicles, space studies, industry, scientific research, food safety, electricity and energy production is also essential on a technological basis.

The general opinion about nuclear energy in the world and in our country has developed towards the conservation of this energy. For this reason, international law defines the peaceful use of nuclear energy as an inalienable right of states. The IAEA Statute, review conferences, and provisions in bilateral security agreements concluded between the IAEA and other countries also reinforce the protection of this right. In this case, it is very important for states that use nuclear energy for peaceful purposes to operate this energy in accordance with the rules of nuclear law and to fulfill their obligations arising from the rules of nuclear law.

In accordance with Türkiye's energy policies, the desire to carry out more nuclear energy projects and gain technical expertise in this field continues. For this reason, Türkiye's legal framework regarding nuclear energy needs to undergo change and development. Closer alignment with international standards and monitoring the development of Turkish nuclear energy law, which will require increased international cooperation on a variety of issues, including safety measures, environmental protection, emergency response, nuclear fuel supply and radioactive waste management, will be a benefit not only for our country but also for the world in a globalizing economy. It becomes a duty. Türkiye is a party to all agreements regarding the use of nuclear energy for peaceful purposes and is open to inspections in this regard.

It is essential to evaluate the principles of peaceful use of nuclear energy established within the scope of international agreements. In this regard, prioritizing nuclear safety and taking appropriate measures to provide sufficient financial resources for this purpose; providing assurance that the requirements established for all activities in terms of safety of nuclear facilities are met; security assessment and verification, radiation protection, discussions with states located in the vicinity of sites selected for the construction of nuclear facilities and the possibility of examining the possible security effects of this facility on their territory; The place of the

principles of peaceful use in the Turkish Legal system, which includes compliance with national and international regulations during design and construction and operation, has been examined, and the evaluations for it within the scope of the Nuclear Regulation Law, which is our general law regarding nuclear energy in Turkish Legislation, are positive, include direct provisions, include implementation and are sufficient.

Author Contributions

The percentage of the author contributions is presented below. The author reviewed and approved the final version of the manuscript.

	N.V.
C	100
D	100
S	100
DCP	100
DAI	100
L	100
W	100
CR	100
SR	100
PM	100
FA	100

C=Concept, D= design, S= supervision, DCP= data collection and/or processing, DAI= data analysis and/or interpretation, L= literature search, W= writing, CR= critical review, SR= submission and revision, PM= project management, FA= funding acquisition.

Conflict of Interest

The author declared that there is no conflict of interest.

Ethical Consideration

Ethics committee approval was not required for this study because of there was no study on animals or humans.

References

Ağır H, Özbek S, Türkmen S. 2020. Türkiye'de yenilenebilir enerji kaynaklarının belirleyicileri: ampirik bir tahmin. Uluslararası Ekon Araş Derg, 6(4): 39-48.

Akleyev AV, Krestinina LY, Degteva MO, Tolstykh EI. 2017. Consequences of the radiation accident at the Mayak production association in 1957 (the'Kyshtym Accident'). J Radiol Protect, 37(3): 19-41.

Çanka KF. 2011. Türkiye'deki yenilenebilir enerjilerde mevcut durum ve teşviklerdeki son gelişmeler. Müh Mak Derg, 52: 103-115.

Çetinkaya Ş. 2019. Türkiye'nin enerji güvenliğinin sağlanması: bir ulusal güvenlik meselesi. Karadeniz Uluslararası Bilim Derg, 43:208-215.

Coşkun AA, Gençay, G. 2011. Kyoto Protocol and "deforestation": A legal analysis on Turkish environment and forest legislation. J Forest Policy Econ, 13(5): 366-377.

Demirgil B, Birol YE. 2018. Yenilenebilir enerji ve ekonomik büyüme arasındaki ilişki: 1990-2017 Türkiye örneği. Çankırı Karatekin Üniv Biyol İdari Bilim Fak Derg, 8: 223-242.

Elvan OD, Birben Ü. 2021. Analysis of the ramsar convention's effectiveness on the Turkish legislation and judicial decisions. Wetlands, 41: 3.

Elvan OD, Turker YO. 2014. Analysis of Turkish groundwater legislation and policy regarding international principles and conventions. Water Sci Technol, 69(10): 2155-2165.

Erkök B, 2022. Almanya'nın enerji tasarrufu politikaları: Türkiye için bir örnek. Mali Ekon, 6: 294-324.

Eş H, Mercan S. 2016. Türkiye için yeni bir sosyo-bilimsel tartışma: nükleer ile yaşam. Türk Eğitim Derg, 5: 47.

Furuncu Y. 2016. Türkiye'nin enerji bağımlılığı ve akkuyu nükleer enerji santrali. Cumhuriyet Bilim Derg, 37: 198-207.

Gizlenci Ş, Acar M, Şahin M. 2012. Türkiye'de yenilenebilir enerji kaynaklarının (biyodizel, biyoetanol ve biyokütle) projeksiyonu. Tarım Mak Bilim Derg, 8: 337-344.

IAEA Safety Standards. 2015. URL: http:// www-ns.iaea.org/standards/conceptsterms.htm (Access date: 02 November 2023).

Kahraman G. 2019. Türkiye'de kentleşmenin enerji tüketimi ve karbon emisyonlarına etkisi. Iğdır Üniv Fen Bilim Enstit Derg, 9(3): 1559-1566.

Kara HE, Türkan N. 2022. Nükleer santrallerden salınan termal suların su ekosistemine ve turizme etkileri. Ohs Acad, 5(2): 57-65.

Katsuya T. 2001. Public response to the Tokai nuclear accident. Risk Analysis, 21(6): 1039–1046.

Kavaz İ. 2021. Nuclear energy in the World and Türkiye. In: International Conference on Eurasian Economies, August 24-25, İstanbul, Türkiye, pp: 296.

Kaya İS. 2012. Nükleer enerji dünyasında çevre ve insan. Abant İzzet Baysal Üniv Sosyal Bilim Enstit Derg, 12(1): 24-29.

Kocaoğlu NK. 2010. Nükleer tesis işletenin hukuki sorumluluğu: karşılaştırmalı ve uluslararası özel hukuk analizi. Ankara Barosu Derg, 68:33-110.

Koltukçu H. 2010. Yenilenebilir enerji kaynaklarının Türkiye açısından swot analizi. Yüksek lisans tezi, Dumlupınar Üniversitesi, Sosyal Bilimler Enstitüsü, Kütahya, Türkiye, ss: 136.

Miden CJ. Verplanken HB. 1990. The stability of nuclear attitudes after Chernobyl. J Environl Psychol, 10(2): 111–119.

Ministry of Energy and Natural Resources. 2023. Nuclear energy. URL: https://enerji.gov.tr/neupgm-nukleer-enerji (accessed date: December 26, 2023).

Muray RL, Holbert KE. 2020. Nuclear Energy. Oxford, UK, 8th ed., pp: 394-397.

Özdemir S, 2020. Alternatif ve nükleer enerji tüketimi ile ekonomik büyüme arasındaki nedensellik ilişkisi: Fransa örneği. Ekon Politik Finans Araş Derg, 3:302-313.

Pamir AN. 2003. Dünyada ve Türkiye'de enerji, Türkiye'nin enerji kaynakları ve enerji politikaları. Metalürji Derg, 134(23): 1-39.

Temurçin K, Aliağaoğlu A. 2003. Nükleer enerji ve tartışmalar ışığında Türkiye'de nükleer enerji gerçeği. Coğrafi Bilim Derg, 1(2): 25-39.

Tüylüoğlu EH, Türkan N. 2023. Nükleer güç santrallerinin çevresel etkileri. Ohs Akad, 6: 50-58.

Uyar, TS. 2017. Barriers and opportunities for transformation of conventional energy system of Turkey to 100% renewable community power. J Towards 100% Renewable Energy: Techniques, Costs and Regional Case-Studies Cham: Springer International Publishing, London, UK, pp: 105-118.

Yıldırım HH. 2019. Yenilenebilir enerji yatırımlarındaki teşviklerin yatırım performansları üzerine etkisi. Finans Ekon Sosyal Araş Derg, 4: 330-345.