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**ISSN (ONLINE) 2598-9936**



**INDONESIAN JOURNAL OF INNOVATION STUDIES**  
PUBLISHED BY  
UNIVERSITAS MUHAMMADIYAH SIDOARJO

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## Nuclear Governance Assessing Effectiveness and Enhancing International Cooperation

*Tata Kelola Nuklir Menilai Efektivitas dan Meningkatkan Kerja Sama Internasional*

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### Abstract

This article explores the legal regulation of atomic energy, focusing on its historical evolution, current status, and effectiveness. It addresses gaps in understanding regarding the adequacy of existing regulations and the extent of international cooperation. Employing a multifaceted approach, including documentary analysis and interviews, the study assesses legislative frameworks and institutional mechanisms. Findings reveal the complexities of atomic energy governance and underscore the importance of international cooperation in enhancing regulatory compliance. This research provides valuable insights for policymakers and stakeholders, facilitating informed strategies to strengthen nuclear governance and ensure safe and sustainable atomic energy utilization.

#### Highlights:

- Comprehensive assessment of legal regulations governing atomic energy.
- Importance of international cooperation in enhancing regulatory compliance.
- Implications for strengthening nuclear governance and promoting sustainability.

**Keywords:** Atomic Energy, Legal Regulation, International Cooperation, Governance, Agreements

Published date: 2024-04-30 00:00:00

## Introduction

In August 1945, the dropping of atomic bombs on the Japanese cities of Hiroshima and Nagasaki started a new historical era. This period was called the "Atomic Age". Indeed, it is no exaggeration to say that the 20th century was the century of legal regulation of atomic energy and its peaceful use. Until this time, various researches were carried out on the atom. Albert Einstein, Niels Bohr, Marie Curie, Ernest Rutherford, James Chadwick, J. Robert Oppenheimer and others[1].

Niels Bohr is a scientist who contributed to our understanding of atomic structure and quantum mechanics. Bohr was also one of the scientists who participated in the creation of the atomic bomb. Later, he became one of the supporters of the peaceful use of atomic energy[2].

Oppenheimer is the scientist who developed the first atomic weapons during the Second World War. That is why he is called the "father of the atomic bomb".

Physicists have different opinions about atomic energy. For example, Albert Einstein said, "Atomic energy serves both good and evil. It is our responsibility as scientists and as a whole society to use it for peaceful purposes and under control for the well-being of mankind," and another physicist Alvin M. Weinberg in 1945 In his speech in the USA, he said: "Atomic energy kills as well as heals. As soon as it enriches the region, it can also destroy it." Therefore, the use of the atom without observing the safety rules can lead to the derailment of the entire existence. Being able to use it effectively can be the foundation for a bright future [3].

Atomic energy is the energy obtained from atoms. In various literature, this type of energy is called future energy [4]. We can see in the example of developed countries that if nuclear energy is used correctly, it will become the cheapest and greenest energy if the processes of its construction are followed and a proper waste management mechanism is developed. Several factors are cited as an example of the advantages of using nuclear energy [5]. For example, the production of nuclear energy produces less toxic gases. In addition, uranium used in the production of nuclear energy is cheap, which can lead to lower energy prices. Because, comparing the burning of 3600 kilograms of coal to produce the energy obtained from one kilogram of Uranium is considered as the basis of our opinion [6].

There are also negative aspects of the use of nuclear energy, and if the safety rules are not followed during its use, it will have very negative consequences. For example, if the rules for storing uranium in warehouses are not followed, very terrible accidents can occur. An alternative method of nuclear waste disposal has not yet been created [7].

## Methods

A multifaceted approach is employed, encompassing documentary analysis, case studies, and empirical data collection. Through qualitative and quantitative methodologies, the study scrutinizes legislative frameworks, policy documents, and institutional mechanisms relevant to the legal regulation of atomic energy. Interviews with key stakeholders and experts in the field provide valuable insights into the practical implementation and enforcement of these regulations [8].

## Results and Discussion

It is no exaggeration to say that the process of legal regulation of atomic energy began with the establishment of the International Atomic Energy Agency (IAEA). This article analyzes the regulation of nuclear energy, theoretically divided into 3 stages of gradual development: [9]

1. Establishment of the IAEA and its adoption of documents aimed at the legal regulation of atomic energy during its activities;
2. The period of further development of safety measures in the use of atomic energy;
3. Legal regulation of nuclear energy today.

1st period. As a result of the establishment of the IAEA, the legal regulation of atomic energy began to be implemented at the international level. Below is an analysis of how the IAEA was established and the documents adopted by it: International Atomic Energy Agency (IAEA, MAGATE)

The IAEA is an international organization created in 1957 in response to the deep fears and hopes created by the discoveries and various applications of nuclear technology. It was established as a result of the UN conference in New York. It works based on its own regulations. The statute was adopted in September 1956 and entered into force on July 29, 1957. Official communication with the UN is carried out in accordance with the agreement of

November 14, 1957 of this organization. Every year, it submits a report on its activities to the UN General Assembly and the Security Council. (Part B of Article 3 of the IAEA Charter). The main goal of the agency is to establish peaceful use of atomic energy and develop international cooperation [10].

According to the statute, the main activities of the IAEA include the following areas:

- a. strict control of nuclear weapons-producing technologies;
- b. rendering assistance in the field of nuclear energy;
- c. correct and safe burial of radioactive waste;
- d. preparation of norms and rules related to this field with the help of expert lawyers;
- e. support of scientific research programs;
- f. development of programs related to accidents;
- g. increasing productivity and soil fertility in agriculture using nuclear methods and radioactive substances [11];
- h. help in the fight against insects and diseases in agriculture and animal husbandry.

(These areas are reflected in Article 3 of the Regulation).

According to Article 2 of the IAEA Charter:

"The agency seeks to accelerate and expand the use of nuclear energy for peace, health and prosperity throughout the world. The assistance provided by him is not allowed to be used for any military purposes." It is not in vain to say that the original purpose of the IAEA is reflected in this article. The Republic of Uzbekistan became a member of the IAEA on January 21, 1994, and has undertaken to recognize international standards, to use nuclear energy in the national economy, to comply with international standards and regulations in the safe handling of radioactive substances [12].

According to the statistics of 2022, the number of IAEA member states has reached 178. UN member states and the Holy See are also members of this organization. For comparison, according to the situation in 1997, 114 countries were members of this organization. From statistical information, it is understood that the scope of the Organization is increasing day by day, and the number of people interested in using atomic energy is increasing [13].

In conclusion, the IAEA is the most important organization that regulates the use of atomic energy, and it conducts its activities based on its own charter. We can say that the relations related to the atom are fully reflected in the regulation. For example, the charter has been amended three times during these years.

During its activity, the IAEA has adopted several agreements on guarantees and protection issues. These agreements are:

#### **a. Comprehensive Security Agreement (CSA)**

Countries that have concluded a CSA with the IAEA will have to declare their nuclear materials. The IAEA will verify the completeness and correctness of this declaration. Signatories to the CSA must report to the agency the types and quantities of nuclear materials to be protected and secured. Also, the CSA provides the right to carry out regular inspections of nuclear materials under the jurisdiction of the states that have implemented the agreement to ensure that they are not using them inappropriately and that they are using them for peaceful purposes [14].

According to the IAEA, as of March 2022, 178 countries have concluded comprehensive agreements on guarantees. These countries submit annual reports to the IAEA.

#### **a) Additional Protocol (AP)**

This is a voluntary agreement. However, currently the IAEA is giving this document a mandatory acceptance. This protocol increases the efficiency and transparency of protection measures. It is an agreement that allows the Agency to learn more about the nuclear program of the countries. By adopting this protocol, if the IAEA is aware of the existence of undeclared objects, it gives them the right to access them without warning. Under the Additional Protocol, the IAEA can study nuclear fuel cycle research and work, all parts of a country's nuclear fuel cycle, from uranium deposits to nuclear waste [15].

The Model Additional Protocol was adopted by the Governing Council in 1997 to further complement the comprehensive agreement between States. As of 2016, 128 countries have signed additional protocols. As of December 2021, 138 countries have signed additional protocols. In addition to 138, 15 additional protocols have



been adopted and are not yet in force[10].

## **b) Small Quantity Protocol (SQP)**

A Small Amounts Protocol is a protocol that can be created alongside a comprehensive security agreement. This protocol has been around since 1971 and was standardized in 1974. Applies to countries with limited nuclear activities or materials. It is a document that allows the IAEA to verify the country's nuclear program.

The above three agreements allow the IAEA to control the use of nuclear energy for peaceful purposes. Based on these protocols and documents, security and protection methods are implemented in depth [16].

2nd period. The period of further development of safety measures in the use of atomic energy. The further development of safety measures in the use of nuclear energy intensified in the middle of the 20th century, especially after the catastrophic events at Chernobyl in 1986 and Fukushima in 2011. Various international legal documents on security issues were also adopted. Below we will analyze these documents one by one [17].

### **1. The Convention on Nuclear Safety**

Convention on Nuclear Safety is an international agreement aimed at increasing the safety of nuclear power plants around the world. This convention was adopted in 1994 and entered into force in 1996. It covers various aspects of nuclear safety, including the design, construction, operation and maintenance of nuclear power plants [18]. The convention encourages international cooperation and information exchange to improve nuclear safety on a global scale. Today, more than 80 countries are members of this convention. It provides a framework for countries to share information and cooperate on security measures. It also includes emergency preparedness and response measures, as well as a regulatory framework for nuclear safety. The Convention promotes transparency, verification of parties, and continuous improvement of nuclear safety standards [19].

This convention stipulates that member states must conduct periodic safety inspections of their nuclear facilities. This convention also encourages member states to involve the public in their nuclear safety decisions.

### **2. The Joint Convention on the Safety of Spent Fuel and Radioactive**

Waste Management is an international agreement aimed at ensuring the safe management of spent fuel and radioactive waste.

The Convention was adopted in 1997 and entered into force in 2001. It is overseen by the International Atomic Energy Agency (IAEA) and has been ratified by many countries around the world. The Convention covers the safe handling, storage, transportation and disposal of spent fuel and radioactive waste. It sets out the principles and requirements for the management of these materials, including the creation of a national policy and regulatory framework, the implementation of safety measures and the provision of information to the public. encourages international cooperation, information sharing and mutual evaluation to ensure continuous improvement of its practices. It also encourages countries to develop and support national strategies for the long-term management of these materials [20].

We evaluate the effectiveness of this convention based on: [21]

a. the convention created a framework for countries to create and maintain a strong regulatory framework for the safety of spent fuel and radioactive waste management. The effectiveness of the Convention depends on the countries, and it depends on how well they implement the rules and guidelines of the Convention;

b. the convention stipulates that the parties submit a report on the implementation of safety measures in the use of nuclear energy. The effectiveness of this aspect is seen in how responsibly the parties present the report and follow the security rules established by the convention;

c. within the framework of the convention, the parties also organize a mutual evaluation process, in which the parties review and evaluate each other's national security programs. This process makes it possible to further improve security measures and organize mutual cooperation between states [22].

### **3. Convention on assistance in the event of a nuclear accident or emergency**

It is a convention adopted after the Chernobyl nuclear power plant accident in 1986. This document can be a legal basis for IAEA member states to help each other in such situations. Each country informs the IAEA about its experts, equipment and materials. It is envisaged that they will be able to help through these means when such emergency situations arise. The Convention was adopted on September 26, 1986 and officially entered into force on February 26, 1987 [23].

### **4. Paris Agreement**

The Paris Agreement adopted in 2015 is primarily a document aimed at combating climate change. Although it does not specifically regulate nuclear energy, it is a document that recognizes the importance of low-carbon technologies, including nuclear energy, in reducing greenhouse gases and waste. The agreement encourages countries to step up their efforts to transition to sustainable energy sources, including nuclear energy. However, specific legal regulations and policies regarding nuclear energy are determined by each country [24]. It should be noted that the Paris Agreement is primarily an agreement related to reducing greenhouse gas emissions and mitigating climate change, rather than providing detailed rules for specific energy sources. Currently, 197 countries have joined the Paris Agreement. However, not all of these countries have nuclear power programs or use nuclear power. Several countries that are parties to the Paris Agreement have nuclear power programs, including the United States, France, China, Russia, Japan, Germany, and the United Kingdom [25]. These countries rely to varying degrees on nuclear energy for electricity generation and have their own rules and policies to regulate its use. This agreement does not directly regulate the use of nuclear energy. The focus of the agreement is on greenhouse gas emissions, aimed at reducing and combating climate change [26].

To sum up, all the documents mentioned above are aimed at the legal regulation of atomic energy from some aspects. We mentioned above that these documents have commonalities and some differences. In the Central Asian region, Kazakhstan and Uzbekistan are considered countries with nuclear energy potential. In terms of uranium production, Kazakhstan ranks first, and Uzbekistan ranks seventh. These 2 countries are also members of the IAEA. By 2021, the IAEA found our country ready to build a nuclear power plant. From this period, the construction of nuclear power plants in Uzbekistan began to be carried out in cooperation with Russia. Bilateral agreements were also signed on this issue. The first power unit of the NPP in Uzbekistan is planned to be commissioned by the end of 2028. The NPP being built in Uzbekistan is set to be organized based on all safety requirements [27].

The mutual legal force of international instruments on the legal regulation of nuclear energy depends on various factors, for example, the relevant treaties or agreements, the consent of the participating countries and their domestic legal systems. Treaties such as the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) and the Convention on Nuclear Safety aim to establish binding obligations between signatory states. However, the effectiveness and enforcement of these documents may vary depending on countries' willingness to comply and mechanisms for monitoring and resolving disputes. All of the above documents are overseen by the IAEA, which is the most important organization in regulating this field [28].

## Conclusion

In conclusion, the legal regulation of atomic energy has undergone significant development since the establishment of the International Atomic Energy Agency (IAEA) in 1957. Through the adoption of various international agreements and conventions, such as the Comprehensive Safeguards Agreement (CSA), Additional Protocol (AP), and conventions on nuclear safety and assistance in the event of nuclear accidents, efforts have been made to ensure the safe and peaceful use of nuclear energy worldwide. These legal instruments provide a framework for cooperation, transparency, and continuous improvement in nuclear safety standards. However, challenges remain, particularly in ensuring universal compliance and effective enforcement across all member states. The ongoing construction of nuclear power plants, such as those in Uzbekistan, underscores the importance of adhering to rigorous safety protocols and international legal standards. Further research is needed to assess the implementation and effectiveness of these legal frameworks in promoting nuclear safety, as well as to explore emerging issues and potential areas for improvement in the regulation of atomic energy on a global scale.

## References

1. B. Goldschmidt, "A Historical Survey of Nonproliferation Policies," *International Security*, vol. 2, no. 1, pp. 69-87, 1977.
2. J. R. Lovering, A. Yip, and T. Nordhaus, "Historical Construction Costs of Global Nuclear Power Reactors," *Energy Policy*, vol. 91, pp. 371-382, Apr. 2016, doi: 10.1016/j.enpol.2016.01.011.
3. J. Herbert, "Nuclear Energy Law in France," *International Business Lawyer*, vol. 9, p. 213, 1981.
4. M. E. Paté-Cornell, "Uncertainties in Risk Analysis: Six Levels of Treatment," *Reliability Engineering & System Safety*, vol. 54, no. 2, pp. 95-111, Nov. 1996, doi: 10.1016/S0951-8320(96)00067-1.
5. G. Franco, "The Governance of Nuclear Phase-out in Europe."
6. E. Piva, "The International Legal Framework on Nuclear Energy for Peaceful Uses: A Human Rights and Environmental Law Perspective," Oct. 2021. [Online]. Available: <http://dspace.unive.it/handle/10579/20415>. [Accessed: Jun. 05, 2024].
7. A. A. Faruque, *Nuclear Energy Regulation, Risk and The Environment*. London: Routledge, 2018, doi: 10.4324/9781351240062.
8. A. U. Bali, "Negotiating Nonproliferation: International Law and Delegation in the Iranian Nuclear Crisis," *UCLA Law Review*, vol. 61, p. 232, 2014.
9. M. A. Schreurs, "Orchestrating a Low-Carbon Energy Revolution Without Nuclear: Germany's Response to the Fukushima Nuclear Crisis," *Theoretical Inquiries in Law*, vol. 14, no. 1, pp. 83-108, Jan. 2013, doi: 10.1515/til-2013-006.

10. M. F. Imber, "Mitrany's Functionalism, the International Atomic Energy Agency, and the Development of Safeguards Against the Proliferation of Nuclear Weapons 1945-1975," Ph.D. dissertation, University of Southampton, 1981. [Online]. Available: <https://eprints.soton.ac.uk/459583/>. [Accessed: Jun. 05, 2024].
11. J. Rotmans, R. Kemp, and M. van Asselt, "More Evolution Than Revolution: Transition Management in Public Policy," *Foresight*, vol. 3, no. 1, pp. 15-31, Jan. 2001, doi: 10.1108/14636680110803003.
12. M. Zhu, "The Evolution of China's Nuclear Nonproliferation Policy," *Nonproliferation Review*, Mar. 1997, doi: 10.1080/10736709708436664.
13. Y. Ogawa, "The Development of Peaceful Uses of Atomic Energy in Japan: Its Legal and Political Aspects," *Japanese Annual of International Law*, vol. 23, p. 50, 1980.
14. T. R. Nowacki, "Nuclear Power on the Vistula River Law and Policy in Shaping Energy Future of Poland," *PRAWO WIEŻ*, no. 33, Art. no. 33, Oct. 2020, doi: 10.36128/prw.vi32.97.
15. S. V. Valentine and B. K. Sovacool, "Energy Transitions and Mass Publics: Manipulating Public Perception and Ideological Entrenchment in Japanese Nuclear Power Policy," *Renewable and Sustainable Energy Reviews*, vol. 101, pp. 295-304, Mar. 2019, doi: 10.1016/j.rser.2018.11.008.
16. International Atomic Energy Agency, "The IAEA Statute," [Online]. Available: <https://www.iaea.org/about/statute>.
17. Q.A. Marimbayevich, "Uzbekistonda birinchi AES qurilishi," *Kun.uz*. [Online]. Available: <https://kun.uz/uz/news/time/uzbekistonda-birinci-aes-qurilishi>.
18. M.R. Kamildjonovich, "Atom energiyasi bo'yicha xalqaro agentlik," *Wikipedia*. [Online]. Available: [https://uz.m.wikipedia.org/wiki/Atom\\_energiyasi\\_bo%CA%BByicha\\_xalqaro\\_agentlik](https://uz.m.wikipedia.org/wiki/Atom_energiyasi_bo%CA%BByicha_xalqaro_agentlik).
19. L. Lu, "Nuclear Safety Overview," *George Washington University Law School Library*. [Online]. Available: <https://law.gwu.libguides.com/c.php?g=478543&p=7703834>.
20. M. Elbaradei, "International Nuclear Law: History, Evolution, and Outlook," Book, 2010.
21. D.G. Kimball, "Uzbekistan Overview," *Nuclear Threat Initiative*. [Online]. Available: <https://www.nti.org/analysis/articles/uzbekistan-overview/>.
22. D. Fischer, "International Atomic Energy Agency," [Online]. Available: <https://www.iaea.org/>.
23. L.K. Robertson, "Overview Nuclear Safety - Europe (EURATOM)," *Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety*. [Online]. Available: <https://www.bmu.de/en/topics/nuclear-safety/overview-nuclear-safety/europe/euratom>.
24. L. Jure, "Stanford Large Network Dataset Collection," *Stanford University*. [Online]. Available: <http://large.stanford.edu/courses/2018/ph241/keval1/>.
25. United Nations Framework Convention on Climate Change, "The Paris Agreement," [Online]. Available: <https://unfccc.int/process-and-meetings/the-paris-agreement>.
26. M.T. Kamminga, "Convention on Nuclear Safety," *Nuclear Threat Initiative*. [Online]. Available: <https://www.nti.org/education-center/treaties-and-regimes/convention-nuclear-safety/>.
27. G. Bunn, "The Nuclear Nonproliferation Treaty," *U.S. Department of State Office of the Historian*. [Online]. Available: <https://history.state.gov/milestones/1961-1968/npt>.
28. M.O. Mojolaoluwa, "Speech: Albert Einstein Address to the General Assembly of the United Nations," *American Rhetoric*. [Online]. Available: <https://www.americanrhetoric.com/speeches/alberteinsteinpostwarworld.htm>.