



**LOOKING FOR A COMMON GROUND ON CONSTRUCTION OF A NUCLEAR
POWER PLANT IN TURKEY: A REVIEW ON AKKUYU NUCLEAR POWER
PLANT**

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ABSTRACT

The term nuclear energy has entered our lives more than 100 years ago and always split people into two. Some believe it will be the end of human race as we know while others think it will help human race thrive in the future. Different Turkish governments have tried to build a nuclear power plant but many projects failed due to varying reasons. Akkuyu project is the most serious one so far and not surprisingly people have different opinions. This study will use stakeholders approach. Sides will be introduced and their points will be presented. Then the arguments will be boiled down to ethical theories and the paper will try to find a common ground for all parties involved.

Keywords: Nuclear Power Plant, Akkuyu, Stakeholders

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1. Introduction

Usage of nuclear energy always divided people since the beginning of the 20th century. Environmentalist groups strongly oppose the idea of a nuclear power plant whereas some people believe it's our inevitable future. The idea of constructing a nuclear power plant is not new in Turkey. There have been multiple failed attempts for the last 40 years, but the topic became trending again with Akkuyu NPP project. The public has different opinions and so does the academics. There have been papers talking about the positive or negative effects of a NPP inside our borders; though it has also been noticed that the literature lacks studies which look for a common ground rather than pointing fingers. This study also tries to dig deeper into the issue that handles the case as a clash of ethical views rather than saying yes or no to the current construction.

Additionally, this study used stakeholder analysis from qualitative analyzing techniques. The core of this method can be summarized as determining the parties associated with the phenomenon, collecting data about their behaviors and analyzing those said behaviors. Thus, the term stakeholder stands for people or groups whom should not be left out during data collecting and data analysis processes for that sample case which is under review (Altunışık et al., 2010: 306).

Overall, this study is written as a result of the observation that the field lacks papers that look for a common ground and boiling down the argument to ethical view levels all the while not getting too far away from the actual case and also offers a practical solution specific to the case in hand.

2. Brief History Of Nuclear Energy In 20th Century

The terms nuclear energy and radioactivity entered our vocabulary more than hundred years ago, back in 1896 upon the discovery. Contrary to what one might think, first studies on radioactive materials did not have huge backings and Marie Curie had to work in a shed for her studies. Five years after the discovery of radioactivity Mr. and Mrs. Curie showcased their most recent finding; an element called Radium which was multiple times more radioactive than Uranium, which led to the discovery of radioactivity in the first place. The year was 1900 and a glowing piece of radium on the stage sparked the interest of two physicists, called Frederick Soddy and Ernest Rutherford, along with the newspapers. Only one year after the showcase in Paris, one day during their studies Soddy and Rutherford found

out that radioactive Thorium was trans-mutating into radium, releasing high energy waves throughout the process (Weart, 1988:5-9).

The first half of 20th century saw large interest on nuclear energy leading up to the WWII. The Manhattan Project, the secret group who produced the bombs used on Nagasaki and Hiroshima, lost some of its members due to the fact that they believed using nuclear energy to create weapons of mass destruction was wrong (Groves, 1983:3-19).

After the war, US President of the time Eisenhower gave the famous `Atoms for Peace` speech at the General Assembly, United Nations (UN). One year later International Atomic Energy Agency (IAEA) was founded with the mission of overseeing nuclear power plants and making sure that they are not used as gateways to produce weaponry (Scheinman, 1987:56-81).

Also in that year, 1954, world's first nuclear power plant (NPP) went critical near Moscow, Russian Federation. It should be noted that history of NPPs is not incident-free. 1986 Chernobyl and 2011 Fukushima are two well-known nuclear disasters in the history of nuclear energy. Though these incidents negatively affected public view towards nuclear energy, they did not do it by any means. As of June 2017, there are 449 operational NPPs worldwide and 60 more are under construction according to the Power Reactor Information System (PRIS) database of the IAEA (PRIS, 2017).

3. Previous Nuclear Power Plant Cases in Turkey

Nuclear energy has not suddenly entered Turkey via Akkuyu Nuclear Power Plant (Akkuyu NPP) project. 1955 marks Turkey's first encounter with nuclear energy. On May 5, 1955, Turkey and USA have signed a treaty as a part of the "Atom for Peace" project with Turkey being the first country to join the program. After the treaty was signed, Turkey took initiatives to get her nuclear program moving. With the help of Istanbul University (IU) and Istanbul Technical University (ITU), Atom Energy Commission was founded in 1956. Since there was no initiative about the usage of nuclear energy before 1955, new laws had to be passed to create the ground rules about the usage of nuclear energy. 1956 was spent on adapting the laws to the newly emerging sector and in 1957 Turkey joined International Atomic Energy Agency (IAEA). Though at this point there was still no law which allowed the production of radioisotopes. This issue was addressed with a change in the law in 1959. Right after the required laws and permissions were in place, construction of Cekmece Nuclear Research and Education Center (CNAEM) near Istanbul started. Four years after the decision

to build CNAEM was made, in 1962, Turkey's first nuclear reactor TR-1 went critical and stayed in operation for 15 years to be replaced by TR-2 in 1981. TR-2 had 5 times the power at 5 MW. In the following years after CNAEM became operational, similar education purposed reactors went critical in capital Ankara as well. In 1972, Nuclear Energy Department started operating under Turkey Energy Commission and just after one year, in 1973, 3 locations including Akkuyu were deemed appropriate for a potential NPP. Deputy Prime Minister at the time claimed; "Turkey will have nuclear power plants and atomic bombs in 8 years." Everything started for Akkuyu in 1976, when the land was legally licensed as NPP zone. In 1979, Turkey's second nuclear reactor, ITU TRIGA Mark II has gone critical. This was, and still is, Turkey's only university reactor. Contrary to what prime minister stated, Turkey signed Treaty on the Non-Proliferation of Nuclear Weapons (NPT) in 1980; meaning Turkey will not produce nuclear weapons and will now assist any country who seeks such thing. The following year Turkey accepted IAEA's authority on all of her existing and potential NPPs. In 1982, Turkey founded its own Turkey Atom Energy Authority (TAEK), replacing Atom Energy Commission. First real step for Akkuyu NPP was taken in 1985 because all other attempts have failed miserably since 1976 when the government agreed with Atomic Energy of Canada Limited (AECL) on principals. After Reactor n.4 of Chernobyl blew up in flames in 1986, AECL walked away from the agreement and Nuclear Energy Department under Turkey Energy Agency was shutdown. Any developments about a potential NPP came to a halt. The 1990s saw other half-hearted attempts to get the project rolling. Between 1992 and 1996 two other auctions took place to determine the constructor of Akkuyu NPP, but both times entrant companies and the government could not come to an agreement and firms walked away once again. Greenpeace heavily protested against NPP in Turkey. They even brought their ship at the time, Sirius, to show how determined they were. Their "victory" was short-lived (Bayulken, 2006: 171-174).

Greenpeace and other smaller environmentalist groups continued their protests against nuclear energy in Turkey at the beginning of the new millennia. In 2010, Russian Federation Government Deputy Prime Minister and Turkey's Minister of Energy and Natural Resources signed a treaty to work together during the construction and operation of NPP (TAEK, 2012). During the following 5 years Akkuyu Nuclear Energy Inc., legal name of the operator company along with Russian state company ROSATOM, got the required permissions and in July 2015 construction has begun. Today, protests are yet to stop and some claim that the construction came to a halt due to public backlash (TAEK, 2011).

Considering the information given above, some important things should be noted. Overall opinion towards NPPs in Turkey has always been `100% for` or `100% against`. Turkey's black and white view and not having a nuclear energy policy in place has caused all the other projects to fail up until this point. Media should be neutral rather than being negatively biased towards nuclear energy. It is understandable that if a person has only heard about nuclear energy via Chernobyl or Fukushima, they will be against it. At the end, what Turkey needs is getting rid of this mentality and the public should be informed on the topic via scientific studies. These studies should lay down the truth without being influenced by any political\social oppression (Palabıyık et al., 2010:176-182).

4. Where Stakeholders Stand On The Issue And Looking For A Common Ground

4.1. Stakeholders: Greenpeace and Environmentalists, The Government and Akkuyu NPP's Views

• Greenpeace and Environmentalists

Greenpeace was founded by Jim Bohlen, Paul Cote and Irving Stowe in Vancouver, BC to protest nuclear weapon testing in Alaska in 1971. Since then organization grew day by day and fought against issues such as but not limited to; nuclear weaponry, destruction of biodiversity and general threats to world peace. Greenpeace has used methods like taking direct action, political lobbying, educating the public etc. during their campaigns. Today Greenpeace doesn't have any bonds to any governments and gets funded by donors and has more than 3 million volunteers. Greenpeace owns 6 boats, 1 helicopter, 1 bus and a hot air balloon that they flew over Taj Mahal to protest nuclear weaponry a few years back (Ostpowich, 2003: 4-5).

Spearheaded by Greenpeace Mediterranean, environmentalist groups in Turkey strongly oppose the idea of having an NPP in the country. They believe that technology is still not developed enough to construct safe NPPs. Fukushima supported this claim back in 2011. Even after 6 years, the site is still not safe and radiations leaks are yet to stop. They also don't believe that NPPs will help the economy grow. The initial investment required for NPPs are really high; and operation costs rise as years pass because the reactor gets old and requires more maintenance (Greenpeace International, 2008: 3-5). Furthermore, if something goes wrong like it did in Chernobyl, it will take decades to rectify the results. Studies show that even though more than 30 years has passed over the accident, average Ukrainian adult faces more health problems compared to those who reside in countries comparable to Ukraine in

term of being developed (IAEA, 2005: 11-21). Another argument that environmentalists don't like hearing is "We need nuclear energy to avoid having blackouts." When a country is allocating resources to supply enough electricity to its citizens, it should never rely on a single form anyways. Renewable energy productions forms like wind, biomass, geothermal etc. can compensate for the loss of electricity supply caused by the withdrawal of nuclear energy. Moreover, as technology develops expenditures will only go down. Portugal is another good example of why environmentalists think there is no need for nuclear since Portugal managed to supply 100% of its electricity need by using only renewables for 107 hours straight. Portugal is not the only country that is trying to get away from nuclear too. Germany has shut down 7 of their nuclear reactors in 2011 immediately as part of the nuclear phase-out (Nuclear Energy in Germany, 2016). In Italy, the referendum asked whether Italy should build NPP or not, 95% of the voters said no (Nuclear Energy in Italy, 2016). Sweden canceled their planned NPPs and stated that they will shut down 3 more reactors by 2020 (Nuclear Energy in Sweden, 2017). Finally, Greenpeace also doesn't believe that NPPs will help combat climate change either. Though it is correct that NPPs do not emit CO₂, building them does not necessarily mean that coal, oil, etc. power plants get shut down. Nuclear energy just compensates for the increased electricity demand. They believe what we need is renewables; since they will actually replace traditional methods. The claim is, even if we assume that by 2030 we drastically increase nuclear energy capacity, emissions will only drop by 5% (Greenpeace International, 2008: 3).

So summing up all the information above, Greenpeace believes that an NPP inside our borders will be suicidal since the risks are very high and we have previous examples of what could be if something were to go wrong. Additionally, Greenpeace believes that nature is not for human use, but humankind is merely a part of nature and should treat it with the respect it deserves. We can say their ideology is preventionism. They think we should protect the environment not because we can use to our liking but it has its own value and deserves to be preserved.

• **The Government**

As stated in the background section, different governments have tried really hard to have an NPP in Turkey. The government believes that a firm wanting to enter the Turkish energy sector and go through with this project is prestigious and shows economic power; since they claim that this project was not a Build-Operate-Transfer (BOT) model. In BOT model projects, fundamentally, the government guarantees to pay for the losses of the

operating firm if the quota isn't met; meaning that even if electricity supplier firms decide not to buy their electricity from Akkuyu NPP, the government will not compensate for their losses. Figure 1 shows how BOT systems work as a whole in detail.

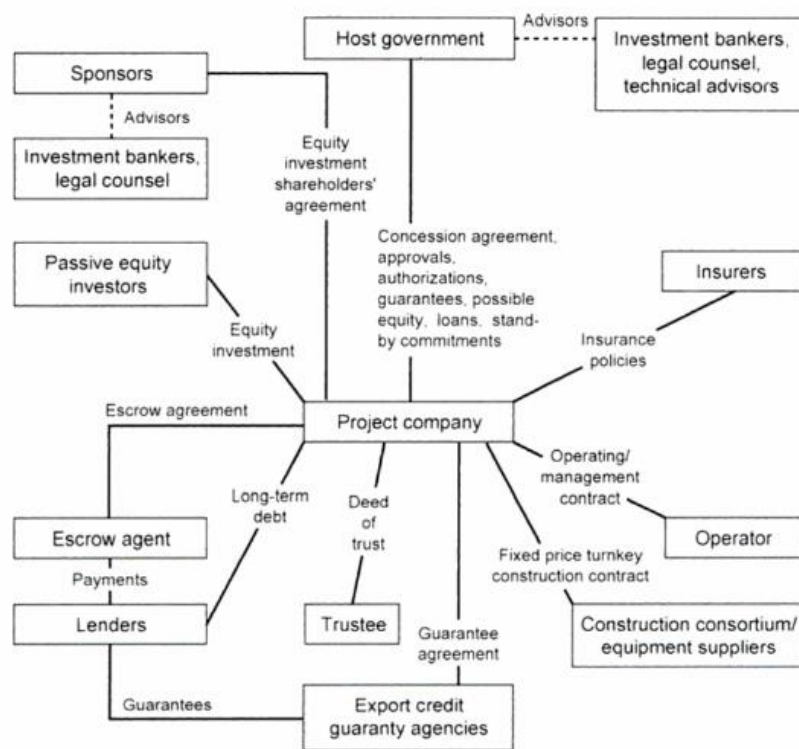


Figure 1: Contractual Arrangements for a Typical BOT

Resource: Walker, C., & Smith, A. (1995). Privatized infrastructure. London: T. Telford. pp. 10.

Moreover, talks about Akkuyu NPP took place right after Turkey shot down a Russian Air Force fighter jet back in 2015. Following the incident, there were claims of construction stopping due to the tense relationship between countries. Government officials never gave out any specific information about the NPP, though the minister claimed that Akkuyu NPP will be the safest building in the country. President Erdogan also stated that they are determined to make this project a reality.

Taking all this information into consideration, the government adapts utilitarianism mentality. The way governments sees is this is an easy cost/benefit analysis. Costs to this NPP is practically none since Russian operators will be paying for the initial construction costs in exchange for having the license to sell the electricity they produce freely in the Turkish market and getting a percentage cut from the earnings. The government turns a blind eye to previous incidents that claim that there's not going to be any problems and the project is safe. So there're no environmental costs according to them. Benefits will be an advertising point to earn voters who are uneducated on the issue, tax income from the use of the land and cut from electricity sold. Comparing those costs and benefits the government decided that project is a go.

• **Akkuyu NPP**

Entities that will operate the power plant, which will be addressed as Akkuyu NPP for practicality, of course, have their own reasons to why they believe that this project should continue. First of all, electricity supplied by the NPP will be immense. The largest dam in Turkey, Ataturk Dam, can produce 2400 MW, whereas Akkuyu NPP will be able to produce 4800 MW when completed (Türkiye Atom Enerjisi Kurumu, 2012).

They also believe that their power plant will be safe. They categorize their safety precautions into 3 different sections; physical barriers, safety systems, and safety against external factors. The sole purpose of this in-depth defense system is to stop the reaction in the reactor and keep the reactor below the critical level, cooling the reactor and the used fuel chamber, keeping radioactive material inside protective barriers and keeping the integrity of protective barriers. To begin with, radioactive material will be stored in a small container called fuel matrix. Multiple fuel matrixes come together to create a "fuel bar". Those fuel bars are cooled via water; they don't emit as much radiation when they cooled. Additionally, all of this is put inside a reactor protection building; meaning no radiation gets out after those many physical boundaries (Akkuyu Nükleer Güç Santrali Projesi, 2011: 6-7).

Besides physical barriers, there are active and passive safety systems that keep the power plant safe. During normal operation, automated systems, which operate under the supervision of a staff member, constantly monitor the levels of radiation inside the reactor and start the shutdown procedure if something goes wrong. This system can remain operational even under extreme conditions. Used fuel cells are also under control. In the case of an emergency, the chamber which holds used fuel cells seals shut, meaning nothing goes out

(Akkuyu Nükleer Güç Santrali Projesi, 2011: 8). According to the operators, Akkuyu NPP is also safe against external factors like earthquakes, snow and ice loads, winds, tornados, floods, tsunamis (Akkuyu Nükleer Güç Santrali Projesi, 2011: 59). Akkuyu NPP will do anything in its power to minimalize environmental effects. During construction, soil disturbed will be returned to its previous status to save any potential fertile lands in the vicinity (Akkuyu Nükleer Güç Santrali Projesi, 2011: 60). The required precautions will also be taken to prevent emissions of any non-radioactive but harmful gasses. Lastly, Akkuyu NPP will have a department just for observing external conditions like; weather forecast, underwater levels, temperatures and chemical structure, seismic conditions, integrity of constructions, differences in gravitational pull, radiation levels, health conditions of locals who reside in the vicinity (Akkuyu Nükleer Güç Santrali Projesi, 2011: 92-93).

Akkuyu NPP will also supply jobs and allow nuclear energy sector to grow in Turkey. Akkuyu NPP also adapts cost/benefit approach. According to them, when all the safety precautions are taken there are no negative externalities so the decision-making process becomes a lot faster.

4.2. Common Ground, Solutions and Justifications

Though it seems like on surface level 3 stakeholders have vastly different opinions, fundamentally, they share some similar values. None of the stakeholders deny the fact that more power plants are needed to satisfy the ever so growing demand. All the stakeholders also agree that conventional fuels like coal, oil etc. will run out in near future and the switch to alternate methods is inevitable. Then it can be concluded that the argument is more about “means” instead of “ends”. Sides disagree on the means part. However, this does not mean that two sides cannot compromise. Even if it sounds unlikely, there just might be a solution which will satisfy all parties. Table 1 below helps to understand where parties stand in terms of ethical theories, ultimate goals and their ways of reaching their objectives.

Table 1: Comparing Ethical Values, Main Purposes and Methods of the Stakeholders

Values	Stakeholders		
	Greenpeace	The Government	Akkuyu NPP
Ethical Theory	Preservationism	Conservationism	Conservationism
Mentality Towards Nature	We're merely a part of nature and not above it. We should preserve it for it has its own value regardless of its usefulness.	Nature should be conserved only so that it is available for humankind's use if need be.	Nature should be conserved only so that it is available for humankind's use if need be.
Main Purpose	Finding new and improved ways of energy production since conventional fuels will run out in near future.	Finding new and improved ways of energy production since conventional fuels will run out in near future.	Finding new and improved ways of energy production since conventional fuels will run out in near future.
Methods	Moving towards renewable energy sources.	Building more power plants, mainly nuclear to provide for the large demand.	Building nuclear power plants and utilizing condensed output from nuclear energy.

It is clear that the actual debate between the stakeholders emerge from the fact that they have different ethical views about the attitude held towards nature. Environmentalists are preservationists whereas the government and Akkuyu NPP are conservationists. The specific solution below is more of a conservationist approach. The important thing to note here is that even though it is true that nature bears a value on its own, it is also normal for humankind to use nature for its own gains. This happens in wildlife all the time. Different animals use nature for their private benefits. If the negative consequences of the NPP are eliminated; both parties can also agree on an ethical basis.

Taking all stakeholders' concerns into consideration; I believe the NPP should be built, but of course, there will be some conditions. To begin with, environmentalists claim we should switch to methods like dams and windmills. Contrary to popular belief, those "renewables" are not actually 100% environmentally friendly. There has been evidence of wind mills causing too much noise and killing bird flocks whose migration paths cross with windmill farms. Dams are also known to be disturbing the natural flow of water and causing droughts downstream to their location. Upstream flora also gets destroyed due to excessive amounts of water stocked behind. Even if we accept those consequences, there are limited

amount of rivers and mountain tops that we can build windmills and dams. These plants are neither known to be, engineering wise, efficient at producing electricity. Geothermal are pretty good alternatives, but there are only a few spots in Turkey which are available for geothermal power plants. At this point, one must wonder “What about risks of nuclear energy?” One thing should be established here. If no accidents happen throughout the lifecycle of an NPP, with correct regulations and enforcement of these regulations, NPP has no negative effects to the environment. This claim is drawn by the assumption that nuclear wastes are contained and buried properly, though. After that, the waste is just left to sit there and if everything is done properly no radiation gets out from those containers.

In terms of economics, it is true that NPPs have higher initial investment costs, but with consistent output, it balances out. Ataturk Dam, for example, cost 4 billion TRY to build and has provided 144 billion kWh energy since 1992. Akkuyu NPP will approximately cost 20 billion TRY, but it will produce around 525 billion kWh of energy in the next 15 years. Moving on, external factors and nuclear disasters deter people from feeling safe around nuclear energy. There are a few things to be addressed. First, Chernobyl blew up during a power-shortage test. During the test, the safety systems were shut down to simulate the effects and human error combined with the fundamental design flaw of the reactor started the chain reactions that lead to the explosion and fire. 31 years passed since Chernobyl and reactor designs progressed a lot. The exact same reactors from Chernobyl have remained critical until 2013 with some modifications. Also, even if there is a power shortage, Akkuyu NPP’s safety systems will remain operational since it will have generators and other precautions. Another known disaster is Fukushima. The tsunami caused by an earthquake hit Fukushima’s shutdown reactors and caused a leak. If we check seismic hazard maps, Akkuyu region, seismically speaking, has a lower chance of getting hit by an earthquake than the whole Japanese Archipelago. Figure 2 shows the seismic hazard map of Turkey with Akkuyu NPP’s location marked whereas figures 3 and 4 show seismic hazard maps of Japanese Archipelago with close-ups of Fukushima Daiichi NPP’s location marked. In the maps, darker areas represent the most dangerous areas where lighter areas show the safest.

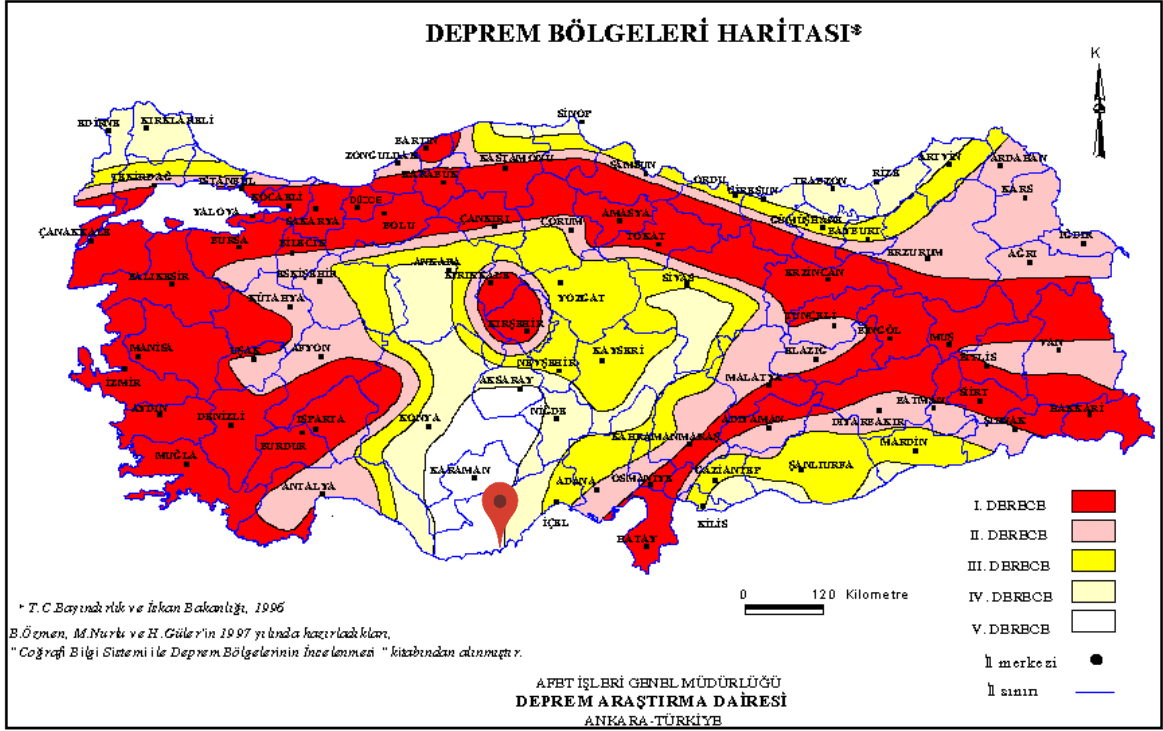


Figure 2: Seismic Map of Turkey with Akkuyu NPP's Location.

Resource: Afet İşleri Genel Müdürlüğü Deprem Araştırma Dairesi. Ankara. from <http://www.deprem.gov.tr/UserFiles/CKUUpload/Upload/20151111101194.gif> Retrieved 9 June 2017.

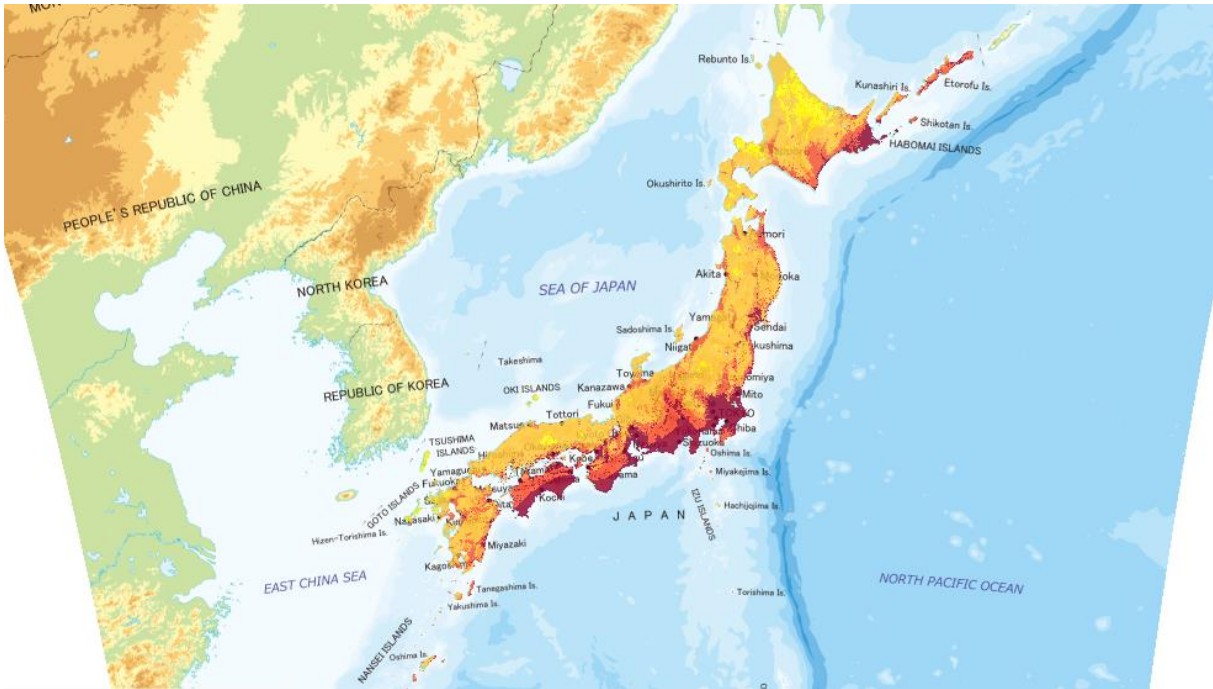


Figure 3: Seismic Hazard Map of the Japanese Archipelagos

Resource: J-SHIS Map. J-shis.bosai.go.jp. from http://www.j-shis.bosai.go.jp/map/?center=137.7835130,38.18644453&zoom=5&flt=0.0,0.0&transparent=0.2&layer=P-Y2017-MAP-AVR-TTL_MTTT-T30_I55_PD&epoch=Y2017&ls=0&lang=en Retrieved 12 June 2017.



Figure 5: Historical Occurrences of Tsunamis in Turkey with Akkuyu NPP's Location Marked.

Resource: Natural Hazards Viewer. Maps.ngdc.noaa.gov. from <https://maps.ngdc.noaa.gov/viewers/hazards/?layers=0> Retrieved 12 June 2017.

Of course, Akkuyu NPP will be safe if only the operators actually do all the things that they claimed they will do like; checking soil and residents for radiation every 3 months. Besides government officials from Turkish Atomic Energy Authority, some high-ranked officials from Greenpeace also should be allowed to attend radiation measurements in the vicinity with their own expert group. If all parties don't agree on the amount of radiation, a 4th party expert group, recognized by IAEA, should be called in to settle things down. If they also conclude that there's a radiation leak, the power plant should begin shutdown procedures effective immediately until contamination is taken under control. Also during normal operation experts associated with Greenpeace should have the right to see the facilities in action without having to notify Akkuyu NPP beforehand, making sure that everything is done by the book. The results of these visits any 3 monthly reports should be available to the public. I believe everything I proposed is perfectly acceptable by all parties involved. If there is full transparency any potential disasters can be identified before they happen, but also Turkey can benefit from this high-end form of energy production.

5. Conclusion

This study focused on Akkuyu NPP in regards to the rather controversial topic of an NPP construction in Turkey. To begin with, paper included the required background info on the topic to familiarize the reader. Then study introduced the main stakeholders on the issue and showed where they stand on this issue practically but also did boil down their views to nature ethics theories.

Then, as a result of comparing the said ethical views, it was seen that in terms of their ethical views parties agreed on the end goal but struggled to come to a middle point about the means to reach the end goal. Besides the meeting points of the ethical views, this study also tried to form a common ground that is practical and applicable to this case. Though the last decision was to go ahead with the construction, the operators have to meet criterion such as but not limited to; regular reports on radiation level, full transparency on how things are operated inside the plant and regular check-ups monitoring the local flora and the fauna.

The author expects to see this topic stay topical since it is rather controversial to if the plant is actually being constructed. Furthermore, there are plans for another nuclear power plant in the northern city of Sinop after Akkuyu plant is done. Thus towards the planned due date of Akkuyu NPP and talks about a potential Sinop NPP will stir the question of 'is it ethical, how do the other stakeholders see this issue and how do they compare'. Considering all this one might expect this paper to stay rather topical in near future and with more papers on the topic public might reach the information they need.

This study was important since it helps to fill the gap of comparing the views of different stakeholders and trying to find a common ground rather than pointing fingers. Moreover, this study hopes to be exemplary to potential future papers on the issue since it tries to tell both sides of the story and looks for a common ground which is new to this issue.

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