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A Review of Turkey's Nuclear Policies and Practices

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Introduction

Even though Turkey's interest in nuclear energy has a long history, it is only recently that she has actually launched actual nuclear power plant (NPP) projects. In 2010 Turkey signed an agreement with Russia for the building and operation of a nuclear power plant in Akkuyu in southern Turkey. This project was unique in that it was the first project internationally that was designed in the Build Operate and Own (BOO) model of financing. In short, it is the project company, established in 2011, that takes on the responsibility and all the associated risks for building, operating the NPP, handling the spent fuel and radioactive waste, and finally decommissioning the plant. In that project, what Turkey offers in return is a purchase agreement for some of the output at a fixed price.[1] Recently Turkey has concluded an agreement with Japan for the building and operation of a second NPP in the province of Sinop in the north of Turkey. As will be discussed in more detail below, the financing and risk sharing model of the Sinop project is very different from that of the Akkuyu project in that in the Sinop project Turkey, through the state-owned Electricity Generation Company (EÜAŞ) takes an equity share in the project. The two models differ in other dimensions as well, especially with regards to the handling of spent fuel and radioactive waste.

NPP projects carry various risks. Some of these risks are financial. NPPs entail very large fixed and relatively low variable costs and they take a long time to build. Many NPP projects have taken longer to build than initially planned and the increase in construction time increases costs. Moreover, the commercial viability of electricity generated by NPP depends crucially on prices of alternative fuels as well as changes in generation technology, changes in the cost efficiency of renewables, etc. How to share the large financial risks among private companies, governments and other stakeholder has been subject of much intense debate.

Even more importantly, electricity generation through NPPs is also subject to accident or safety risks. Accidents have a relatively low probability of occurring but when they do occur, the humanand economic costs are devastating, as exemplified by the Chernobyl and Fukushima accidents. Hence electricity generation through nuclear energy is heavily regulated. An important objective of regulation is to keep safety risks at minimal or socially tolerable levels. Clearly, regulatory oversight is a critical factor that may increase construction costs. At the same it is the quality of regulatory institutions that determine whether safety risks are indeed kept at minimal or socially acceptable levels.

[1] The economic and risk sharing aspects of the Akkuyu Project has been analyzed in Kumbaroğlu (2011) and Atiyas (2011).

The objective of this chapter is to provide an assessment of developments in nuclear energy in Turkey in the last few years. The chapter is organized as follows. The next section provides an account of the main elements of the legal and regulatory framework surrounding nuclear energy in Turkey. The third section undertakes an analysis of the Sinop NPP project and compares it with the Akkuyu project. The fourth section re-visits the regulatory framework in Turkey and evaluates it against the benchmarks identified in the recent Principles of Conduct identified by a group of nuclear power plant and reactor exporters. The final section concludes.

The regulatory framework[2]

An important source of national legal and regulatory frameworks for nuclear energy is rules, norms and standards laid out in international law such as the Convention on Nuclear Safety (CNS), the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste ("Joint Convention") various standards established by the International Atomic Energy Agency (IAEA), and the "Safety Directive" and "Waste Directive" of the European Union.[3] The Convention on Nuclear Safety is the basic international law that creates a general framework for measures that need to be taken to ensure nuclear safety. The enforcement capacity of the CNS is weak and it mainly relies on peer review and pressure. However, along with norms and standards provided by the International Atomic Energy Agency it does provide some basic principles with which stakeholders can monitor and evaluate progress towards ensuring safety in nuclear energy in member countries. The Joint Convention requires the contracting parties to take appropriate legislative, regulatory and administrative measures to govern the safety of spent fuel and radioactive waste management and to ensure that individuals, society and the environment are adequately protected against radiological and other hazards by regulating the appropriate siting, design and construction of nuclear facilities. Similar to CNS, the Joint convention also stipulates a reporting and peer review mechanism for effectiveness. The reports are required to include lists of spent fuel and radioactive waste management facilities and inventories of spent fuel and radioactive waste. As was the case with the CNS, the Joint Convention also does not entail an effective enforcement mechanisms or sanctions in case of non-compliance. The Safety and Waste Directives of the European Union are both inspired

[2] This section draws heavily from Atiyas (2015) and Atiyas and Sanin (2012).

[3] Council Directive 2009/71/Euratom of 25 June 2009 establishing a Community framework for the nuclear safety of nuclear installations, and Council Directive 2014/87/Euratom of 8 July 2014 amending Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations ("Safety Directive") and Council Directive 2011/70/Euratom of 19 July 2011 establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste" ("Waste Directive").

closely inspired by the CNS and the Joint Convention, respectively, as well as IAEA standards, and in general aim at making them "legally binding and enforceable at the EU level".[4]

The importance of the existence for these norms for the evaluation of national regulatory systems is clear. The quality of regulation in the area of nuclear energy depends crucially on the institutional and governance characteristics of the regulatory framework and in particular of the agency given the task of regulation. International norms provide some of the crucial standards and benchmarks against which national systems can be evaluated. Since Turkey is a candidate country for EU membership, the benchmarks provided by the Safety and Waste directives are especially important. Clearly international or EU norms are not immune from criticism for their substance or lack of teeth,[5] but they can be taken to provide a minimum against which actual frameworks can be evaluated.

With regards to international law, Turkey has signed the CNS but has not yet ratified the Joint Convention. Indeed, Turkey has recently submitted a Full Report to the 6th Review Meeting of Nuclear Safety Convention (TAEK, 2013) which provides significant information on progress on the development of the regulatory framework in Turkey.

The main characteristics of the national regulatory framework regarding nuclear energy in Turkey can be summarized as follows. There are two basic laws that form the legal framework for nuclear energy in Turkey. The first, the Law on the Construction and Operation of Nuclear Power Plants and Energy Sale (Law No. 5710, "Nuclear Law" for short) was enacted in 2007 and the second, the Law on the Turkish Atomic Energy Authority (TAEK, Law No. 2690) was enacted in 1982. TAEK is the authority responsible for nuclear safety and security and the Nuclear Law also stipulates that until a new agency with the task of regulation and supervision of nuclear activities is established, TAEK will serve as the regulatory authority. TAEK is authorized by Law No. 2690 to ensure nuclear safety and security by licensing and inspecting nuclear facilities and activities. Two ministries take an important role in nuclear power projects: Energy policy and in particular security of supply of electricity in Turkey is under the responsibility of the Ministry of Energy and Natural Resources (MENR). The Ministry of Environment and Urbanization (MEU) implements the Decree on Environmental Impact Assessment

[4] Blohm-Hieber (2011). See also Stanic (2010). The Safety Directive of the EU and its relevance for Turkey has been discussed in some detail in Atiyas (2015). The Waste Directive is discussed in some detail below. Another important dimension of international law relates to liability policy in the case of a nuclear accident. The international norms regarding nuclear liability and the situation in Turkey is discussed further below in this chapter.

[5] See for example the criticism by Michele Rivasi, European Parliament's Greens/EFA group shadow rapporteur on the community framework for the nuclear safety of nuclear installations, at https://www.theparliamentmagazine.eu/articles/opinion/nuclear-safety-directive-accused-%E2%80%98lacking-substance%E2%80%99

(1997) which requires operators of facilities, including of nuclear power plants, to prepare, in the planning stage of project, Environmental Impact Assessment (EIA) Reports which should be submitted to the MEU. Approval of the MEU is required before construction can proceed.

Rules regarding licensing of nuclear installations are laid out in "Decree on Licensing of Nuclear Installations" dated 1983. The Decree lists the various permits and licenses that need to be obtained by nuclear operators. The Decree authorizes TAEK to inspect nuclear facilities and enforce penalties, including the revocation of licenses. There are three main licenses corresponding to different stages of nuclear projects: The site license, construction license and operating license. This decree has been complemented by a "Directive on Determination of Licensing Basis Regulations, Guides and Standards and Reference Plant for Nuclear Power Plants" issued in 2012. The Directive lays out a hierarchy of rules. Basically it states that the issues on which existing Turkish regulations do not offer sufficient clarification are to be covered IAEA safety documents. In case the IAEA safety rules do not offer sufficient clarification, then remaining issues are to be dealt with by vendor country or other third party country laws and regulations.

A critical condition to ensure the safety of nuclear power enumerated in international law is the existence of a national legal and regulatory framework. The two laws that govern nuclear power in Turkey, mentioned above, discussed above do not meet this condition; hence, Turkey does not yet have a framework law (Ercan and Schneider, 2014). The Nuclear Law does not address issues of safety, it mainly addresses rules and procedures for the competitive selection of companies that will build nuclear power plants and incentives to be provided to electricity produced by nuclear power plants. It also requires, for each nuclear project, the establishment of a decommissioning fund to finance the costs of dismantling the plant and a national radioactive waste fund to meet the costs of temporary and final storage of waste as well as the construction licensing operation and decommissioning of the storage facility.

Another important condition to ensure safety in nuclear power emphasized in international law and literature is the existence of an independent regulator. As a general rule, it is required that the regulator should not have any operational or developmental role in the nuclear industry. There are a number of additional internationally recognized formal requirements of independence. First, the political authority should not have the power to overturn the decisions of the regulatory authority. Second, the decision makers of the authority, namely the president and members of the Board (if there is one) should be appointed for fixed terms and the political authority should not have the power to remove them before their term expires, except under conditions of severe wrongdoing or illness etc. Third, the regulator should have financial independence, that is, its budget should not be

at the mercy of the current government. This is often ensured by establishing independent sources of finance, such as earmarked taxes and/or license revenues. Fourth, the regulator should be independent in its personnel policy and should have the means to recruit skilled personnel on the basis of merit.

Independence is not absolute. The boundaries of the independence of the regulatory authority is established by the founding law. In principle the political authority should also establish policy for nuclear energy and nuclear safety, possibly in the same founding legislation, also determining the boundaries of the regulator's authority and independence. Furthermore, there should be mechanisms that ensure the accountability and transparency of the regulatory authority both towards the political authority and more importantly towards the general public. This is important: while the formal conditions listed above are necessary for high quality regulation, international experience strongly suggests that they are not sufficient. There are many ways in which the *de-facto* independence of the regulatory authority can be compromised by the efforts of both the political authority and the regulated companies. Accountability and transparency are the principal means which ensure that the authority of the regulatory authority is used in the public interest.

The regulatory framework for nuclear energy in Turkey has severe shortcomings with regards to the principles established above. As mentioned above, under the current legal framework TAEK acts as the regulatory authority. According to its founding law, TAEK still has the task of coordinating and supporting research and development activities in the field of nuclear energy, violating the basic principle that the regulatory body should be independent from promotional activities. TAEK reports to the Prime Minister. The president of TAEK is chosen by the Prime Minister and appointed by a joint decision of the Prime Minister, the President of the Republic and the MENR. Importantly, however, the TAEK law does not protect the president from removal from duty by the political authority, in violation of another internationally accepted conditions of independence. The actual decision making process of TAEK also makes it vulnerable to political influence. One of the important bodies taking part in the decision making process is the Atomic Energy Commission (AEC). It plays an important role in the licensing procedure: for example cancellation of licenses is an AEC decision. The AEC is chaired by the President of TAEK and consists of the Vice Presidents, one member from each of the Ministries of National Defense, Foreign Affairs, Energy and Natural Resources and of four faculty members educating, training and researching in the field of nuclear energy.[6] The Prime Minister presides the Atomic Energy Commissions meetings whenever s/he deems necessary. Moreover, the members of AEC are appointed by the Prime Minister for a four year term, and there

[6] Article 6 of TAEK Law.

is no provision protecting members from discretionary removal from duty. Hence the Prime Minister can have a huge influence on the decisions of the AEC, jeopardizing its independence. TAEK's financial independence is also limited because its budget depends on yearly appropriations from the budget of the Prime Ministry. Another dimension is audit: most regulatory authorities in Turkey are audited by the Turkish Court of Accounts, which is the top authority that carries out financial, compliance and performance audits of the public administrative bodies and reports to the parliament. By contrast, TAEK is audited by the Supreme Audit Council which is organized under the Prime Ministry. If the need arises, TAEK may be audited by inspectors associated with the Ministry of Finance as well, upon the approval of the Prime Minister. Hence in terms of audit as well, TAEK is highly dependent on the political authority. Finally, the TAEK Law is highly deficient in terms of measures that would ensure transparency. The only mention in the law is that TAEK should announce the necessary information to the public. Compared to international best practice, this is extremely vague.[7]

It would be fair to say that Turkey does not yet have a comprehensive nuclear energy policy. There is no government document which clearly sets the case and justification for nuclear energy, and an analysis of the costs and benefits of nuclear energy against alternatives. Principles of good governance would have required that such policy would be established after going through various forms of public consultation. Finally, such a policy would have enunciated the various steps, milestones and targets that would be attained in the future.

Turkey's submission to the 6th Review Meeting of the CNS (TAEK, 2013) mentions that a draft Nuclear Energy and Radiation Law would be presented to the Parliament in December 2013. As of April 2015, this has not yet happened. A draft was apparently circulated for a short period and discussed in the news media,[8] but has not yet appeared on the websites of the MENR or TAEK.[9]

[7] See Atiyas (2015) and Atiyas and Sanin (2012) for a detailed discussion.

[8] For example, an article in the daily Zaman dated February 19, 2013 discussed some elements of the draft law: http://www.zaman.com.tr/ekonomi_turkiye-atom-enerjisi-kurumu-kapaniyor_2055613.html accessed April 25, 2015.

[9] Interestingly, a copy was made available at the www.enerjiport.com website in March 2013 and circulated among energy e-mail groups in Turkey. Since this is not yet an officially publicized copy, it would be premature to provide detailed comments on the draft law. Suffice it to indicate, however, that the draft law is much more detailed and has a much wider scope than the current legislation. It also eliminates TAEK and established a new regulatory agency with somewhat more specific safeguards regarding independence (it explicitly states, for example, that the president and members of the Board cannot be recalled before their terms expire. The draft also stipulates that the building of nuclear facilities requires a decision of principle (article 58). Before the adoption of this decision, the MENR is required to allow residents who live near the proposed facilities as well as local governments to express their opinions in writing.

The Sinop Project

The Sinop nuclear power plant is planned to be built by a consortium consisting of the Mitsubishi Heavy Industries and Itochu Corporation from Japan and GDF Suez from France. The project consists of the construction and operation of four ATMEA-1 reactors with capacity of 4400 MW. The total cost of the project is estimated to be $22 billion and the first unit is expected to start operations in 2023.

"The Agreement Between the Government of the Republic of Turkey and the Government of Japan on Cooperation for Development of Nuclear Power Plants and the Nuclear Power Industry in the Republic of Turkey" was signed in April-May of 2013 and was made into law in Turkey on January 9, 2014.[10] This was followed by an "Agreement between the Government of Japan [GoJ] and the Government of The Republic of Turkey [GoT] on Co-Operation for Development of Nuclear Power Plants and The Nuclear Power Industry in the Republic of Turkey" (henceforth "the Sinop Agreement"). This agreement, along with the Memorandum of Cooperation and proposed Host Government Agreement (HGA) has been presented to the parliament in Turkey for adoption in December 2014.[11] It was made into law on April 1, 2015 (Law No. 6642, published in Official Gazette dated April 10, 2015).

According to the Sinop Agreement, the areas of cooperation between the two parties will include conducting a feasibility study and an economic impact assessment of the project, and the design, construction, operation, repair and decommissioning of the nuclear power plant at the project site as well as supply of the nuclear fuel (art. 2). Areas of cooperation also include ensuing nuclear safety, conduct operation and maintenance training programs and establishing a nuclear technology center for the development of the skilled labor force for the plant.

Cooperation for the development of nuclear power *industry* in Turkey, will include efforts in areas such as (art. 3): "a) development of nuclear regulations such as those on nuclear security and supervision, safety and licensing including license extension of nuclear power plants; (b) development of a quality management system with regard to the operation of nuclear power plants; (c) development of technologies in the field of the operation, maintenance and decommissioning of nuclear power plants and the management of spent fuel and radioactive waste

[10] "Türkiye Cumhuriyeti Hükümeti ile Japonya Hükümeti Arasında Nükleer Enerjinin Barışçıl Amaçlarla Kullanımına Dair İşbirliği Anlaşmasının Onaylanmasının Uygun Bulunduğuna Dair Kanun", Official Gazette, January 18, 2014. The agreement itself can be found at http://www2.tbmm.gov.tr/d24/1/1-0850.pdf or at http://www.mofa.go.jp/mofaj/files/000018111.pdf.

[11] The draft law along with attachments can be found at http://www2.tbmm.gov.tr/d24/1/1-1004.pdf.

in the light of relevant policies of the Republic of Turkey; (d) promotion of the establishment of a nuclear fuel fabrication plant; (e) provision of technical assistance to relevant Turkish entities through training for the enhancement of their capacity; (f) organization of workshops, meetings, seminars and conferences, including those to promote public awareness and acceptance on the peaceful uses of nuclear energy; and (g) development and transfer of technology in the field of nuclear power industry."

The Sinop Agreement stipulates that for the purposes of coordinating the cooperation, parties will establish a steering committee. (art. 3). Turkey gives the site for free but without ownership, and provide the necessary infrastructure (art. 4). Art. 5 states that the GoT will sign with the project company a Host Government Agreement (HGA) and the relevant Turkish entity (meaning TETAŞ, the Turkish Electricity and the Contracting Company, will sign a power purchase agreement PPA with the project company.

Regarding the financing of the project, art. 6 states that the GoJ will "encourage" appropriate Japanese financial institutions "in particular the Japan Bank for International Co-operation[JBIC] and the Nippon Export and Investment Insurance [NEII], to extend the financing required for the Project. When such financing is extended, its terms and conditions as well as the procedures for its utilization will be governed by a financing agreement between the Project Company and appropriate Japanese financial institutions."

The Sinop Agreement makes explicit reference to technology transfer. Specifically art. 8 states that "The Government of Japan strongly supports and shall not arbitrarily impede the transfer of technology required for the implementation of the Project in line with a technology transfer plan which will be made by the Government of the Republic of Turkey and the Project Company with due consideration to the outcome of the feasibility study and the economic impact assessment of the Project."

The Annex to the Agreement lists the "essential elements of the host government agreement". According to the Annex the aim of the project is to "design, engineer, procure, construct, operate, maintain, repair, refurbish and decommission a nuclear power plant at the Project Site (hereinafter referred to as "the NPP") which is comprised of four (4) units of the ATMEA 1 type reactor." The Annex states that the commercial viability of the project and whether the site is appropriate for the implementation of the project will be assessed through a feasibility study which will be based on the terms and conditions to be agreed between EUAS (and/or a consortium formed by EUAS) and a consortium to be formed by Mitshubishi Heavy Industries. Within two years after its

establishment, the Project company will finalize an economic impact assessment which will report the impact of the project on the Turkish economy and the industry.

The project company will have 70 percent debt and 30 percent equity. GoT is responsible for raising 49 percent of equity in cash and the Japanese consortium for 51 percent. EUAŞ will hold between 30-49 percent of equity as long as the PPA is in force. And the Japanese consortium holds 51 percent as long as the PPA is in force.[12]The company will conclude a financing agreement with appropriate Japanese financial institutions, in particular JBIC with the support of NEII.

The Annex also provides some details for the PPA to be signed between TETAŞ and the project company. Article 4 mentions a tariff rate of 10.80-10.83 US cents per kWh that was apparently calculated during talks between GoT and project participants (meaning EUAŞ, Mitsubishi Heavy Industries, Ltd. and ITOCHU cooperation) and clarifies that this tariff was based on several assumptions, including the assumption that the four units will be commissioned by 2024-2028, the PPA will be valid for 20 years from the date of commercial operation for each unit, that the mentioned rate is a 20 year average and that it is subject to the outcome of the feasibility study and "a price adjustment mechanism". The price adjustment mechanism is not further explained in the Annex. The rate does not include fuel cost, but it does include contributions to waste management and decommissioning funds (0.3 cents per kWh).

Article 6 of the Annex stipulates that the final disposal of spent fuel and radioactive waste will be the responsibility of the GoT. Art. 7 states that the GoT will put in place a legal framework for liability for nuclear damage. According to article 8, the Project Company will develop a localization plan which will include a targeted localization ratio, which will be defined in the feasibility study. The issue of technology transfer is also emphasized in the Annex. Article 9 states: "The Government of the Republic of Turkey and the Project Company are to make, in co-operation with the provider(s) of the ATMEA1 type reactor technology, a technology transfer plan for the implementation of the Project with due consideration to the outcome of the Feasibility Study and the economic impact assessment."

Further details about the project can be found at the HGA submitted to the parliament along with the draft law. According to art. 7.8 of the HGA, the project company will be exempt from the Law on

[12] In a press interview, Mr. Yıldız, the Minister of Energy and Natural Resources stated that in the agreement with Japan there are two prices, 10.80 cents/kWh without fuel and 11.80 cents/kWh including the fuel. He also stated that the price was valid for 20 years and was not subject to escalation. http://www.hurriyet.com.tr/ekonomi/23220783.asp May 7 2013, accessed April 20, 2015.

Public Procurement, the Law on Public Procurement Contracts and the Procurement and Tender Regulation of EÜAŞ.

Regarding the PPA, HGA states that (art. 6.6) "the MENR, TETAŞ and the Project Company shall agree on all assumptions which the Tariff will be based on and on the calculation methodology of the Tariff during the feasibility study" (art. 6.6). This article further clarifies that the 10.80-10.83 cents/kWh tariff rate mentioned in the Annex to the Agreement is not binding but seems to be mentioned as a reference rate. Article 14 states that TETAŞ will purchase 100% of electricity at the tariff rate plus fuel cost. According to art. 14.5 "the tariff cost will consist of investment cost, fixed operating cost, variable operating cost and contributions to the fund for the management of spent fuel and radioactive waste and for decommissioning." According to art. 14.6, TETAŞ will also pay to the project company an amount that "represents all direct expenditure relating to Nuclear Fuel supply". This reimbursement will take place "on an 'as incurred' and 'pass through' basis."

What are the risk characteristics of the Sinop project? A major risk of NPPs is of course market risk, the risk that electricity that will be produced will prove too expensive relative to alternatives. The PPA basically eliminates market risk, since TETAŞ commits to purchase 100 percent of the project company's output. The second component of risk has to do with the extent to which tariffs will actually cover costs. While it seems clear from the above that many of the details of tariff calculations will depend on the findings of the feasibility study, what is not clear is whether the tariff will be fixed once estimates of the various costs are determined or whether allowance will be made to adjust the tariff to reflect deviations from cost estimates. Another major risk element in the construction of nuclear plants is the time it takes to finish the project. Many nuclear plant projects take longer to build than initially estimated. A tariff structure that is not sensitive to realizations of cost but depends only on estimates of costs places all financial risks associated with construction costs on the seller rather than the purchaser of electricity. While the articles mentioned above from the HGA suggest that the tariff or its structure will be determined once the feasibility study is concluded, which would in turn suggest that tariffs will not be sensitive to cost realizations, the parties may still decide to adopt a formula rather than a level which could render actual tariffs sensitive to cost realizations.

The HGA has specific references to a number of plans geared to the transfer of know-how and development of nuclear industry capabilities in Turkey. In article 19.2 it is stated that the "Localization Plan shall include concrete and comprehensive proposals and action methods with respect to amount of equipment and instalment required for the facilities and how domestic participation ratio will be satisfied". The same article mentions that the Plan will "conclude with the

establishment of comparative advantage in local industries." The "Human resources Development Plan is addressed in art. 19.2, which states that the plan, to be delivered to MENR after the completion of the feasibility study, shall "give due consideration to the employment of Turkish citizens" and will include a training program. The Technology Transfer Plan (art. 19.5) will address the transfer of technology as necessary in connection with the development of the Localization Plan and the Human Resources Development Plan. Also the project company will build a Nuclear Technology Training Center (NTTC) which will become "a world class training center" to provide training of the project company's workforce and to develop human resource capacity in Turkey (art. 19.6).

Differences between the Akkuyu and Sinop Projects

There are important differences between the Akkuyu and Sinop projects.

The first important difference relates to ownership structure. In the Akkuyu project, GoT has no ownership stake in the project company at all. The project company is Russian owned and subject to Turkish law, it may seek private partners, but public ownership is not foreseen. The situation is different in the Sinop project. Initially, and as long as the PPA is in effect, EÜAŞ, which as a state owned entity, will hold at least 30 percent share in the project company and the EÜAŞ consortium (meaning EÜAŞ and other private or public entities that may participate) will hold 49 percent share. The rest of the shares will be held by the Japanese Consortium (meaning GDF Suez SA, ITOCHI Corporation and Mitsubishi Industries and affiliates or their successors). Hence while in the Akkuyu project the GoT is a complete outsider to the project and interacts with it only in its capacity as regulator, this is not the case in the Sinop project where GoT is an insider.

A second important difference relates to differences in risk sharing. In the Akkuyu project, only part of the electricity of output is subject to purchase guarantees, whereas this ratio is 100 percent of output in the case of Sinop. As mentioned above, the presence of purchase guarantees significantly reduces market risk for the Sinop project relative to Akkuyu.

The third important difference relates to building of domestic capabilities. The Akkuyu project did not have any provisions for technology transfer. The issue of technology transfer is specifically mentioned in the Sinop project. Even though at this point the specifics are not laid out in detail, the HGA states that the project company will come up with a localization plan, a human resource development plan and a technology transfer plan. Such issues were not addressed in the Akkuyu project.

Finally, an important difference relates to policy towards nuclear spent fuel. In the Akkuyu project, the project company is responsible for decommissioning and nuclear waste management. Hence spent fuel is ultimately going to be sent to Russia, though, according to Bilezikçi Pekar (2014), some uncertainties remain, as discussed below. In the Sinop project, by contrast, the HGA states in article 21 that "the project company is responsible for the management of spent fuel and radioactive waste, until spent fuel and radioactive waste are transferred to the final disposal facilities which are the responsibility of the government." As will be discussed below, Turkey's policy with regard to the management of spent fuel and radioactive waste is lacking, an issue further addressed below.

Policy towards spent fuel and radioactive waste

One of the most important policy issues related to nuclear power generation is the management of spent fuel and radioactive waste. In an active reactor, fuel is used for about 3-7 years.[13] When used fuel is removed from the reactor, it is highly radioactive and generates both heat and radiation. The fuel is first stored under water, both for cooling and to shield radiation. Generally used fuel is kept under water for a minimum of 9-12 months during which the need to cool the fuel is reduced. At this point there are two management strategies: one option is to reprocess the fuel to extract the material that can be used to produce new fuel. If this option is adopted, then the fuel is sent to a reprocessing facility. This process, also called closed fuel cycle, generates fuel and high level waste, which needs to be handled in a way that is similar to spent fuel of the same age. The other option, open cycle, is to treat spent fuel simply as waste, and store it until eventually it is disposed of.

Countries diverge in terms of how they handle nuclear waste. Some countries see spent nuclear fuel as a valuable energy resource, and have opted to reprocess spent fuel. Others treat spent fuel as pure waste. This is the case, for example, in the US, where it is argued that the cost of recovering the energy content is higher than the value of the energy recovered.[14] In principle exporting spent fuel is a third option (Högselius, 2009). In this case the producing country neither reprocesses spent fuel nor disposes of it, instead spent fuel is sent to a third country where it is either disposed of or reprocessed. However, high level waste from reprocessing is often returned to the exporting country (ibid.) France, Russia, the United Kingdom, Japan, India, Pakistan, and, China have reprocessing facilities (Moratilla Soria et al., 2011). Armenia, Belgium, Bulgaria, Czech Republic, Italy, Netherlands

[13] This section draws on Bilezikçi Pekar (2014), IAEA (2006, 2012).

[14] Bunn et. al. (2001) also mention that reprocessing and recycling may create unnecessary proliferation hazards.

are among countries that have exported their spent fuel, some of them with no waste return (Högselius, 2011).

The ultimate step in the cycle of the management of spent fuel is disposal. There is no unanimous agreement on the method of disposal and disagreements have occurred on issues such as the nature of the most suitable physical location, the depths under which the waste will be placed or the nature of barriers that are needed (Högselius, 2011). One important issue is whether the waste should be retrievable by future generation who may end up seeing the waste not as waste but as a potential resource.

Indeed most countries have delayed decisions regarding the nature of final disposal of spent fuel or of high level waste generated by reprocessing and currently choose to store them in interim storage (Moratilla Soria, 2011). Hence at the present time, there are no disposal facilities (as opposed to storage facilities) in operation in which used fuel, not destined for reprocessing, and the waste from reprocessing, can be placed. According the World Nuclear Organization, "there is currently no pressing technical need to establish such facilities, as the total volume of such wastes is relatively small. Further, the longer it is stored the easier it is to handle, due to the progressive decrease of radioactivity." [15] Instead, the current trend seems to be an sustained increase in the time the spent fuel may be placed under interim storage and the IAEE (2013) reports that "durations in excess of 100 years are now being envisaged". IAEE also reports that with increasing durations of storage, the emerging challenge is showing that aging plants still meet newest regulations for storage. In any case, the nature of final disposal is a decision that is being postponed.

The EU Waste Directive seems to take a somewhat different approach and emphasizes that for high-level waste "it is broadly accepted that deep geological disposal represents the safest and most sustainable option" for disposal (recital 23) and that the storage of radioactive waste is an interim solution, but not an alternative to disposal. The Waste Directive obliges member states to establish a "national framework" which will provide, among others, a system for licensing of radioactive waste and spent fuel facilities; a system of control, inspection and documentation; enforcement actions; national requirements for public information and participation; and a financing scheme for spent fuel and radioactive waste management. In particular, the national program will include "the concepts or plans and technical solutions for spent fuel and radioactive waste management from generation to disposal; and the concepts or plans for the post-closure period of a disposal facility's lifetime,

[15] Nuclear Fuel Cycle Overview at http://www.world-nuclear.org/info/Nuclear-Fuel-Cycle/Introduction/Nuclear-Fuel-Cycle-Overview/
accessed April 1, 2015

including the period during which appropriate controls are retained and the means to be employed to preserve knowledge of that facility in the longer term". Article 6 of the Waste Directive obliges member states to establish a regulatory authority in the field of spent fuel and radioactive waste. The Waste Directive also establishes a mechanism for reporting and peer review, and stipulates an obligation to inform the public as well as to involve the public effectively in decision-making processes in accordance with national and international obligations. Regarding reporting, there is a requirement that "Member States shall submit a report to the Commission on the implementation of this Directive for the first time by 23 August 2015, and every 3 years thereafter, taking advantage of the review and reporting under the Joint Convention" (Article 14.1). In addition, "Member States shall periodically, and at least every 10 years, arrange for self-assessments of their national framework, competent regulatory authority, national programme and its implementation, and invite international peer review of their national framework, competent regulatory authority and/or national programme with the aim of ensuring that high safety standards are achieved in the safe management of spent fuel and radioactive waste" (article 14. 3.). As emphasized by Blohm-Hieber (2011) one of the main objectives of the obligation to establish a national programme is to prevent wait and see policies. It is also intended to ensure a higher degree of transparency and credibility and enables external monitoring by the European Commission.

Spent fuel and radioactive waste in nuclear energy projects in Turkey

As indicated above, Turkey has not yet ratified the Joint Convention, which is awaiting ratification, and this represents an important gap in the legal framework for nuclear energy in Turkey.

According to the intergovernmental agreement (henceforth the Akkuyu IGA) between Turkey and Russia the project company is responsible for the management of spent fuel to be generated by the Akkuyu nuclear plant (article 12.4). The Akkuyu Company is to contribute 0.15 US cents per kWh to a special fund to be established for the management of nuclear waste. The Akkuyu IGA also stipulates that spent nuclear fuel of Russian origin may be reprocessed by the Russian federation, subject to a separate agreement between the two countries. Hence, on the face of it Turkey is not faced with a spent fuel and radioactive waste management problem in the case of the Akkuyu plant. However, as emphasized by Bilezikçi Pekar (2014) many uncertainties remain. One of the important uncertainties raised by Bilezikçi Pekar (2014) is whether there would be a reprocessing agreement, and reprocessing the spent fuel is the option chosen, whether the highly radioactive waste would be sent back to Turkey. Uncertainties notwithstanding, it seems that the immediate interpretation of the

IGA is that "Turkey aims to give all the responsibility of nuclear waste management to Russia" (ibid. p. 13).

The situation is different in the Sinop project. According to the Sinop Agreement the final disposal of the spent fuel and radioactive waste is the responsibility of the GoT (article 6). The HCA states that responsibility for that management of spent fuel and radioactive waste lies with the project company until they are transferred to final disposal facilities, which is under the responsibility of GoT (article 21). The HCA also states that during the feasibility study the MENR will set up a dedicated joint committee with the joint company "to cooperate and define the level of contribution and strategy and division of responsibilities among the parties" for the management of spent fuel and radioactive waste (article 21.3). The committee will cooperate to define the "structure and management of the Spent Fuel and Radioactive Waste Fund" and the management of spent fuel and radioactive waste until the transfer to the government for final disposal.

Whether the spent fuel from the Sinop plant will be reprocessed at this point is not clear. According to the Sinop Agreement, the reprocessing option is available. If spent fuel would be reprocessed in France, the high level waste thereby generated would be returned to Turkey, as per French legislation, as emphasized in Bilezikçi-Pekar (2014). The Sinop agreement does raise the possibility that the spent fuel may be reprocessed in Turkey, but this would be subject to an agreement between GoJ ad GoT and subsequently the establishment of a re-processing facility[16].

In any case, though, Turkey will ultimately will have to make decisions about long term storage.

TAEK has issued a "Regulation on Radioactive Waste Management" in 2013. The Regulation states that the management of radioactive waste is the responsibility of the person carrying out the activity that generates it. It stipulates that high level radioactive waste shall only be disposed of in deep disposal facilities. The regulation lays out general principles for the authorization, siting and design of radioactive waste facilities as well as their construction, commissioning, operation and decommissioning. This is a step in the right direction but as yet Turkey does not have a national plan of the type described in the EU Waste Directive.

[16] Non-proliferation concerns would also need to be addressed given the ability to extract plutonium from spent fuel as a result of re-processing.

Suppliers' Principles of Conduct: Where Does Turkey Stand?

Recently a set of exporters of nuclear plants have recently established a Principles of Conduct (PoC) that will guide negotiations of nuclear plant contracts with client countries.[17] The purpose of this section is to undertake an evaluation of the extent to which Turkey meets the standards established in the PoC.

The first principle of the PoC relates to safety, health and radiological protection. Under this principle the customer country is expected to be an active party to the CNS (or has indicated its intention to become an active party). Turkey meets this requirement, and as mentioned above, has already issued a report to the 6th Review Meeting of the CNS (TAEK 2013). The principle also requires that "the vendor will have made a reasonable judgment that the customer has a legislative, regulatory and organizational structure needed for implementing a safe nuclear program with due attention to safety either in place or under development." In particular, the principle refers to IAEA Safety Standard "Establishing the Safety Infrastructure for a Nuclear Power Programme".[18] There is general agreement that Turkey does not yet have that infrastructure. In particular, Turkey neither has a comprehensive nuclear law (Ercan and Schneider, 2014) nor an independent regulatory agency in the field of nuclear energy. The existence of an "effectively independent and competent" regulatory authority is a crucial component of the safety infrastructure (IAEA, 2011, Action 24). The current regulator, TAEK is not independent both because it is directly attached to the Ministry of Energy, which is responsible for promotion of nuclear energy, but more importantly its institutional structure does not ensure independence in the internationally accepted definitions of this term.[19]

Another principle elucidated in the PoC relates to environmental protection and the handling of spent fuel and nuclear waste. One of the requirements is that the customer state has "ratified, accepted or otherwise applied" the principles of IAEA's joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management". As was indicated above, Turkey has not ratified the Joint Convention yet. The principle also requires that the customer country has enacted laws or developed a regulatory framework that formalizes a credible national strategy to manage spent fuel and radioactive waste and dispose of all radioactive wastes. As noted above, it would be fair to say that Turkey does not yet have a well formulated spent fuel policy.

The PoC also lists a principle of compensation for nuclear damage. Mainly, the principle states that the vendor will make a reasonable judgment that the customer country has or will have a legal

[17] http://carnegieendowment.org/publications/special/misc/nppe/
[18] IAEA 2011.
[19] See the discussion above and Atiyas (2015).

regime for the compensation of the public in the event of an accident. This regime would "contain adequate liability limits and financial protection consistent with current international standards". It also explicitly asks for a treaty relationship with the vendor state under either the Vienna Convention, as amended, or the Paris Convention, as amended.[20]

The two conventions referred to in the PoC are two international conventions that regulate third party liability: a) the Paris Convention on Third Party Liability in the Field of Nuclear Energy (Paris Convention), which was established in 1960 under the auspices of the OECD, and b) the Vienna Convention on Civil Liability for Nuclear Damage (Vienna Convention), which was established in 1963 under the auspices of the International Atomic Energy Agency (IAEA). The parties to the former were all western European countries whereas those to the latter were predominantly from Eastern Europe, Africa and Latin America. The Paris Convention was extended by the Brussels Supplementary Convention, in effect increasing the amount of funds to compensate for damage in the event of a nuclear accident. The Paris/Brussel and Vienna Convention regimes were linked in 1988 through the Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention. Through the Joint Protocol, a party to one protocol is treated as a party to both protocols and the parties can choose which Convention will be applicable in case an incident occurs. The Paris Convention was amended several times. In particular, the 2004 Protocol to Amend the Paris Convention and the 2004 Protocol to Amend the Brussels Supplementary Convention increased liability amounts, expanded the meaning of "nuclear damage" as well as the geographical scope of in which victims may claim damage.

Turkey has ratified the Paris Convention in 1961 and the Joint Protocol in 2006, and has signed but not the 2004 Protocol to Amend the Paris Convention. As of now, Turkey does not have a specific national law regulating third party liability. However, Article 5.5 of the Nuclear Law (Law No. 5710 states: "In case of an accident in the course of transport of radioactive material or radioactive waste or at the nuclear power plant, the 1960 Paris Convention on Nuclear Third Party Liability, its additional amendments and other national and international liability provisions shall apply.". This means that basically the Paris Convention is applicable in the area of third party liability, plus possibly the liability regime of the Turkish Code of Obligations (see also Ercan and Schneider, 2014). The Paris Convention sets a maximum cap of 15 million SDR on the operator's liability (which has been

[20] The PoC also refers to IAEA's Convention on Supplementary Compensation for Nuclear Damage, an initiave of the IAEA, which is not yet in force. In order to pass into force the CSC must be ratified by five countries with at least 400 GW thermal of installed nuclear capacity. Currently the only ratifying party with significant nuclear generating capacity is the USA. http://www.world-nuclear.org/info/Safety-and-Security/Safety-of-Plants/Liability-for-Nuclear-Damage/ accessed January 20, 2015.

increased to a minimum of 700 million Euro in the 2004 Protocol).[21] It has been reported (İldiri and Elyiğit, 2014) that the MENR has prepared a draft nuclear liability law which "provides an upper limit to the operator's liability. In addition, it provides the establishment of a nuclear damage determination commission, to determine the amount of damage exceeding the limits of the operator's liability. Further, the Draft Nuclear Liability Law states that operators and nuclear fuel carriers must provide a guarantee and insure the plant for possible damages."[22] It is understood that the provisions of the draft law are consistent with the 2004 Amendment to the Paris Protocol.

This assessment suggests that Turkey is quite far from meeting the legal standards established in the PoC. At the same time, the language of PoC is quite forgiving in that what the vendors commit to is not to ensure that the client country meets those standards but that these standards are "under development". In that sense, the PoC requires an assessment of likely future developments in the client country.

Conclusion

The legal and regulatory framework in Turkey is clearly not adequate to address and handle safety risks associated with nuclear energy. Turkey does not yet have a framework law in the field of nuclear energy or a regulatory authority that is independent. For the future, Turkey has a number of important tasks. The first is to develop a coherent policy framework in the field of nuclear energy. This sould include background studies on why nuclear energy is necessary and an investigation of its costs and benefits and should also entail a process of public consultation. The second is to complete the legislative infrastructure for nuclear energy. This entails passing laws and regulations that would provide a general framework for nuclear energy and address specific fields where the legal infrastructure is lacking, such as third party liability or management of spent fuel and radioactive waste. The third important task, closely interrelated with the second, is to set up an adequate governance structure for a regulatory authority that ensures independence, accountability and transparency.

These tasks may be challenging from a technical point of view. However, with allocation of sufficient financial and human resources they are not impossible to accomplish. The real challenge is political.

[21] The Convention (art. 7) states that this amount may be lowered or increased, but so far the GoT has not done anything to change that amount.

[22] http://www.mondaq.com/x/358624/Energy+Law/Imminent+Significant+Changes+To+Turkish+Nuclear+Energy+Legislation accessed January 20 2015.

An institutional structure that ensures high quality regulation requires the delegation of significant amount of decision making authority to the regulatory authority as well as establishing channels of public consultation and participation into decision making processes. Current political trends in Turkey are in the opposite direction. There is widespread perception that the independence of regulatory authorities are being curtailed through both formal and informal means by the political authority. In general, it can be stated the transition to nuclear power would be better served by a political environment conducive to independent and high quality regulation.

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