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Master of Management, Economics and Industrial
Engineering



Stakeholders Management in Nuclear Power Plants: An Analysis in Six Different Countries

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1. EXECUTIVE SUMMARY

1.1.ABSTRACT

The aim of this thesis work is to analyze and compare the stakeholders involved in the construction of the Nuclear Power Plants of different countries, in order to (1) Understand how the nuclear industry has been developed in different countries; (2) Recognize the importance of stakeholders in megaprojects; (3) Have a reference guideline of nuclear projects already developed; (4) Generate a model of stakeholder configuration based on the experience of six different countries, to apply to a newcomer country interested in building a nuclear infrastructure.

It was emphasized the importance of the stakeholders management by showing the influences they can have in order to achieve their goals. In this respect, it was followed the (Frooman, 1999)'s approach, by answering the three questions that open the path to the methodology used: "who are they" (Attributes); "what do they want" (their Ends) and "how are they going to get it" (Means). The stakeholders' attributes identification was based on the Power, Legitimacy and Urgency theory.

After this process, six countries were studied, which have a long history in the construction of Nuclear Power Plants. France, United Kingdom, Finland, Japan, United States and Korea are pioneer counties in the development of nuclear energy. Each one of them has a different approach according to their internal conditions, the nature of the utilities and the role of the state. Consequently, the stakeholders' organization is different and becomes a key to understand how the nuclear energy projects are managed in each country. For the analysis and classification of the stakeholders it was used the framework based on the Power, Legitimacy and Urgency theory, with the purpose of giving them the necessary attributes that will evidence the importance of each one of them inside the network.

Finally this analysis led to four model structures that were applied to a newcomer country interested in initiate nuclear generation projects.

KEY WORDS: Nuclear Power Plant – Stakeholders – Megaprojects – Stakeholders configuration.

1.2.INTRODUCTION

Nuclear Plants have become an important alternative for energy generation after many years of research for them to be safe and secure for the communities and the environment. Since this kind of megaprojects are complex and involve a high amount of money and time, as well as a high number of stakeholders, the study of them is a tool in the way to achieve the success of the project.

(Mitchell, Agle, & Wood, 1997) and (Bourne & Walter, 2005) among others, have showed how an understanding of the needs and expectations of the stakeholders can drive to the success of the project. Even if the scope is achieved by the manager, a project can still be a not successful if one of the stakeholders are not completely satisfied. Stakeholders Management, as it is

called now, has been studied in different kind of projects, of low, medium and high budget size.

The intention of this thesis is to use the study of stakeholders, to understand the importance and the relationship between them in a Nuclear Plant construction, comparing 6 different countries in order to (1) Understand how the nuclear industry has been developed in different countries; (2) Recognize the importance of stakeholders in megaprojects; (3) Have a reference guideline of nuclear projects already developed; (4) Generate a model of stakeholder configuration based on the experience of six different countries, to apply to a newcomer country interested in building a nuclear infrastructure.

Four research questions were developed in order to better show the objectives of this thesis. The answer of these questions will describe to the reader what should he/she learn after reading this document. They are the following:

Q1) Why a nuclear plant project's scope and objectives can be affected by its stakeholders?

Q2) Which are the most important stakeholders in a Nuclear Plant Projects? Which are the most influential according to the countries studied?

Q3) Why and which are the factors that make the stakeholders configuration different in each of the studied countries?

Q4) Which should be the stakeholder configuration of a country that wants to develop a Nuclear Plant Project?

1.3.LITERATURE REVIEW

To answer the questions above is used a general to specific approach described in Figure 1-1. It is important to first understand what is a stakeholder, which are their attributes, their interests and the means used to reach their objectives in a project. Then focus the concept on megaproject and finally indicate the role of stakeholders in a Nuclear Plant Project in different countries. This was done to analyze the relationship that exists between them according to the country they belong to, and generate a final model.

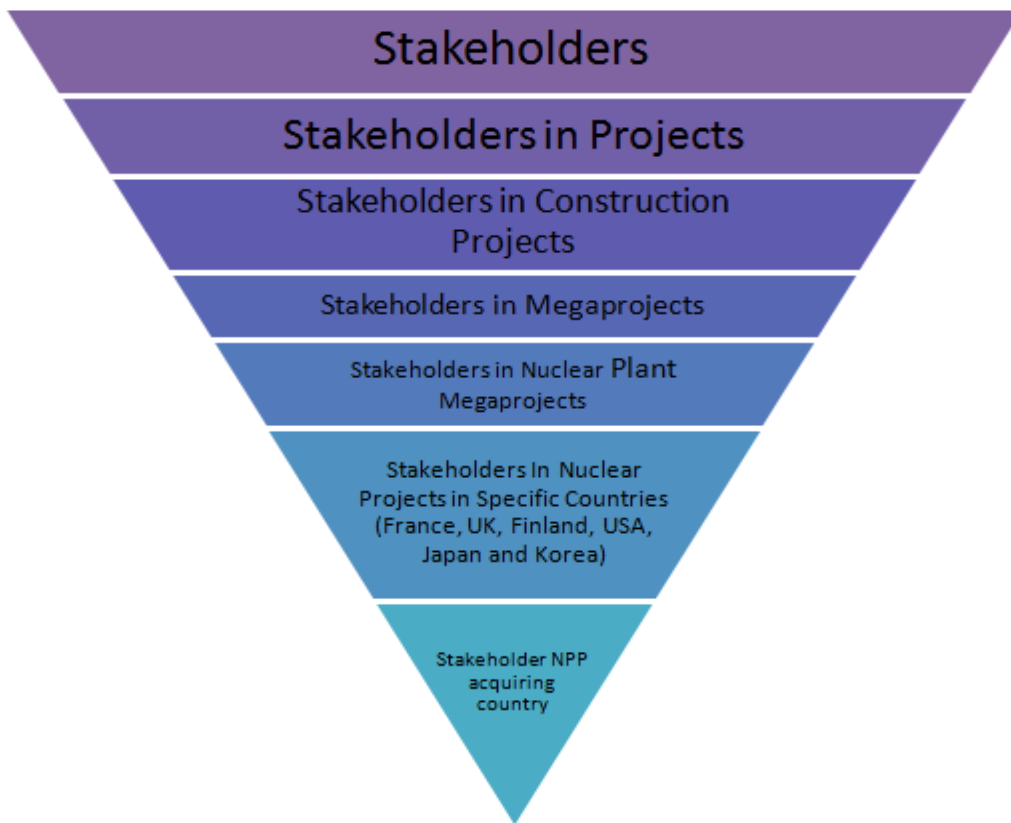


Figure 1-1 Methodology

1.3.1. Stakeholder Definition

As mentioned before, as a first step different definitions were studied to understand the concept of stakeholder and its role in a project. The Stanford Research Institute and authors such as (Clarkson M. , 1994), and (MacEloroy & Mills, 2000), have studied the concept of stakeholders and proposed definitions. However the one that is still the base for all definitions is the one (Freeman R. , 1984) proposed in his book “Strategic Management: A stakeholder Approach” that define stakeholders as:

“A group or individual who can affect or is affected by the achievements of the organization’s objectives.”

This definition centers the concept of stakeholder to specific actors in the organization. Not all actors are stakeholders and not all have the same role. As a first approach to the definition of the stakeholders they can be clustered in different categories as shown in Figure 1-2.

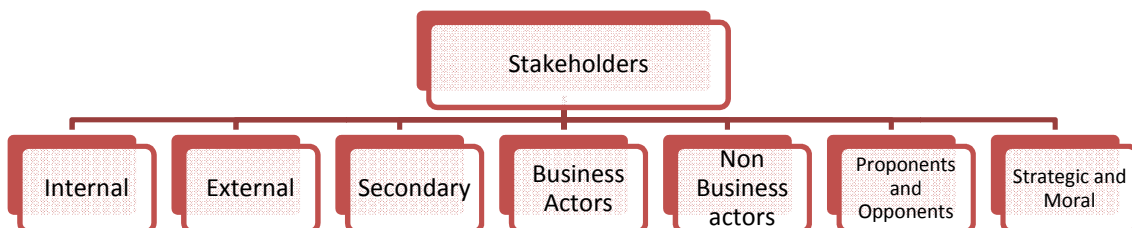


Figure 1-2 Attributes of Stakeholders

Each stakeholder has a specific role depending on the scope of the project. Having these noticed, identifying the category will give a first view of what is the role of the stakeholder and will guide the identification of it along the lifecycle of the project.

But, why is important to know what a stakeholder is? Why should they be identified?

The study of stakeholders has become more important with time. Researchers on the topic and project managers have realized that "without attention to needs and expectations of the diverse stakeholders, a project will probably not be regarded as successful even if the project manager was able to stay within the original time, budget and scope" (Bourne & Walter, 2005). Some important aspects:

- ✓ The most important stakeholder are not just the shareholders. (Freeman & McVea, 2001)
- ✓ Attention should be put on the most relevant stakeholders in each of the phases of the project. For that, it should be done a stakeholder identification. (International Finance Cooperation, 2007)
- ✓ One stakeholders' role can change along the lifecycle of the project. (International Finance Cooperation, 2007)
- ✓ Business environments are dynamic. (Freeman & McVea, 2001)
- ✓ Stakeholder identification is key for the decision making process. (Mitchell, Agle, & Wood, 1997)

(Freeman & McVea, 2001), (International Finance Cooperation, 2007), (Mitchell, Agle, & Wood, 1997) state the importance of stakeholder management to guarantee the success of the project. Having the resources is not the only important thing, knowing *how* and *when* the right moment to use them is, is what really counts in a successful project.

1.3.2. Stakeholders Theories

Having understood the concept of stakeholder and why they are important, the research continued with a description of some theories developed to identify stakeholders in a project.

These theories are based in the work of (Frooman, 1999)'s approach, answering the three questions that open the path to the methodology used: "Who are they" (Attributes); "what do they want" (their Ends) and "how are they going to get it" (Means). The stakeholders' attributes identification was based on the (Mitchell, Agle, & Wood, 1997)'s Power, Legitimacy and Urgency theory; (Bijker, 1987) social constructivism mapping theory and (Johnson & Scholes, 1999) Power/Interest matrix theory. As for the ends, it was mentioned the numerous interests they can have; and for the means it was defined three different strategies: (Galaskiewicz & Wasserman, 1994) with the Network theory; (Eisenhardt, 1989)'s Agency theory and (Pfeffer & Salancik, 1978)'s Resource Dependency Theory.

1.3.3. Construction Project and Megaproject Background

Since a Nuclear Plant Project is a construction megaproject, a research on the characteristics of projects and megaprojects was made to understand in which aspects the stakeholders can influence each of them.

1.3.3.1. Stakeholders in Construction Projects

A Construction Project, like other projects, is temporal with a unique output translated into buildings, bridges, highways etc. Depending on the chosen infrastructure to construct, the project is more complex and has its specific characteristics. However there are general characteristics that describe the construction business.

- ✓ Environmental and Social Impact.
- ✓ High amount of Resources Used.
- ✓ High number of stakeholders involved.

This characteristic makes a construction project a complex one, especially for the factor in the social and environmental impact and the high amount of stakeholders involved. Consequently it is important to identify and understand when and in which way stakeholders should be involved in the different phases of a construction process, to guarantee the success of the project as stated by (International Finance Cooperation, 2007). Table 1-1 describes the phases of the construction process and the importance of stakeholders in each one.

PROJECT PHASE	CHARACTERISTICS	STAKEHOLDER
Project Concept	Definition of the overall parameters of the project to according to the scope.	Early engagement of stakeholders can decrease the changes along the project and can help to avoid project opposition.
Feasibility Studies and Project Management	Identification of strengths, and weaknesses of the existing project as well as opportunities and threats that can be presented.	Identification of the stakeholder in this phase is important because their decisions and interventions will have a high impact during the whole lifecycle of the project. Identifying their needs and ways of satisfaction in order for them to become facilitators to the project.
Construction	Physical processes are done. Worker and managers work together using the resources to accomplish <u>what</u> was planned, <u>how</u> it was planned.	In this phase is time to show to the stakeholders what was planned and how it is done. For the community, for example, is a moment to show how the project is environment friendly.
Operation	Is the moment to show if the project resulted as planned or not. Human resources decrease and the scope of the project is finished.	Stakeholders identified in this phase are the ones that will give continuity to the project with a new scope.

Table 1-1 Stakeholders' involvement in the Phases of a construction project (International Finance Cooperation, 2007)

The role of each of the stakeholders should be identified in each of the phases mentioned before. In this way the project manager will understand the role of the stakeholder through the lifecycle of the project and will know how to handle its needs and expectation depending on the phase the project is.

1.3.4. Stakeholders in Megaprojects

Megaprojects are, as exposed by (Flyvbjerg, Bruzelius, & Rothengatter, 2003), projects that require huge physical and financial resources, which have become relatively common as a result of demands for new remote mineral resources, needs for infrastructure in less-developed countries and the desire to exploit economies of scale. The very great concerns of the actual and potential sponsors of such projects make important to perform analyses of the costs, problems and operations of megaprojects.

According to (Federal Highway Administration, 2007) and (Flyvbjerg, Bruzelius, & Rothengatter, 2003) megaprojects have the following characteristics:

- ✓ Unique construction projects known for their complexity, vast size, expensive cost, and long time frame compared to conventional construction projects.
- ✓ Known for their poor performance in terms of cost and time where the cost overrun could exceed initial project cost and the time extension would extend for years.
- ✓ Sized in terms of such variables as the scale of investment, the number of project staff, the social impact of the project, and the complexity of the project
- ✓ Infrastructure projects that cost more than \$500 million dollars
- ✓ Attract high level of public attention or political interest because of substantial direct and indirect impacts on the community, environment and budgets.
- ✓ Are inherently risky due to long planning horizons and complex interfaces between the project and its context, and between different parts of the project.
- ✓ Often the project scope or ambition level change significantly over time.

it can be said that megaprojects, due to their size, budget and scope, have an enormous impact on their stakeholders, that is why during the last years, has arose a great concern about the analysis and study of the uncertainty in megaprojects and how can be possible to improve the forecasting methods to prevent or be prepared for the possible bias that can be present during the project realization.

1.3.5. Differences between stakeholders in construction projects and in megaprojects.

In construction projects stakeholder have the same importance than in megaprojects, however the fact that a higher amount of money is involved and a longer time schedule is carried on, the stakeholders' management becomes different for each one.

The following are some of the differences there are between stakeholders in construction megaprojects and construction projects, (Zhai, Xin, & Cheng, 2009):

Stakeholder Involvement: In megaprojects the number of stakeholders is higher therefore the interests and expectations to fulfill are higher too, increasing the complexity of the project.

Community Involvement: The range of the community involvement is higher in a megaproject due to the higher environmental impact it for the society. The community affected for the construction of a bridge is much different at that affected by the construction of an airport.

Shareholders Involvement: In a construction project one company can be the sponsor, meanwhile megaprojects are characterized by having more than one shareholder to respond too. As part of the stakeholders this also contributes for the complexity of the project.

Decision Making Process: Due to the magnitude of budget and resources, each decision taken in a megaproject can change drastically its direction. That is why it is important the involvement of the right stakeholder in this process, to impact the project as less as possible.

1.3.6. Stakeholders in Nuclear Power Plants

A nuclear plant is a megaprojects characterized by its environmental impact and high amount of stakeholders involved. They are unique and have a high complexity of technical and technological processes.

The construction of a nuclear plant demands a high initial investment, long planning horizons and operational life and an important management of disposals and radioactive waste. These characteristics make this project a very complex one, and due to its environmental impact, it involves a high number of stakeholders to be able to carry it out, (International Finance Corporation, 2007). Therefore is important to carefully identify, from the beginning stakeholders and processes to minimize mistakes and bad decisions that can end up in the delay of the project and as a consequence in an increase or the costs.

Table 1-2 describes the stakeholders proposed by the (International Atomic Energy Agency, 2009), that can be present when the decision of constructing a nuclear plant is taken. These stakeholders can be clustered with different categorizations to help understand its role in the construction of a nuclear plant project. In this case a 4 categorization cluster was chosen.

ECONOMIC	SOCIAL
<ul style="list-style-type: none"> ▪ Facility Owner ▪ Funding Entities ▪ Government ▪ Local Authorities ▪ Elected Officials ▪ Trade Unions ▪ Waste Manager ▪ Decommissioning manager ▪ Nuclear Industry 	<ul style="list-style-type: none"> ▪ General Public ▪ Local Communities ▪ Media
ENVIROMENTAL	TECHNICAL
<ul style="list-style-type: none"> ▪ Regulators (environmental) ▪ Neighboring countries ▪ Pressure Groups 	<ul style="list-style-type: none"> ▪ Regulators (Nuclear safety) ▪ Researches and Scientists ▪ Contractors ▪ Operation Staff ▪ Waste Manager

Table 1-2 Stakeholders' Clusters (International Atomic Energy Agency, 2009)

Each one of these stakeholders is important in every step of the construction and operation of a nuclear plant. Depending on the country, the political system, and the kind of nuclear plant, the importance of each stakeholder changes. That is why, is necessary to identify since de beginning the different conditions around the construction of the project, to recognize the strategy to manage the stakeholders.

1.4.MEHODOLOGY

As mentioned before, to arrive to the final model proposed by this thesis, several theories were studied to identify stakeholders in project. Between them, one was chosen to use in the stakeholder identification in each of the six countries selected.

1.4.1. Stakeholder Identification Theories

After comprehending what a stakeholder is and the importance they have in a project, the next step is to learn how to identify them. Several theories were exposed to identify the stakeholders and to be able to decide which are the most relevant and influential in each of the phases of the project. It was followed (Frooman, 1999)'s approach which formulates three questions that will lead to the stakeholders identification and therefore, to a better understanding of their behavior and to the right response from the organization towards their influences:

1. Who are they (*Attributes*)
2. What do they want (their *Ends*)
3. How are they going to get it (*Means*)

In order to define “*who are they*”, it is possible to find many lists of stakeholders and categorization but one of the most widespread works is that of (Mitchell, Agle, & Wood, 1997), where three key attributes are identified: Urgency, Power and Legitimacy.

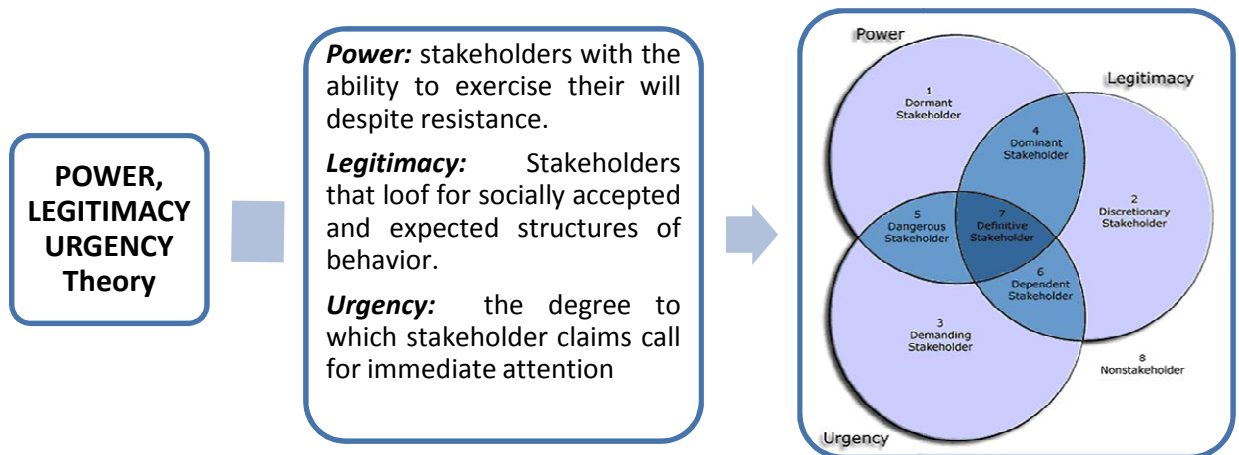


Figure 1-3 Power, Legitimacy, and Urgency Theory (PLU)

This approach is one of the most used techniques in order to identified the stakeholders that the management needs to take care of, to not risk the achievement of the project or the organization’s goals. The assignation of these attributes (Power, Legitimacy and Urgency) becomes the first step in the stakeholder identification and categorization to elaborate the techniques to control the stakeholder salience and influence in the project.

To get a complete picture of the stakeholders’ position, it is used the stakeholder mapping, inspired by theories of social constructivism, typically known as the Social Construction of Technology, developed and applied by (Bijker, 1987) which is a practical and strategic tool that allows the manager to distinguish between commonality of purpose and specific stakeholders interest, to build coalitions and neutralizing blockages.

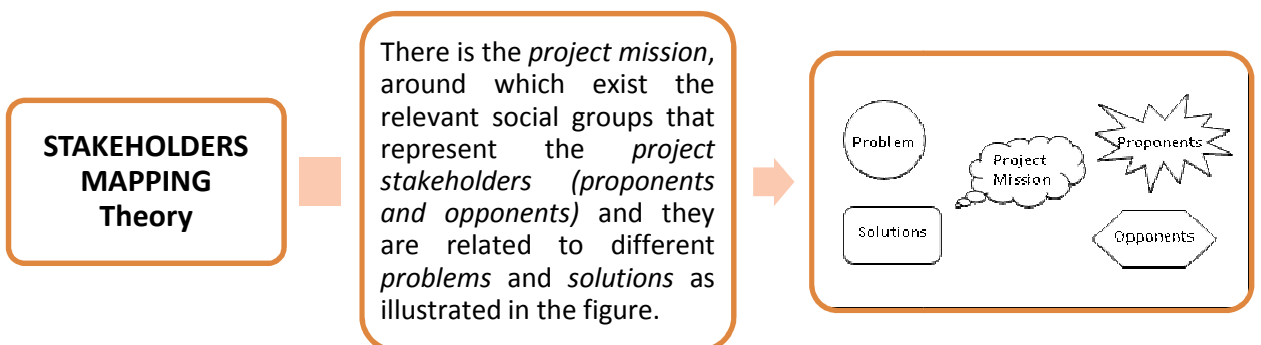


Figure 1-4 Stakeholder Mapping theory

After identifying the complete set of stakeholders, it becomes easier to classify the stakeholders in terms of those who possess an interest in the project and the solutions to its problems.

Once the map is prepared, (Johnson & Scholes, 1999) categorize the stakeholders, by using a power/interest matrix.

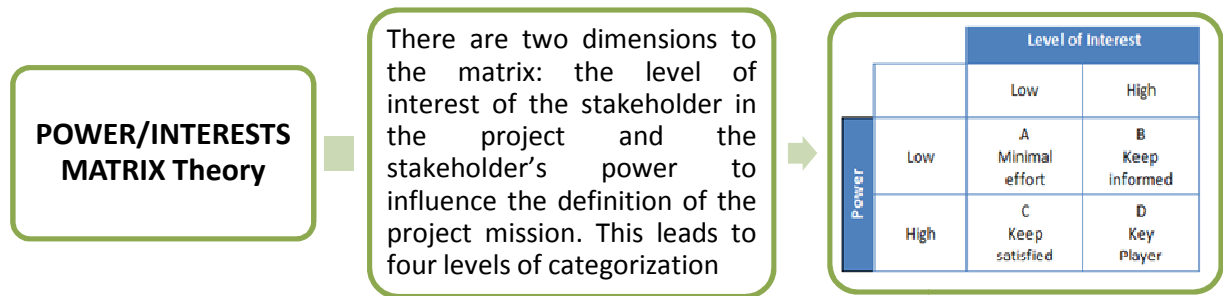


Figure 1-5 Power/Interests Theory

By using Power/Interest matrix, it can be determined which stakeholders to manage closely and which stakeholders to put minimum effort in. This helps the manager to channel the time and energy on the stakeholders that have the most power and interest in project success.

After the identification of the stakeholders attributes, it should be answer “*what do they want*” which has generated numerous lists of stakeholders interests, such as concrete versus symbolic, economic versus social, and local versus domestic versus international. But the most relevant output of the question is to divergent interests is the one that has to be approached in the stakeholder’s management theory.

Finally for the third question “*How are they going to get it*”, appears the analysis of the stakeholders influence strategies. Here three theories will be explained: *Network theory* (Galaskiewicz & Wasserman, 1994) , *Agency Theory* (Eisenhardt, 1989) and *Resource Dependence Theory* (Pfeffer & Salancik, 1978).

Network Theory: (Galaskiewicz & Wasserman, 1994) propose that instead of analyzing individual behaviors, attitudes and beliefs, social network analysis focuses its attention on how these interactions constitute a framework or structure that can be studied and analyzed in its own right. This theory shows how stakeholders can build relationships among them in order to influence the organization and all the patterns and associations that might be created should be monitored and controlled by the manager, because as the grouping and alliances rise, also can arise the power that individual stakeholders would not have by themselves. By mapping the stakeholder and their connections, it is simpler to see these patterns and specific care can be directed to them.

Agency Theory: Within the Multinational Company, headquarters (as principal) delegates decision-making responsibilities to the subsidiary (the agent). Agency problems arise in this relationship whenever the subsidiary’s own interests are incongruent with those of headquarters. (Chang & Taylor, 1999) reported that in the context of headquarters-subsidiary relations and within the agency perspective, conflict amongst managers has been framed as one where managers at headquarters are linked in an agency relationship with managers in operating divisions. In other words, the subsidiary will act to pursue its own interests, even when these diverge from those of the firm as a whole.

Resource Dependence Theory: (Pfeffer & Salancik, 1978) argued that because organizations are not self-contained or self-sufficient, the environment must be relied upon to provide support. For continuing to provide what the organization needs, the external groups or organizations may demand certain actions from the organization in return. The Resource dependence theory explains the external control of the organization, meaning the stakeholders influence strategies to pursue their own interest. The firm's need for resources gives opportunities to other agents to gain control over. In this sense, stakeholders with resource control over the firm could use two main influence strategies to control it: Withholding (Pfeffer & Leong, 1977), and Usage strategies (Frooman, 1999).

- ✓ Withholding: The stakeholder power of withdraw determined resources that are basic for the organization, becoming an evident threat for the project mission, (Pfeffer & Leong, 1977).
- ✓ Usage Strategies: With this strategy, the stakeholders continue the supply of the resource but with some conditions attached, (Frooman, 1999).

For the purpose of this thesis the theory chosen to identify the importance and roles of the stakeholders in the construction phase is the (Mitchell, Agle, & Wood, 1997) **Power, Legitimacy, Urgency theory**, as it gives a simple but correct profile of the stakeholders in a project and allows the identification of the key actors while associates them into groups that finally leads to the recognition of the most influent.

1.4.2. Country Analysis

A group of six countries was selected to develop the research on stakeholders interaction in Nuclear Plant Projects. The countries were the following:

- ✓ France
- ✓ United Kingdom
- ✓ Finland
- ✓ United States
- ✓ Japan
- ✓ Korea

These countries were selected because they are pioneers in the development of nuclear energy, each one having a different approach depending on the country's conditions. In addition they have many reactors and a lot of available information about the planning, construction and operation of nuclear power plants.

A final comparison between what was found in each country, leads to three models of stakeholders interaction structure proposed by this work.

1.5.RESULTS

The framework studied above provides the guidelines to analyze six countries and to generate their stakeholder interaction models.

1.5.1. Country Analysis

After understanding the importance of stakeholders in nuclear megaprojects, an analysis of the stakeholder of the nuclear industry of France, Finland, UK, USA, Japan and Korea is made. This analysis plans to describe the main actors, their definition and the relationship between them. Finally a comparison between the countries leads to a model identification for those countries that would like to begin working with nuclear energy development. The following are the stakeholders present in each of the countries that were analyzed:

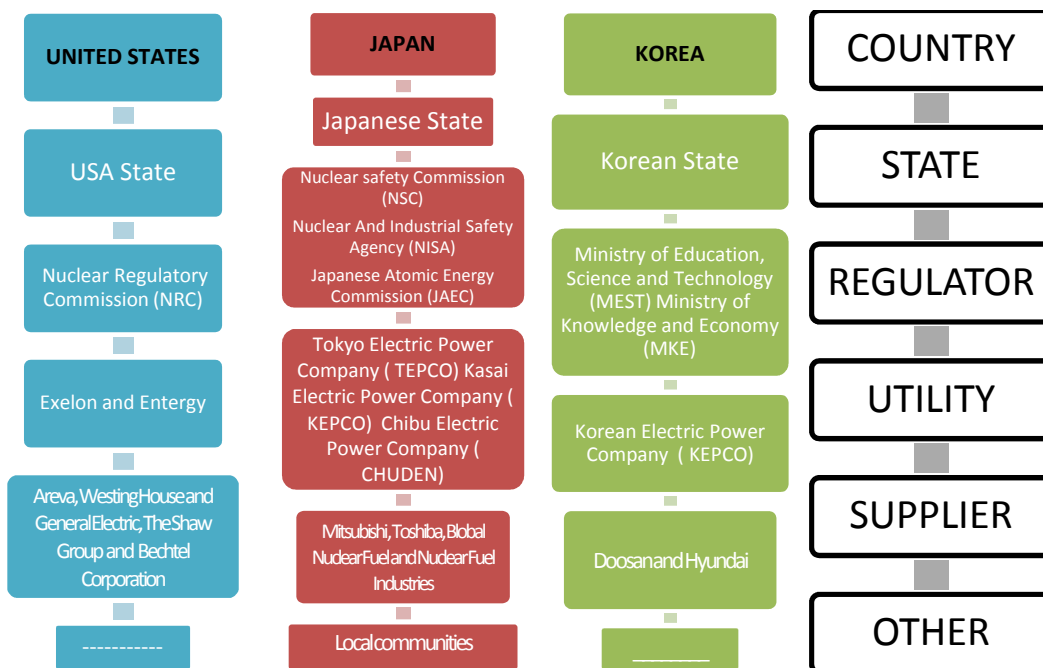
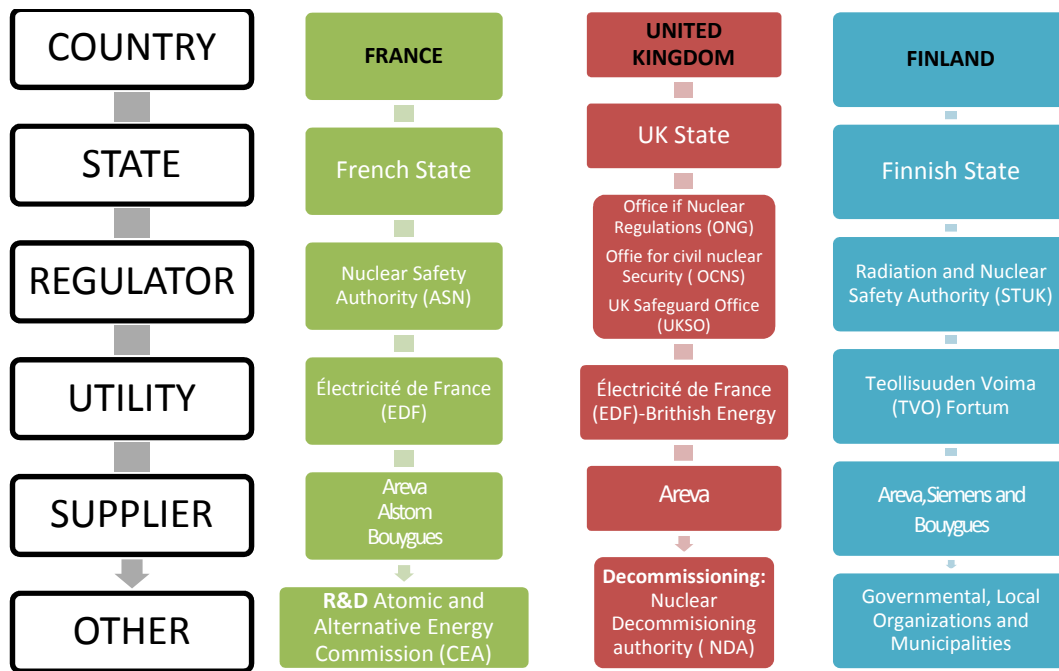


Figure 1-6 Stakeholders in NPP France, UK, Finland, USA, Japan and Korea

Each stakeholder is a key for the execution of the projects in each country. To understand the role and the importance of them in the construction phase, a map is developed relating the stakeholders and specifying what kind of link it has between the actors. Following this, the corresponding attributes are assigned to each stakeholder in order to make the final identification of every country.

FRANCE

The French State is the main actor since it controls the two more powerful players. The ASN is a public institution, but can exert its power over the utility, to the point of stopping the construction if it is required. The utility (EDF) controls the main suppliers AREVA, Alstom and the other constructors, but at the same time, Alstom works as a partner with AREVA. Even though Alstom owns a 37% of Bouygues, they work independently and Bouygues is the main subcontractor of AREVA, so the civil work depends on it.

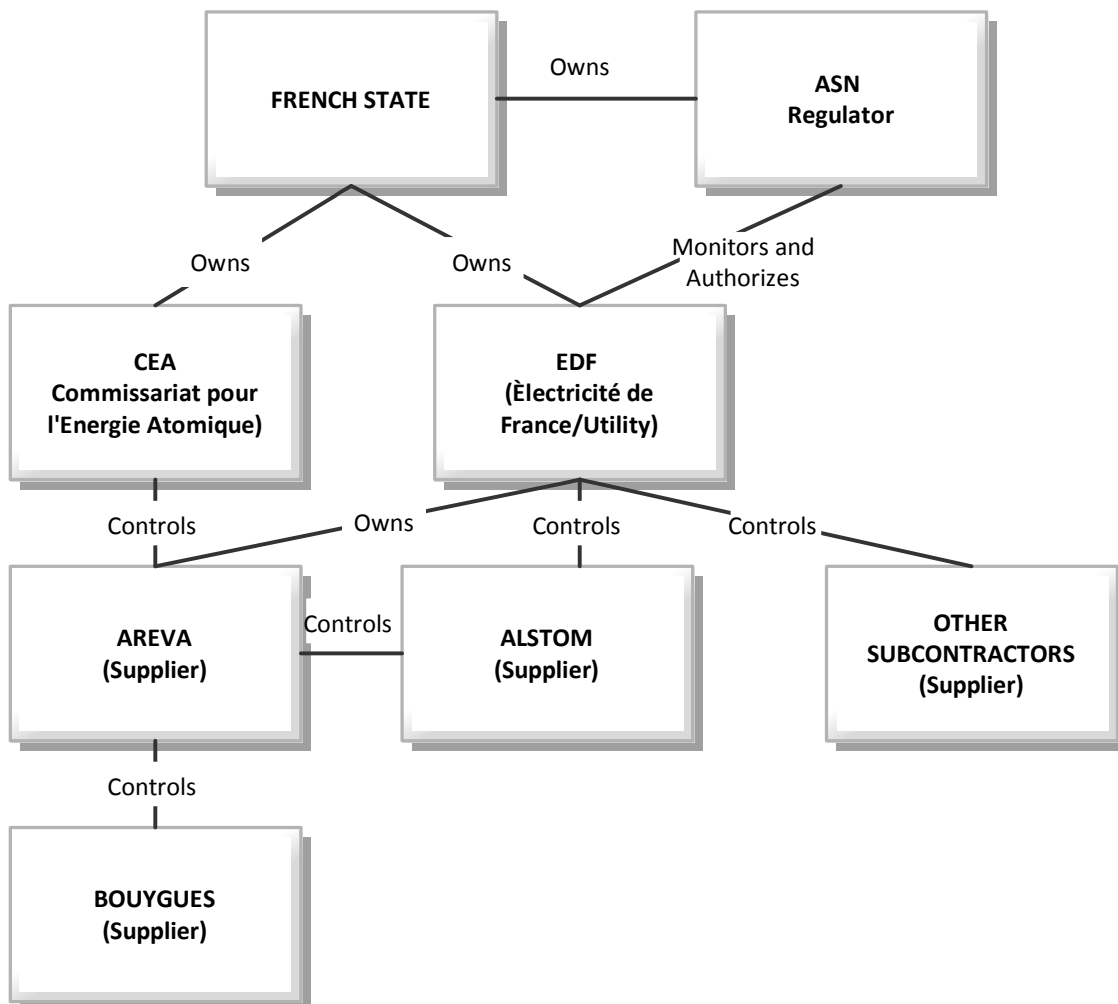


Figure 1-7 Mapping of Stakeholders in France

STAKEHOLDER CATEGORY	ATTRIBUTES	DEFINITION
State	Power, Legitimacy and Urgency	DEFINITIVE
Regulator	Power, Legitimacy and Urgency	DEFINITIVE
Utility	Power, Legitimacy and Urgency	DEFINITIVE
Supplier	Power and Urgency	DANGEROUS
Sub Contractors	Legitimacy	DISCRETIONARY

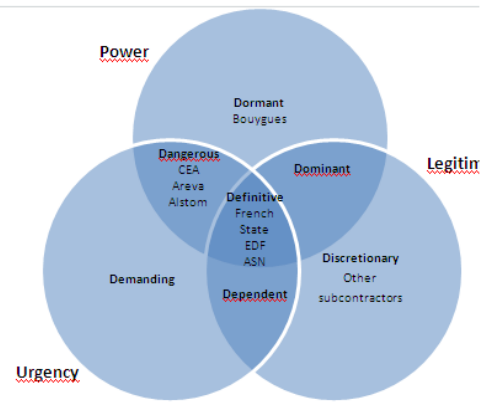


Figure 1-8 Identification of Stakeholders in France

As Figure 1-8 shows, the definitive stakeholders for France are the State, the Utility and the authority. Since both, the utility and the authority are government dependent; they all work together as one, becoming the most important stakeholder for the industry in France.

UNITED KINGDOM

In Figure 1-9 is shown the relationship between the most important stakeholders that actually belong to the nuclear industry in UK. The government as the head of the map, has under its care the regulator composed by the ONR, OCNS, UKSO as well as the decommissioning authority the NDA. On the other hand the EDF, has the relationship directly with the authority since is a private company. The link of the government with the utility is given through the regulators. Finally the British energy stands under the EDF as its owner now, and Areva as the principal supplier of the utility.

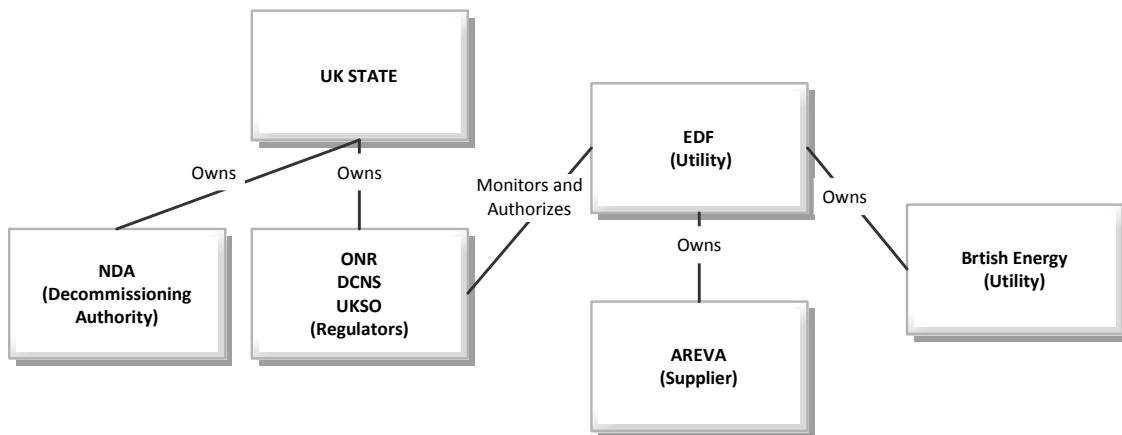


Figure 1-9 Mapping Actual Stakeholders in United Kingdom

STAKEHOLDER CATEGORY	ATTRIBUTES	DEFINITION
State	Power, Legitimacy and Urgency	DEFINITIVE
Regulator	Power and Legitimacy	DOMINANT
Utility	Power, Legitimacy and Urgency	DEFINITIVE
Supplier	Power	DORMANT
Decommission	Legitimacy and Urgency	DEPENDANT

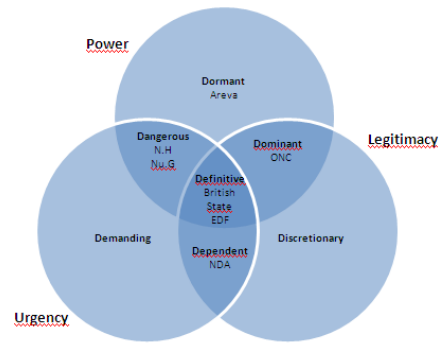


Figure 1-10 Identification of Stakeholders in UK

For UK the government and the Utility are the definitive stakeholders. EDF has the economic means for the development of the new nuclear projects, meanwhile it needs the government support to authorize the sites in which the construction will be made, and the possibility of new utilities to enter the industry. On the other hand the authority is a dominant stakeholder used by the government as a tool to assure the safety of the nuclear activities.

FINLAND

The main actors in the Finland Nuclear industry are grouped according to the Figure 1-11. Here it is shown the supply network of the actors, being two of them the most important players: TVO and Fortum as utilities of the current nuclear plants. The Finnish state only interacts with them through the authority STUCK and the ministry of Employment and Economy. The other municipalities are also involved in the control and supervision of the nuclear plants installed in their lands according to the law. Areva and Siemens are the main suppliers and at the same time they control the constructors Bouygues and other subcontractors for the civil work.

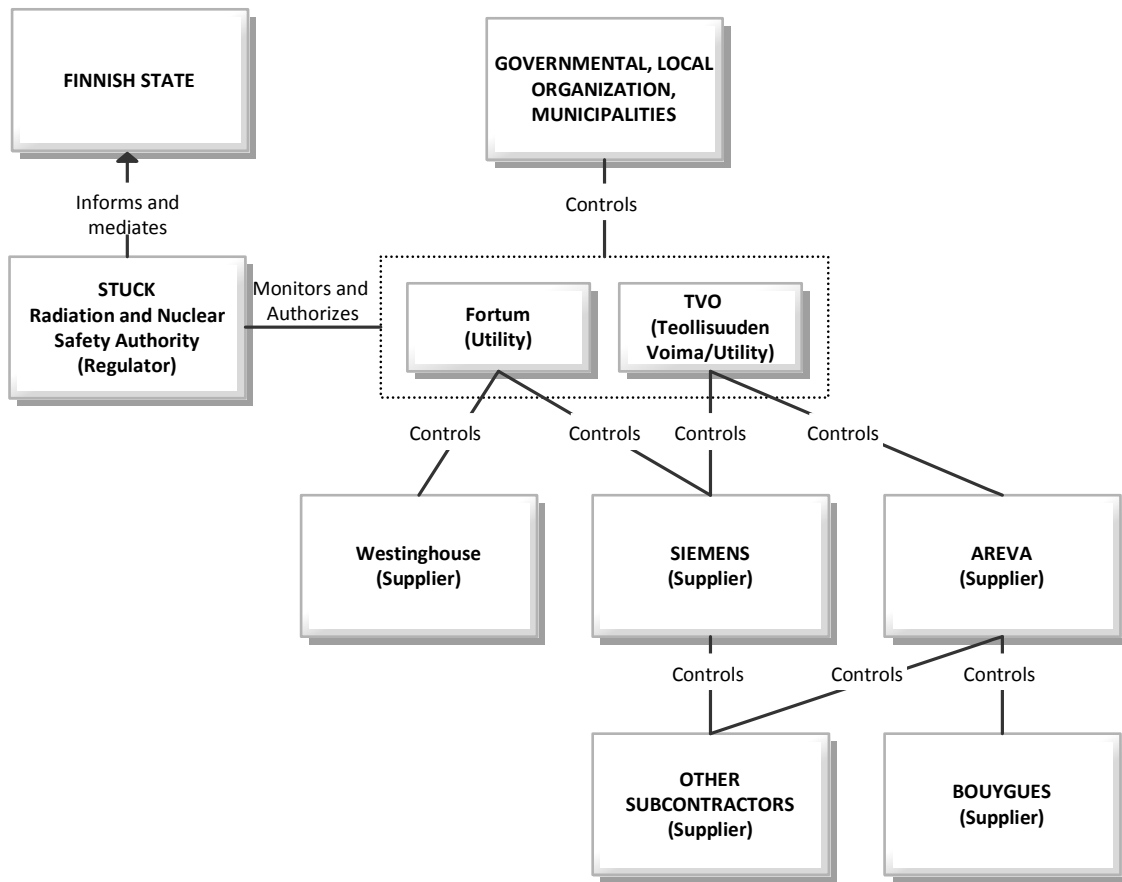


Figure 1-11 Mapping of Stakeholders in Finland

STAKEHOLDER CATEGORY	ATTRIBUTES	DEFINITION
State	Legitimacy	DISCRETIONARY
Regulator	Power, Legitimacy and Urgency	DEFINITIVE
Utility	Power, Legitimacy and Urgency	DEFINITIVE
Supplier	Power and urgency	DANGEROUS
Go. And Local Municipalities	Legitimacy	DISCRETIONARY

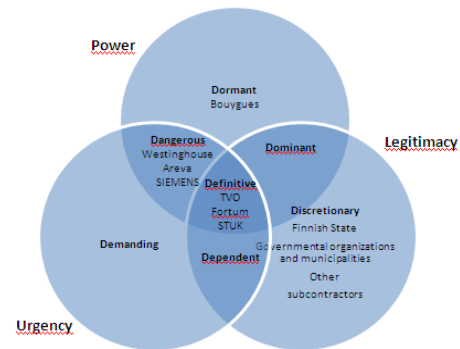


Figure 1-12 Identification of Stakeholders in Finland

For Finland, the definitive stakeholders are the authority and the utilities. They have managed to organize the industry and assure the security of the procedures giving comfort to the finish community and winning with this their support. The state is a discretionary stakeholder that supports the industry and is in behalf of the well being of the community. As for the suppliers, they are dangerous stakeholders with the knowledge and experience of the nuclear megaprojects, and are key for guaranteeing the correct construction and performance of the nuclear plants. Any mistake or error they do, will affect directly the project.

UNITED STATES OF AMERICA

The US main stakeholder can be grouped as it is seen in the Figure 1-13. This is a network, where the state doesn't have any important role in the chain, but it can act through the authority in order to protect the people. And due to the new projects for building the NPPs in Florida and Georgia and the loans offered by the government, it will start having some kind of control over the utilities. The NRC highly controls the utilities as they only can start or continue with operations after the authorization and licenses of the NRC. To show the role of the utilities, were chosen the two most important in the country: Exelon and Entergy, which have the highest number of nuclear plant in USA. The owners decide which supplier to use, the three most important are Westinghouse, General Electric and Areva. At the same time, they decide the construction companies, from which The Shaw Group and Bechtel were chosen to explain.

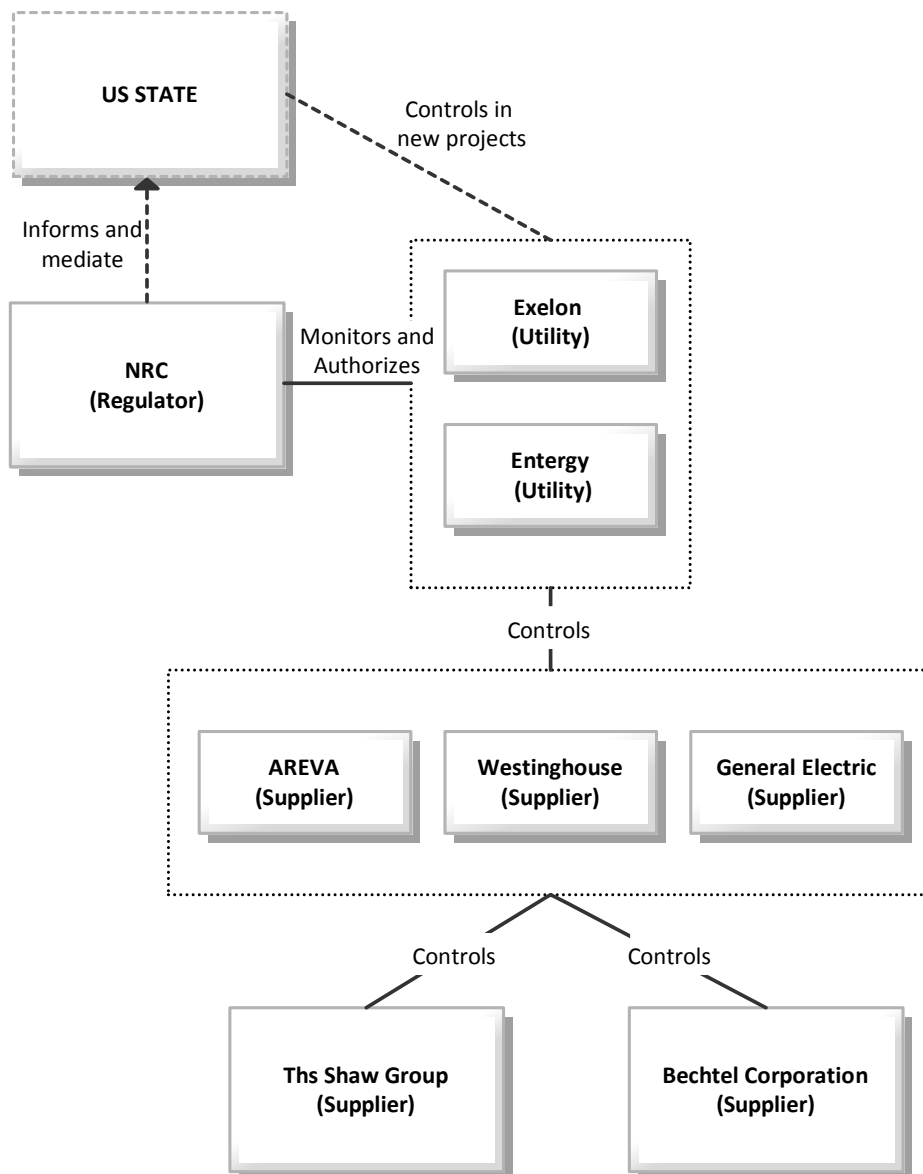


Figure 1-13 Mapping of Stakeholders in USA

STAKEHOLDER CATEGORY	ATTRIBUTES	DEFINITION
State	Power and Legitimacy	DOMINANT
Regulator	Power, Legitimacy and Urgency	DEFINITIVE
Utility	Power and Urgency	DANGEROUS
Supplier	Power and urgency	DANGEROUS

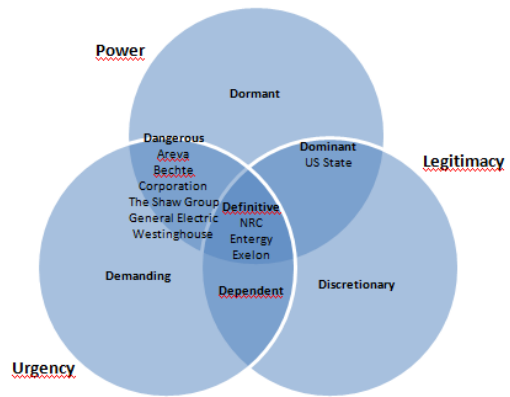


Figure 1-14 Identification of Stakeholders in US

For the USA, the definitive stakeholder is the authority. As in Finland they have manage to organize the industry and keep the community as a supportive stakeholder. On the other hand the USA counts with a high number of utilities that have high experience in the nuclear sector. They in fact, are international companies that have helped to develop the industry in other countries such as Japan or Korea, and have become dominant stakeholder. As for the government, they work as supporters and will always be in behalf of the USA citizens.

JAPAN

The following is the mapping of the relationship of the most important stakeholders present in the nuclear industry in Japan. To have a better understanding of the configuration that exists today, Figure 1-15 shows the before and after the Fukushima accident since it was an event that drastically affected the industry.

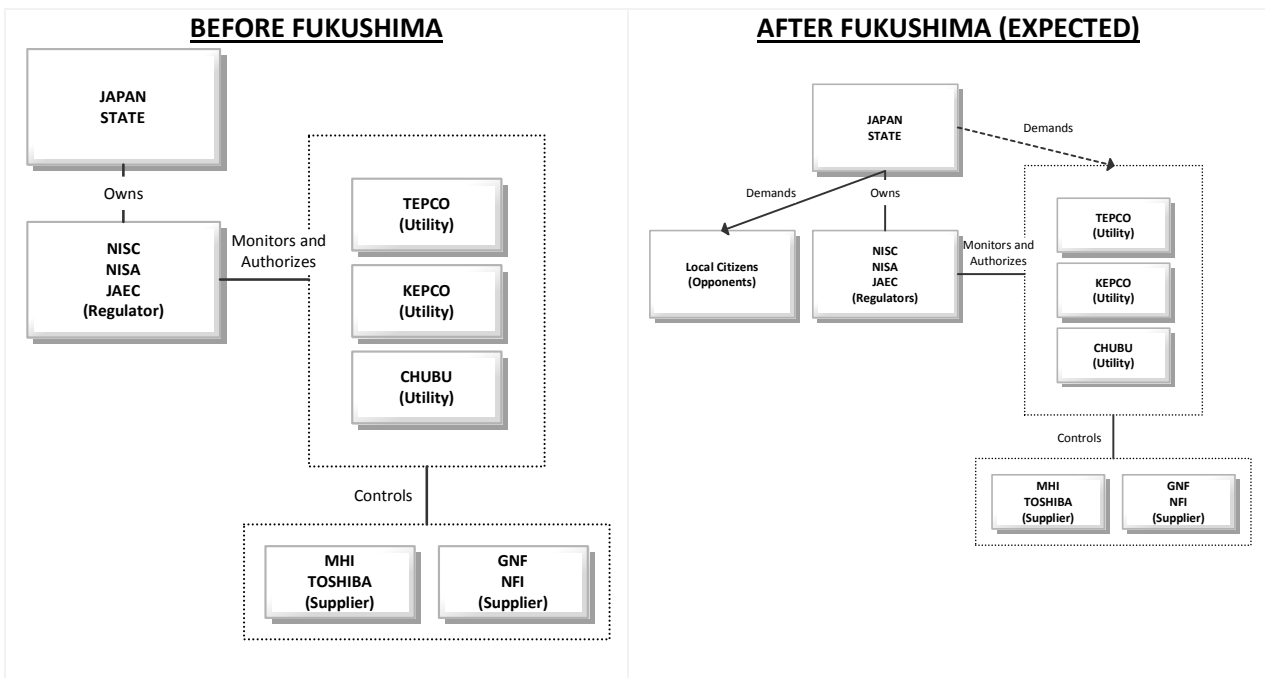


Figure 1-15 Mapping of Stakeholders in Japan

The Japanese State commands the map by being the authority under which the regulators perform. The utilities, as being private, were linked to the government just through the regulators before the accident. After the accident the government took control of the decisions made to be able to fix as soon as possible the problems brought with the accident and bring comfort to the Japanese society.

STAKEHOLDER CATEGORY	ATTRIBUTES	DEFINITION
State	Power, Legitimacy and Urgency	DEFINITIVE
Regulator	Power and Legitimacy	DOMINANT
Utility	Power, Legitimacy and Urgency	DEFINITIVE
Supplier	Power	DORMANT
OPONENTS	Legitimacy	DISCRETIONARY

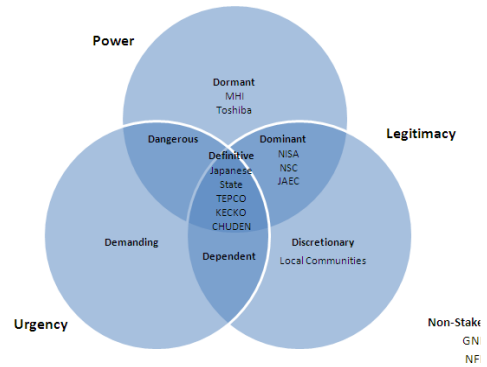


Figure 1-16 Identification of Stakeholders in Japan

For Japan the dominant stakeholders are the State and the Utilities. The state has become definitive after the Fukushima accident as it had to get in charge of the situation. The utilities as being private have the financial means to have the control of the construction and operation of the projects all along. The authorities are dominant stakeholders that work on the behalf of the community and the safety of the nuclear activities through policies. However its lack of urgency is affecting the immediate response of the other stakeholders in the industry that end in disasters as the Fukushima incident.

KOREA

The Figure 1-17 describes the relationship of the stakeholders in Korea. The Korean State owns the utility KEPCO and is the creator of the entities MEST, KINS and MKE that now regulate and monitor the activities of the nuclear industry in Korea. Therefore the three more important actors are government dependent, however they have managed to develop their specific role without intervening with the responsibilities of the others.

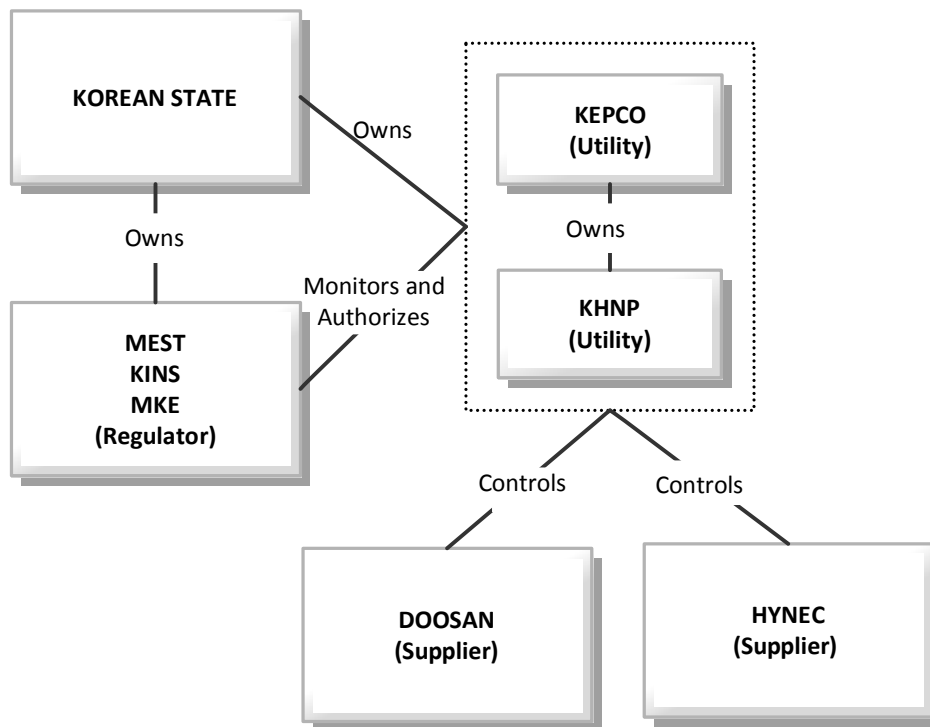


Figure 1-17 Mapping of Stakeholders in Korea

STAKEHOLDER CATEGORY	ATTRIBUTES	DEFINITION
State	Power, Legitimacy and Urgency	DEFINITIVE
Regulator	Power, Legitimacy and Urgency	DEFINITIVE
Utility	Power and Urgency	DANGEROUS
Supplier	Power	DORMANT

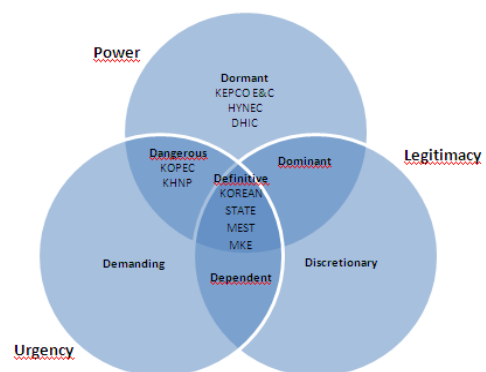


Figure 1-18 Identification of Stakeholders in Korea

For Korea the definitive stakeholders are the State and the Authorities. They have acquired this role, since they were the ones that developed the strategies to bring to the country the nuclear industry. The state owns the only utility (KOPEC) that until now is the generator of nuclear energy and that has been able to bring the knowledge of the construction and operation to the Korean workers.

1.5.2. Comparison

After identifying and analyzing the stakeholders in the six countries, it is made a comparison in order to show the similarities and differences between the organization and the interaction of the stakeholders in each one of them.

GOVERNMENT

COUNTRY	STAKEHOLDER DEFINITION
FRANCE	DEFINITIVE
UNITED KINGDOM	DEFINITIVE
FINLAND	DISCRETIONARY
UNITED STATES	DOMINANT
JAPAN	DEFINITIVE
KOREA	DEFINITIVE

REGULATOR

COUNTRY	STAKEHOLDER DEFINITION
FRANCE	DEFINITIVE
UNITED KINGDOM	DOMINANT
FINLAND	DEFINITIVE
UNITED STATES	DEFINITIVE
JAPAN	DOMINANT
KOREA	DEFINITIVE

UTILITY

COUNTRY	STAKEHOLDER DEFINITION
FRANCE	DEFINITIVE
UNITED KINGDOM	DEFINITIVE
FINLAND	DEFINITIVE
UNITED STATES	DANGEROUS
JAPAN	DEFINITIVE
KOREA	DEFINITIVE

SUPPLIER

COUNTRY	STAKEHOLDER DEFINITION
FRANCE	DANGEROUS
UNITED KINGDOM	DORMANT
FINLAND	DANGEROUS
UNITED STATES	DANGEROUS
JAPAN	DANGEROUS
KOREA	DANGEROUS

Figure 1-19 Comparison between the identified stakeholders of each country

For the model generation, after describing the attributes of the main stakeholders, it was also identified that the most important of them are the government and the utility. They represent the definitive stakeholders in the construction phase of a Nuclear Plant project in the six countries studied before. They are the ones in charge of taking the decisions and majorly influence the project, in matters such as the budget, the time of the project and the specifications of how it should be built. The authorities become a tool for the government with regard to demand security and safety for the processes. But this affirmation is an exception for USA and Finland where the reins are handled by the regulators and not the government. Finally the suppliers depend on the utilities decisions but can become dangerous in the moment they start to establish strategies to gain market share in the sector.

1.5.3. Countries' Models

Since the *government*, the *utility* and the *authority* are the most influential, the relationship between these stakeholders was the one studied to generate the models that represent each country.

Additionally, it was created a summarizing table with some parameters of the energy and nuclear industry that could be used as a guide on the configuration of the models.

Parameters	FRANCE	KOREA	UK	USA	JAPAN	FINLAND
State Share	85%	51%	0%	0%	0%	0%
Reactor Exports	Yes	Yes	Yes	Yes	Yes	No
Reactor Imports	No	Yes	Yes	Yes	Yes	Yes
Degree of Development	Developed	Developed	Developed	Developed	Developed	Developed
Type of Government	Democracy	Democracy	Constitutional Monarchy	Democracy	Constitutional Monarchy	Democracy
Market policy	Mixed economy	Market Economy	Mixed economy	Mixed economy	Free - Market economy	Mixed economy
Authorities depending on the government	Yes	Yes	Yes	No	Yes	No
Nuclear Program	38 years	49 years	71 years	65 years	56 years	33 years
Number of reactors	56	21	18	104	54	4
Reactors under construction	Yes	Yes	No	No	Yes	Yes
Percentage of total energy	75%	31%	18%	20%	30%	25%
Generation of fuel	Yes	No	Yes	Yes	Yes	No

Table 1-3 Nuclear industry parameters for France, Korea, UK, USA, Japan and Finland

Table 1-3 clearly makes some distinctions, showing for example, how France and Korea states are the major investors in the built nuclear plants, while for the other countries there is no state ownership. And among the six countries, these two present a successful nuclear industry which constitutes the two highest figures of generated energy by nuclear sources. As for UK and Japan, they both have the same type of government and no shares in the nuclear plants of their countries. Nevertheless it is the Government the one who controls the utilities and their actions, through the authorities, being the government and regulators the most important and critical actors. In the particular case of Unites States and Finland, the authorities are entities completely separated from the government and only act as a communication mean for the government to be aware of the situations, since these regulators are the ones who directly demand, monitor and control.

After making the stakeholder identification and parameter comparison between the six countries, were chosen five characteristics that integrated the two results in order to recognize the relationship between the stakeholders.

- 1. Degree of development:** there is an economic and politic difference in a developed, developing or underdeveloped country. This defines first the capacity of the country to invest in a Megaproject of a nuclear plant, and also the relationship between the utilities and the government.
- 2. Wealth of the Country:** knowing how the economy of the country is, if it has grown in the past few years, if it is stable or not etc., can give an idea about if the country (or government) is able to engage this kind of projects.
- 3. Degree of control of the government over the enterprise sector:** knowing which kind of government is ruling the country (democracy, socialism, totalitarianism, etc.) and relating

it to a market policy (free, regulated or planned market policy) it can be understood the relationship between the companies that work in the energy industry and the government.

4. **The role of the energy authority in the country:** being able to understand the role of the authority in the energy industry of a country as- is, can show how would be the interaction of the authority for the nuclear sector with the other stakeholders.
5. **Private or Public companies in the energy sector:** realizing which is the nature of the companies in the energy sector, it is possible to have an idea of which could be the role of the new companies or those in the energy sector that become part of the new nuclear energy industry.

This review helps to better understand the differences among the studied countries and supports the integration into the three models that will be described next.

FRANCE and KOREA

Model of a Stakeholders configuration that will work in a developed country with an organized and wealthy government that possesses a strong link between it and the energy providing companies. A country where the roles of every entity (utilities and regulators) are precisely defined. Having specific power and functions that will not cross the boundaries of one another, even if they are all dependent on the government.

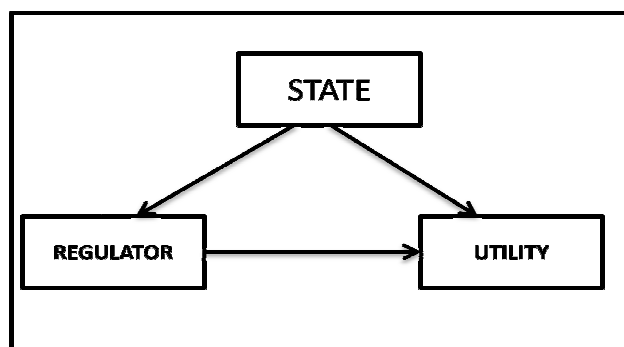


Figure 1-20 FRANCE and KOREA MODEL

USA and FINLAND

Model of Stakeholders arrangement that will operate in a developed country with strong private companies with the capital to make the first investment for the megaproject of a nuclear plant. The authority is the most powerful stakeholder that can work separately from the government. The regulator is the one who manages to coordinate the links over the stakeholders and guarantees the correct, and secure performance of the nuclear projects.

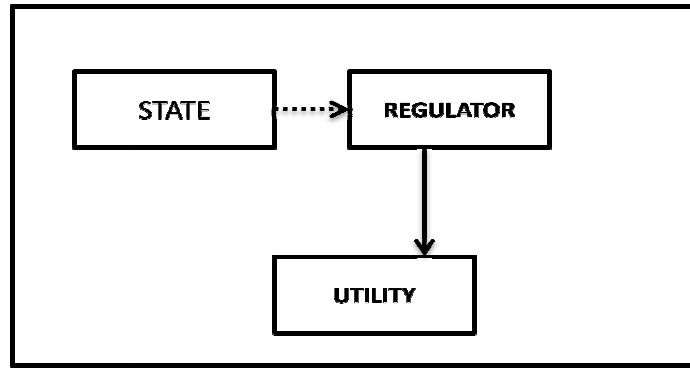


Figure 1-21 USA and FINLAND MODEL

UK and JAPAN

Model of Stakeholders configuration that will work in a developed country with a strong economy and government, that can assume the responsibility of the investments to develop the first nuclear projects. At the same time, these countries have to count with strong private companies that could take the responsibility in a close future to continue with the project development. The regulators in this model depend from the government and will become the link between the utilities and the latest.

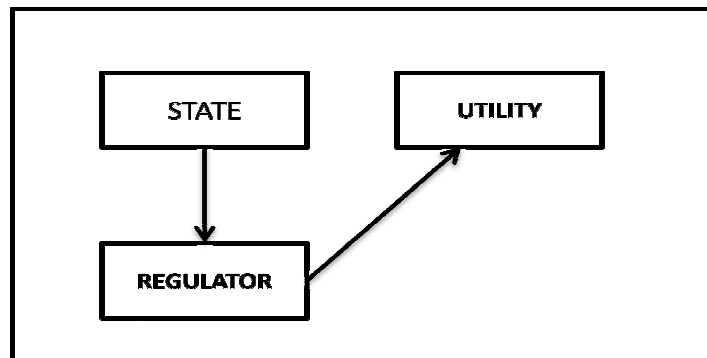


Figure 1-22 UK and JAPAN MODEL

With these three representations it can be possible to get a first approach to construct the model of a specific country that wants to join the nuclear industry. They would become a start in order to arrange the stakeholders configuration depending on several parameters also used to generate the models above. The nature of the utilities, the role of the government and the dependence of the authorities are some of the key characteristics primarily considered to obtain these results.

1.5.4. Model application

For the better understanding of the application of the models, a country was selected based on the report made by the International Atomic Energy Association of “Common User Considerations (CUC) by Developing Countries for Future Nuclear Energy Systems”. Among the countries mentioned in this report, were selected those which don’t have Nuclear power plants but are interested on starting with the nuclear energy generation. As a second aspect, it was evaluated the GDP of each country since a higher GDP represents a higher economic

growth and consequently the possibility of having money to spend in this kind of megaprojects.

Country	GDP (US Dollars)	Country	GDP (US Dollars)
Algeria	4,495	Libyan	9,957
Angola	4,423	Malaysia	8,373
Bangladesh	673	Mongolia	2,207
Belarus	5,765	Morocco	2,808
Bolivia	1,993	Namibia	5,330
Burkina Faso	536	Nigeria	1,222
Cameroon	1,143	Philippines	2,140
Croatia	13,754	Poland	12,271
Dominican Republic	5,195	Senegal	1,042
Estonia	13,939	Sudán	1,425
Ethiopia	358	Syria	2,891
Georgia	2,620	Tanzania	527
Ghana	1,283	Uruguay	11,996
Indonesia	2,946	Venezuela	13,451
Jordan	4,560	Vietnam	1,191
Kenya	775	Yemen	1,130

Table 1-4 Group of developing Countries with corresponding GDP per Capita (The World Bank, 2010)

After comparing the GDP, the countries with the three highest values are Croatia, Estonia and Poland. For deciding among these three, the last criterion was based on the availability of information, being Poland the one that has the most. Having this said the country selected is **POLAND**.

After analyzing Poland’s economic, politic and energy background, as well as their nuclear history, it was possible to identify the stakeholders that would be involved in the construction of nuclear plant.

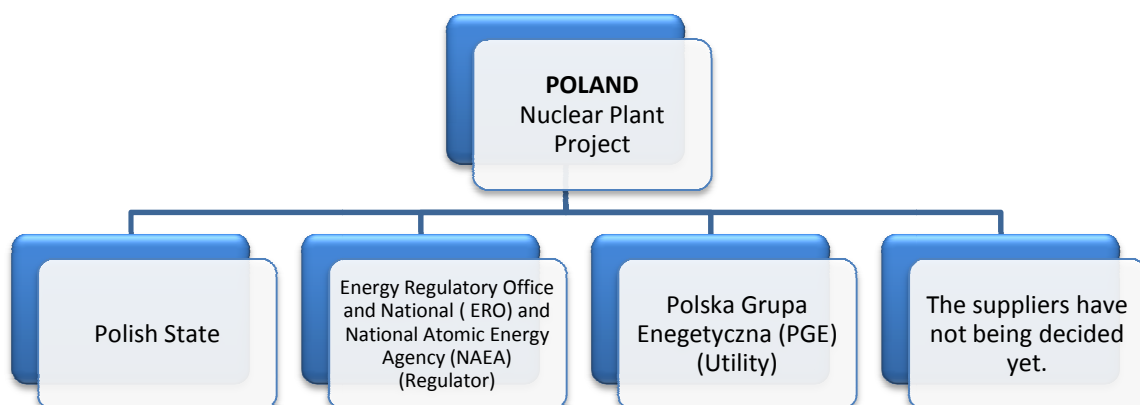


Figure 1-23 Stakeholders Present in Poland’s Nuclear Plant Project

To understand which model better describes Poland’s stakeholders interaction, the five characteristics used to build the four models proposed are defined as it follows:

6. **Degree of development:** Poland is currently an emerging country. After they started to be ruled by a democratic government, following the policies of free market and industry privatization, they are having an economic strengthening which could be demonstrated by the fact that it was the only country in the EU that presented an economic growth during the 2009 period of crisis. This reality has helped to increase the investment and to the development of new projects for the well being of the country.
7. **Wealth of the Country (Government capability):** Poland's GDP (12,271 USD) is among the highest of the developing countries previously analyzed that might be interested in the construction of Nuclear power plant. This value has been increasing in the past years, which allows the country to think about investing in a megaproject such as a Nuclear plant.
8. **Degree of control of the government over the enterprise sector (free market or regulated market):** Since 1990, Poland has been working with a free market policy which opens the possibilities to the foreign direct investment and gives the opportunity to the companies to be independent as they support the local development.
9. **The role of the energy authority in the country "As is":** As it was described, the only authority in the energy sector in Poland is the Energy Regulatory Office, which is in charge of giving the licenses, generating the policies and monitoring the companies' performance. However, Poland counts with a National Atomic Energy Agency that right now is working with radiation protection and radiological monitoring of the environment and according to the state, it should also work with the nuclear safety and security. Both entities are both dependent on the government.
10. **Private or Public companies in the energy sector:** Nowadays, Poland continues with the privatization of the companies, in order to increase the economic capability of the country, however as a government decision, around twenty companies belonging to the energy and infrastructure sectors will remain in state ownership, this includes the utility PGE.

According to what was stated before, the model that better suits the relationships and interactions between the stakeholders in the construction of the Nuclear plant in Poland is the France and Korea model which was described as:

Model of a Stakeholders configuration that will work in a developed country with an organized and wealthy government that possesses a strong link between it and the energy providing companies. A country where the roles of every entity (utilities and regulators) are precisely defined. Having specific power and functions that will not cross the boundaries of one another, even if they are all dependent on the government.

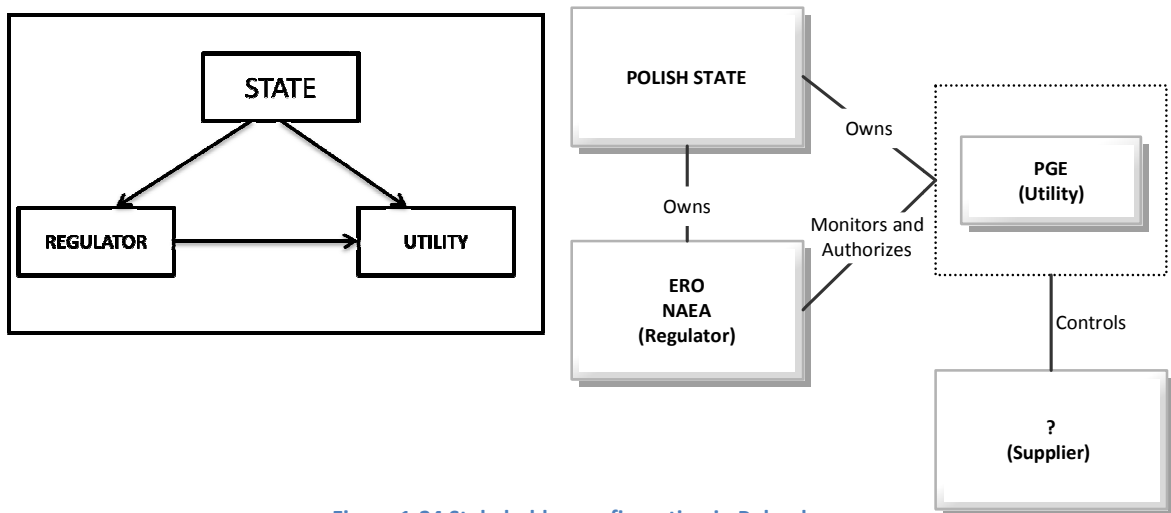


Figure 1-24 Stakeholder configuration in Poland

The Polish State is the main stakeholder by being the one proposing the project and identifying the high necessity of building a NPP. Their purpose includes long-term energy security, electricity production economics as well as the need to maintain the Polish economy competitiveness; which gives them all the reasons to push, maintain and finance the project. As owners of the utility PGE, the State is easily in control of the processes and plays an important role during all the life cycle of the plant. At the same time, the authorities, being part of the Government, would exert a high influence in the decisions made by the utility and the supplier, by controlling all the steps of the process and guaranteeing the well execution in accordance to the law and the security policies.

It is important to highlight that this analysis can change if the basic characteristics that described the model change. That could be in the case of a variation in the economic activity of Poland, if the country decides to privatize the utility, if there is a major event that demands extreme measures and could alter the power distribution of the stakeholders, among others.

1.6. CONCLUSIONS

After performing an intensive research on stakeholders in megaproject, having studied six different countries to understand their stakeholder configuration, and developing 3 models to recognize the relationship between them, this work has reached to the following answers for the research questions:

Q1) Why a nuclear plant project's scope and objectives can be affected by its stakeholders?

Stakeholders are the group of individuals that are somehow involved and have interests in the development of a specific project. Moreover, they are the suppliers of financial means, policies, laws, permits, knowledge, materials, among others, for the execution of any project. The higher the number of stakeholders involved, the higher becomes the complexity of their management and therefore the project itself. These stakeholders' interests and expectations can make them exert their power in order to achieve their own objectives. This acts have an impact in the scope of the project that changes along the lifecycle of the project. Therefore the importance of each type of stakeholder is different in each one of the stages,

and as a consequence all of the stakeholders have to be taken into account for the decision making process.

As it is stated in chapter 4, nuclear plants are defined as megaprojects due to their high complexity, high amount of time and money involved and impact in society. Any change made in the project due to a requirement, a major force decision, an event or accident, can drastically affect the budget and the time of the project.

Nuclear plant projects are a concern of the State, reason why, the government plays a definitive role as it was affirmed in the comparison between the six countries analyzed. Any decision made by the government can change the direction of the nuclear industry in a country. United Kingdom decision of not provide economic support to the nuclear projects, ended up in the introduction of EDF as owner of the actual nuclear plants, which once were owned by a local utility (British Energy). After Fukushima the state had to intervene by shutting down all reactors that could represent a threat, until they are inspected. In France, the ASN ordered a construction stop at the EPR Flamaville site for a few weeks in order to ensure improved documentation and implementation of quality standards for concrete, welding, and steel framing.

On the other hand Nuclear plants are unique projects in each country. There is not a single plant the same as other, due to the different conditions presented in each country. This gives power to the utilities and the suppliers that already have the technology and knowledge. These stakeholders have a high influence in the construction phase and can use strategies to change or obtain what they want .

Moreover, due to its high impact in the society, a nuclear plant project tends to be affected by the community if they enforce strong protests against the cause. There are cases where nuclear plants project have not started due to high community pressure on the government. This is what is happening today in Japan after the Fukushima accident. The community disagreement has increased and the industry is in a delicate process of trying to demonstrate the security and safety of the industry before the country's eyes.

These examples show how one stakeholder can change the course of a project, no matter the dimensions or the power behind it. The success of the construction of a nuclear plant can highly depend on the right involvement of the stakeholders. Due to its condition of megaproject, the impact in time (delays) and money (budget) that the stakeholders' influences can make are of great relevance and require a whole management approach.

Q2) Which are the most important stakeholders in a Nuclear Plant Projects? Which are the most influential according to the countries studied?

The table above shows the group of stakeholder that may be involved in a nuclear plant project.

ECONOMIC	SOCIAL
<ul style="list-style-type: none"> ▪ Facility Owner ▪ Funding Entities ▪ Government ▪ Local Authorities ▪ Elected Officials ▪ Trade Unions ▪ Waste Manager ▪ Decommissioning manager ▪ Nuclear Industry 	<ul style="list-style-type: none"> ▪ General Public ▪ Local Communities ▪ Media
ENVIROMENTAL	TECHNICAL
<ul style="list-style-type: none"> ▪ Regulators (environmental) ▪ Neighboring countries ▪ Pressure Groups 	<ul style="list-style-type: none"> ▪ Regulators (Nuclear safety) ▪ Researches and Scientists ▪ Contractors ▪ Operation Staff ▪ Waste Manager

After the investigation of the nuclear industry in the six countries, and comprehending how was the interaction of the stakeholders in the process for the construction of a Nuclear plant, it was decided that the most important stakeholders were:

- ✓ Government:
- ✓ Authority
- ✓ Utility
- ✓ Suppliers
- ✓ Community

The government represents the leading head of the configuration except for the countries of Finland and USA. The state is in charge of using the authority as a tool to maintain the security and safety of the industry and protect the community an environment. In the case of USA and Finland the authority is the one that guides the industry of course supported but not ruled by the government. For the countries of France and Korea the government is also the owner of the utility becoming the most influential stakeholder for them. For Japan and UK, the utilities are private and the government enforces its power over the authorities. The suppliers all depend on the decision of the utility while the community is a stakeholder that can become dangerous in the moment of the construction if they are not well dealt with since the beginning of the project.

Having this said after the country analysis and the definition of the role of the stakeholders, the principal and most influential stakeholders at the moment of the construction of the nuclear plant are the **Government, the utility and the authority**. The suppliers and the community depend on the execution and decisions of these three to be able to make part of the stakeholder configuration of each country.

Q3) Why and which are the factors that make the stakeholders configuration different in each of the studied countries?

By describing the background of the nuclear industry in each one of the countries it was seen that the conditions were different. Korea for example entered this industry when it was still a developing country meanwhile the rest were already developed. Finland and USA are countries with a very strong authority that since the beginning established strict policies and found the means to enforce them impeccably. France and Korea are countries in which the state owns the utility while in Japan and UK the utilities are private. These differences led to three models proposed based in the links and relationship of the main stakeholders: the State, the Utility and the authority. The characteristics that answered how could be the relationship between these stakeholders where the following:

- ✓ Degree of development:
- ✓ Wealth of the Country
- ✓ Degree of control of the government over the enterprise sector
- ✓ The role of the energy authority in the country As-IS
- ✓ Private or Public companies in the energy sector

The degree of development and the wealth of the country can tell us if the country will have the means to invest in this kind of projects and if the government would have the conditions to enter as a money provider if it is required. The degree of control of the government in the enterprise sector gives an idea of how could be the relationship of the government and the utility. Even if the utility is a foreign one, in a country where the government controls the enterprise sector it will tend in some way to control this utility. This relationship can be also defined analyzing how public or private is the energy sector in the country at the moment. Depending on the size and importance of the energy company in the country, the economic means can be given only by the utility without needing the help of government involvement in this aspect. Finally the role of the authority in the energy sector as-is working at the time is an start to realize how should be set the authority for the nuclear industry.

Q4) Which should be the stakeholder configuration of a country that wants to develop a Nuclear Plant Project?

The stakeholder configuration of a newcomer country interested in joining the nuclear industry has to be guided by the recognition of their own characteristics and the comparison of them with the already found in the proposed models. This thesis looks for providing a tool that allows the interested country to compare their own parameters with the five characteristics defined in the chapter 4: (1) Degree of development; (2) Wealth of the Country; (3) Degree of control of the government over the enterprise sector; (4) The role of the energy authority in the country As-IS; (5) Private or Public companies in the energy sector.

In this sense, after analyzing the background and current state of the energy industry, the involvement of the government in the project and the role of the authorities, the newcomer can identify their stakeholders relationships with one of the three models in which were grouped the six countries studied.

For the specific case of Poland, which was the selected country to apply this argument, the definition of the five characteristics led to the conclusion that the model that better suits the relationships and interactions between the stakeholders in the construction of the Nuclear plant is the France and Korea model. Poland could use the experience of these two countries to base its stakeholder configuration as well as apply all the lessons learned by them in the generation of their nuclear industry.

As done it was done for Poland, another country could use these models in order to get a guide to generate their own stakeholder configuration.

Stakeholders Management in Nuclear Power Plants: An Analysis in Six Different Countries

2. INTRODUCTION

In every developing project, the whole stakeholders matter becomes a significant issue to be approached in order to minimize or alleviate all the risks that are latent, due to the influence the stakeholders can have in the specific phases of an the process. That is why, around this topic, it has been widened an entire theory that look for the best strategies in order to deal with this concerns. Stakeholder Theory is managerial in that it recommends attitudes, structures, and practices and requires that simultaneous attention be given to the interests of all legitimate stakeholders. But in order to determine all the legitimate stakeholders, there should be performed an identification process, that will be given through the *power, urgency and legitimacy theory*, aiming to define the importance and roles of the stakeholders.

Given the attributes a stakeholders possess, it can be applied different strategies to meet the requirements they demand; for this reason the stakeholder theory appears as the best solution to face theses menaces. It becomes imperative to recognize the links and association among stakeholders and establish the network supply and control chain to have a clear view of the risks and strategies needed to direct the parts. All this process turns to be even more crucial when it is the case of Megaprojects.

In megaprojects, such as Nuclear Power Plants (NPP), the stakeholder identification and organization is from critical importance. The ambitious objectives, amount of money, interests involved and the time required, make the NPP an adequate example of how stakeholders management is required to guarantee the success of the project. And starting from this identification approach, can be drawn models that look for being useful to projects of Nuclear Power Plants, specially for new countries that want to penetrate this industry. Here it is where the investigation was focused. By analyzing six countries already successful in the industry, can be defined ways of arranging the stakeholder according to the characteristics and the particulars of the country, and their cases of success could be used as an example to compare and define another country's NPP stakeholders structure. The relevance on executing this investigation is given by the fact that nowadays new NPP projects are being initiated, in the hopes of finding a more sustainable source of energy. This megaproject becomes difficult by itself, and demands several approaches to alleviate its complexity, so the stakeholders management is one of them.

One of the major requirements for sustaining human progress is an adequate source of energy. The current largest sources of energy are the combustion of coal, oil and natural gas. They will last quite a while but will probably run out or become harmful in tens to hundreds of years. Nuclear power plants use the power of the atom to generate electricity with a very low fuel cost and much less pollution than fossil fuel plants. The various advantages of the process, such as low greenhouse gases emissions and low cost, makes it the an attractive option specially for countries with a complete lack of natural resources needed to provide their own energy. However, the planning, building, and operating of a nuclear power plant is a long, costly, and very complex process, adding the difficult stakeholder management process that is included with the Nuclear Power Plant project.

The analysis performed within this work, shows the stakeholders organization structure for France, United Kingdom, Finland, Japan, United States and Korea, which will give different models adapted to the types of countries, that can be used as a comparison for the final selected country, looking for its venture in the nuclear industry. These countries present diverse configuration due to the nature of the utilities, the authorities and the government; While in the France case, almost the whole chain is managed and control by the state, in other countries like United States of America, the utilities are completely independent and the state doesn't play an important role inside the supply network.

Finally the research performed will lead to the appropriate structure of the stakeholders network of a Nuclear Power Plant in the chosen country, being a management tool for all the interested in the nuclear industry.

CHAPTER 3: APPROACH TO STAKEHOLDERS

In this chapter will be approached several definitions needed for the complete understanding of the stakeholders role within a project and the reasons for studying them and consider them during the development of a project. The application of different theories will be shown in order to answer the questions about who are the stakeholders?, what do they want?, how are they going to get it? And the analysis of them in different phases of a construction projects will be specifically pointed up.

3. APPROACH TO THE STAKEHOLDERS

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3.1. Project Management

3.1.1. What is a Project

People have been undertaking projects since the earliest days where humanity found the benefits of working as an organized community rather than as an individual. Through human kind history there have been examples such as: The hunting parties of our prehistoric ancestors, where there was specific goal of finding food in specific periods of time, the pyramids, the Great Wall of China or the Apollo Project to send man to the moon among others. The term project is frequently in the daily conversations, describing what people will like to do in the next weekend or the next five years with clear goals of time and a final unique output.

A project has specific characteristics that distinguish it from ongoing work or business operations. Projects are temporary in nature, they are not an everyday business process and have definitive start dates and end dates. Projects can last minutes, hours, days, weeks, months or years. This characteristic is very important because a large part of the project effort is dedicated to ensuring that the project is completed at the appointed time. To ensure this, schedules are developed to show when tasks should begin and end.

Projects exist to be able to deliver a product or service that hasn't existed before. In other words each project is "unique". This is other of the specific characteristics that differs a project from an operative work which involves activities that are continuous without an ending date and that are often repeated in the same processes and produce the same results. The purpose of operations is to keep the organization functioning while the purpose of a project is to meet its goals and to conclude. Therefore, operations are ongoing while projects are unique and temporary. A project is completed when its goals and objectives are accomplished. The organization of the activities, the resources involved and the decisions taken are all driven by the accomplishment of these goals. Sometimes projects end when it's determined that the goals and objectives cannot be accomplished or when the product or service of the project is no longer needed and the project is cancelled.

3.2. What is a stakeholder

3.2.1. Definitions

The study and evaluation of the Stakeholders in a company has become one of the most crucial processes during the execution of a project, after all, they are the ones who affect in a

large part the organization, and their influence can clearly change the mission and scope that was defined during the early stages of the project development.

For a better understanding of the concept “STAKEHOLDERS” the following illustrates some of the definitions this concept has had over time,

- ✓ *(Standford Research Institute, 1963): “Those groups in which the organization is dependent for its continual survival”*
- ✓ *(Freeman R. , 1984): “A group or individual who can affect or is affected by the achievements of the organization’s objectives.”*
- ✓ *(Clarkson M. , 1994): “Those with legitimate claims who are placed at risk as a result of a firm’s activities. Without the element of risk there is no stake.*
- ✓ *(MacEloroy & Mills, 2000): Project stakeholders are a person or group of people who have a vested interest in the success of a project and the environment within which the project operates.*

Each definition comes according that the business environment had at the time. However, what is true, is the strength the concept has acquired since the beginning, and today even a stakeholder management has been developed to be able to understand their needs and expectations in order to establish goals and objectives of the project that they will fulfill and follow.

3.2.2. Type of Stakeholders

Due to the diversity of stakeholders and the need to understand their role and impact on the project, is important to be able to identify what type of stakeholder each one is. In this way it will be easier to recognize their needs and expectations, and the importance each one has through all the process of the project.

The following are the different categories given to stakeholders by literature investigation until today:

- ✓ **Internal:** those who are members of the project coalition or providing finance.
- ✓ **External:** those others affected by the project in a significant way. (Calvert, 1995).
- ✓ **Secondary stakeholders**(Clarkson M. , 1995)
- ✓ **Business actors:** consultants, financial backers, agents, engineering companies, sub-contractors (strategic stakeholders). (Cova et al, 2005).
- ✓ **Non-business actors:** governments, syndicates, lobbies, unions, pressure groups, activists, etc (Cova et al, 2005).
- ✓ **Proponents and opponents** (Winch, 2004).
- ✓ **Strategic stakeholders and moral stakeholders** (Frooman, 1999).

Each category of stakeholders have a specific role depending on the scope of the project. Having these noticed, identifying the category will give a first view of what is the role of the stakeholder and will guide the identification of it along the lifecycle of the project.

3.3. Why to study stake holder?

The study of stakeholders has become more important with time. Researchers on the topic and project managers have realized that “without attention to needs and expectations of the diverse stakeholders, a project will probably not be regarded as successful even if the project manager was able to stay within the original time, budget and scope” (Bourne & Walter, 2005).

In the initial approaches of stakeholder management back in the 70's many traditional views ignored some stakeholders, marginalized others and consistently traded-off the interests of others against favorable stakeholder groups. (Freeman & McVea, 2001). The attention was placed on the group of the shareholders, thinking that they were the most important stakeholders, and that satisfying their needs, will guarantee the success of the project. However they realized that the business environment is dynamic and that this approach will only be successful in stable environments that present small changes during the process of the project.

Project managers, who have the responsibility to respond to the needs and expectations of the stakeholders, have realized that due to the instable business environment, the impact of stakeholders along the lifecycle of the project also changes. Therefore the importance of each type of stakeholder is different in each of the stages of the project, and as a consequence all the stakeholders have to be taken into account for the decision making process.

To be able to understand how the stakeholders affect the project in each of the stages, after the categorization, there has to be a specific identification of their interests and influences to be able to understand their behavior in each stage of the project, and thus know how to address to each one to satisfy their needs and expectations.

3.4. How to describe and analyze Stakeholder in projects

There is not only one approach aiming to the classification, analysis or management of the stakeholders and their influence in projects. In order to carry out a stakeholders analysis, two major steps have to be followed: Stakeholders identification and Stakeholders classification. From this point, numerous frameworks have appeared, which seek the prioritization and categorization of stakeholders, in order to control their demands and manage the influence they can have on the firm's decisions.

Several authors have come up with different frameworks that look for a better understanding of stakeholders behavior according to some factors that characterize the stakeholder nature. (Freeman R. E., 1984)'s widely used definition labels stakeholders as “Any group or individual who can affect or is affected by the firm's objectives”. Being this definition completed by (Goodpastor, 1991) who noted two types of stakeholders: *strategic* (the one who affects the firm) and *moral* (the one who is affected by the firm). Each type is managed in different ways according to the strategy literature or the ethics literature of the whole stakeholders literature. For the first one, there should be a managing of interests which makes this approach unidirectional in nature, with relationships viewed from the firm's vantage point (Freeman R. E., 1984); whereas for the second one, it is necessary to try a balancing of

interests, based more on the ethics than on the strategy, and giving a bidirectional account of the firm and its stakeholders.

The study and evaluation of the Stakeholders in a company has become one of the most crucial processes during the execution of a project, after all, they are the ones who affect in a large part the organization, and their influence can clearly change the mission and scope that was defined during the early stages of the project development.

The stakeholder theory aims to show how the stakeholders try to influence the firm's decision making and its behavior. For the evaluation of their conducts within the firms and project, it has been necessary to develop frameworks in order to group them, manage them and classifying them. With this in mind, according to (Frooman, 1999), it is possible to answer three questions that will lead to the stakeholders identification and therefore, to a better understanding of their behavior and to the right response from the organization towards their influences:

4. Who are they (*Attributes*)
5. What do they want (their *Ends*)
6. How are they going to get it (*Means*)

In order to define *who are they*, it is possible to find many lists of stakeholders and categorization but one of the most widespread works is that of (Mitchell, Agle, & Wood, 1997), where three key attributes are identified: Urgency, Power and Legitimacy; arguing that the various combination of these attributes are the indicators of the amount of attention management needs to give to a stakeholder.

3.4.1. Identification of stakeholders: Who are they?

(Mitchell, Agle, & Wood, 1997) argued that stakeholder salience will be positively related to the cumulative number of stakeholder attributes: power, legitimacy and urgency. Perceived by managers to be present.

Firstly, according to (Weber, 1977), stakeholders possessing *power* have the ability to exercise their will despite resistance. Power is explained using resource dependence theory (RDT), agency theory, and transaction cost economics. RDT explains how an organization's dependence on a stakeholder for critical resources puts the organization in a relatively more dependent position, warranting managerial attention. Secondly, agency theory considers the potential for opportunism in a relationship, one party taking advantage of their more powerful position. Secondly, the marketing organization's performance will be affected by stakeholders' *legitimate* interest in its activities and outputs. Legitimacy is defined by (Suchman, 1995) as, "a generalized perception or assumption that the actions of an entity are desirable, proper or appropriate within some socially constructed system of norms, values, beliefs and definitions". The third attribute this framework is *urgency*, or "the degree to which stakeholder claims call for immediate attention". According to (Mitchell, Agle, & Wood, 1997), urgency is implicit in each of the organizational theories already discussed, although not a primary feature of any one theory. They proposed that it is comprised of two attributes: the time sensitivity and the

criticality of the claim to stakeholders. Urgent stakeholders will demand immediate managerial attention.

To understand the importance of the different stakeholders, they are classified in seven possible categories, according to the number of components they have, recognizing the importance directly connected to the number of attributes they have. So the stakeholders are divided as it is seen in the figure:

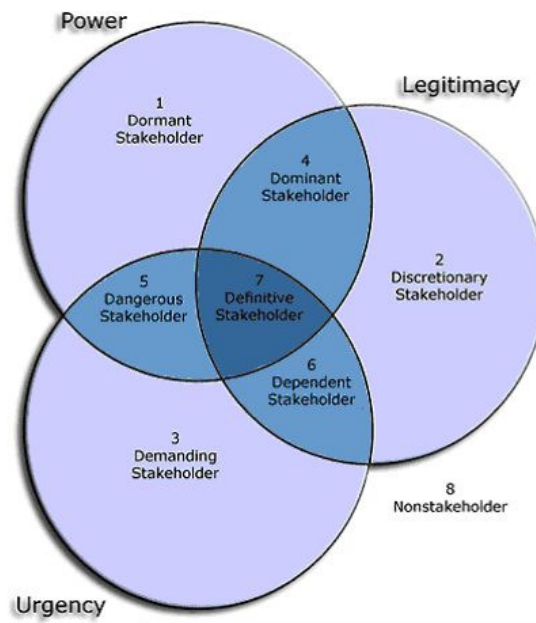


Figure 3-1 Stakeholders Identification According to the Attribute

The least relevant category of stakeholder is the one that owns only one of the three attributes. In the figure, it would be represented by the areas 1,2,3. These are called “Latent Stakeholder”. When the stakeholder has two attributes, , the importance and expectations increase; these stakeholders are called “Expectant Stakeholder”. And when one of the stakeholders has all the attributes, it is ranked as “Highly Salient Stakeholder”, as in the area 7.

In a synthetic way, these are the main characteristics of the seven typologies of stakeholders, according to (Mitchell, Agle, & Wood, 1997):

1. Dormant Stakeholder.

- Power is its only attribute.
- The interaction with the organization is minimum or inexistent.

2. Discretionary Stakeholder.

- Only attribute: Legitimacy.
- There is no pressure to the manager to start an active relationship with this stakeholder.

3. Demanding Stakeholder.

- It has urgent requests, but no Legitimacy or Power.
- They can be irritating but not dangerous.

4. *Dominant Stakeholder.*

- It has Power and Legitimacy.
- They have certain relevance to the manager.

5. *Dangerous Stakeholder.*

- They have legitimate requests but no Power.
- Depend on other stakeholders with Power in order to get what they require.

6. *Dependent Stakeholder.*

- It lacks of Legitimacy.

7. *Definitive Stakeholder.*

- They have the three attributes, assuming in this way, a primarily role.

8. *Non-stakeholders.*

- ✓ No power, no legitimacy and no urgency.

This approach is one of the most used techniques in order to identified the stakeholders that the management needs to take care of, to not risk the achievement of the project or the organization's goals. The assignation of these attributes (Power, Legitimacy and Urgency) becomes the first step in the stakeholder identification and categorization to elaborate the techniques to control the stakeholder salience and influence in the project.

3.4.1.1. Stakeholder mapping

To get a complete picture of the stakeholders' position, it is used the stakeholder mapping, which is a practical and strategic tool that allows the manager to distinguish between commonality of purpose and specific stakeholders interest, to build coalitions and neutralizing blockages.

To the development of a stakeholders map it is necessary to have a clear project mission (what does the project or organization want to achieve), define the stakeholders, define all the possible influences and finally all the relationship between them. This process allows the identification of the key individuals, of the possible cooperation, the necessary parties on the different stages of the process and who can block or support the project mission.

After identifying the complete set of stakeholders, it becomes easier to classify the stakeholders in terms of those who possess an interest in the project and the solutions to its problems. This stakeholder mapping is inspired by theories of social constructivism, typically known as the Social Construction of Technology, developed and applied by (Bijker, 1987). It defines an artifact, which is the technological object, material or immaterial, towards which the actors in Social Construction of Technology analysis are oriented. In this context, the artifact is the *project mission*, the relevant social groups represent the *project stakeholders (proponents and opponents)* and they are related to different *problems* and *solutions* as illustrated in the figure:

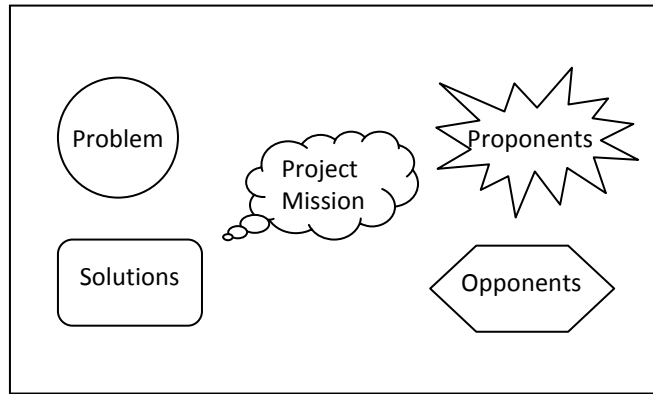


Figure 3-2 Code to Stakeholder Maps

The Social Construction of Technology theory allows to map the stakeholders in a clearer way, and showing graphically the Stakeholders positive and negative influences they could have during the project development toward the project mission.

3.4.1.2. Power/Interest Matrix

Once the map is prepared, (Johnson & Scholes, 1999) categorize the stakeholders, by using a power/interest matrix. There are two dimensions to the matrix: the level of interest of the stakeholder in the project and the stakeholder’s power to influence the definition of the project mission. This leads to four levels of categorization, as shown in the following figure:

		Level of Interest	
		Low	High
Power	Low	A Minimal effort	B Keep informed
	High	C Keep satisfied	D Key Player

Table 3-1 Categorization of stakeholders (Johnson & Scholes, 1999)

If the stakeholders are at the far corners of the Table 3-1 then the definition process is likely to be turbulent and the process map unstable. If the stakeholders are clustered near the center, then the map will appear as relatively stable.

The stakeholders in group A require only minimal effort and monitoring but should still be watched. The stakeholders in group B should be kept informed of the progress; they can be important to influence the more powerful stakeholders. The stakeholders in group C are powerful, but their level of interest in the strategies of the organization is low; they are generally relatively passively, but may suddenly emerge as a result of certain events, moving to group D on that issue. They should be kept satisfied. Often this group will include second-tier financiers who treat the project simply as another investment opportunity, their power over the project is considerable, but their interest may be fairly low, as they would simply remove their finance in not satisfied. The stakeholders in group D are both powerful and highly

interested in the strategies of the organization. The acceptability of strategies to these key players should be an important consideration in the evaluation of new strategies. They are committed totally to the project, such as the client; the first-tier financiers and those on the supply side who are betting their company on the project for one reason or another.

By using Power/Interest matrix, it can be determined which stakeholders to manage closely and which stakeholders to put minimum effort in. This helps the manager to channel the time and energy on the stakeholders that have the most power and interest in project success.

3.4.2. Interests of stakeholders: What do they want?

After the identification of the stakeholders attributes, it should be answer “what do they want” which has generated numerous lists of stakeholders interests, such as concrete versus symbolic, economic versus social, and local versus domestic versus international. But the most relevant output of the question is to divergent interests is the one that has to be approached in the stakeholder’s management theory.

3.4.3. Influence Strategies: How are they going to get it?

Finally for the third question “How are they going to get it”, appears the analysis of the stakeholders influence strategies. It is a manager job to find the right strategies to protect the project mission against the influence strategies of the stakeholders. This is not only about defining the latter ones, but about finding the right approach to control them, starting with the strategic stakeholder theory.

There are many theories used as a possible approach for understanding influence strategies, which examine how the environment affects organizations. Among these theories Network theory, Agency Theory, and Resource dependence theory have been shown to be productive approaches to developing stakeholder theory.

In the next part will be approached the different influence strategies stakeholders could employ, departing from different theoretical perspectives. Getting a better insight into the characteristics of stakeholders’ influence strategies is useful to understand managers’ positions in weighing and balancing different interests, thus providing an input for stakeholder-oriented management. The three theories are applicable to a construction or nuclear plant project development, and in the following chapter it will be shown how the construction of a Nuclear Power Plant has a large and connected network of stakeholders (Network theory), how it also work with the Principle - Agent model (Agency theory) and how it depends on the resources of the supplier to accomplish its goals (Resource Dependence Theory).

3.4.3.1. Network Theory

(Galaskiewicz & Wasserman, 1994) proposes that instead of analyzing individual behaviors, attitudes and beliefs, social network analysis focuses its attention on how these interactions constitute a framework or structure that can be studied and analyzed in its own right. The authors also summarize basic network assumptions and (Wellman, 1988) lists the principles which describe the network analysis. This is shown in Table 3-2.

Network Analysis Principles and Assumptions		
Principles	Assumptions	Methodological Issues
Behavior is interpreted in terms of structural constraints on activity rather than in terms of inner forces within units	Actors and their actions are viewed as interdependent units	What are the boundaries of the network under study?
Analyses focus on the relations between units	Relational ties (linkages) between actors are channels for transfer of "flow" of resources	What type(s) of relations will be measured? Do the relations measured represent the range of relevant components of the construct?
A central consideration is how the pattern of relationships among multiple (actors) jointly affects network members behavior	Network models focusing on individuals view the network structure environment as providing opportunities for an constraints on individual actions	Will binary or value data be collected? Does the operationalization of the relationship construct(s) require assessing the strength of the ties?
Analytical methods deal directly with the patterned relational nature of social structure	Network models conceptualize the structure (whether social, economic, political, and so forth) as enduring patterns of relations among actors	Are the ties directional or non-directional? Are the exchange ties between network partners reciprocal?

Table 3-2 Network Analysis Principles and Assumptions (Wellman, 1988); (Galaskiewicz & Wasserman, 1994)

The analysis of (Galaskiewicz & Wasserman, 1994) sets that the primary focus of social network analysis is the interdependence of actors and how their positions in networks influence their opportunities, constraints and behaviors.

As a conclusion, Network theory shows how stakeholders can build relationships among them in order to influence the organization and all the patterns and associations that might be created should be monitored and controlled by the manager. Because as the grouping and alliances rise, also can arise the power that individual stakeholders would not have by themselves. By mapping the stakeholder and their connections, it is simpler to see these patterns and specific care can be directed to them.

3.4.3.2. Agency Theory

In order to understand how can external entities affect the organization, several theories appear as a possible approach for understanding influence strategies. These theories examine how the environment affects them and Agency Theory¹ is one of them.

In construction projects and megaproject is highly present the principal - agent model, which makes important to resort to the theory in order to get the best approach towards this kind of conflict. This is why next will be shown a brief explanation about agency theory based on the common example of a Multinational company.

Divergences can arise between owners and managers in the division of the value created by the firm as well as amongst managers in the struggle for power and control rights within the firm. Within the agency perspective, conflict amongst managers has been framed as one where managers at headquarters are linked in an agency relationship with managers in operating divisions.

As it is said by (O'Donnell, 2000), Agency theory is one of the most widely used theories to explain the organization of relationships within a Multinational Company (MNC). (Chang & Taylor, 1999) reported that in the context of headquarters – subsidiary relations, more severe agency problems are controlled by increased headquarters control. Within the MNC, headquarters (as principal) delegates decision-making responsibilities to the subsidiary (the agent). Agency problems arise in this relationship whenever the subsidiary's own interests are incongruent with those of headquarters. In other words, the subsidiary will act to pursue its own interests, even when these diverge from those of the firm as a whole. Monitoring is the most commonly recommended solution to the agency problem, with the level of monitoring dictated by the extent of divergence of interests between principal and agent (the severity of the agency problem).

(Mudambi & Pedersen, 2007) conclude that agency theory is one of the complementary frameworks within which to understand decision-making by managers. It applies when the stakeholder's decision rights are "loaned" by headquarters (in the case of MNC, subsidiaries'). The degree of autonomy allowed to subsidiaries is directly related to the benefits that they create for the parent MNC. Headquarters uses hierarchical "hard control" mechanisms to curtail the autonomy of subsidiaries. Subsidiaries creating limited strategic value may be allowed considerably more autonomy.

In this sense, agency theory is shown as one of the causes for conflict of interest among the network of stakeholders of the organizations, and the approach to control the problems that can appear due to this fact is led by the hard control over subsidiaries, if they are working

¹ Literature defines Agency theory directed at the agency relationship, in which one party (the principal) delegates work to another (the agent), who performs that work. Agency theory is concerned with resolving two problems that can occur in agency relationships. The first is the agency problem that arises when (a) the desires or goals of the principal and agent conflict and (b) it is difficult or expensive for the principle to verify what the agent is actually doing. The second is the fact of risk sharing that arises when the principal and agent have different attitudes towards risk. (Eisenhardt, 1989).

towards a mission different from the one of the focal organization. As the objectives of the stakeholders and in the case of MNC, as the objectives of subsidiaries come closer to the objectives of the focal organization, less control is required.

3.4.3.3. Resource Dependence Theory

(Pfeffer & Salancik, 1978) argued that because organizations are not self-contained or self-sufficient, the environment must be relied upon to provide support. For continuing to provide what the organization needs, the external groups or organizations may demand certain actions from the organization in return. It is the fact of the organization's dependence on the environment that makes the external constraint and control of organizational behavior both possible and almost inevitable.

The Resource dependence theory explains the external control of the organization, meaning the stakeholders influence strategies to pursue their own interest. The firm's need for resources gives opportunities to other agents to gain control over. In this sense, stakeholders with resource control over the firm could use two main influence strategies to control it: Withholding and Usage strategies.

3.4.3.4. Types of Stakeholders Influence Strategies

Withholding strategies: the stakeholder power of withdraw determined resources that are basic for the organization, that is withhold, becoming a evident threat for the project mission. For example, employees withhold labor by striking and creditors withhold debt financing by nonrenewal of loans. This strategy is used when the balance of power lies on the side of the stakeholder. (Pfeffer & Leong, 1977).

Usage Strategies: with this strategy, the stakeholder continues the supply of the resource but with some conditions attached.(Frooman, 1999).

By using withholding strategies, most of the costs are assumed by the company. This happens mostly when the power relies in the stakeholder than on the organization. Whereas usage strategies are used when the balance of power is equal for the organization and the stakeholder, so the costs are split between them.

(Frooman, 1999) has recognized two types of strategies, direct and indirect, based on the fact that withholding and usage strategies do not have to be performed by a stakeholder but, instead, could be performed by an ally of the stakeholder with whom the focal firma has a dependence relationship. In this sense, direct strategies are those in which the stakeholder itself manipulates the flow of resources of the firm, whereas indirect strategies are those in which the stakeholder works through an ally, by having the ally manipulate the flow of resources to the firm.

According to (Pfeffer & Salancik, 1978), these inter organizational influences can be determined by the level of power that possess either the organization or the stakeholder. When there is an asymmetrical relationship between the parties, the net power can turn one of the parties in the dependent or less dependent one. This categorization will set the likelihood of one of them to use the influence strategies. This means that the less dependent

part of the relationship will not tend to dominate the interorganizational influences as shown in Table 3-3.

Typology of Resource Relationships			
		Is the Stakeholder dependent on the Firm?	
		No	Yes
Is the Firm dependent on the stakeholder?	No	Low Interdependence	Firm power
	Yes	Stakeholder power	High Interdependence

Table 3-3 Typology of Resource Relationships

The stakeholder can choose the way it will implement the influence strategy depending on the power it has over the company and the level of dependence of each other, that is, a low level of dependence of a firm on a stakeholder implies low power of the latter, forcing it to use indirect strategies that could involve and ally with whom is easier to get a response from the firm.

The level of stakeholder dependence determines the type of resource control chosen, therefore a high level of dependence of the stakeholder on the firm means that the welfare of the stakeholder is closely tied to the welfare of the firm. The stakeholder, then, will not choose to withhold a critical resource from the firm; rather, the stakeholder will tend to focus on usage strategies as its means of influence.

Typology of Influence Strategies			
		Is the Stakeholder dependent on the Firm?	
		No	Yes
Is the Firm dependent on the stakeholder?	No	Indirect/Withholding (Low Interdependence)	Indirect/Usage (Firm power)
	Yes	Direct/Withholding (Stakeholder power)	Direct/Usage (High Interdependence)

Table 3-4 Typology of Influence Strategies

After defining the level of power of the stakeholders and the organization it is easy to identify and predict their influence strategies and it can be possible to start the procedures to avoid them or mitigate this effect.

To conclude, in this section have been discussed several theories which demonstrate the ways of control that stakeholder have, according to their power and characteristics inherent to each one of them. Knowing the theories and the can show a project manager the best way to deal with stakeholders guaranteeing the security of the project by using the alternative before explained.

3.5. Stakeholders in Construction Projects

3.5.1. Characteristics of construction projects

A Construction Project works according to the project definition. It's temporal with an unique output translated into buildings, bridges, highways etc. Depending on the chosen infrastructure to construct, the project is more complex and has its specific characteristics. However there are general characteristics that describe the construction business.

Every construction project has to deal with two special factors: Environmental and Social impact. The environmental impact can be seen from two sides: The impact of the environment during the development of the project, or the impact of the execution of the project on the environment. As for the social impact we refer to how the execution of the different process of the project can affect the people leaving around. These two factors have to be taken into account very seriously at the moment the project is being planned, because they can affect drastically the schedule and the budget of the whole project.

Other factor that characterizes this industry is the high amount of resources used, such as materials and personnel, which make the budgeting a complex process.

Finally construction projects deal with a big group of stakeholders that need to be taken into account in the planning of every stage of the project to be able to satisfy in the end the goals of time, cost and quality.

3.5.2. Analysis of Stakeholders in construction projects

As mentioned before the roles of stakeholders found in the stages of the construction projects are different. The right involvement of the right stakeholders in the project can guarantee the success of the project.

The following describe the best way to deal with stakeholders in each of the stages of the construction process:

1. Project Concept

In this stage are developed general guidelines to assist in defining the overall parameters of the project. What should be done or not, to achieve the goals of the project. Each process is evaluated to find the risks or the possible problems that can happen during the execution of the project.

In this part of the project, stakeholder engagement at the early stages, is about gauging potential local support for, or opposition to, different options and alternatives and identifying key issues and concerns that might affect the viability of a project. (International Finance Cooperation, 2007)

Engaging stakeholder groups early in relation to these strategic decisions and alternatives can help to avoid project opposition and other reputational risks, expensive re-design, and compensation payments. It can also increase the chances that local stakeholders will align with you around the value proposition of the project. Moreover, early engagement may provide

valuable opportunities to align the employment, training, infrastructure, and service demands of the project with the related plans and priorities of government agencies and local communities. (International Finance Cooperation, 2007).

2. Feasibility studies and project management

This stage aims to objectively and rationally identify the strengths and weaknesses of the existing project as well as, opportunities and threats presented by the environment, and the planning of the management of resources required to carry through, the project to success.

The identification of stakeholders in this stage is very important. These stakeholders will generate high impact during the whole process of the project so is very important to identify their needs and ways of satisfaction for them to become facilitators and not opponents to the project.

The essential elements of stakeholder engagement at the time of project feasibility, according to the (International Finance Cooperation, 2007) are:

- ✓ Forward planning the engagement as one complex activity, with a schedule and sufficient staff with the right capabilities.
- ✓ Focusing principal efforts on those stakeholders most affected by the project, whether because of proximity or vulnerability to change.
- ✓ Demonstrating that people's opinions and ideas are receiving serious consideration, whether by "designing-out" identified risks, "designing-in" additional local economic or social benefits, or incorporating the views of stakeholders in testing the feasibility of various design and risk management options.

3. Construction

In this stage of the project the physical processes are done. Workers and managers work together using the resources to be able to accomplish what was planned and how it was planned as much as possible.

Stakeholder engagement during the construction phase will relate to all activities leading up to and during the physical construction of facilities, infrastructure or buildings (and the "temporary works" needed to complete construction, such as access roads), as well as the management of contractors and construction contracts.

For affected communities and stakeholder groups with interests in biodiversity and the natural environment, the construction phase is a time of great concern. Depending on the nature and scale of the project, adverse impacts and risks can be many and diverse, including loss of land and natural resources that are important to local livelihoods; deterioration of surface water bodies; damage to road, water, and health infrastructure; heightened risks of communicable disease; conflicts between the local population and the temporary workforce; loss of habitat and wildlife disturbances; and nuisances and health concerns from heavy traffic, dust, noise, excessive lighting, and air emissions.

Engagement during construction is essentially about involving stakeholders in assessing whether measures are working as intended, being responsive to grievances, and identifying alternatives where there are failings. How your company manages its engagement with stakeholders during the construction period can often set the tone for community, local government and other external relationships for the remainder of the project's operational life.

4. Operation

In this final stage the physical processes are over and there is a high reduction on the human resources. Here is when it is shown if the project resulted as planned and as the client wanted to, if their needs and expectations were properly fulfilled.

Depending on the nature and scale of the project, stakeholder engagement may be relevant to the performance of a range of departments and functions within the company and should be integrated into existing systems, including health and safety, environmental management, procurement and contractor management, logistics management, site or plant inspections and audits, external communications, security considerations, and project risk management.

Here it is important to validate both the accuracy of the predictions of environmental and social impacts, and the effectiveness of mitigation and compensation measures. Expert panels, third-party monitors, community participation in impact monitoring, and the regular communication of the company's environmental and social performance are all forms of stakeholder engagement that strengthen effective management of impacts during operations.

In this section was explained how, not only it is necessary to identify the main stakeholders in a general view of the project, but also to segregate them according to the stages of the project, in order to identify the most relevant ones in each phase, leading to a specific treatment towards them which requires engagement and communication.

The role of each stakeholder should be identified in the phases mentioned before. In this way the project manager will understand the role of the stakeholder through the lifecycle of the project and will know how to handle its needs and expectation depending on the phase the project is at.

CHAPTER 4: STAKEHOLDERS IN MEGAPROJECTS

In chapter 3 it was clarified the whole stakeholders' concept and how, after identified, they can be discriminated and approached according to the phase of the project. Now it will be shown the importance of them in megaprojects and Nuclear Plants as megaprojects. In order to do this, there will be at the beginning of the chapter a clarification about what a megaproject is, its characteristics and all the risks they face along the megaproject life cycle.

4. STAKEHOLDERS IN MEGAPROJECTS

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4.1. What is a Megaproject?

It is difficult to define exactly what a mega-project is. There are however different definitions:

- ✓ As defined by (Flyvbjerg, Bruzelius, & Rothengatter, 2003), a mega-project is an extremely large-scale investment project costing more than €1 billion (or dollar) and attracting a lot of public attention because of substantial impacts on communities, environment, and budgets.
- ✓ Megaprojects can also be defined as initiatives that are physical, very expensive, and public. Mega-projects are however not only implemented in the public sector. Examples of mega-projects in the private sector include mergers and acquisitions (Weston, et al., 2003; Couzy, 2008; Sands, 2009).
- ✓ (Haidar & Ellis Jr, 2010) define megaprojects as large, complex, and expensive projects that often result in undesired outcomes with enormous cost overruns and time extensions. Megaprojects have been studied in many academic areas such as public planning, urban decision making, and economic analysis areas. They have been analyzed as complex hard to finance projects with economic gain and social impact.

Megaprojects are said to be projects that require huge physical and financial resources, which have become relatively common as a result of demands for new remote mineral resources, needs for infrastructure in less-developed countries and the desire to exploit economies of scale. The very great concerns of the actual and potential sponsors of such projects make important to perform analyses of the costs, problems and operations of megaprojects.

In spite of this increasing number, (Flyvbjerg, Bruzelius, & Rothengatter, 2003) affirm that megaprojects have often poor performance records in terms of economy (project costs and revenues), environment and public support. The bad performance of mega-projects usually results in inefficient use of resources. If the decision makers would have disposed of accurate information about the real performance, they might have resolved: not to implement the project; or to implement the project in another form; or implement another project. In other words, non-viable projects, or projects that are less viable than forgone projects, may be implemented because their viability was inaccurately predicted.

Moreover, the physical and economic scale of megaprojects is such that companies and even whole nations may be affected in both the medium and long term by the success or failure of just a single project. Unsuccessful performance of projects can lead to bankruptcy of companies and serious problems for governments.

In (Merrow, 1988)'s report, 52 civilian projects were analyzed, ranging in cost from 500 million to 10 billion (in 1984 dollars), in order to answer the following questions:

- ✓ Have megaprojects generally met their cost, schedule, and performance goals?
- ✓ Do megaprojects typically display poorer outcomes than smaller projects?
- ✓ What factors drive good and bad outcomes?
- ✓ What steps can be taken to minimize the cost, schedule and performance risks associated with megaprojects?

Most of the projects in the database met their performance goals; many met their schedule goals; few met their cost goals. The average cost growth, measured from the beginning of detailed engineering (a fairly late point in project evolution), was 88 percent. The total cost overruns for 47 projects amounted to over 30 billion dollars. Only four of the projects were completed within the allotted time.

Cost growth and schedule slippage for projects in the megaprojects database are driven primarily by conflicts between the projects and host governments, institutional problems relating to environmental regulation and opposition, health and safety rules and regulation, and labor practices and procurement controls.

The same is proposed by (Flyvbjerg, Bruzelius, & Rothengatter, 2003), who affirms that at the same time as many more and much larger infrastructure projects are being proposed and built around the world, it is becoming clear that many such projects have strikingly poor performance records in terms of economy, environment and public support. Cost overruns and lower-than-predicted revenues frequently place project viability at risk and redefine projects that were initially promoted as effective vehicles to economic growth as possible obstacles to such growth. The success of these projects is so important to their sponsors that firms and even governments can collapse when they fail. Regarding cost overruns there is no indication that the calamity identified by the Major Projects Association is limited to the public sector. Private sector cost overruns are also common.

For environmental and social effects of projects, one similarly finds that such effects often have not been taken into account during project development, or they have been severely miscalculated. In Scandinavia, promoters of the Oresund and Great Belt links at first tried to ignore or downplay environmental issues, but were eventually forced by environmental groups and public protest to accept such issues on the decision making agenda. In Germany, high-speed rail projects have been criticized for not considering environmental disruption. Dams are routinely criticized for the same thing. However, environmental problems that are not taken into account during project preparation tend to surface during construction and operations; and such problems often destabilize habitats, communities and megaprojects themselves, if not dealt with carefully. Moreover, positive regional development effects, typically much touted by project promoters to gain political acceptance for their projects, repeatedly turn out to be non-measurable, insignificant or even negative.

In consequence, the cost-benefit analyses, financial analyses and environmental and social impact statements that are routinely carried out as part of megaproject preparation are called

into question, criticized and denounced more often and more dramatically than analyses in any other professional field we know.

Finally, project promoters often avoid and violate established practices of good governance, transparency and participation in political and administrative decision making, either out of ignorance or because they see such practices as counterproductive to getting projects started.

(Flyvbjerg, Bruzelius, & Rothengatter, 2003) also defined a megaproject paradox, which consists in the irony that more and more megaprojects are built despite the poor performance record of many projects.

Most appraisals of megaprojects assume, or pretend to assume, that infrastructure policies and projects exist in a predictable world of cause and effect where things go according to plan. In reality, the world of megaproject preparation and implementation is a highly risky one where things happen only with a certain probability and rarely turn out as originally intended.

As a conclusion, it can be said that megaprojects, due to their size, budget and scope, have an enormous impact on their stakeholders, that is why during the last years, has arose a great concern about the analysis and study of the uncertainty in megaprojects and how can be possible to improve the forecasting methods to prevent or be prepared for the possible bias that can be present during the project realization.

As megaprojects can affect many people, such as government, investors, community, among others, it is possible to have obstacles since the conception of the idea. The money that is needed and the impacts that can be generated turn the people against it, which can lead to a false forecasting process made of lies about the projected costs, benefits and risks. And this is how during the project realization, the problems get bigger as it evidences cost overruns, benefit shortfalls and mismanagement of risk that jeopardizes the completion of the project.

This is why the control and communication on the stages of projects and megaprojects is so important and the management of the stakeholders is crucial, so can be known the risks and benefits for each of them, as far as for the project and the stakeholders themselves.

4.1.1. Characteristics

Megaprojects are unique construction projects known for their complexity, vast size, expensive cost, and long time frame compared to conventional construction projects. They are known for their poor performance in terms of cost and time where the cost overrun could exceed initial project cost and the time extension would extend for years. There are different specialized megaprojects such as power plants. According to (Haidar & Ellis Jr, 2010) report, nuclear power plants are the most expensive to build and lead to enormous cost overruns. The cost overruns of nuclear power plants built between years 1966 to 1977 averaged to 200%.

The size of a project is always defined in terms of such variables as the scale of investment, the number of project staff, the social impact of the project, and the complexity of the project. (Federal Highway Administration, 2007) defines megaprojects as major infrastructure projects that cost more than \$500 million dollars, or as projects of a significant cost that attract a high

level of public attention or political interest because of substantial direct and indirect impacts on the community, environment and budgets.

Given their infamous reputation, megaprojects have attracted researchers' attention from different academic areas. They have been studied from many points of views especially the public planning, urban decision making, economic analysis, and social impact point of views. The most notable researcher in the topic is Bent Flyvbjerg, dealing with cost overrun in mega projects and according to him in (Flyvberg, 2007), megaprojects have the following characteristics:

Such projects are inherently risky due to long planning horizons and complex interfaces between the project and its context, and between different parts of the project.

- ✓ Decision making, policy, and planning are often multi-actor (stakeholders) processes with conflicting interests.
- ✓ Often the project scope or ambition level change significantly over time.
- ✓ Statistical evidence shows that such unplanned events are often unaccounted for, leaving budget and other contingencies sorely inadequate.
- ✓ As a consequence, misinformation about costs, benefits, and risks is the norm.
- ✓ The result is cost overruns and/or benefit shortfalls with a majority of projects.

(Flyvberg, 2007) also identifies different types of explanation:

- a. *Technical explanations*: explain inaccuracy in term of unreliable or outdated data and the use of inappropriate forecasting models , honest mistakes, lack of experience on the part of forecasters.
- b. *Psychological explanations*: Planners and project promoters make decisions based on delusional optimism rather than on a rational weighting of gains, losses, and probabilities.
- c. *Political explanations*: Forecasters and managers deliberately and strategically overestimate benefits and underestimate costs in order to increase the likelihood of the projects. Planners and promoters purposely spin scenarios of success and gloss over the potential for failure.

(Flyvbjerg, Bruzelius, & Rothengatter, 2003) set forth four key instruments of accountability for which they suggest rearrangement of the project development process:

- ✓ Transparency, focusing on public scrutiny of all information, active (and early) participation from stakeholder groups, and independent peer reviews;
- ✓ Performance Specifications, setting forth all requirements relating to policy objectives before approving the technical solution (bridge, tunnel, etc.), and including environmental outcomes and safety issues, not just financial feasibility;
- ✓ Regulatory Regime, formulating the rules for financial and economic performance, necessary complementary investments, and methods for dealing with risks (including political risk, in a prospective fashion); and
- ✓ Risk Capital, emphasizing that projects should be structured so that private capital is put at risk (without sovereign guarantee), for at least one-third of total capital needs. Private

capital at risk is intended to shift risks to those better able to understand and protect against them, and to obtain more realistic assessment of those risks from the private sector.

They also argued two basic types of accountability that define liberal democracies: (1) public sector accountability through transparency and public control, and (2) private sector accountability via competition and market forces. Both types of accountability may be effective tools to curb planners' misrepresentation in forecasting and to promote a culture which acknowledges and deals effectively with risk.

In order to achieve accountability through transparency and public control, the following would be required as practices embedded in the relevant institutions.

- ✓ National-level government should not offer discretionary grants, but instead "block grants," to local infrastructure agencies. Discretionary grants create perverse incentives. Block grants ensure that every dollar spent by a local authority on one type of infrastructure reduces their ability to fund another.
- ✓ Forecasts should be made subject to independent due diligence.
- ✓ Forecasts should be benchmarked against comparable forecasts, for instance using reference class forecasting as described in the previous section.
- ✓ Forecasts, due diligence, and benchmarking should be made available to the public as they are produced, including all relevant documentation.
- ✓ Public hearings, citizen juries, and the like should be organized to allow stakeholders and civil society to voice criticism and support of forecasts.
- ✓ Scientific and professional conferences should be organized where forecasters would present and defend their forecasts in the face of colleagues' scrutiny and criticism.
- ✓ Projects with inflated benefit-cost ratios should be reconsidered and stopped if recalculated costs and benefits do not warrant implementation. Projects with realistic estimates of benefits and costs should be rewarded.
- ✓ Professional and occasionally even criminal penalties should be enforced for planners and forecasters who consistently and foreseeably produce deceptive forecasts.

To achieve accountability in forecasting via competition and market forces, the following would be required, again as practices that are both embedded in and enforced by the relevant institutions:

- ✓ The decision to go ahead with a project should, where at all possible, be made contingent on the willingness of private financiers to participate without a sovereign guarantee for at least one third of the total capital needs. The objective is to protect the taxpayer from risk and create pressures on performance.
- ✓ Forecasters and their organizations should share financial responsibility for covering cost overruns and benefit shortfalls resulting from misrepresentation and bias in forecasting.
- ✓ The participation of risk capital should not mean that government reduces control of the project. On the contrary, it means that government can more effectively play the role it should be playing, namely keeping the project at arm's length as the ordinary citizen's guarantor for safety, environment, risk, and a proper use of public funds.

In this section were examined the causes and possible cures of megaproject's overruns. Flyvberg's focus is on cost overruns in megaprojects, benefit shortfalls, regional and economic growth effects, environmental impacts and risks, forecasting, optimism bias, strategic misrepresentation, risk assessment and management, accountability, democracy, and new governance structures for megaprojects in city and regional development. Adequate system integration should be applied in order to improve project performance through the application of the correct work practices, which are based in transparency, control and responsibility over the forecasts results related to budget, time and risks. It is necessary to involve the stakeholders so that they know the risks and benefits they are exposed to.

4.1.2. Examples of megaprojects

Some examples of megaprojects are shown in this section, reported by (Haidar & Ellis Jr, 2010) so it is possible to observe the dimension of the construction in terms of size, scope, budget and overruns.

The Denver Airport Megaproject

The Denver International Airport is one of the largest airports in the world. It was initially planned to cost 2.5 billion dollars in 1990, but that figure grew to a 5.3 billion dollars in 1995. The airport was built on a 53 square mile construction site and was composed 2 terminals, 3 airside concourses, 6 runways, 88 air carrier gates, and 32 commuter gates. The concourses were connected to the terminals through a 6,200 ft long tunnel system. The design team was composed of 61 designers of different specializations. Furthermore, there were 134 construction contracts and about 2000 subcontracts agreed to by the airport officials.

Boston's Central Artery/Tunnel Project

The Boston Artery/Tunnel is the largest and most expensive public works project ever taken in the United States. It is a 7.8 mile system of bridges and underground highways and ramps. It includes the world's widest cable-stayed bridge and a deep underwater connection. It imposed several engineering challenges. The construction site was a dense urban area so traffic was to be kept flowing. The soil was to be stabilized to ensure minimal damages to existing structures.

Nuclear Power Plants

Power plants in are in general very large in scale. According to (Haidar & Ellis Jr, 2010) report, a resource loaded schedule is estimated to be a five-year schedule with site preparation taking 12 to 18months, construction (first concrete to fuel loading) taking 36 to 42 months, and commissioning and testing taking 6 to 12 months. The project complexity is so great that the number of contractors and suppliers who can undergo such projects is limited. According to the Department of Energy nuclear power plant assessment in (Haidar & Ellis Jr, 2010), constructing a nuclear power plant needs highly-skilled and highly-valued qualified construction workers and specialized workers such as boilermakers, pipefitters, electricians, and ironworkers.

To summarize, the word "Mega" also implies the size of the task involved in developing, planning, and managing projects of this magnitude. Substantial benefit shortfalls trouble many

megaprojects. Finally, regional development effects and environmental impacts often turn out very differently from what proponents promised. Cost overruns combined with benefit shortfalls spell trouble. But an interesting paradox exists for megaprojects: More and bigger megaprojects are being planned and built despite their poor performance record in terms of costs and benefits, and more controls and techniques should be implemented in order to overcome the possible bias and problems that appear during the project development process.

4.2. Stakeholders in Megaprojects

4.2.1. Difference between stakeholders in construction projects and megaprojects

As described above, megaprojects have a great impact due to the importance given by the high budgets, long duration and the high number of stakeholders involved. The higher the number of stakeholders is, the higher the complexity of the project. (Zhai, Xin, & Cheng, 2009)

In construction projects stakeholder have the same importance than in megaprojects, however the fact that a higher amount of money is involved as well as the number of stakeholders, makes a lot more interests to fulfill all along the project . In megaprojects interests, expectation, and demands increase making it very important to give the proper attention to the stakeholders in order to end up with a successful project.(Bourne & Walter, 2005)

As an example, public interests in megaprojects can be more difficult to handle. While in a construction of a bridge or a building only the neighborhood is involved as a stake holder, in a construction of an airport, all the people that is affected by noise, roads closed, resource taken etc, have to be involved and that could be 20% of the city population. In other words, the radius of public repercussion increases tremendously between a construction project and a megaproject.

Another example can be the difference between a construction of a bridge and of a tunnel in terms of shareholders involved. While in the construction of the bridge shareholders can be just a private company and a bank, the shareholders for the construction of the tunnel may involve, more than one private company, more than one bank, the government and a local firm. The strategy to manage the two different groups of stakeholders would be completely different in both cases.

4.2.2. What is the importance of analyzing Stake holders in Megaprojects?

The stakeholders are the providers of the resources of the whole project. They are involved in all the processes that are needed to be able to accomplish the scope defined and are the ones that decided if the project was successful or not. Due to these important facts stakeholders should be involved and identified since the beginning of the project, and have to be taken into account during the whole duration of the project.

Stakeholders are in charge of making the decisions for the project to progress. Due to the magnitude of budget and resources, each decision taken in a megaproject can change drastically its direction (A.Di Giulio G. Locatelli M.Mancini, 2011) Because of this fact that is important for the right stakeholders to take the right decisions in the right moment. For this

reason, being able to identify them, understand their needs and their individual goals will make it easier to organize and handle the right team to develop the desired project.

As said before, stakeholders should be identified before the project starts and monitored them all along the project. At the same time the project manager should be aware that there will be other stakeholder that will appear while the progress of the project and has to be able to identify them quickly so they become a tool and not a obstacle for scope of the project.

4.3. Nuclear plants as a Megaproject

4.3.1. Stakeholders in nuclear plants

A nuclear plant is a megaprojects characterized by it environmental impact and high amount of stakeholder involved. Nuclear projects are unique and have a high complexity of technical and technological processes. Since all of these kind of projects are different is difficult to have previous ones that entirely help with their experience. Due to this fact is important to carefully identify, from the beginning stakeholders and processes to minimize mistakes and bad decisions that can end up in the delay of the project and as a consequence in an increase in costs.

Nuclear energy became an alternative for electricity production, since the 1950. It became stronger in the late 1970 after the fuel crisis and nuclear plants started to be constructed ever since becoming a strong alternative by the days.

Nowadays nuclear power provides about 6% of the world's energy and 13–14% of the world's electricity(World Nuclear News, Another drop in nuclear generation, 2010) . According to the European Nuclear Society, until August 7 of 2011 in 30 countries 432 nuclear power plant units with an installed electric net capacity of about 366 GW are in operation, and 65 plants with an installed capacity of 63 GW are in 16 countries under construction.

The following are the countries that have nuclear plants in the whole world:

Country	In Operation		Under Construction	
	Number	Electr. net output	Number	Electr. net output
		% MW		%MW
Argentina	2	0,25%	1	1%
Armenia	1	0,10%	-	0%
Belgium	7	1,58%	-	0%
Brazil	2	0,50%	1	2%
Bulgaria	2	0,51%	2	3%
Canada	18	3,35%	-	0%
China		0,00%		0%
		0,00%		0%
Mainland	13	2,68%	27	43%
		0,00%		0%

Taiwan	6	1,33%	2	4%
		0,00%		0%
Czech Republic	6	0,99%	-	0%
Finland	4	0,72%	1	3%
France	58	16,84%	1	3%
Germany	17	5,46%	-	0%
Hungary	4	0,50%	-	0%
India	20	1,17%	5	6%
Iran	-	-	1	1%
Japan	54	12,49%	2	4%
Korea, Republic	21	4,98%	5	9%
Mexico	2	0,35%	-	0%
Netherlands	1	0,13%	-	0%
Pakistan	2	0,11%	1	0%
Romania	2	0,35%	-	0%
Russian Federation	32	6,05%	11	15%
Slovakian Republic	4	0,48%	2	1%
Slovenia	1	0,18%	-	0%
South Africa	2	0,48%	-	0%
Spain	8	2,00%	-	0%
Sweden	10	2,48%	-	0%
Switzerland	5	0,86%	-	0%
Taiwan	6	1,33%	2	4%
Ukraine	15	3,50%	2	3%
United Kingdom	19	2,70%	-	0%
USA	104	26,87%	1	2%
Total	442	100,00%	65	100%

Table 4-1 Nuclear Plants per Country(European Nuclear Society, 2011)

The construction of a nuclear plant demands a high initial investment, long planning horizons and operational life and an important management of disposals and radioactive waste. These characteristics make this project very complex one, and due to its environmental impact, it involves a high number of stakeholders to be able to carry it out.

The environmental impact has generated the need to have entities that create, control and monitor specific regulations for the plants to work properly without becoming a threat of the society. At the same time other entities are created to continue the research on the production of energy to make it less aggressive to the environment. The following are some of the organizations created to regulate, maintain and improve nuclear energy production. These as well become important stakeholder to be aware off.

1. **American Nuclear Society ANS (United States):** Is an organization that recognizes the importance of the nuclear science and technology and promotes its research, develops nuclear consensus standards, and provides knowledge to society through its publications.
2. **World Nuclear Association WNA (International):** is the international organization that promotes nuclear energy and supports the many companies that comprise the global nuclear industry. Created by the nuclear industry, the WNA represents its needs and opinions, and shows to the world its performance, and new projects or researches.
3. **International Atomic Energy Agency IAEA (International):** The IAEA is an independent intergovernmental organization, in the United Nations family that serves as the global local point of nuclear cooperation. Develops nuclear safety standards and assists its Member States in the using of nuclear science and technology for peaceful purposes, protecting the human health and environment. Also verifies through inspections that States comply with the Non-Proliferation treaty that states the use of nuclear knowledge for peaceful use only.

These 3 entities represent the different type of organizations that can be found in the nuclear industry. There are those entities in charge of the research for more efficient and safer processes as the ANS. There are the others that support and promote the industry which will always be in favor and will promote the best image to the world as the WNA. Finally there are the entities as the IAEA that develops safety standards, policies and best practices to guarantee the protection of the human health and the environment.

The organizations mentioned above are just a part of the stakeholders involved in the nuclear plant megaproject. The following are some examples of the stakeholders proposed by the International Atomic Energy Agency that can be present when the decision of constructing a nuclear plant is taken:

1. **Facility owner:** is the operator (sometimes also the constructor) of the Nuclear Plant. Is the one with the technical knowledge and the know-how to be able to run a nuclear facility.
2. **Funding entities:** Are individual organizations or authorities that support the nuclear energy industry and give funds. This includes the government and ratepayers. These stakeholders are demanding in terms of results, they want to see where the money is going.
3. **Operations staff:** Is the workforce that operates the Nuclear Plant facility. These stakeholders have high responsibility and have strong relationship with the unions managers and the local community.
4. **Government:** Includes the national government and governmental bodies having an essential role in ensuring the existence of an appropriate legal framework and establishing relevant infrastructures. Governments need to be assured that the project will not embarrass them, that the project is in line with the agreed policy and is affordable, all of which may change during the course of the project. (International Atomic Energy Agency, 2009).
5. **Regulators:** Organizations in charge of developing the rules and policies need to develop a project according to the wellbeing of the community and the environment. They are also in charge of monitoring that the facilities and their operation are according to them.

6. **Local authorities:** Comprise authorities on the municipality level, as well as regional and provincial authorities, which issue specific permits and control some activities on the site. (International Atomic Energy Agency, 2009)
7. **Elected officials:** Elected officials are all politically elected members of city councils, regional assemblies and national parliaments. Elected officials play a very important role at the local level, as they typically represent the most affected constituencies. They are also charged with making decisions in the overall best interests of their jurisdiction. (International Atomic Energy Agency, 2009)
8. **Trade unions:** Groups that represent the needs and wants of the workforce in the nuclear plants. When these unions come together, represent a very dangerous stakeholder for the nuclear industry.
9. **Waste managers:** In charge of collecting, selecting disposing and storing the wastes after the process of energy production is finish. These stakeholders are very important actors in the environmental matters that cause high controversy in this industry.
10. **Local enterprises:** Enterprises that can benefit from the facility or that are threatened by it.
11. **International parties:** International organizations, institutions or groups of people with which the country has any kind of treaty or that make part of the development of R&D in the specific country.
12. **Contractors:** Those companies that are involved in the construction of the nuclear facilities.
13. **Decommissioning managers:** Are the ones in charge of the decommission process and represent very important stakeholder in the last part of the nuclear plant lifecycle.
14. **Nuclear industry:** It covers utilities, manufacturers of components, designers, and architect/ engineers, who can benefit from the nuclear plant project.
15. **Local communities:** Local habitants that are affected directly by the construction of the nuclear plant in the surroundings.
16. **General public:** The general public considered is the public and individuals beyond the local communities close to the facility. The general public is an heterogeneous group of stakeholders to the nuclear plant project, having a wide range of interest in the matter.
17. **Neighboring countries, tribal nations:** Near countries that can be affected directly or indirectly by the developing of nuclear plants in a specific country.
18. **Researchers and scientists:** These stakeholders are in charge of developing the technology and the procedures to maintain and improve the nuclear energy use and production.
19. **Media:** Are all the means that publishes news about the process of developing the nuclear plants through all their lifecycle. This stakeholder can be an opponent and become a supporter, depending on the situation.
20. **Pro and anti/nuclear groups:** Groups that have chosen a side and define themselves as opponents or supporters of the nuclear energy use, and work for it.

These stakeholders can be clustered in with different categorizations to help understand its role in the construction of a nuclear plant project. In this case a 4 categorization cluster was chosen as proposed by the International Atomic energy Agency. The clusters are Economic,

Environmental, Social and Technical and the stakeholders belonging to each one are shown in the following table.

ECONOMICAL	SOCIAL
<ul style="list-style-type: none"> ▪ Facility Owner ▪ Funding Entities ▪ Government ▪ Local Authorities ▪ Elected Officials ▪ Trade Unions ▪ Waste Manager ▪ Decommissioning manager ▪ Nuclear Industry 	<ul style="list-style-type: none"> ▪ General Public ▪ Local Communities ▪ Media
ENVIROMENTAL	TECHNICAL
<ul style="list-style-type: none"> ▪ Regulators (environmental) ▪ Neighboring countries ▪ Pressure Groups 	<ul style="list-style-type: none"> ▪ Regulators (Nuclear safety) ▪ Researches and Scientists ▪ Contractors ▪ Operation Staff ▪ Waste Manager

Tabla 4.3-1 Stakeholders' Clusters (International Atomic Energy Agency, 2009)

Each of these stakeholders is important in each step of the construction and operation of a nuclear plant. Depending on the country, the political system, and the kind of nuclear plant, the importance of each stakeholder changes. That is why, is very important to identify since de beginning the different conditions around the construction of the project to identify the strategy to manage the stakeholders.

In the next chapter, the description of the stakeholders of nuclear plants megaproject in different countries is made to understand how this important group changes depending on the conditions where the project is developed.

CHAPTER 5: ANALYSIS BY COUNTRY

After understanding the importance of stakeholders in nuclear megaprojects, this chapter will focus on the analysis of the stakeholders of the nuclear industry for France, Finland, UK, USA, Japan and Korea. The analysis will be made according the Power, Legitimacy, Urgency theory explained in chapter 1. Finally a comparison will be made between the six countries, to be able to understand why and how are the stakeholders similar or different and how their stakeholder organization can become a model for countries that would want to develop a nuclear industry in the future.

5. ANALYSIS BY COUNTRY

In this chapter, there will be performed an analysis of the Nuclear Industry beginning with a general review of the world and then going deeper in the industry of countries of France, Finland, USA, Korea, UK and Japan, that are an example for the nuclear industry. These countries are pioneers in the development of nuclear energy each one having a different approach depending on the country's conditions. Consequently, the stakeholder organization is different and are the key to understand how does the nuclear energy projects work in each country.

According to the World Nuclear Industry Status Report 2010-2011 (Schneider, Froggatt, & Thomas, 2011), there have been two major waves of grid connections since the beginning of the commercial nuclear age in the mid-1950s. As it is shown in the Figure 5-1, a first wave peaked in 1974, with 26 reactor startups. The second wave occurred in 1984 and 1985, reaching the historical record of 33 grid connections in each year. By the end of the 1980s, the uninterrupted net increase of operating units had ceased, and in 1990 for the first time the number of reactor shutdowns outweighed the number of startups.

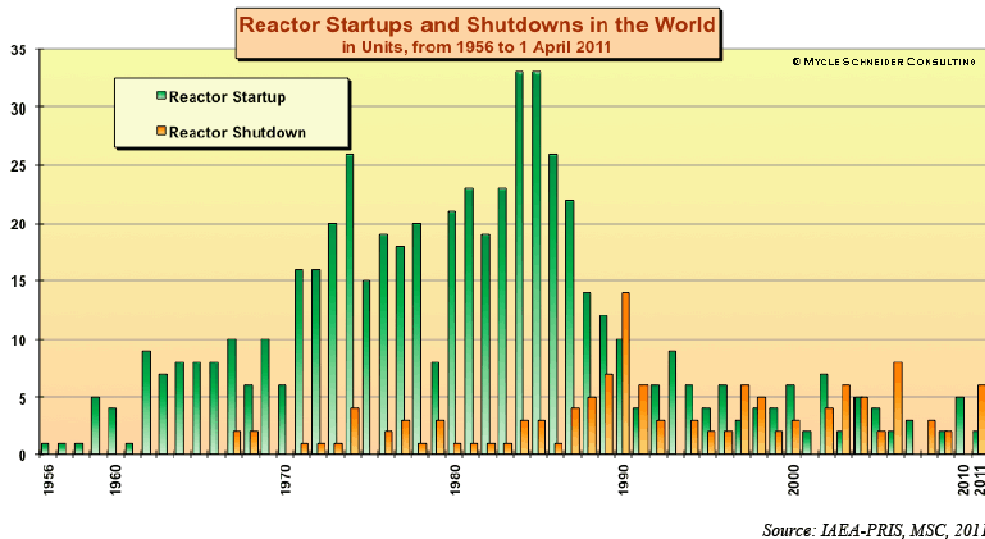


Figure 5-1 Reactors Startups and Shutdowns in the World (Schneider, Froggatt, & Thomas, 2011)

The Nuclear Industry Status Report 2010-2011 (Schneider, Froggatt, & Thomas, 2011) shows that as of April 1, 2011, a total of 437 nuclear reactors were operating in 30 countries, down seven from the historical maximum of 444 in 2002. Since then, 25 units were started up and 32 were connected from the grid, including six units at the Fukushima plant in Japan. These are very conservative numbers since it is unlikely that the seven units that have been “provisionally” shut down in Germany following the Fukushima events will ever start up again.

The use of nuclear energy has been limited to a small number of countries, with only 31 countries, or 16 percent of the 192 members of the United Nations, operating nuclear power plants in 2009 as it can be seen in the Figure 5-2. One country, Lithuania, shut down its last

reactor in 2009, so that currently only 30 countries operate nuclear power plants. Half of the world's nuclear countries are located in the European Union (EU), and they account for nearly half of the world's nuclear production. France alone generates close to half of the EU's nuclear production. As previously noted, there was no growth in nuclear electricity generation in 2009. The 2,558 TWh of nuclear energy produced corresponded to about 13 percent of the world's commercial electricity.

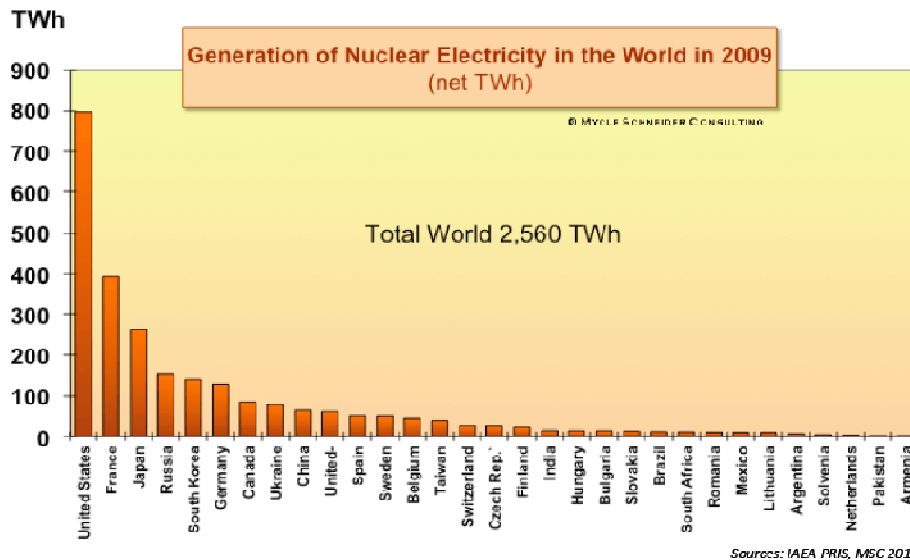


Figure 5-2 Generation on Nuclear Electricity in the World in 2009 (Schneider, Froggatt, & Thomas, 2011)

5.1. Overview of Current New Build

The report (Schneider, Froggatt, & Thomas, 2011) also confirms how currently, 14 countries are building nuclear power plants, and most of the sites are accumulating substantial and costly delays. As of April 1, 2011, the IAEA listed 64 reactors as “under construction,” nine more than at the end of 2009. This compares with 120 units under construction at the end of 1987, and a peak of 233 such units, totaling more than 200 GW, in 1979, revealed in the Figure 5-3. The year 2004, with 26 units under construction, marked a record low for construction since the beginning of the nuclear age in the 1950s.

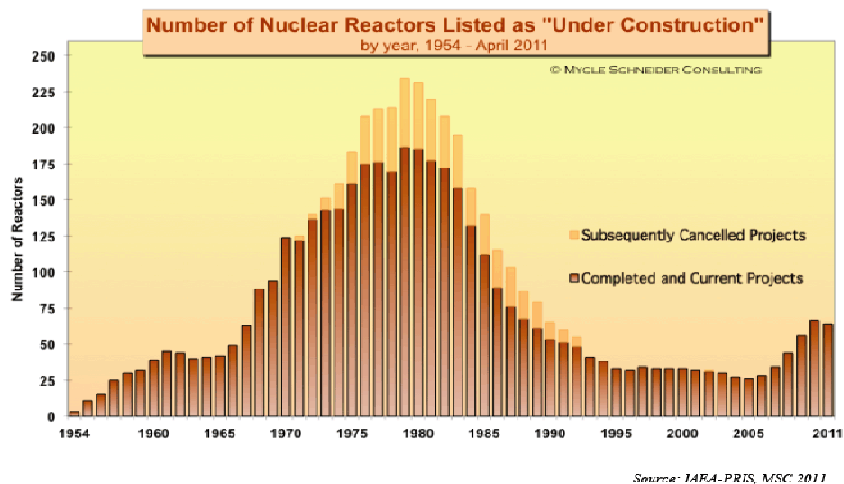


Figure 5-3 Nuclear Reactors Listed “ Under construction” (Schneider, Froggatt, & Thomas, 2011)

The geographical distribution of nuclear power plant projects is concentrated in Asia and Eastern Europe, extending a trend from earlier years. Between 2009 and April 1, 2011, a total of nine units were started up, all in these two regions.

5.2. France

5.2.1. Country’s Background on Nuclear Industry

As it is said by the Nuclear Industry Status Report 2010-2011 (Schneider, Froggatt, & Thomas, 2011), France is the worldwide exception in the nuclear sector. Thirty-seven years ago, the government launched the world’s largest public nuclear power program as a response to the so-called oil crisis in 1973. However, less than 12 percent of France’s oil consumption that year was used for power generation. More than three decades later, France has reduced overall fossil fuel consumption (oil, gas, coal) by less than 10 percent and the oil consumption in the transport sector has increased far more than the annual consumption substituted by nuclear energy in the electricity sector.

France's decision to launch a large nuclear program dates back to 1973 and the events in the Middle East that they refer to as the "oil shock." The quadrupling of the price of oil by OPEC nations was indeed a shock for France because at that time most of its electricity came from oil burning plants. France had and still has very few natural energy resources. It has no oil, no gas and her coal resources are very poor and virtually exhausted. French policy makers saw only one way for France to achieve energy independence: nuclear energy, a source of energy so compact that a few pounds of fissionable uranium is all the fuel needed to run a big city for a year. Plans were drawn up to introduce the most comprehensive national nuclear energy program in history. Over the next 15 years France installed 56 nuclear reactors, satisfying its power needs and even exporting electricity to other European countries.

How was France able to get its people to accept nuclear power? What is about French culture and politics that allowed them to succeed where most other countries have failed?

Claude Mandil, the General Director for Energy and Raw Materials at the Ministry of Industry, cites at least three reasons. First, he says, the French are an independent people. The thought of being dependent for energy on a volatile region of the world such as the Middle East disturbed many French people. Citizens quickly accepted that nuclear might be a necessity. A popular French riposte to the question of why they have so much nuclear energy is "no oil, no gas, no coal, no choice." Second, Mandil cites cultural factors. France has a tradition of large, centrally managed technological projects. And, he says, they are popular. "French people like large projects. They like nuclear for the same reasons they like high speed trains and supersonic jets." (Palfreman, 2011).

In addition to this, (The World Nuclear Association, Nuclear Power in France, 2011) stated in its report the following

- France derives over 75% of its electricity from nuclear energy. This is due to a long-standing policy based on energy security.

- France is the world's largest net exporter of electricity due to its very low cost of generation, and gains over EUR 3 billion per year from this.
- France has been very active in developing nuclear technology. Reactors and fuel products and services are a major export.
- It is building its first Generation III reactor and planning a second.
- About 17% of France's electricity is from recycled nuclear fuel.

In 2008 French electricity generation was 575 billion kWh gross, and consumption was about 462 billion kWh - 6800 kWh per person. Over the last decade France has exported up to 70 billion kWh net each year and EdF expects exports to continue at 65-70 TWh/yr, principally to Germany, Italy, and UK, but also to Belgium, Spain, and Switzerland. Imports are typically about 10 TWh/yr.

As a result of the 1974 decision, France now claims a substantial level of energy independence and almost the lowest cost electricity in Europe. It also has an extremely low level of CO2 emissions per capita from electricity generation, since over 90% of its electricity is nuclear or hydro.

In the Figure 5-4 it can be appreciated the nuclear plant distribution along the country

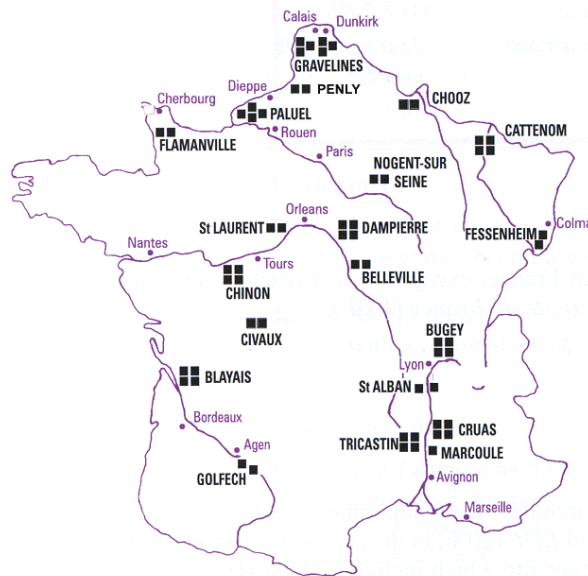


Figure 5-4 Nuclear Plant distribution in France (The World Nuclear Association, Nuclear Power in France, 2011)

5.2.2. Description of Main Actors

In the case of France, its nuclear power industry has been called "a success story" that has put the nation "ahead of the world" in terms of providing cheap, CO2-free energy, as it was described in the Study France's Nuclear-Power Success (Weaver, 2008).

Before World War II, France had been heavily involved in nuclear research through the work of the Joliot-Curies. In 1945 the Provisional Government of the French Republic (GPRF) created

the Commissariat à l'Énergie Atomique (CEA) governmental agency, its mandate is to conduct fundamental and applied research into many areas, including the design of nuclear reactors, the manufacturing of integrated circuits, the use of radionuclides for medical treatments, seismology and tsunami propagation, and the safety of computerized systems.

In 2001, Areva, was created by the merger of CEA Industry, Framatome and Cogema (now Areva NC). Its main shareholder is the French owned company CEA, but the German Government also holds, through Siemens, 34% of the shares of Areva's subsidiary, Areva NP, in charge of building the EPR (third-generation nuclear reactor).

State

French Government: The government controls directly the Authority (ASN), the buyer/utility (EDF), and the most important contractor (AREVA). It owns the CEA and the 85% of EDF shares. Moreover, many other important contractors are French, among them: Alstom and Bouygues. France, as stated by President Sarkozy, aims at becoming a leading exporter of atomic energy. (The World Nuclear Association, Nuclear Power in France, 2011)

The French Government is the entity who owned the two most important players (CEA and EDF) and it was the one who decided to start with the nuclear program since 1973. It has the **power** as the NPP projects are owned by it. If it has a claim, it would required immediate attention, giving also the attribute of **urgency**, as for example happened After France's failure to win the contract for four nuclear power plants in the United Arab Emirates, and President Sarkozy ordered a report on the French nuclear industry on 27 July 2010 (Nuclear Information and Resource Service, 2010). And it has the **legitimacy** as it watches for the safety and health of the people and the country.

Regulators

ASN: Autorité de sûreté nucléaire. French Nuclear Safety Authority is the administrative authority in charge, on behalf of the State, to regulate the nuclear safety and radiation protection in order to protect the workers, patients, the public and the environment from the risks involved in nuclear activities. (ASN, 2011)

As the ASN is the French Nuclear Safety Authority it has the **power** and **urgency** which can be represented in the episode of 2008 when the ASN ordered a construction stop at the EPR Flamaville site for a few weeks in order to ensure improved documentation and implementation of quality standards for concrete, welding, and steel framing (Grubler, 2010). It has also **legitimacy** as it is authorized to execute its requirements and ask for the appropriate specifications to the utilities as in the case explained before.

CEA: (Commissariat à l'énergie atomique et aux énergies – Atomic and Alternative Energies Commission) is a French “public establishment related to industrial and commercial activities” whose mission is to develop all applications of nuclear power, both civilian and military. A leader in research, development and innovation, the CEA mission statement has two main objectives: To become the leading technological research organization in Europe and to ensure that the nuclear deterrent remains effective in the future. CEA owns 79% of AREVA SA shares.(CEA, 2011).

As it was mentioned by (Grubler, 2010) following the (Jasper, 1992) perceptive analogy from Greek mythology the main groups of actors in a nuclear scale-up are gods (governments), “titans” (large industries and utilities), and finally “mortals” (the general public). In the particular case of the CEA, it possesses the **power** as it is the state nuclear R&D organization, and controls the now AREVA NC, which is also one of the most important suppliers in the Nuclear Plant construction chain. The CEA paired up with the EDF on reducing uncertainty in orders and above all in safety regulations, assuring a consistent technology strategy (e.g., in the increase of unit scales), as well as communicating within the étatist system the perceived economic advantages and implementation success in largely internal documents. Being so important and owned by the state, it can be said that it has **urgency** as it is the owner of important processes during the construction of the plant, such as the design of the reactor and the waste management.

Utility

EDF: Électricité de France is the main French Utility. The French government owns 85% of its shares. EDF operates 59 nuclear reactors with the total capacity of over 63 GWe. EDF acts as the architect–engineer in the project. In nuclear power projects, the role of an architect–engineer is highly similar to that of a main contractor. It is in charge of managing the project at the highest level, defining technical reference standards, allocating, managing and overseeing, contracts, and interfacing with the safety regulator (ASN). Compared to the role of a main contractor, the role of the architect–engineer emphasizes the overseeing of planning and design while a considerable degree of responsibility for construction is carried by other project actors.

It has the same attributes as the CEA since they are partners in the construction of Nuclear Plants in France. Both are owned by the government and it possesses the engineering resources, personnel, and know-how. As it is the utility, **power** is an attribute since it manages the resources, it has the **urgency** of being on time and below the budget and the **legitimacy** as it fulfilled all the requirements, got all the permissions and it is legally authorized to perform its job.

Suppliers

AREVA: it is a French industrial group owned more than 90% by the French State. It is divided into three main divisions which cover all the aspects of generating electricity with nuclear technology: AREVA NP (Nuclear Power): in charge of developing and building nuclear reactors; AREVA NC (Nuclear Cycle): covers the entire nuclear fuel cycle, from mining to waste disposal; and AREVA T&D (Transmission and Distribution): power transmission and distribution. (AREVA, 2011).

Areva constitutes the major supplier of the project, which gives the attribute of **power** while it has key resources for the construction of the NPP (Reactor, Fuel cycle, Nuclear power, transmission and distribution). It has **urgency** since it needs to compete with other suppliers to be picked as the main supplier.

Alstom: it is a large French multinational conglomerate. The company has been awarded a contract of 350 million Euros for all engineering, procurement, construction and commissioning of the complete turbine island (steam turbine, generator, condenser, moisture separator re-heaters and auxiliary equipment). Every EDF reactor already in service uses conventional island equipment supplied by Alstom. The company also provides a variety of services including product retrofitting for nuclear and fossil steam turbines and refurbishment of existing power plants, maintenance as well as servicing under long term agreements for Alstom, GE and Siemens gas turbines. (Alstom, 2011)

Since it is an important supplier, Alstom has the **power** attribute due to the important resources it is in charge of. The company provides components for power generation: boilers, steam turbines and gas turbines, wind turbines, generators, air quality control systems and monitoring and control systems for power plants, as well as related products. In France, Alstom is currently providing the "conventional island" (turbogenerator unit) of Flamanville 3, the third generation of nuclear power plants. And as a supplier it has the **urgency** of being chosen among its competitors.

Bouygues: French construction company, is the main subcontractor of AREVA regarding construction of civil work. In April 2006, Bouygues acquired the French government's 21% stake in Alstom. At 30 June 2011, Bouygues owned 30.74% of Alstom. (Bouygues, 2011).

Bouygues is the main construction company, its power is derived by the fact that it counts with engineering and civil works to conclude the project, but its **power** is minor compared with its owner's which is AREVA. Once AREVA is chosen for the work, Bouygues doesn't have the urgency to compete, since it is certain that the construction contract will be given to it due to the fact that it is owned by Areva.

Other Subcontractors: These are other suppliers controlled by the EDF in charge to support the construction activities during the project.

They support all the construction process but have no power at all since their replacement wouldn't mean a difficulty, but if they see their interests somehow affected, they have the **legitimacy** to express their requests.

5.2.3. Mapping

The main stakeholders are organized according to their relationship with one another. To clarify this, the Figure 5-5 shows a stakeholders' map regarding the control, being the French State on the top since it controls the two more powerful players. At the same time, the ASN is a public institution, but can exert its power over the utility, to the point of stopping the construction if it is required. The utility (EDF) controls the main suppliers AREVA, Alstom and the other constructors, but at the same time, Alstom works as a partner with AREVA. Even though Alstom owns a 37% of Bouygues, they work independently and Bouygues is the main subcontractor of AREVA, so the civil work depends on it.

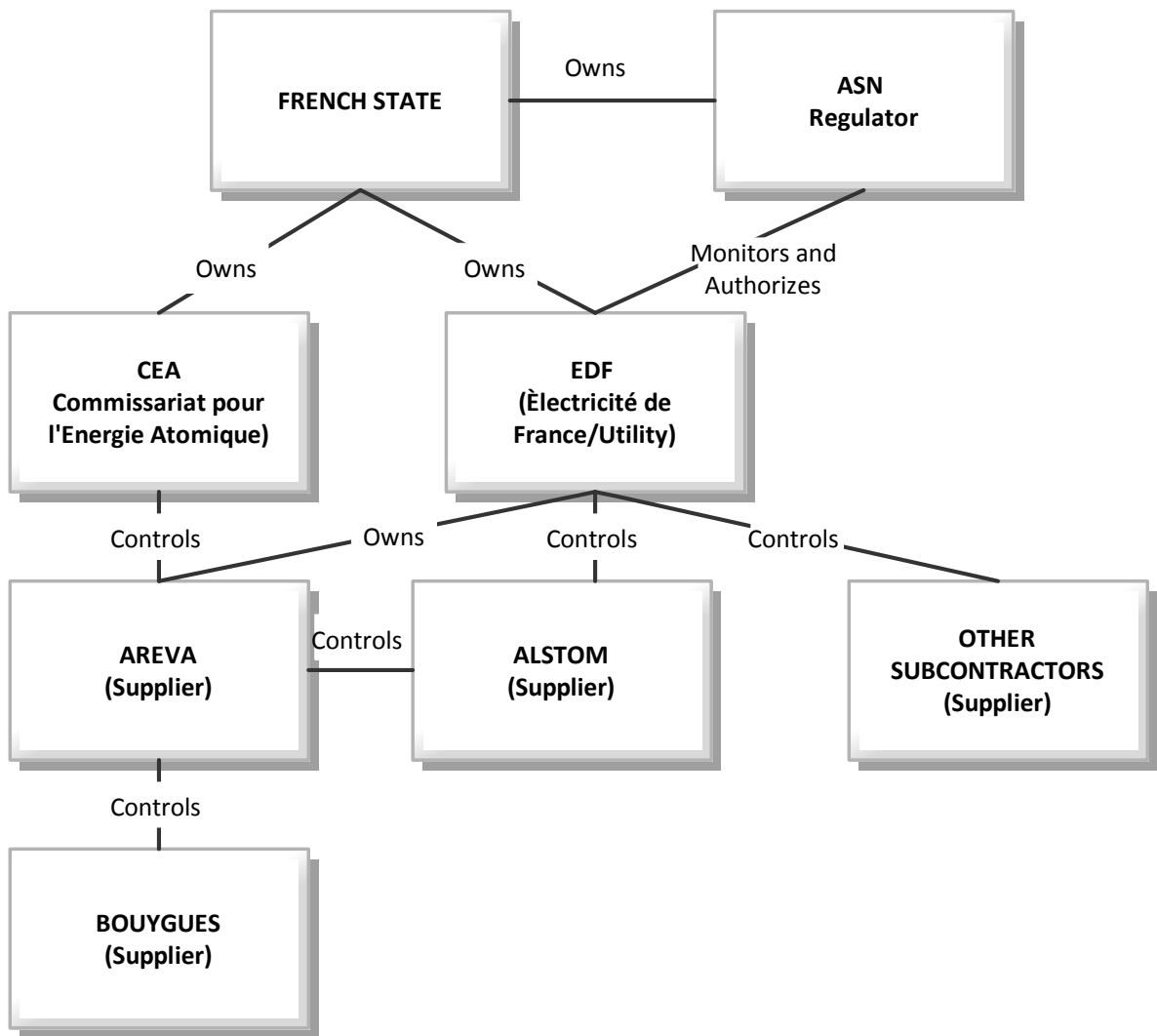


Figure 5-5 Mapping of Stakeholders in France

5.2.4. Identification

The stakeholders named above are the key ones during the construction stage of the Nuclear Plant. They play different roles and have a degree of importance that was classified according to the Power, Legitimacy and Urgency theory. After this attributes identification, the main stakeholders are grouped in seven possible categories, according to the number of components they have, recognizing the importance directly connected to the number of attributes they have.

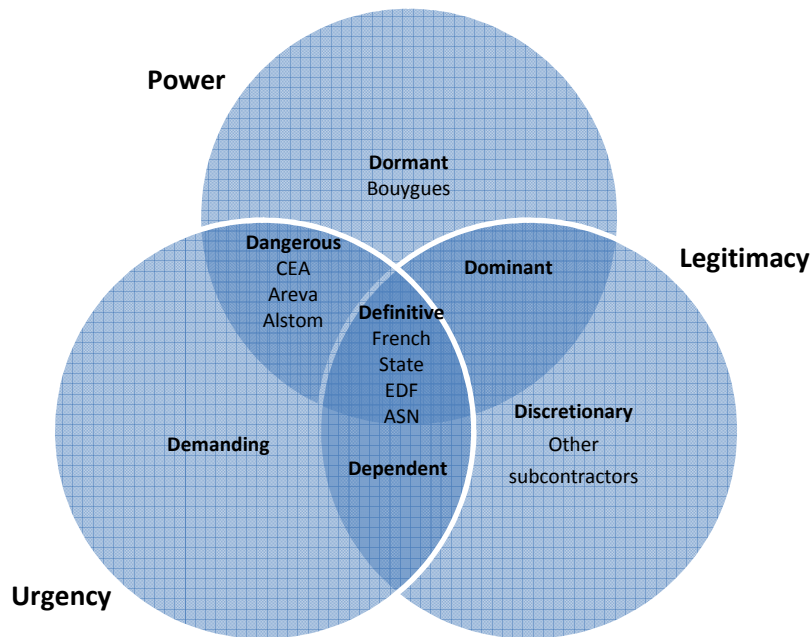


Figure 5-6 France Stakeholders Identification According to the Attributes

As Figure 5-6 shows, the definitive stakeholders for France are the State, the Utility and the authority. Since both, the utility and the authority are government dependant; they all work together as one, becoming the most important stakeholder for the industry in France.

5.3. United Kingdom

5.3.1. Country's Background on Nuclear Industry

British scientists initiated the development of nuclear energy through to the early 1940s. This work was picked up again after the Second World War and while the USA was initially focused on reactors for marine propulsion, the world's first commercial-scale nuclear power reactor started up in the UK in 1956.

A fleet of 26 Magnox power reactors was built, followed later by 14 advanced gas-cooled reactors (AGRs), and finally a single PWR Sizewell B.

In 1995 the government concluded that new nuclear would not receive public sector support. At the time there firms were not strong economically to assume the total responsibility for the construction of nuclear plant and the idea of new nuclear plants was abandoned. However it led for companies to privatize and invest in UK nuclear industry. By 1998 British Company became the private firm leader generators for the UK, and nuclear power plants contributed around 25% of total annual electricity generation.

In 2005 The Nuclear Decommissioning Authority began operation taking control of the country's nuclear liabilities becoming the owner of nuclear plants and facilities of those firms that weren't able to continue the operation.

Finally in early in 2008 the government gave again green light to nuclear new build stating that the government will support the nuclear industry but will not give any financial aid for the construction of the plants. It will only operate as the authority and regulator for the behalf of the community. Due to this decision British Energy became the object of a bidding war that was eventually won by EDF. The £12.5 billion acquisition was completed in January 2009. Later in 2009, Centrica bought a 20% stake in British Energy for £2.3billion¹¹.

The NDA also auctioned its sites and the winners of the bid were the consortiums, Horizon Nuclear Power (RWE power and E.ON UK) and NuGeneration (GDF Suez, Iberdrola, and SSE). This two have intention to built ERP or A1000 reactors for the new plants.

Nowadays UK has in operation eight nuclear plants owned by the EDF that generate 18% of the total demand of electricity, and has other eight in developing process for the new generation of plants that will supply electricity for the country.

Plant	Type	First power	Expected shutdown
Oldbury 1	Magnox	1967	End 2012
Wylfa 1&2	Magnox	1971	End 2012
Dungeness B 1&2	AGR	1983 & 1985	2018
Hartlepool 1&2	AGR	1983 & 1984	2019
Heysham I-1 & I-2	AGR	1983 & 1984	2019
Heysham II-1 & II-2	AGR	1988	2023
Hinkley Point B 1&2	AGR	1976	2016
Hunterston B 1&2	AGR	1976 & 1977	2016
Torness 1&2	AGR	1988 & 1989	2023
Sizewell B	PWR	1995	2035

Table 5-1 Power Reactors Operating in the UK

5.3.2. Main actors with description

British State

British Government: The British state financed and supported the nuclear plant industry until 1996. It was until 2008 that the government gave again its support to this way of energy generation, but was very clear in stating that there was not going to be any public financing. However it is still the authority and regulator, to assure the development of the projects is according to the standards of safety for the community and the environment.

Since the government authorizes the construction of the nuclear plants is a stakeholder with **power**. Even if it is not financing the industry, it's the owner of sites (NDA) and the regulator (ONR) that gives the respective licenses to the companies to construct in the UK. The perfect example was when at the end of the 1990's the government decided not to support anymore the nuclear plants as an energy provider and no more plants were constructed. However in 2008 a green light for new nuclear plants to be constructed was given by the government and new firms entered the country to invest in this new generation of nuclear plants that will supply the UK with electric energy. At the same time state's claims are completely **legitimate**.

They pursue the wellbeing of the country by protecting the people inside and outside the industry. This is done through the conditions and specification that firms have to have to be able to construct and operate the nuclear plants in the UK. A perfect example was when the country faced the accident of Sellafield in Cumbria in 2005. After that, the government decided to shut down the nuclear plant because it represented a threat for the community. This shows that the government has legitimacy and the power to enforce its will. Finally as shown in the examples before, each time the state says or does something it immediately gets the attention from the industry giving **urgency** as the final characteristic to this stakeholder.

Regulators

Office of Nuclear Regulations (ONR): From 1 April 2011 The ONR was created as a non statutory body outside the Health and Safety Executive (This entity was in charge of the offices that regulated the nuclear industry in UK). The ONR is now in charge of the Security, Safety, and the compliance of the safeguarding in the nuclear industry. This Office issues the licenses for construction, operation, and decommissioning of nuclear plants. Through the **Office for Civil Nuclear Security (OCNS)**, approves security arrangements within the industry and enforces compliance. Through the **UK Safeguard Office (UKSO)** ensure that the UK complies with its international safeguards obligations, which are measures to verify that States comply with their international obligations not to use nuclear materials (plutonium, uranium and thorium) for nuclear explosives purposes.

As this office is dependant of the government and works as the regulator of the industry has the characteristics of **power** and **legitimacy**. The power is given by the government and is strong in the matters of license and monitoring in the construction face. Is the authority that could in any moment stop the process if there is any irregularity found. At the same time is in charge of making sure that regulations and specifications are accomplished to protect the wellbeing of the community as well as the use of resources having a strong legitimacy on its claims.

Utility

British Energy Generation Ltd: Private firm that owns and operates UK's eight nuclear power stations which have a combined capacity of almost 9,000 megawatts, providing UK with 20% of its electricity requirements. They work with two types of nuclear reactor: the advanced gas-cooled reactor (AGR); and a pressurized water reactor (PWR). In 2008 was bought by EDF French Company.

EDF Energy Development Company of France: Owned by the French Government, (85 % of its shares) is the biggest utility in France running 59 power plants. At the same time is the leading nuclear energy company in Europe. By now produces 630.4 Twh electricity power worldwide. In 2008 EDF bought British Energy, and is now owner of the sites that will be used for the next generation of nuclear plants that will provide electricity to the UK.

EDF has the **power** of knowledge. It decides who are the suppliers and the subcontractors for the construction process. When the government says the "when", EDF has the experience and the background to decide "how". They can stop the project anytime if something is not going according the plan, or can approve additional procedures to improve the process based on

experience in other countries. Moreover, being the one that is investing its capital and having the specialized experience for the construction and operation of nuclear plants, EDF claims are critical and have the **urgency** to be fulfilled. In this way it is guaranteed that the construction will be done with the precise specifications, and the procedures that will make the plant work in an optimal way. Finally the third attributes also appears due to the fact that EDF achieve all the requirements of the regulators to run as the principal utility giving it **legitimacy** to be performed in the nuclear projects.

Decommissioning and Waste management

Nuclear Decommissioning Authority (NDA): is a non-departmental public body created through the Energy Act 2004. It's in charge of the decommissioning and waste management of the shut down plants. It also acquired the associated civil nuclear liabilities and assets of British Nuclear Fuel Company (BNFL) and UK Atomic Energy Authority (UKAEA) since they were not able to continue with their economic responsibilities. Due to this, is now owner of 19 sites where nuclear run by the two companies and that now enter in decommissioning or that are ready for the new generation of nuclear plants in the UK.

Moreover, now that the government decided to support the new plan, but not spend government resources, it has given power to the utility EDF. However, through the NDA, noticing that it owns sites that will be used for the next generation of nuclear plants, and that is still an authority for the decommissioning process (government's responsibility), the government stills manage to have the control over the projects. NDA is a key stakeholder for the government.

Being NDA the authority at the end of the process, the NDA has **legitimacy** on its claims for the constructions to have what is needed to handle the waste after the process of generation. In this way the management of the waste will be efficient and risks for the community and the environment will decrease. At the same time, this stakeholder presents the characteristic of **urgency**, due to the fact that if any requirement is made during the construction, it has to be done for the plant to be finally approved for operation.

New Power Plant Plan Utilities

NDA sold some of its sites to private firms in order to continue with the Government plan of using the infrastructure of the sites that already have nuclear plants. At the same time it also contributes economically to cover the liabilities acquired that go up to 75, 4 billion pounds, and the annual spending of the normal operation of the NDA that are around 3 million pounds per year. (World Nuclear Association., 2011)

The firms that won the bid, where the followings:

Horizon Nuclear Power: Is a 50-50 Joint Venture of RWE npower with E.ON UK . By 2025 the consortium plant to have around 6000MWe of nuclear capacity in operation.

RWE npower: Is an integrated UK energy private company and is part of the RWE Group, one of Europe's leading electricity and gas companies. It serves around 6.5 million customer accounts and produce around 10% of the electricity used in Great Britain.

E.ON UK: Is a private UK Company subsidiary of E.ON (the world's largest investor-owned power and gas company). It supplies electricity and gas to over 5 million domestic, small and medium-sized enterprise and industrial customers across the UK .

NuGeneration: Joint venture of GDF Suez (37.5%), Iberdrola (37.5%) and SSE (25%). The consortium now intends to prepare detailed plans for developing new nuclear power generating plant at the site with a total capacity of up to 3.6GW.

GDF Suez: Is the emerging company after the union of water supply and treatment, waste management and energy company **Suez** and power firm **Gaz de France**. Before the fusion, the French State owned 80% of the Gaz de France company, now it owns 35% of the shares of the new company. This French company is now leader in gas supplying in France and second in electricity production and supplying. It operates in 36 countries in the world and is now investing in the UK new plan of nuclear power generating plants.

Iberdrola: Spanish private company leader in global wind power producer and the first energy producer company in Spain. In 2010 decided to invest un UK`s new plan of nuclear power generating plants.

SSE, Scottish & Southern Energy: UK private company which operates and invests in energy production distribution an supply mainly in UK and Ireland. Owns 11290 megawatts of electricity generation capacity and distributes electricity to 3.5 million of homes and work places.

Since Horizon Nuclear Power and NuGeneration bought the sites for the new power plant development, they have **power** to decide the reactor to use, who are going to be the suppliers and the subcontractors, and “when” and “how” the construction process will be done. Moreover, as well as EDF, they have the characteristic of **urgency** in his claims, being firms that have the specialized experience and that are investing their capital for the construction of the nuclear plants.

Supplier

AREVA NP: Areva is the most important reactor vendor in France. For the new nuclear plant building, Arevas`s reactor ERPTm has been chosen as the most appropriate according the requirements of regulators and authorities in the matter.

Being the architect engendering chosen due to it experience in the reactor vendor industry, Areva acquires the characteristic of **power** among the suppliers that will come. It has the experience and the knowledge that gives it power to take important decisions as well as demand during the construction process.

5.3.3. Mapping

As a first mapping it`s shown the relationship between the most important stakeholders that actually belong to the nuclear industry in UK. The government as the head of the map, has under his care the regulator composed by the ONR, OCNS, UKSO as well as the decommissioning authority the NDA. On the other hand the EDF, has the relationship directly with the authority since is a private company. The link og the government with the ytulity is

given through the regulators. Finally the British energy stands under the EDF as its owner now, and Areva as the principal supplier of the utility.

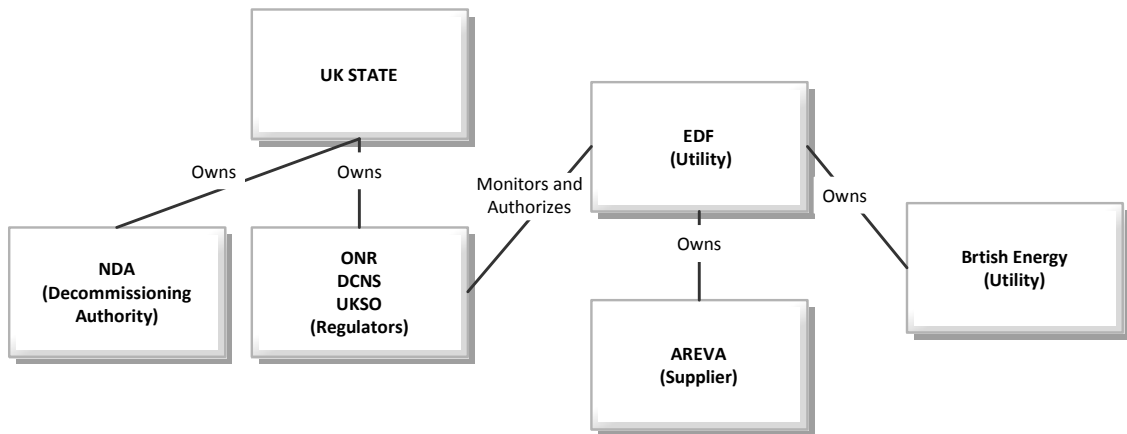
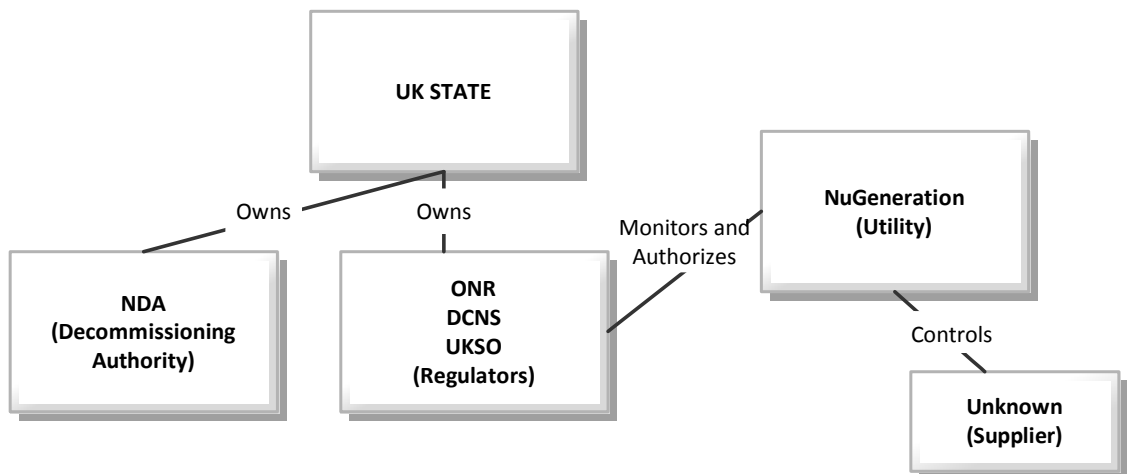


Figure 5-7 Mapping Actual Stakeholders in United Kingdom

The other two mapping, represent what will be the new power plant generation of stakeholders that has been decided until today for the construction of the next 8 power plants in the UK. As for what is actually occurring in the UK, the dependences are still the same, the only thing that changes is that new utilities are involved that will decide which suppliers and constructors to involve in the projects.



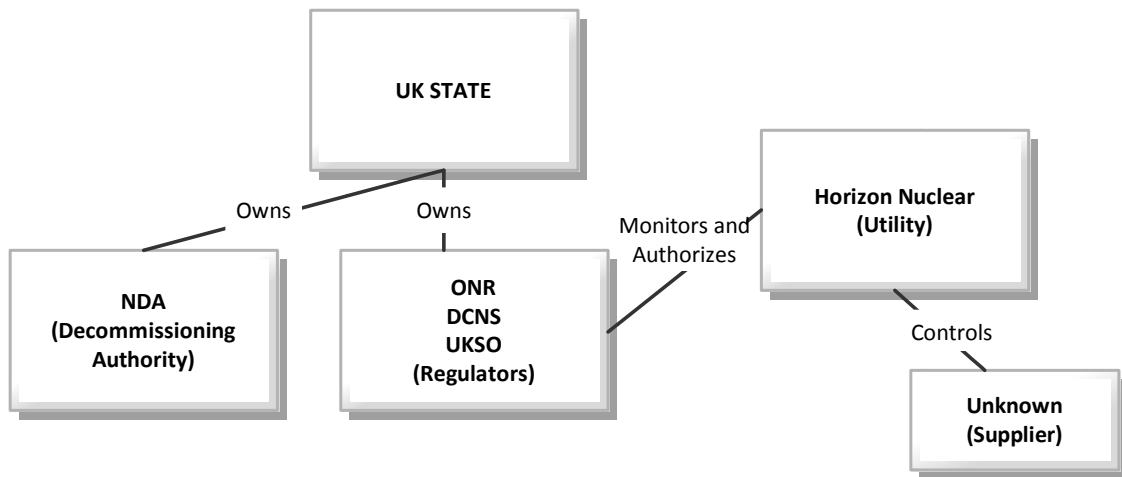


Figure 5-8 Mapping Next Generation of Stakeholders in United Kingdom

5.3.4. Identification

After identifying the characteristics of each of the stakeholders they can now be classified according to the Power, Legitimacy and Urgency theory.

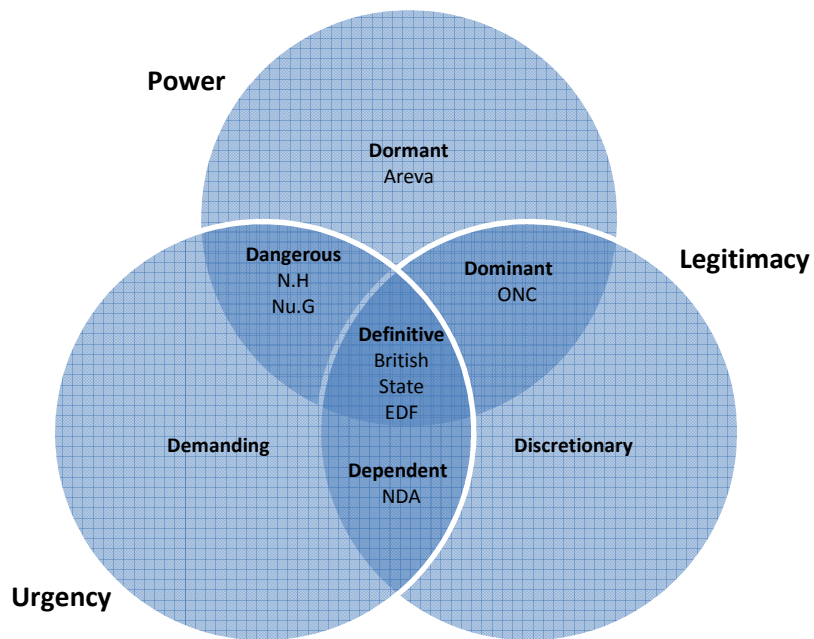


Figure 5-9 UK Stakeholders Identification According to the Attributes

For UK the government and the Utility are the definitive stakeholders. EDF has the economic means for the development of the new nuclear projects, meanwhile it needs the government support to authorize the sites in which the construction will be made, and the possibility of new utilities to enter the industry. On the other hand the authority is a dominant stakeholder used by the government as a tool to assure the safety of the nuclear activities.

5.4. Finland

5.4.1. Country's Background on Nuclear Industry

At the moment, around a quarter of the electricity used in Finland is produced with nuclear power. The first four nuclear power plants in Finland were built at the turns of the 1970s and 1980s and roused no major political discussion. In 1986, the tragic accident in the Chernobyl nuclear power plant in Ukraine led to put on ice almost everywhere, nuclear power plant projects. The Finnish Parliament voted against the fifth nuclear power plant in 1993 but decided in favor of its construction in 2002. The construction began in 2003. (Statistics Finland, 2007)

- Finland has four nuclear reactors providing nearly 30% of its electricity.
- A fifth reactor is now under construction and two more are planned.
- Provisions for radioactive waste disposal are well advanced.

According to the (The World Nuclear Association, Nuclear Power in Finland, 2011), Finland generates about 82 billion kWh per year and has a very high per capita electricity consumption, some 16,000 kWh per head per year. While some of it comes from nuclear (22.6 billion kWh, 27.8% in 2009) and hydro (12.6 TWh, 15.5% in 2009), much of it is either imported (12.4 TWh, 15.3% net in 2009) or generated from imported fuels (mostly coal and some gas). Coal is imported from Russia and Poland, all of its gas comes from Russia, and 14% of 2009 electricity was from Russia.

The country is part of the deregulated Nordic electricity system which faces shortages, especially in any dry years, when hydroelectric generation is curtailed.

Finland's nuclear contribution is about 31.8% to the total electricity generation in the country. Fortum Corporation and Teollisuuden Voima Oy (TVO) are the key players in the Finnish nuclear energy industry. The operational nuclear reactors are of Pressurized Water Reactor (PWR) and Boiling Water Reactor (BWR) type. Two boiling water reactors supplied by the Swedish company Asea Atom are operated by Teollisuuden Voima Oy (TVO); and two modified Russian pressurized water reactors (VVER) with Western containment and control systems are operated by Fortum Corporation. Finland is dependent on imports for its electricity requirements from countries such as Russia, Estonia, Sweden and Norway. The electricity consumption in the country is met through nuclear, hydro and others from imports mainly through coal and gas. 14% of the country's electricity was imported from Russia in 2009. The total net capacity of the four existing nuclear power plants was around 2,716 MW in 2010. (Global Data, 2011).



Figure 5-10 Nuclear Plant distribution in Finland

5.4.2. Description of main actors

State

Finnish Government: the Finnish State interacts with the project through authorities. The supreme management and supervision in the nuclear energy sector are vested with the Ministry of Employment and the Economy. (Ministry of Employment and the Economy, 2010)

The Finnish Government has no power over the entities that own the Nuclear power plants, but its connection with them are only through the authorities, that's why it can be said that it has the **legitimacy** to intervene when public health is somehow compromised.

Regulator

STUK (Radiation and Nuclear Safety Authority): operating under the Ministry of Social Affairs and Health, is responsible for the supervision of nuclear safety and the use of radiation. It is a regulatory authority, research centre and expert organization, whose mission is to protect people, society, environment and future generations from the harmful effects of radiation. The ultimate quality objective of operations is to keep the radiation exposure of people as low as is reasonably achievable and to prevent radiation and nuclear accidents with a very high certainty. (STUK, 2011)

As the only authority, the STUK has the **power** to cancel or delay the operations in the Nuclear Power Plant if it doesn't have the necessary requirements for its proper performance. It also has the **urgency**, since a call from the STUK should be immediately attended, as there is an imminent risk of stopping the complete project if they decide to. And finally, STUK has the **legitimacy** as it is the legal entity in charge of making the utilities follow the regulations.

Utility

Teollisuuden Voima (TVO): is a private limited company founded in 1969 to produce electricity for its shareholders at cost price. It states its mission as: "To produce electricity for shareholders safely, reliably and economically while preserving the environment". TVO already owns the two NPPs operating in Olkiluoto. The company is 27% owned by Fortum and 57% owned by Pohjolan Voima Oy. Two boiling water reactors supplied by the Swedish company Asea Atom are operated by Teollisuuden Voima Oy (TVO) and at the moment it is the utility of the fifth reactor in construction.

Since it is the owner of the project, it has all the **power** by being the one who manages the budget and money in the project. Its requirements should be immediately met by the project management as it is the one who provides all the resources, which also grants it with **urgency** and it has the legal rights to make any demands, so it has **legitimacy**.

Fortum: Fortum has been producing nuclear energy since 1977. The company owns the nuclear plant in Loviisa, Finland which covers around 10% of the country's energy production. Its nuclear assets also cover Sweden with share ownership in the nuclear plants in Forsmark and Oskarshamn. In addition, Fortum is shareholder in Teollisuuden Voima Oyj, which currently operates two nuclear units in Olkiluoto, and is constructing a third unit in co-operation with Areva-Siemens consortium. (Fortum, 2011).

Fortum possesses the same characteristics as TVO, power, urgency and legitimacy, but both companies are owners of different reactors.

Suppliers

Westinghouse: In order to comply with newly developed Finnish regulations, Westinghouse supplied the instrumentation and Siemens supplied the sleeves in the Loviisa Nuclear Plant in Finland. Due to this unorthodox approach of supplying some things from US companies and the rest from Atomenergoeksport, a Soviet at the time, the plant got the nickname of "Eastinghouse".

Westinghouse as a major supplier, possesses the attributes of **power** due to the importance of its functions and the dangerous strategies it could follow if it is its desire, and **urgency** for its selection while competes with other possible suppliers, like Areva.

AREVA: See the France case with the respective description. For the construction of the new reactor in Olkiluoto, Areva is supplying the nuclear island, the Digital Control System and the first fuel core, and civil works. It is also supplying parts of balance of plant comprising access building, waste building and an EPR simulator. As leader of the consortium, Areva is coordinating the overall project, including functional and technical integration of the complete plant. (Power-technology.com, 2010).

Areva constitutes the main supplier for TVO, that's why it has the **power** to apply any resource strategy in case it considers it necessary, for the case the new Olkiluoto. It has the **urgency** of being chosen among the other suppliers that can offer the same products.

SIEMENS: Siemens was contracted to provide the turbines and generators. For the case of Olkiluoto, a consortium formed by Areva and Siemens signed the contract for the turnkey construction with TVO. Siemens PG built the turbine island and will be supplying the turbine generator set. That includes engineering and design, procurement and delivery of electro-mechanical equipment, turbo-generator protection and control system, civil works, erection and commissioning. (Power-technology.com, 2010). For the case of Loviisa, Westinghouse and Siemens supplied equipment and engineering expertise.

Same as Areva, it is one of the main suppliers, with great **power** over the resources needed for the Power Plant adequate performance. The same as Areva, it has the **urgency** of being chosen as the main turbine supplier, among the competitors it has.

Bouygues: a French construction company, is the main subcontractor of AREVA regarding construction of civil work in Olkiluoto 3.

It is the most **powerful** contractor for the civil work of the Nuclear Power Plants in Finland, which gives it the same characteristics as Areva, in the sense of resources strategies, but once Areva is chosen, it is certain its participation on the project, which doesn't give it the attribute of urgency.

Governmental, Local organizations and Municipalities: In addition, many other governmental and local organizations, as well as the municipalities locating the nuclear power plants, participate in the supervision of the nuclear power plants required by the nuclear energy law or other legislation.

These entities are generally very enthusiastic and supportive about the Power Plant construction as it generates jobs inside their local communities. They have the **legitimacy** to supervise and demand the satisfaction of their requirements but a very low power to get and immediate response, that's why they have to use other means, such as the government support based on the law.

Other Subcontractors: These are other suppliers controlled by Fortum or TVO, in charge to support the construction activities during the project.

Their power is limited, but as a supplier, they have the **legitimacy** to express their requests if they see themselves affected by any decision.

5.4.3. Mapping

The main actors in the Finland Nuclear industry are group according to the Figure 5-11. Here it is shown the supply network of the actors, being two the most important players: TVO and Fortum as utilities of the current nuclear plants. The Finnish state only interacts with them through the authority STUCK and the ministry of Employment and Economy. The other municipalities are also involved in the control and supervision of the nuclear plants installed in their lands according to the law. Areva and Siemens are the main suppliers and at the same time they control the constructors Bouygues and other subcontractors for the civil work.

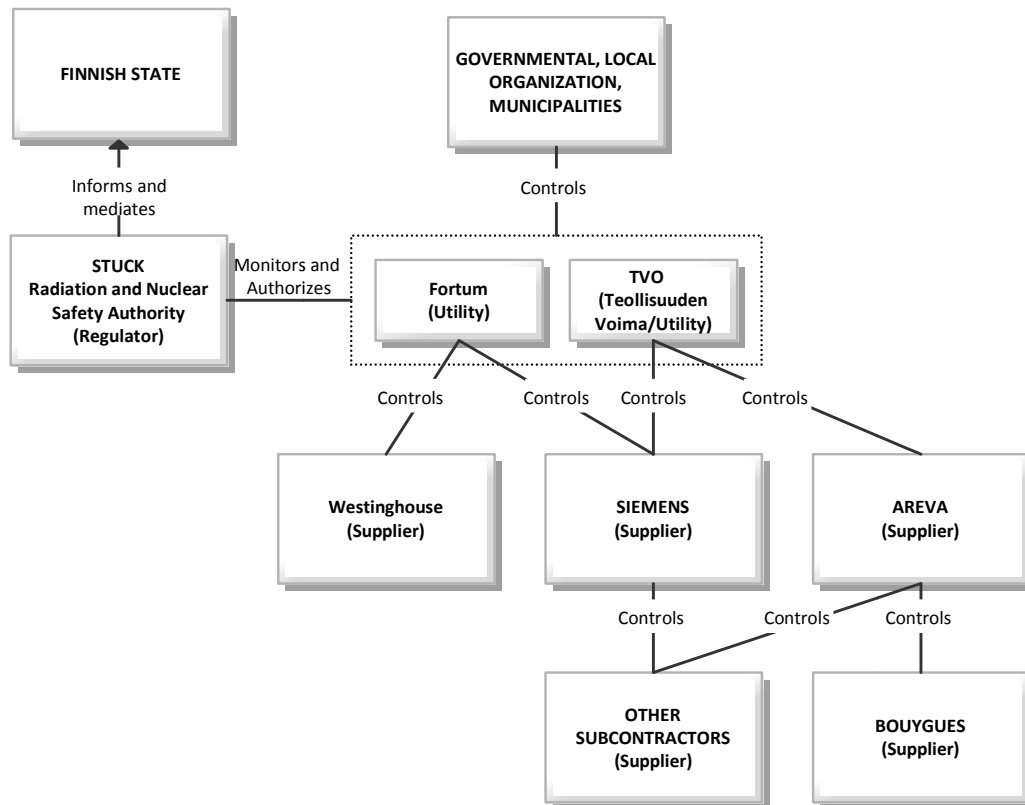


Figure 5-11 Mapping of Stakeholders in Finland

5.4.4. Identification

After giving to each of the stakeholders the characteristics, they can be displayed in the following graphic Figure 5-12 where the attributes are grouped according to the Power, Legitimacy and Urgency theory.

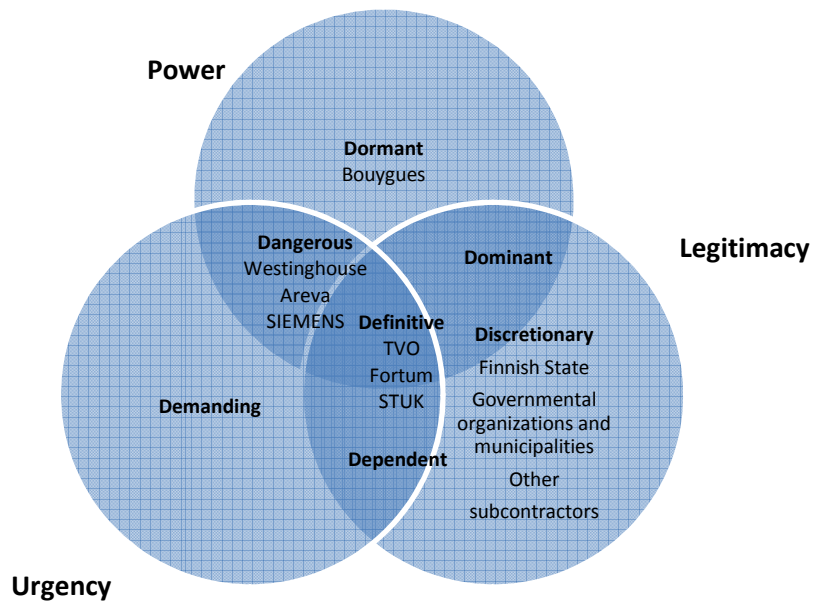


Figure 5-12 Finland Stakeholders Identification According to the Attributes

For Finland, the definitive stakeholders are the authority and the utilities. They have managed to organize the industry and assure the security of the procedures giving comfort to the finish community and wining with this their support. The state is a discretionary stakeholder that supports the industry and is in behalf of the well being of the community. As for the suppliers, they are dangerous stakeholders with the knowledge and experience of the nuclear megaprojects, and are key for guaranteeing the correct construction and performance of the nuclear plants. Any mistake or error they do, will affect directly the project.

5.5. United States of America

5.5.1. Country's Background on Nuclear Industry

Nuclear energy produces electricity for one in five homes and businesses across the United States, with 104 reactors in 31 states. The country's largest source of carbon-free electricity is nuclear energy, accounting for nearly 70 percent of all emission-free electricity generated. America's reactors operate around the clock, thereby stabilizing the entire country's electricity distribution system and electricity marketplace. (Nuclear Energy Institute, 2010)

Construction of new nuclear power plants in the United States was almost unimaginable during the 1980s and 1990s. Vague rumors about possible new reactors would occasionally prompt a flurry of speculation, but they were invariably unfounded. In fact, no reactor has been ordered in the United States since 1978, and that plant was later cancelled, as eventually were all U.S. reactor orders after 1973. No U.S. reactor has been completed since 1996, the Tennessee Valley Authority's Watts Bar 1, which had been ordered in 1970. Today, there are still no orders, but interest in new U.S. reactors is no longer merely a rumor. In 2003, three utilities submitted applications to the Nuclear Regulatory Commission (NRC) for early approval of potential reactor sites under a cost-shared program with the Department of Energy (DOE). In 2004, DOE announced cost-sharing agreements with two industry consortia to apply for NRC licenses to construct and operate new reactors. Since then, a dozen more utilities and other companies have announced plans to apply for reactor licenses. (Parker & Holt, 2007).

The USA is the world's largest producer of nuclear power, accounting for more than 30% of worldwide nuclear generation of electricity. The country's 104 nuclear reactors produced 799 billion kWh in 2009, over 20% of total electrical output.

Following a 30-year period in which few new reactors were built, it is expected that 4-6 new units may come on line by 2020, the first of those resulting from 16 license applications to build 24 new nuclear reactors made since mid-2007. However, lower gas prices since 2009 have put the economic viability of some of these projects in doubt. Government policy changes since the late 1990s have helped pave the way for significant growth in nuclear capacity. Government and industry are working closely on expedited approval for construction and new plant designs. The USA has 104 nuclear power reactors in 31 states, operated by 30 different power companies. (The World Nuclear Association, Nuclear Power in the USA, 2011)

In 2008, the country generated 4,119 billion kWh net of electricity, 9% of it from coal-fired plant, 22% from gas and 6% from hydro. Nuclear achieved a capacity factor of 91.1%, generating 805 billion kWh and accounting for almost 20% of total electricity generated in

2008. Total capacity is 1088 GWe, less than one-tenth of which is nuclear. Annual electricity demand is projected to increase to 5000 billion kWh in 2030. Annual per capita electricity consumption is currently around 12,400 kWh. There are 69 pressurized water reactors (PWRs) with combined capacity of about 67 GWe and 35 boiling water reactors (BWRs) with combined capacity of about 34 GWe – for a total capacity of 101,263 MWe (see Nuclear Power in the USA Appendix 1: US Operating Nuclear Reactors). Almost all the US nuclear generating capacity comes from reactors built between 1967 and 1990. There have been no new construction starts since 1977, largely because for a number of years gas generation was considered more economically attractive and because construction schedules were frequently extended by opposition, compounded by heightened safety fears following the Three Mile Island accident in 1979. A further PWR – Watts Bar 2 – is expected to start up by 2013 following Tennessee Valley Authority's (TVA's) decision in 2007 to complete the construction of the unit. Despite a near halt in new construction of more than 30 years, US reliance on nuclear power has continued to grow. In 1980, nuclear plants produced 251 billion kWh, accounting for 11% of the country's electricity generation. In 2008, that output had risen to 809 billion kWh and nearly 20% of electricity, providing more than 30% of the electricity generated from nuclear power worldwide. Much of the increase came from the 47 reactors, all approved for construction before 1977, that came on line in the late 1970s and 1980s, more than doubling US nuclear generation capacity. The US nuclear industry has also achieved remarkable gains in power plant utilization through improved refueling, maintenance and safety systems at existing plants. (The World Nuclear Association, Nuclear Power in the USA, 2011).

In August 2009, the Florida Cabinet approved site certification for Progress Energy Florida's Levy nuclear power plant, the first nuclear facility approved in the state since 1976. If approved and built, the project would be among the first nuclear plants in the country to be constructed on a green field site in more than 30 years, and it would involve development of one of the single largest transmission infrastructure projects in Florida's history. (Environment News Service, 2009).

President Obama announced \$8.3 billion in loan guarantees on February 2010 for two nuclear reactors to be built in Burke County, Georgia. A new nuclear power plant has not been built in the United States in three decades. The new reactors are to be part of an expansion of an existing nuclear facility near Augusta, Georgia, operated by Atlanta-based Southern Co. The loan guarantees will help create 3,500 on-site construction jobs and 850 permanent operations jobs, administration officials claimed. The reactors will help provide power to over 550,000 homes and 1.4 million people, it said. (CNN, 2010). In this case, for the new projects, the Government will have some control over the utilities

5.5.2. Description of Main Actors

State

USA Government: The United States Government takes no part in the construction or ownership of the nuclear plants in the country. Even the regulatory Commission is an independent agency that once before was part of the Atomic Energy Commission (AEC). An increasing number of critics during the 1960s charged that the Atomic Energy Commission's

regulations were insufficiently rigorous in several important areas, including radiation protection standards, nuclear reactor safety, plant siting, and environmental protection. By 1974, the AEC's regulatory programs had come under such strong attack that Congress decided to abolish the agency. The agency was abolished by the Energy Reorganization Act of 1974, which assigned its functions to two new agencies: the Energy Research and Development Administration and the Nuclear Regulatory Commission, (U.S. NRC, 2011) where the latest is linked to the government by being a federal agency or independent agency, which exercise some degree of independence from the President's control.

As its principal mission is to take care of the people, the Government only has the attribute of *Legitimacy*, because it does not have any part on the NPP construction and the utilities are completely private entities. Nevertheless it has the right to express concerns in the case of seeing affected people's rights. Currently, the Government of USA is sponsoring the new projects of Nuclear Power Plants in the country, by giving a financial support, which also gives it the attribute of *power*.

Regulator

NRC: Today, the NRC's regulatory activities are focused on reactor safety oversight and reactor license renewal of existing plants, materials safety oversight and materials licensing for a variety of purposes, and waste management of both high-level waste and low-level waste. In addition, the NRC is preparing to evaluate new applications for nuclear plants. Several utilities have submitted applications for licenses to build new power reactors. (U.S. NRC, 2011)

The U.S. Nuclear Regulatory Commission strictly regulates the commercial and institutional uses of nuclear energy, including nuclear power plants. Quality construction, continuous preventive maintenance and ongoing reactor operator training have contributed to the nuclear energy industry's excellent safety record. (Nuclear Energy Institute, 2010).

It is the most critical stakeholder as it possesses the three attributes *Power, urgency, legitimacy*, since it is constant during the whole processes of the Nuclear Plant construction and all the utilities highly depend on the permissions and licenses in order to operate and follow to next steps. When an utility wants to construct a NPP, the NRC is the first entity it has to approach to.

Utility

The US nuclear power industry has undergone significant consolidation in recent years, driven largely by economies of scale, deregulation of electricity prices and the increasing attractiveness of nuclear power relative to fossil generation. As of the end of 1991, a total of 101 individual utilities had some (including minority) ownership interest in operable nuclear power plants. At the end of 1999, that number had dropped to 87, and the largest 12 of them owned 54% of the capacity. With deregulation of some states' electricity markets came a wave of mergers and acquisitions in 2000- 1 and today the top 10 utilities account for more than 70% of total nuclear capacity. The consolidation has come about through mergers of utility companies as well as purchases of reactors by companies wishing to grow their nuclear capacity (The World Nuclear Association, Nuclear Power in the USA, 2011). Here will be explained the two most important utilities, given the number of Power Plants they own.

Exelon: Exelon Generation has one of the industry's largest portfolios of electricity generation capacity, with a nationwide reach and strong positions in the Midwest and Mid-Atlantic. It is the largest owner/operator of nuclear plants in the United States. Exelon delivers electricity to approximately 5.4 million customers in northern Illinois via ComEd and southeastern Pennsylvania via PECO, as well as natural gas to approximately 490,000 customers in the Philadelphia area via PECO. (Exelon, 2011). In October, 2009 Exelon had full or majority ownership of 17 nuclear reactors in 10 nuclear power plants. (Rowe, 2009).

The owner of the project has the **Power** since it is the one who controls budget and demands an accurate time schedule. This makes it a critical stakeholder that has to be informed of all the steps of the process. It is also characterized by the **urgency**, so its requirements should be met as soon as it is possible. Besides, it possesses the **legitimacy** as it is legally allowed to demand and execute its power. Exelon is the utility with the largest number of NPP in the US, that's why it is used, along with Entergy as representation for the rest of utilities in the country.

Entergy: A member of the Fortune 500, Entergy owns and operates power plants with approximately 30,000 megawatts of electric generating capacity, and it is the second largest nuclear generator in the United States after Exelon Corporation. (Entergy, 2011). Entergy's main operating segments consist of the U.S. Utility segment and the Non-Utility Nuclear segment. The U.S. Utility segment provides retail electricity services to approximately 2.7 million customers in Arkansas, Louisiana, Mississippi, and Texas. The Non-Utility Nuclear segment operates a total of ten nuclear power plants. Entergy operates more than 40 plants using natural gas, nuclear, coal, oil and hydroelectric power with approximately 30,000 megawatts of electric generating capacity. Entergy provides electricity to 2.7 million utility customers in Arkansas, Louisiana, Mississippi and Texas. Entergy owns 11 nuclear reactors and manages another reactor in Nebraska. (Entergy, 2011).

It has the same attributes than Exelon: **Power, urgency and legitimacy**. They both represent all the utilities present in the United States.

Suppliers

Areva: It is one of the active Nuclear fuel companies with fabrication facilities in the United States. In the USA, AREVA is present in 40 locations across 20 states and employs 5,000 people. AREVA supplies network products to two-thirds of all US utilities. Moreover, AREVA was ranked the No. 1 US supplier in nuclear energy products and services, in Energy Management Systems and in Energy Market Systems. AREVA NC Inc.'s headquarters are located in Bethesda, MD, while AREVA NP Inc.'s North American Headquarters are located in Lynchburg, VA. AREVA is the leading nuclear energy supplier in the United States and a growing player in the renewable energy business. As the only company with expertise in every step of the nuclear energy production cycle, AREVA leads the nuclear energy industry from uranium mining and fuel fabrication to plant construction and nuclear waste management. (AREVA, 2011).

Areva is the most important company worldwide in the industry. It has the knowledge and experience in the construction of Nuclear power plants, which makes it an important stakeholder that should be attended and informed in order to continue with the supply it

provides, that's a reason why it has **Power** and as well as in the previous France and Finland cases, it has the **urgency**.

Westinghouse Electric Company: Westinghouse Electric Company provides fuel, services, technology, plant design, and equipment for the commercial nuclear electric power industry. (Westinghouse, 2011). It is owned by Toshiba and operates a fuel fabrication facility in Columbia, South Carolina, which processes 1,600 metric tons Uranium (MTU) per year. It previously operated a nuclear fuel plant in Hematite, Missouri but has since closed it down. Nearly 50 percent of the nuclear power plants in operation worldwide, and nearly 60 percent in the United States, are based on Westinghouse technology. The four core product lines of Westinghouse are Nuclear Automation, Nuclear Fuel, Nuclear Services, Nuclear Power Plants.

The United States is the country with the largest number of Nuclear Power plants, from more than 20 utilities, holding companies, constructors and suppliers. Westinghouse has the same **Power** attribute as Areva, since it is one of the most important suppliers and its experience by being from the beginning on the US nuclear industry gives it great influence during the construction of the plants it operates on. Mainly by the strong competition in the area, Westinghouse has the **urgency** of being chosen among its competitors.

General Electric: GE pioneered the BWR technology that has become widely used throughout the world. It formed the Global Nuclear Fuel joint venture in 1999 with Hitachi and Toshiba and later restructured into GE-Hitachi Nuclear Energy. It operates the fuel fabrication facility in Wilmington, North Carolina, with a capacity of 1,200 MTU per year. GE Hitachi has provided advanced and sophisticated technology for nuclear energy for over five decades. Three main product lines support this capability: advanced reactor technologies, nuclear services, and nuclear fuel cycle. GE is unparalleled globally, for advanced power systems and uninterrupted energy services. Our installed base of steam and heavy-duty gas turbines has grown to over 10,000 units, representing over a million Megawatts (MW) of installed capacity in more than 120 countries. (GE Energy, 2011).

It is an important supplier also involved in the turbine provision. It has the **Power** in the same way as Areva and Westinghouse, but in the different nuclear plants they work at. As well as Westinghouse, it has the **urgency** of being selected, for the same reasons.

The Shaw Group: A Fortune 500 company with 27,000 employees around the world, Shaw serves the energy, chemicals, environmental, infrastructure and emergency response industries. Shaw Power is divided into fossil and nuclear divisions, and includes the former Stone & Webster, Inc. Shaw's Power division provides global engineering, design, procurement, construction, and maintenance services to the energy industry. (Shaw Group, 2011) In 2006 the company acquired a 20% interest in the Westinghouse Electric Company, which makes it its main constructor. Shaw has over 30 years of experience in managing wastes of all types, including radioactive, mixed, hazardous, and sanitary. They work closely with federal, state, and local regulators to ensure safety and compliance in the handling, processing, treating, transporting, and disposal of these wastes.

The Shaw group is one of the main constructors, chosen by the main suppliers in order to build according to the specifications. It has the **Power** as it is an important company that works

around the world and their experience is required for the NPP projects it has worked on. It has a strong competition with Bechtel Corporation, that's why **urgency** is also an attribute.

Bechtel Corporation: is the largest engineering company in the United States, ranking as the 3rd-largest privately owned company in the U.S. With headquarters in the Financial district of San Francisco. Bechtel participated in the building of Hoover Dam in the 1930s. It has also had involvement in a number of other high profile construction engineering projects: numerous power projects such as refineries and nuclear power plants. (Bechtel, 2011).

Same as The Shaw Group, it is one of the main constructors, chosen for the utilities and suppliers due to their background in the nuclear sector. It also has the **Power**, making its satisfaction crucial for the precision of the project. It has the **urgency** in the same terms as The Shaw Group, due to the desire of being selected for the job

5.5.3. Mapping

The US main stakeholder can be group as it is seen in the Figure 5-13. This is the supply network, where the state doesn't take any important role in the chain, but it can act through the authority in order to protect the people. And due to the new projects for building the NPP's in Florida and Georgia and the loans offered by the government, it will start having some kind of control over the utilities. The NRC highly controls the utilities as they only can start or continue with operations after the authorization and licenses of the NRC. To show the role of the utilities, were chosen the two most important in the country: Exelon and Entergy, which have the highest number of nuclear plant in USA. The owners decide which supplier to use, the three most important are Westinghouse, General Electric and Areva and at the same time, they decide the construction companies, from which The Shaw Group and Bechtel were chosen to explain.

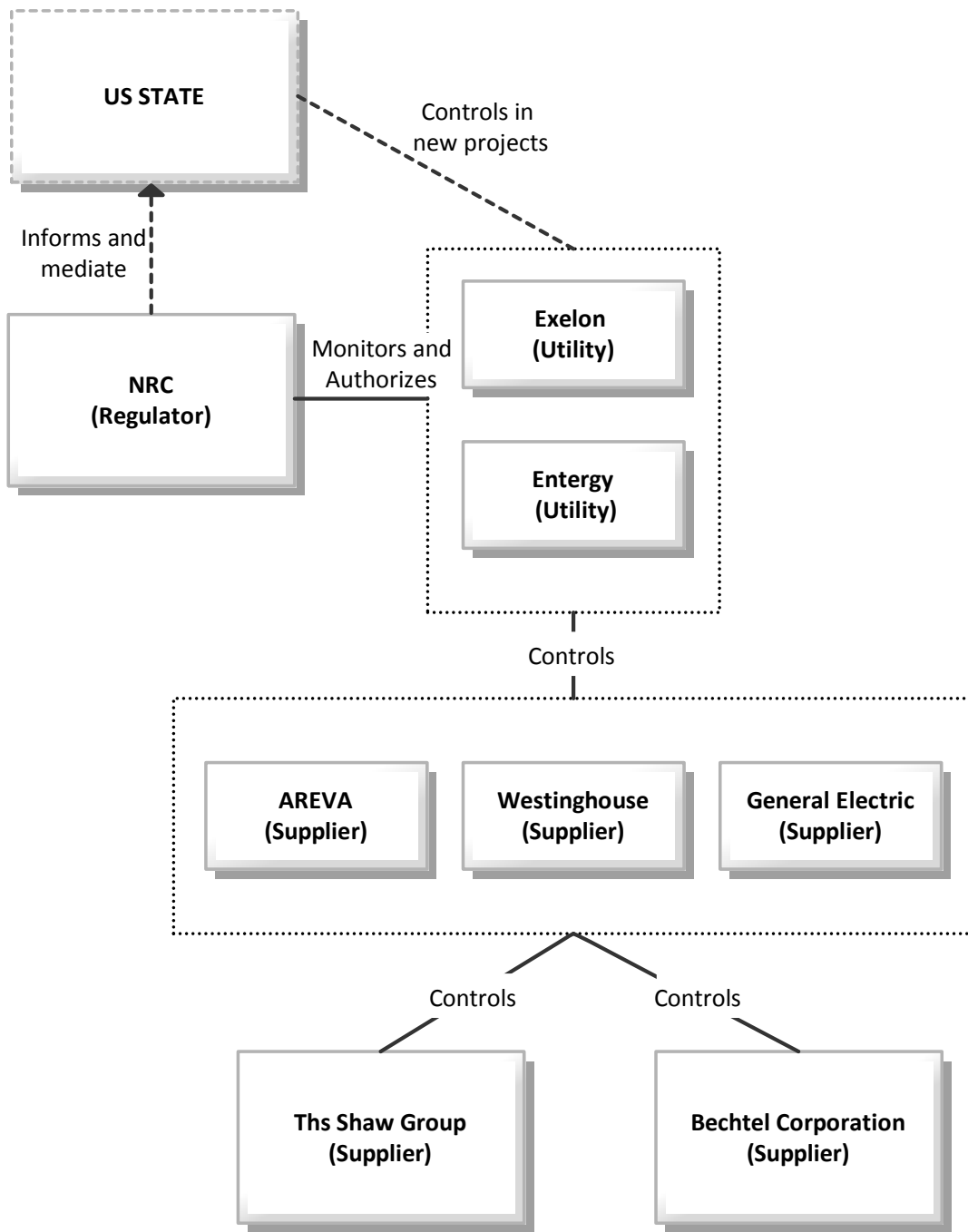


Figure 5-13 Mapping of Stakeholders in USA

5.5.4. Identification

Finally the stakeholder were divided and categorized in the following Figure 5-14 according to their attributes.

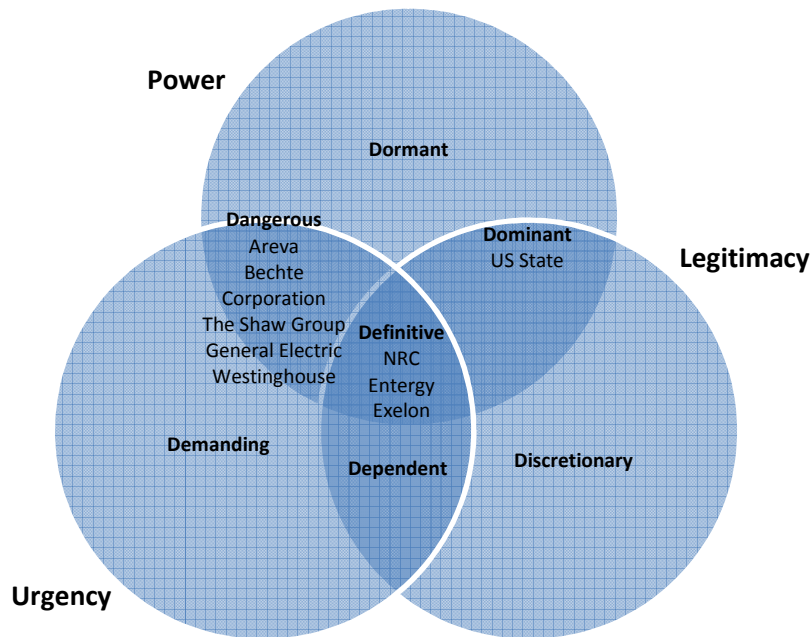


Figure 5-14 USA Stakeholders Identification According to the Attributes

For the USA, the definitive stakeholder is the authority. As in Finland they have manage to organize the industry and keep the community as a supportive stakeholder. On the other hand the USA counts with a high number of utilities that have high experience in the nuclear sector. They In fact, are international companies that have helped develop the industry in other countries such as Japan or Korea, and have become dominant stakeholder. As for the government, they work as supporters and will always be in behalf of the USA citizens.

5.6.Japan

5.6.1. Country's Background on Nuclear Industry

Despite being the only country to have suffered the devastating effects of nuclear weapons in wartime, Japan has embraced the peaceful use of nuclear technology to provide a substantial portion of its electricity.

As showed by the World Nuclear Association report on Japan, Japan has developed the research of nuclear power generation since the middle of the 1950s, with Y230 million being budgeted for nuclear energy. The Atomic Energy Basic Law, which strictly limits the use of nuclear technology to peaceful purposes, was introduced in 1955. The law aims to ensure that three principles – democratic methods, independent management, and transparency - are the basis of nuclear research activities, as well as promoting international co-operation. A test power reactor, JPDR, started operation in 1963 and Tokai Power Station, the first commercial reactor went into commercial operation in 1966 with a generation capacity of 166 MW.

Having few natural resources of its own, it depends on imports for some 84% of its primary energy needs. Initially it was dependent on fossil fuel imports, particularly oil from the Middle East (oil fuelled 66% of the electricity in 1974). This geographical and commodity vulnerability

became critical due to the oil shock in 1973. At this time, Japan already had a growing nuclear industry, with five operating reactors. Re-evaluation of domestic energy policy resulted in diversification and in particular, a major nuclear construction program. A high priority was given to reducing the country's dependence on oil imports. A closed fuel cycle was adopted to maximize the utilization of imported uranium, extracting an extra 25-30% of energy from nuclear fuel by recycling the unburned uranium and plutonium as mixed-oxide fuel (MOX).(World Nuclear Association, 2011)

Driven by considerations of energy security and the need to minimize dependence on current imports the main elements regarding nuclear power are:

- Continue to have nuclear power as a major element of electricity production.
- Recycle uranium and plutonium from used fuel, initially in LWRs, and have reprocessing domestically from 2005.
- Steadily develop fast breeder reactors in order to improve uranium utilization dramatically.
- Promote nuclear energy to the public, emphasizing safety and non-proliferation.

Being nuclear energy an important element in the future of Japan, the Japan Atomic Energy Agency (JAEA) has modeled a 54% reduction in CO₂ emissions (from 2000 levels) by 2050 leading on to a 90% reduction by 2100. This would lead to nuclear energy contributing about 60% of primary energy in 2100 (compared with 10% now), 10% from renewable (now 5%) and 30% fossil fuels (now 85%). This would mean that nuclear contributed 51% of the emission reduction: 38% from power generation and 13% from hydrogen production and process heat.

In June 2010 METI resolved to increase energy self-sufficiency to 70% by 2030, for both energy security and CO₂ emission reduction. It envisages deepening strategic relationships with energy producing countries. Nuclear power will play a big part in implementing the plan, and new reactors will be required as well as achieving 90% capacity factor across all plants. (World Nuclear Association, 2011)

In March 11 2011 Japan suffered what is called now, the worst nuclear accident ever happened. As described by the USB Investment Research its Q series on Global Nuclear Energy, the accident occurred in the Fukushima nuclear plant “when a 9.0 magnitude earthquake occurred in the north east coast of Japan. The power plant coped with the earthquake, even though the earthquake’s intensity exceeded the designed tolerances. At the time of the earthquake, Units 4, 5, and 6 were all shut down for planned maintenance. Units 1, 2 and 3 were shut down automatically after the earthquake. However, the seawall protection proved inadequate. The earthquake generated a tsunami, which TEPCO (the utility in charge of the plant) estimated to be about 14 meters high, being this more than double the wave height that the plant’s sea wall was designed to protect against. As a result, the generator building was swamped and the diesel back-up generators failed and as a consequence the proper cooling also failed “. High temperatures produced an explosion that had to be cooled with sea water and helicopters throwing water from the sky. This water was able to cool the reactor but was contaminated with radioactive substances and spread through the plant area and the surroundings.

This accident brought an alert not only to Japan, but to the nuclear industry in the whole world. Each country is now acquiring the specifications needed to protect their plants from disasters like this one.

At present Japan has 51 reactors totalling 44,642 MWe (net) operational, with two (2756 MWe) under construction and 12 (16,532 MWe) planned. In 2010 the first of those now operating reached their 40-year mark, at which stage some may close down.

Japan will continue to develop nuclear power as a mainstay of non-fossil energy, while placing the highest priority on safety.



Figure 5-15 Nuclear Plants In Japan ((Japan Nuclear Emergency Response, 2011)

5.6.2. Description of Main Actors

State

Japanese Government: Has the role of authority and regulator. It's in charge of the decision on Long term nuclear energy utilization program, judgment of adequateness of introduction of NPP, supervision of nuclear security and safety, and education on nuclear science and technology among others.

Being the authority, the state has **legitimacy** on all the decisions or demands concerning the safety of the Japanese society, and has the power to enforce them. The state has no power over the utilities, being them private, but has the **power** and **urgency** on demanding the partial or definitive closing power plant that represents danger to the Japanese society. As an

example, after the Fukushima accident, units 4 and 5 at Chubu Electric's Hamaoka plant were shut down at the government's request to increase their resistance to tsunamis and are unlikely to restart before the end of 2012.

Regulators

Nuclear Safety Commission (NSC): is charged with a range of missions including planning, deliberation and making decisions on regulations and policies related to nuclear safety as well as prevention of radiation hazards, based on expert knowledge on nuclear technologies and radiological protection. (Japanese Nuclear Safety Commission, 2011)

Nuclear and Industrial safety Agency (NISA): Is a government dependent entity that since 2001 is responsible for the administration of nuclear safety issues, deals with the nuclear fuel cycle and the research and development of reactors.

Japanese Atomic Energy Commission (JAEC): Institution that plans, deliberates, and decides concerning basic policies or strategies for the promotion of research, development, and utilization of nuclear energy, to adjust the activities of administrative organizations concerned, to compile the budget for these organizations to pursue the policies, and to give opinions to the competent Ministers on the adequacy of applying the criteria of the Law on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors. (Japan Atomic Energy Commission, 2011)

Since these entities are government dependent, they have same attributes. They have **legitimacy** over all their demands since they were created to protect the Japanese citizens and the environment, and **power** to enforce them. However each one uses the power to enforce its demands depending on their specific responsibility.

Utility

Tokyo Electric Power Company (TEPCO): Is the largest electric utility in Japan and the 4th largest electric utility in the world after German RWE, french Électricité de France and Germany's E.ON. In September 2010 Tepco said it planned to invest JPY 2.5 trillion (\$30.5 billion) on low-carbon projects domestically by 2020 to generate more than half of its power free of carbon. Most of this capacity will be nuclear. According to this, is expected for Tepco to play a key role in achieving Japan's targets for reduced carbon dioxide emissions

Kansai Electric Power Company (KEPCO): Is the second electric utility in Japan , with its operational area of Kansai region.

Chūbu Electric Power Company (CHUDEN): Is the electric provider for the middle Chūbu region of the Honshū island of Japan. It ranks third among Japan's largest electric utilities in terms of power generation capacity, electric energy sold, and annual revenue.

These three which are the most important utilities in Japan, have the attributes of **power**, urgency and **legitimacy**. They have the power over the decisions made in the construction process (as for example suppliers) as well as in the budget elaboration and execution. At the same time, being the specialized companies on energy providing, their demands during the

construction process become urgent, they need immediate attention to guarantee that the posterior generation will be successful. Finally the legitimacy is given by the authorities that affirm they perform with the requirements needed for the project. However after the Fukushima accident this legitimacy has being threatened.

Suppliers

Mitsubishi Heavy Industries / Atmea: Is a private company that operates a fuel manufacturing plant in Tōkai, Ibaraki, and contributes many heavy industry components to construction of new nuclear plants. As well, has recently designed its own APWR plant type where its fuel fabrication has been completely PWR fuel. It was selected by the Japanese government to develop fast breeder reactor technology and formed Mitsubishi FBR Systems. MHI has also announced an alliance with Areva to form a new company called Atmea.

Toshiba Power System Company: Is a private company that delivers constructs nuclear, hydroelectric and thermal plants. It's able to manufacture both Boiling Water Reactors (BWR) and Pressurized Water Reactors (PWR). The company also develops comprehensive research and investment support enhancements in thermal power generation efficiency, promotion of renewable energy, and advances in nuclear power safety and efficiency to reduce CO2 emissions. Today it includes the company Westinghouse Electric.

Independently on what they supply to the nuclear plant, the suppliers have the **power** to determine they processes of manufacturing and to demand special specification during the construction process. At the same time they have the **urgency** of being chosen among all the possible suppliers that work in this sector and that can provide the same products as they do.

Global Nuclear Fuel (GNF): First called Japan Nuclear Co, Ltda and changed to GNF the 1 of January of 2001, was formed as a joint venture with General Electric Nuclear Energy (GENE), Hitachi, and Toshiba. Is pioneer nuclear fuel manufacturer, has delivered more than 70,000 fuel bundles to various nuclear power plants across the country and contributed to the stable supply of energy, and handles MOX fuel design and quality control.(Global Nuclear Fuel, 2011)

Nuclear fuel industries: NFI operates nuclear fuel fabrication plants in both Kumatori, Osaka and in Tōkai, Ibaraki, fabricating 284 and 200 (respectively) metric tons Uranium per year. The Tōkai site produces BWR, HTR, and ATR fuel while the Kumatori site produces only PWR fuel.

The fuel manufacturers have no attributes during the construction process so it can be said that they are **non-stakeholders** in this part of the process.

Opponents

Local Citizen Movements: After the Fukushima accident in March 2011, communities have become an important stakeholder due to the increase in opposition. Before the accident a pool made by the Atomic Energy Agency said that 82% of the Japanese were in favor of building nuclear plants. After the accident the support has reduce in a 41 to 54 %. Citizens

protests and manifestations had put more pressure on government's entities for them to give the Japanese society safety.

The community has **legitimacy** on their claims because they are in pro of the safeness of the community. Until today it cannot be specifically said that they have power, because they haven't stopped any construction yet. However after the Fukushima accident, the communities have been gathering and getting stronger over time, so it can be said that they are in the process of developing this attribute.

5.6.3. Mapping

The following is the mapping of the relationship of the most important stakeholders present in the nuclear industry in Japan. To have a better understanding of the configuration that exists today, Figure 5-16 shows the before and after the Fukushima accident since it was an event that drastically affected the industry.

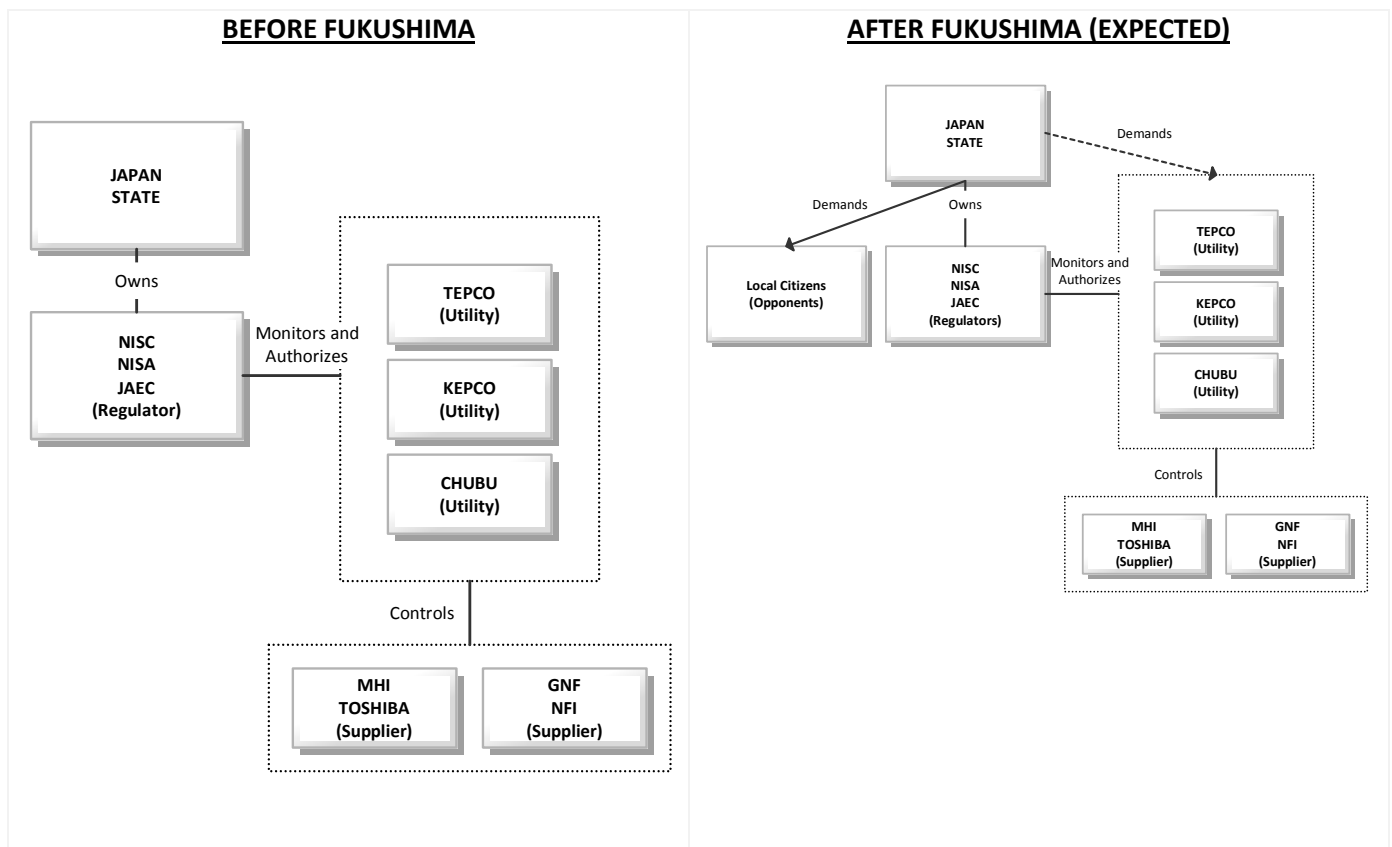


Figure 5-16 Mapping of Stakeholders in Japan before and after the Fukushima accident

The Japanese State commands the map by being the authority under which the regulators perform. The utilities, as being private, were linked to the government just through the regulators before the accident. After the accident the government took control of the decisions made to be able to fix as soon as possible the problems brought with the accident and bring comfort to the Japanese society. Prime Minister Kan instructed TEPCO on April 12 to

present a future plan for restoration from the accident. In response to the instruction, TEPCO announced on April 17 the “Roadmap towards restoration from the accident,” which was drafted by the government and TEPCO under the Response Headquarters for the Accident in Fukushima NPS. (Prime Minister of Japan and his Cabinet, 2011). As for the nuclear reactors, from the 54 that existed in Japan, 40 have been shut down after the accident for monitoring and adaptation to the seismic conditions of the country.(The Globe and Mail, 2011)

The government needs to show to the citizens that the State is in control and that it will guarantee the safety on the nuclear project to be able to continue with the energy generation. After the accident the community has become an active stake holder and represents a potential threat if the state cannot guarantee the security they ask for.

5.6.4. Identification

After giving to each of the stakeholders the characteristics, they can be displayed in the following graphic, where the attributes are grouped according to the Power, Legitimacy and Urgency theory.

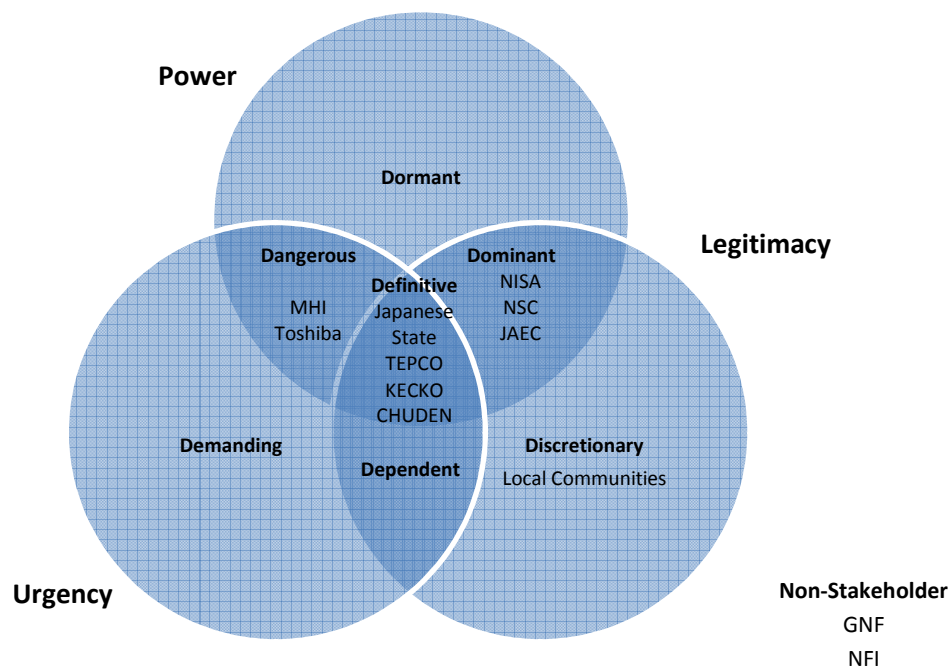


Figure 5-17 Japan Stakeholders Identification According to the Attributes

For Japan the dominant stakeholders are the State and the Utilities. The state has become definitive after the Fukushima accident having to get in charge of the situation. The utilities as being private have the economic means had the control of the construction and operation of the projects all along. The authorities are dominant stakeholders that work on the behalf of the community and the safety of the nuclear activities through policies. However its lack of urgency is affecting the immediate response of the other stakeholders in the industry that end in disasters as the Fukushima incident.

5.7.Korea

5.7.1. Country's Background on Nuclear Industry

Korea is recognized as one of the most rapidly industrialized countries in the world, with GDP growth at the annual rate of 8.6 percent in 1964–1994. Along with the economic growth, the consumption of primary energy has increased at a similar rate during the same period.(Sup Sun & Kyun Hong, 1999)

Nuclear activities were initiated when South Korea became a member of the International Atomic Energy Agency in 1957. In 1958 the Atomic Energy Law was passed and in 1959 the Office of Atomic Energy was established by the government. The first nuclear reactor to achieve criticality in South Korea was a small research unit in 1962.

The Korean government placed nuclear power as one of the highest priorities of a national development program together with steel-making, petrochemical and ship-building. The government launched and maintained a national nuclear power program with strong volition and a favorable intermediate and long-term plan even though the program needed much larger funding than readily available. With the existence of the firm guarantee from the government, domestic and overseas companies could actively participate in the national nuclear power program with reduced risk. (Choi, et al., 2009)

Ten years later construction began of the first nuclear power plant - Kori-1, a Westinghouse unit built on turnkey contract. It started up in 1977 and achieved commercial operation in 1978. After this there was a burst of activity, with eight reactors under construction in the early 1980s.(World Nuclear Association, 2011).

The Ministry of Education, Science & Technology's third comprehensive nuclear energy development plan, for 2007-11, projected that South Korea should develop its nuclear industry into one of the top five in the world. Korea has managed to emerge as one of the Organization for Economic Cooperation and Development (OECD) member states with the 6th rank in the world nuclear power generation capacity with its 20 NPPs to supply 17,454MWe corresponding to 36% of the total electricity use in 2008. (Choi, et al., 2009)

Today South Korea is set to become a major world nuclear energy country, exporting technology. It won a \$20 billion contract to supply four nuclear reactors to UAE. Nowadays 21 reactors provide 31% of South Korea's electricity from 18.7 GWe of plant. The aim reaffirmed in mid 2011 is to provide 59% of electricity from 40 units by 2030.(World Nuclear Association, 2011)

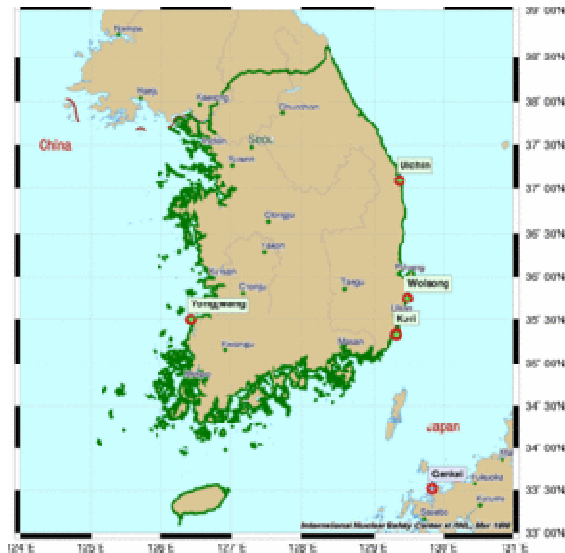


Figure 5-18 Nuclear Plant distribution in France (Japan Nuclear Emergency Response, 2011)

5.7.2. Description of Main Actors

State

Korean Government: Being Korea a developing country, the state played a very important role in the developing of nuclear power industry. The state placed nuclear power as a highest priority investing high amounts of money, creating the KEPCO utility, and the regulatory entities to guarantee the no proliferation agreement made when it joined the Atomic Energy Agency in 1957. Today it is the authority and as well owner of the utility, supporting and controlling the nuclear power generation trying to become a major world nuclear energy country, exporting technology.

Since the government has being the head of the nuclear power development and now maintenance in Korea, it has present the three attributes: **Power, legitimacy and Urgency**. Its demands and decisions have legitimacy, being always concerned on the well being of citizens and the environment. It has the power to enforce those demands, and the other stakeholders see these demands as urgent and have to look for the way to accomplish them in order to continue with the development of the industry not only in Korea, but in the rest of the world.

Regulator

Ministry of Education, Science and Technology (MEST): Is government dependant and it ensures the enforcement of nuclear legislation. It is in charge of nuclear policy elaboration and monitoring as well as licensing of power plant construction and operation. The entity under this ministry responsible for assisting the government in its licensing and regulatory activities having particular attention to protect public health and environment is the **Korean Institute of Nuclear Safety (KINS)**. With the KINS also works the **Nuclear Safety Commission** in charge of the significant decisions on the safety of nuclear energy. (Nuclear Legislation in OECD Countries KOREA, 2011)

Ministry of Knowledge Economy (MKE): Is responsible of proposing general policies with regards to energy production and the utilization of resources, in accordance with the

recommendations of the Atomic Energy Commission. The minister defines basic policy with respect to programs for the development of nuclear energy and supervises the electricity generation of nuclear power plants. (Nuclear Legislation in OECD Countries KOREA, 2011)

Being the regulators under the government dependent, they become the tool for enforcing its demand and decisions through policies and licensing processes. Being this the case they have the same attributes of **Legitimacy, Urgency and Power**, however each entity applies those in the area they were created to supervise.

Utility

Korean Electric Power Corporation (KEPCO): Is a government-invested (government owns 51% of share), integrated electric utility company, and is the only company engaged in power transmission and distribution in Korea. KEPCO generates approximately over 93% of total electricity produced through its wholly-owned six companies **Korea Hydro & Nuclear Power (KHNP)**, Korea Midland Power (KOMIPO), Korea Western Power, Korea East-West Power, Korea Southern Power, Korea East-West Power. Additionally has important subsidiaries in charge of engineering and construction such as **KEPCO E&C** and **KNF** (Korean Nuclear Fuel) which specializes in the design and manufacture of nuclear fuel, In 2009 the company was the lead on a winning tender submitted in Abu Dhabi for construction of the first Nuclear Power plant in the United Arab Emirates. (Research & Development Magazine, 2011)

Korean Hydro & Nuclear Power Co Ltd (KHNP): Is the largest among the six power generating subsidiaries from Korea Electric Power Corporation (KEPCO), accounting for approximately 25% of electricity producing facilities, hydro and nuclear combined. It operates nuclear power plants in Kori, Yonggwang, Ulchin and Wolsong, and several hydroelectric power generation facilities in the Hangang system, providing approximately 40% of the national power supply.

During the construction of the power plant the utility has the attributes of **Power, legitimacy and Urgency** being the specialized company that will guide suppliers and constructor through the whole process. The utility has the power to choose its suppliers and constructor subcontractors, and decide how the construction process will be held. At the same time has the legitimacy by having all the specifications asked by the regulators that authorized it to develop the megaproject.

Supplier

Doosan Heavy Industries & Construction: Is Korea's only power generation equipment manufacturer, supplying standard nuclear reactor models. Its involvement in nuclear power plants started in 1976 with the construction of Units 1 & 2 at the Yeonggwang Nuclear Power Complex. Since then, it has completed 15 reactors and is currently building six more. (Doosan Heavy Industries & Construction, 2011)

Hyundai Engineering and Construction (HYNEC): Is the mayor construction company in South Korea carrying also international civil work projects involving nuclear power plants. It was founded in 1947 by Hyundai Civil Works in 1947, and constructed the first Nuclear Plant (Kori 1). It is recognized for its advanced technologies and today is in charge also of the construction of the NPP in UEA.

Being the specialized companies that have the experience with the products and services needed to develop the construction of a nuclear plant, they have the attribute of **power**. Not anyone can do what they do. On the other hand, when competition is present, they develop the attribute of **urgency**, having the need to being selected by the utility.

5.7.3. Mapping

In the Figure 5-19 is described the relationship of the stakeholders in Korea. The Korean State owns the utility KEPCO and is the creator of the entities that now regulate the nuclear industry in Korea. Therefore the three more important actors are government dependant, however have managed to develop each one their specific role without intervening with the responsibilities of the others.

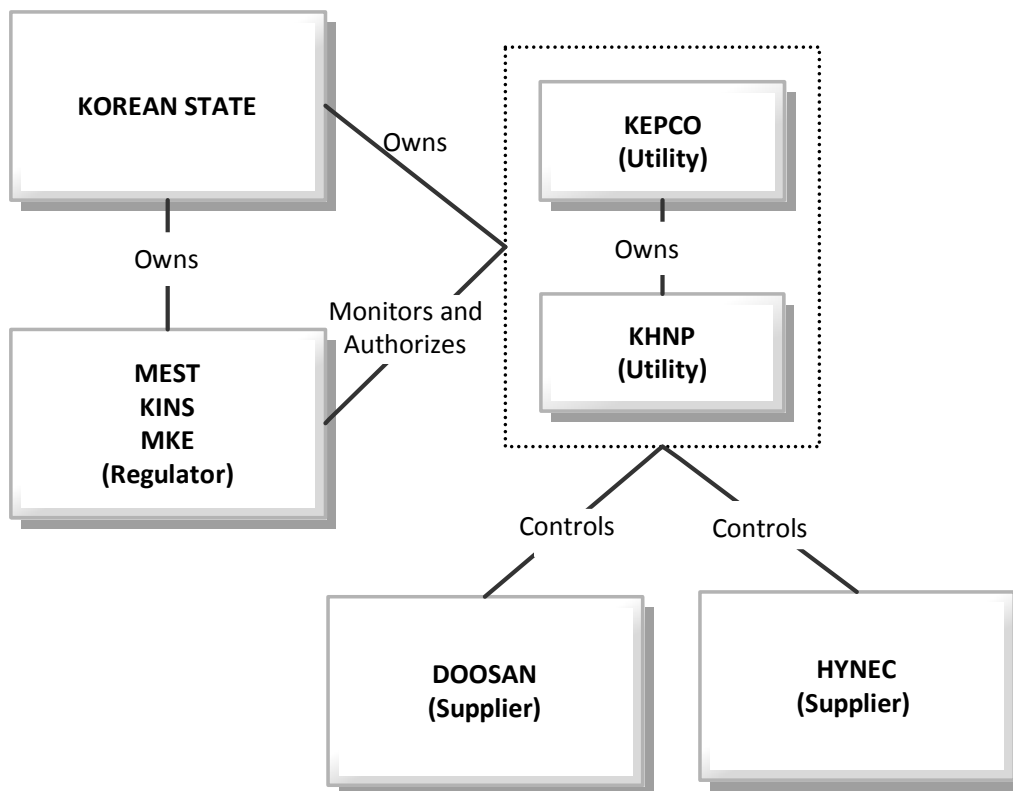


Figure 5-19 Mapping of Stakeholders in Korea

5.7.4. Identification

After giving to each of the stakeholders the characteristics, they can be displayed in the following graphic, where the attributes are grouped according to the Power, Legitimacy and Urgency theory.

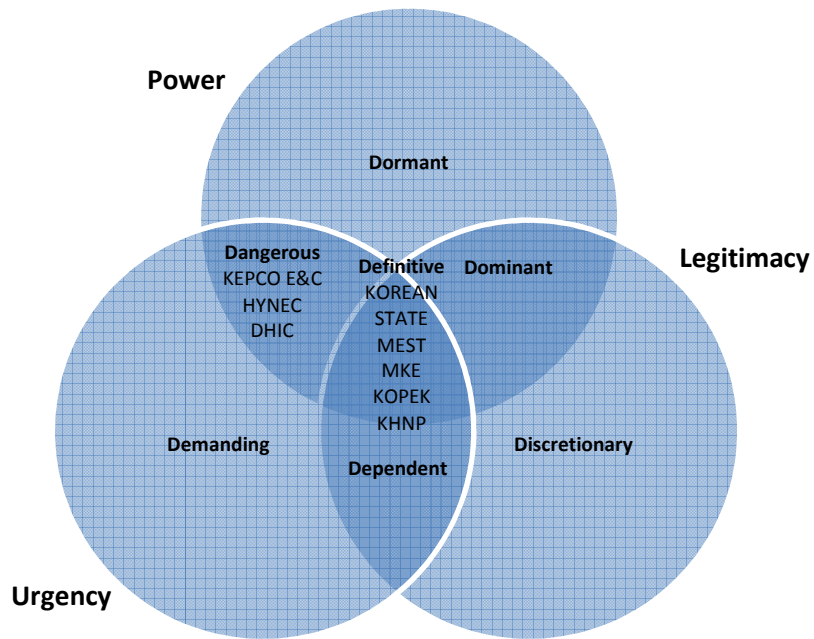


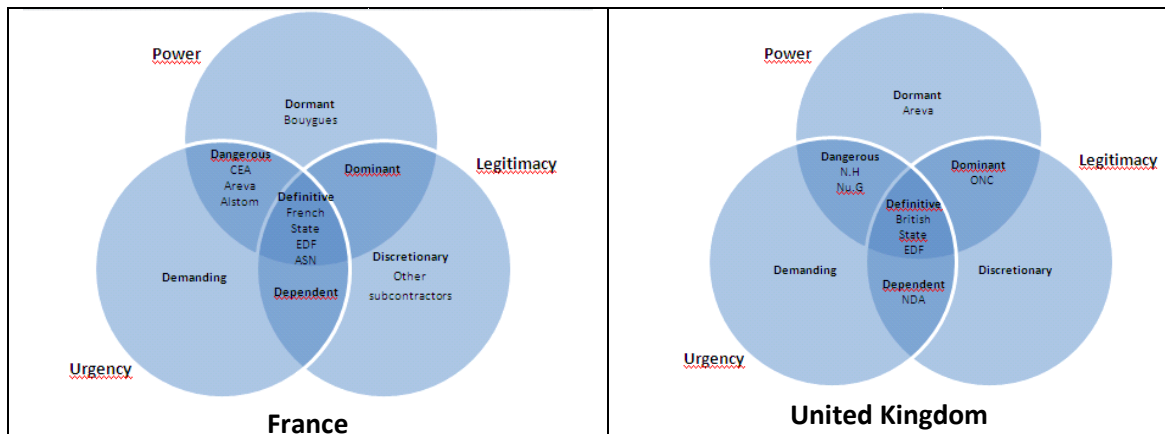
Figure 5-20 Korea Stakeholders Identification According to the Attributes

For Korea the definitive stakeholder are the State working side by side with the utility and the Authorities. They have acquired this role, since were the ones that developed the strategies to bring to the country the nuclear industry. The state owns the utility (KOPEK) that until now is the performer of nuclear energy and that has being able to bring the knowledge of the construction and operation to the Korean workers.

5.8.Comparison

After identifying and analyzing the stakeholders in the six countries, a comparison will be made in order to show the similarities and differences between the organization and the interaction of the stakeholders in each one of them.

The Figure 5-21 shows the final scheme that summarizes the identification of the stakeholders according to the Power-Urgency-Legitimacy theory.



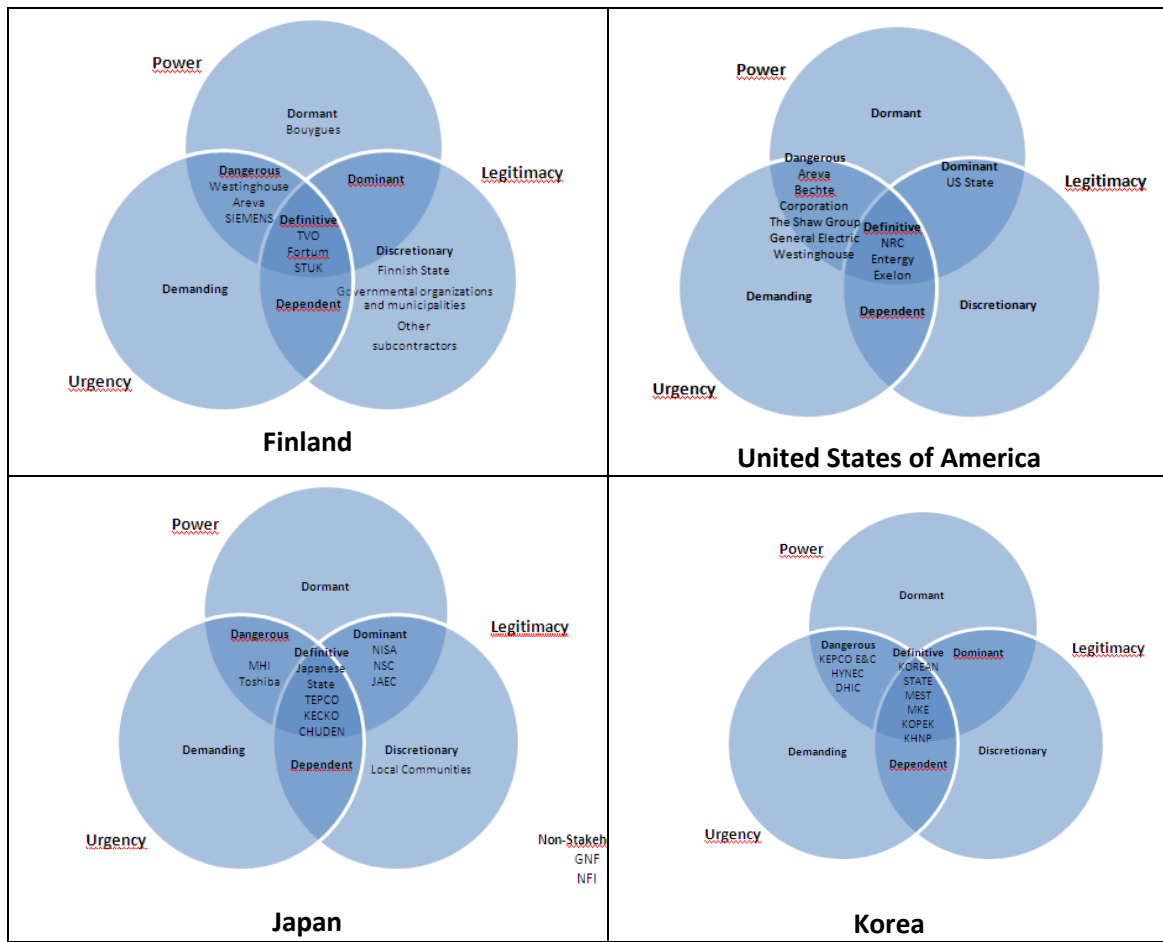


Figure 5-21 Stakeholders' final identification

In the figure can be seen how the **Government** plays a definitive role only in France, UK, Korea and Japan. Being France and Korea the case where the Government is owner not only of the authorities but also from the utilities. This allows it to decide and demand at any moment in the whole life cycle of a Power plant project. Japan is a particular case, where the Government has become a definitive stakeholder, acquiring the characteristic of urgency due to the past accidents, of Tokaimura in 1999, and Fukushima, in 2011, after which the government realized it needed to intervene in order to protect the safety of the Japanese society.

On the other hand, for the case of United States and Finland, the government plays a secondary role by being discretionary stakeholders, which represents an alee that generates policies and laws to work in behalf both the safety of the society and the environment as well as the development and the growth of the nuclear industry in each country.

As for the **authorities** or **regulators**, the NRC for United States is the definitive stakeholder. Being not dependent of the Government, it has the autonomy to regulate and monitor the nuclear activities in the country during the whole process. It anyone wants to enter of leave the nuclear industry it has to be authorized by this and only this entity.

Moreover for Finland and France, the STUK and the ASN are a definitive stakeholder as they are the entities that have been in charge of standardizing the policies and laws that have brought the nuclear industry to where it is today. These two countries are an example for the rest of states interested in joining the nuclear industry because they have managed to

establish rigorous processes that are able to insure the security throughout the lifecycle of the nuclear power plant as well as processes that protect the community and the environment. As for Korea, the authorities KINS and MEST represent the government tool to enforce its power respectively to each entity, once again in behalf of the security and safety of the country, becoming as well a definitive stakeholder.

In Japan, the NSC, NISA and JAEC are dominant stakeholders due to the fact that they don't represent an urgent stakeholder. This can be seen in Fukushima accident, where the authority asked several times to the utility to change some obsolete pieces of the reactor and this request was not attended. Unfortunately this contributed to the fatal accident.

For UK as well as for Japan the authorities are dominant as they work as a tool for the government to guarantee the secure performance of the activities, and is the link of the authority with the utilities. Moreover NDA represents an important authority that gives the government economic resources to still have some control over the new power plant projects coming ahead for UK.

Speaking about the **utilities**, for the countries of Finland, France, Japan and Korea they are identified as the definitive stakeholders. In Finland TVO and Fortum have the monopoly of the industry and count with the support both of the Government and the society. In the case of France and Japan, the power and urgency are given by the fact that they have the financial means to execute a nuclear plant project as well as the know-how and the long time experience working in this kind of megaprojects. Their legitimacy is given by being chosen for the authorities as the utilities that work according to their laws and standards. However for Japan, as stated before this legitimacy is being threatened by the accident of Fukushima.

Korea's larger utility, KEPCO is owned by the government, consequently its power is given through the government and the fact that along with it they created and developed the nuclear industry as it is today. Meanwhile, United States is a country with several utilities independent of the government and a high number of nuclear reactors. Their power is given by the fact that they have the financial means to execute a nuclear plant project. UK counts with the new acquisition of EDF as the most important utility independent from the UK government but still dependent from the French State. As in Japan and USA, its power is given by the financial means it has that can sponsor the current nuclear projects as well as the new project of power plants that UK has for the next years.

In all the countries, the **suppliers** have the power as they have the experience and knowledge in this specific industry, which make the utilities dependent on what they can supply. Moreover, this power can be increase according to the strategies they might use to make the utilities agree to their terms and conditions. Urgency is also another frequent characteristic found, due to competence. The suppliers have the urgency of being selected among the group in each country. This urgency plus the power of the specialized experience make them a dangerous stakeholder in matters of prices at the moment to choose with whom to work with.

Finally, as for the **opponents**, they have a strong presence in Japan due to the previous accidents that have alerted the community as well as all the stakeholders involved in the

nuclear projects in the country. Each one of them is taking the direct measures to face this new reality that the nuclear industry is living nowadays.

5.9. Countries' Models

The comparison described above shows us that the most influential stakeholders are the *government*, the *utility* and the *authority*. They represent the definitive stakeholders in the construction phase of a Nuclear Plant project. They are the ones in charge of taking the decisions and majorly influence the project, in matters such as the budget, the time of the project and the specifications of how it should be built. The authorities become a tool for the government with regard to demand security and safety for the processes. But this affirmation is an exception for USA and Finland where the reins are handled by the regulators and not the government.

Since the *government*, the *utility* and the *authority* are the most influential, the relationship between these stakeholders was the one studied to generate the models that represents each of the country.

Additionally, it was created a summarizing table with some parameters of the energy and nuclear industry that could be use as a guide on the configuration of the models.

Parameters	FRANCE	KOREA	UK	USA	JAPAN	FINLAND
State Share	85%	51%	0%	0%	0%	0%
Reactor Exports	Yes	Yes	Yes	Yes	Yes	No
Reactor Imports	No	Yes	Yes	Yes	Yes	Yes
Degree of Development	Developed	Developed	Developed	Developed	Developed	Developed
Type of Government	Democracy	Democracy	Constitutional Monarchy	Democracy	Constitutional Monarchy	Democracy
Market policy	Mixed economy	Market Economy	Mixed economy	Mixed economy	Free - Market economy	Mixed economy
Authorities depending on the government	Yes	Yes	Yes	No	Yes	No
Nuclear Program	38 years	49 years	71 years	65 years	56 years	33 years
Number of reactors	56	21	18	104	54	4
Reactors under construction	Yes	Yes	No	No	Yes	Yes
Percentage of total energy	75%	31%	18%	20%	30%	25%
Generation of fuel	Yes	No	Yes	Yes	Yes	No

Table 5-2 Nuclear industry parameters for France, Korea, UK, USA, Japan and Finland

Table 1-3 clearly makes some distinctions, showing for example, how France and Korea states are the major investors in the built nuclear plants, while for the other countries there is no state ownership. And among the six countries, these two present a successful nuclear industry which constitutes the two highest figures of generated energy by nuclear sources. As for UK and Japan, they both have the same type of government and no shares in the nuclear plants of their countries. Nevertheless it is the Government the one who controls the utilities and their

actions, through the authorities, being the government and regulators the most important and critical actors. In the particular case of United States and Finland, the authorities are entities completely separated from the government and only act as a communication mean for the government to be aware of the situations, since these regulators are the ones who directly demand, monitor and control.

After making the stakeholder and parameter comparison between the 6 countries, five characteristics that integrated the two results were chosen in order to identify the relationship between the stakeholders.

1. **Degree of development:** there is an economic and political difference in a developed, developing or underdeveloped country. This defines first the capacity of the country to invest in a Megaproject of a nuclear plant, and also the relationship between the utilities and the government.
2. **Wealth of the Country:** knowing how the economy of the country is, if it has grown in the past few years, if it is stable or not etc., can give an idea about if the country (or government) is able to engage this kind of projects.
3. **Degree of control of the government over the enterprise sector:** knowing which kind of government is ruling the country (democracy, socialism, totalitarianism, etc.) and relating it to a market policy (free, regulated or planned market policy) it can be understood the relationship between the companies that work in the energy industry and the government.
4. **The role of the energy authority in the country:** being able to understand the role of the authority in the energy industry of a country as- is, can show how would be the interaction of the authority for the nuclear sector with the other stakeholders.
5. **Private or Public companies in the energy sector:** realizing which is the nature of the companies in the energy sector, it is possible to have an idea of which could be the role of the new companies or those in the energy sector that become part of the new nuclear energy industry.

This review helps to better understand the differences among the studied countries and supports the integration into the three models that will be described next.

FRANCE and KOREA

Model of a Stakeholders configuration that will work in a developed country with an organized and wealthy government that possesses a strong link between it and the energy providing companies. A country where the roles of every entity (utilities and regulators) are precisely defined. Having specific power and functions that will not cross the boundaries of one another, even if they are all dependent on the government.

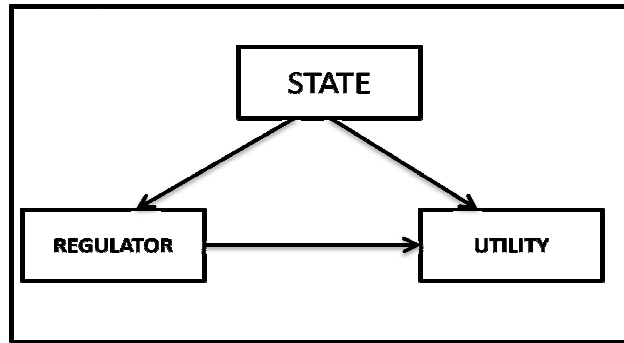


Figure 5-22 FRANCE and KOREA MODEL

USA and FINLAND

Model of Stakeholders arrangement that will operate in a developed country with strong private companies with the capital to make the first investment for the megaproject of a nuclear plant. The authority is the most powerful stakeholder that can work separately from the government. The regulator is the one who manages to coordinate the links over the stakeholders and guarantees the correct, and secure performance of the nuclear projects.

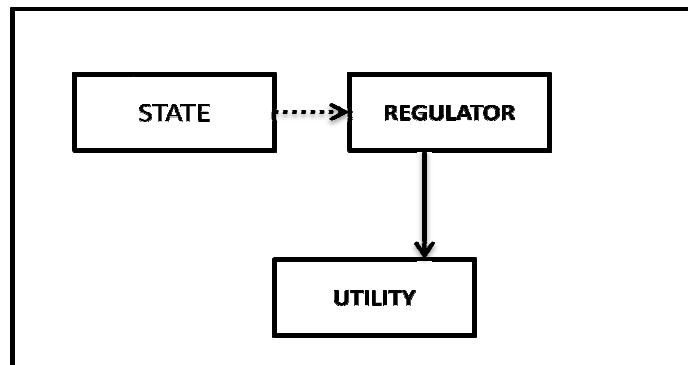


Figure 5-23 USA and FINLAND MODEL

UK and JAPAN

Model of Stakeholders configuration that will work in a developed country with a strong economy and government, that can assume the responsibility of the investments to develop the first nuclear projects. At the same time, these countries have to count with strong private companies that could take the responsibility in a close future to continue with the project development. The regulators in this model depend from the government and will become the link between the utilities and the latest.

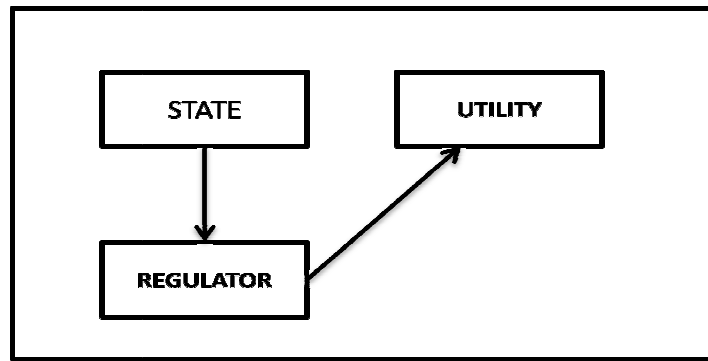


Figure 5-24 UK and JAPAN MODEL

With these three representations it can be possible to get a first approach to construct the model of a specific country that wants to join the nuclear industry. They would become a start in order to arrange the stakeholders configuration depending on several parameters also used to generate the models above. The nature of the utilities, the role of the government and the dependence of the authorities are some of the key characteristics primarily considered to obtain these results.

CHAPTER 6: NEWCOMER IN THE NUCLEAR INDUSTRY: MODEL APPLICATION

In this chapter it will be selected and described one country interested in a nuclear energy generation. It is presented a general background of the energy sector and what the country has done regarding nuclear energy. This scenario is explained in order to understand which could be the main stakeholders involved in the future industry, as well as how could be their links and relationships. The approach is based on the research of the countries and the models defined in Chapter 5. Finally it is illustrated the application of one of the models to the future nuclear industry of the country.

6. CHOSEN NEWCOMER IN THE NUCLEAR INDUSTRY: MODEL APPLICATION

For a better understanding of the application of the models presented in the chapter 4, in this chapter will be described a country interested in developing nuclear energy projects. It will be presented a political, economic, and energy sector background, as well as what the country has done regarding to the Nuclear generation activity. Following this, will be made an understanding of the five characteristics mention before, to be able to apply the model that fits better to the conditions of the country as-is. Finally the decision of the model is supported with the stakeholder description and the final Mapping of how will be the relationship of the stakeholders if the country engages in the Nuclear Energy activity.

6.1.The Country

The selection of the country was done based on the report made by the International Atomic Energy Association of “Common User Considerations (CUC) by Developing Countries for Future Nuclear Energy Systems”. This report talks about 54 countries that have a small amount of energy provided by nuclear reactors or no reactors at all but are developing projects to start using them. For these reason this repot was used and a country was select a country among these 54.

Algeria, Angola, Argentina, Armenia, Bangladesh, Belarus, Bolivia, Brazil, Bulgaria, Burkina Faso, Cameroon, Chile, Croatia, Czech Republic, Dominican Republic, Egypt, Estonia, Ethiopia, Georgia, Ghana, Hungary, Indonesia, Islamic Republic of Iran, Jordan, Kazakhstan, Kenya, Latvia, Libyan Arab Jamahiriya, Lithuania, Malaysia, Mexico, Mongolia, Morocco, Namibia, Nigeria, Pakistan, Philippines, Poland, Republic of Moldova, Romania, Senegal, Slovakia, South Africa, Sudan, Syrian Arab Republic, Thailand, Tunisia, Turkey, Ukraine, United Republic of Tanzania, Uruguay, Venezuela, Vietnam and Yemen.

As said above, this group of countries includes those that have little and no nuclear reactor activities. For the purpose of this thesis the country selected has to have no nuclear plant constructed jet. However it should have interest in using this technology and has to have started some projects for it.

The next criterion for the final selection was the GDP per capita. Having already stated that a Nuclear Power plant requires high investment and high movement of money throughout the country, a higher GDP represents a higher economic growth and consequently the possibility of having money to spend in this kind of megaprojects.

After taking out the countries that already have reactors, the group that remained is shown in Table 6-1 with their correspondent GDP.

Country	US Dollars	Country	US Dollars
Algeria	4,495	Libyan	9,957
Angola	4,423	Malaysia	8,373
Bangladesh	673	Mongolia	2,207
Belarus	5,765	Morocco	2,808
Bolivia	1,993	Namibia	5,330
Burkina Faso	536	Nigeria	1,222
Cameroon	1,143	Philippines	2,140
Croatia	13,754	Poland	12,271
Dominican Republic	5,195	Senegal	1,042
Estonia	13,939	Sudán	1,425
Ethiopia	358	Syria	2,891
Georgia	2,620	Tanzania	527
Ghana	1,283	Uruguay	11,996
Indonesia	2,946	Venezuela	13,451
Jordan	4,560	Vietnam	1,191
Kenya	775	Yemen	1,130

Table 6-1 Group of developing Countries with corresponding GDP per Capita (The World Bank, 2010)

After comparing the GDP, the countries with the three highest values are Croatia, Estonia and Poland. For deciding among these three, the last criterion was based on the availability of information, being Poland the one that has the most. Having this said the country selected was **POLAND**.

6.2. Poland Political and Economic Background

Poland is a developing country that in 1989 had its first democratic government since the end of the World War II, and alternating periods with right and left oriented parties that have governed since. Polish government, nowadays, consists of the Prime Minister (Donald Tusk), the cabinet, and the president of the Republic of Poland (Bronisław Komorowski), and they have continued with the, democratic, free market, and pro-Western policies have that have been installed since the 1990's. (Encyclopedia of Nations, 2011)

General priorities of the government include the Internal Market, Relations with the East, External Energy Policy, Common Security and Defense Policy, the EU 2014-19 Financial Perspectives, Enlargement (signing the Accession Treaty with Croatia), and Intellectual Capital.

Regarding the economy of Poland, the ushering of market-based reforms and large-scale privatization in 1990 heralded a new era of integration of Poland with the world economy. Moreover, Poland and has shown remarkable resilience to the global financial crisis. (World Bank., 2011) In the decade leading up to the crisis, Poland's increasing integration with Europe had brought about strong economic expansion. In 2009, Poland was the only country in the EU to avoid a decline in economic activity having an economy that grew by 1.7 % while the EU declined by 4.2 %. (World Bank., 2011)

Poland is one of the fastest growing EU countries in 2010. In 2010, real GDP expanded by 3.8 % in 2010, the fourth highest rate in the EU. While growth in 2009 was mainly due to the positive

contribution from net exports, growth in 2010 was driven by domestic factors.(World Bank., 2011). Growing domestic demand was fuelled by rebuilding of stocks and the privatization of small and medium state-owned companies and a liberal law on establishing new firms that has encouraged the development of the private business sector.

Growth is expected to stabilize at around 4 % over the next few years (World Bank., 2011). The recovery is expected to be driven by improving global conditions, investments supported through EU funds, improved corporate profitability, revived credit growth, and consumption growth, on the back of further reductions in unemployment.

In Table 6-2 are shown some of the statistics of the country.

	2010
GDP (billions)	468,59
GDP growth (annual %)	3,82
GDP per capita (current US\$)	12.271
Inflation, GDP deflator (annual %)	1,28
Population (millions)	38,19
Population growth (annual %)	0,09
Time required to start a business (days)	32

Table 6-2 Poland Data (World Bank, 2011)

6.3. Energy Industry Background

In order to get familiarized with the energy industry of Poland, it was performed a review of the history and current state of the electricity in Poland, its sources and plans for the future, taking into account the Kyoto treatment, the energy security and the independence of the country with reference to producing its own energetic power.

In the year 2000, Poland was producing a total of 135.2 billion kWh of electricity and consuming 119.3 billion kWh. About 63% of this goes to industry. These figures had not changed all that much since 1990. In fact, electricity consumption in the years just before 1990 was almost as high as it was in 2008, something that has probably given Poland a bit more breathing space or in other words has delayed the blackouts. Spare capacity though is starting to run short and Poland is today using almost exactly as much electricity as it generates.

According to Polskie Sieci Elektroenergetyczne Operator S.A. data comparing 2010 to 2009, production of electricity rose 3.6% while consumption rose 4.5% and consumption of electricity is predicted to grow by 2.2% annually. The average energy needs of a Polish citizen were almost half of the EU average but that is changing and by 2025 it is predicted that Poland will have caught up = even higher consumption. It is Poland's domestic coal reserves that have saved the country thus far and made it the least dependent on imported energy. (Scatts, 2011)

6.3.1. Poland's energy mix

In the Poland's Energy Security Strategy article by (Nyga, 2011), it is stated how domestic coal reserves are of vital importance for the Polish economy. Poland is the biggest hard coal producer in the EU. Nearly all of its generated electricity (around 92-94%) comes from coal-fired power plants fueled principally by hard coal and lignite. This is primarily due to Poland's vast domestic deposits of coal. According Poland's National Energy Strategy, the country's energy mix is going to change over the next two decades due to the rise in the use of renewables, natural gas and nuclear energy. At present, due to the significant role of coal in the Polish energy mix, Poland ranks the lowest among the European Union countries in terms of its level of energy import dependency. Poland's energy import dependency level is 14.7%, while the EU average in 2004 was 50.1% according to Eurostat, the European Commission statistical agency.

But (Scatts, 2011) in his article about Powering Poland affirms that whilst this was an understandable strategy to employ many years ago, increasingly strict environmental regulations will make it impossible for Poland to continue to rely on coal-powered plants for electricity. In addition to the adverse environmental aspects of burning coal there is the requirement for Poland to be producing 15% of its electricity from renewable sources by 2020.

The situation for import dependency for oil and gas is decidedly different than it is for coal. Poland imports nearly 90% of its crude oil and 66% of its natural gas. Its main supplier remains Russia. The heavy reliance on external supplies of gas to Poland remains a threat to the security of energy supply to the nation.

Poland's energy profile is therefore reflective of or shaped by both vast domestic coal reserves (which are of special concern in maintaining zero-emissions' economic growth) and a heavy reliance on imported fuels, of which gas is of particular political and economic importance. .

The dominant position of coal in the Polish energy mix is a challenge especially in light of efforts to limit CO₂ emissions. The post-Kyoto world energy order demands a tightening of restrictions on overall GHG emissions. (Nyga, 2011).

In the Energy Priorities of the Polish Presidency of the EU Council: The Czech Perspective, (Binhack, 2011) shows how besides the high import dependency in oil and gas from Russia and principal importance of domestic coal for electricity production, it is the lack of diversity in electricity production sector that defines the current energy debate at the national level. Environmental targets in the EU 2020 agenda require 15 percent share of renewables by 2020. The actual share is 7.2 percent which is already behind the 2008 target of 7.8 percent of total energy consumption. Despite Poland's commitments under the Kyoto CO₂ emissions target, there is a pressure on Poland to adopt more environmental friendly means of electricity production. It is not only about the use of renewables but also about gas fired power plants and nuclear energy, which has no share in electricity production in Poland so far. Nuclear energy is an important topic for the future of the Polish energy mix. Poland wants to have one nuclear power plant operational by 2020 as the policy makers seek to decrease gas imports and reliance on coal-firing power plants in order to match environmental goals.

6.3.2. Current companies in Energy Industry

Poland's energy industry is currently dominated by three major players, in charge of managing the main energy sources of the country, the generation, distribution and retail. Being the main actors in the country, they are the most likely to be part of the development of a Nuclear plant project.

Polska Grupa Energetyczna.

The Polish Energy Group (PGE Polska Grupa Energetyczna) is the largest energy group in Poland involved in the generation, distribution and sale of electricity. PGE Polska Grupa Energetyczna S.A. is one of the biggest heat and power sector companies in Central and Eastern Europe. Due to a combination of its own fuel (lignite) resources, power generation and final distribution networks, PGE delivers power supply to approximately 5 million households, businesses and institutions. (EnerCee, 2011).

The PGE Group is comprised of more than 100 subsidiary companies. The holding company is PGE Polska Grupa Energetyczna S.A., which is a 100% state-owned company. The PGE Group has its origin in the establishment of Polskie Sieci Elektroenergetyczne S.A. ("PSE S.A.") in 1990 as a result of the major restructuring of the Polish energy sector. PSE S.A. was a major energy company, active mainly in electricity transmission and wholesale trade. In 2004 the activities of the Transmission System Operator were legally unbundled from PSE S.A. with creation of a subsidiary company. Since 2007 the Polish TSO (with its transmission assets) has been a separate company fully-owned by the Polish State. (Zadroga, 2008).

Generating more than 54 TWh annually (approximately 40% of the total electricity generated in Poland) utilizing its 12.3 GW power generation capacity (more than 35% of the total installed capacities in Poland), the PGE Group trades in electricity on the wholesale market and provides supply of electricity to approximately five million customers in Poland. The PGE Group's share of the retail electricity market is approximately 26%. The PGE Group consists of two large lignite mines, more than 40 power plants and combined heat and power plants (CHP) (including renewable, hydro and wind power plants), eight Distribution System Operator Companies, eight electricity Retail Sales Companies, an electricity wholesale company and enterprises operating in other industries (including the telecommunications industry). Hard coal and lignite are the basic fuels used in the power plants of the PGE Group. (Zadroga, 2008)

The activities of Polska Grupa Energetyczna focus on the following areas: Conventional Power Generation, Wholesale, Distribution, Retail, Renewable Power Generation. Sustainable development is one of the major principles of PGE Capital Group. By 2012 the Company intends to spend PLN 38.9 bn on investment. Over 20% of these funds will be expenditure on the development of renewable sources of energy. (EnerCee, 2011)

The PGE Capital Group – key facts (EnerCee, 2011):

- ✓ 53,8 TWh – the volume of the power generated by the PGE Capital Group.
- ✓ 43,1 m tons – the volume of the lignite excavated by the PGE Capital Group's lignite mines.

- ✓ 12.4 GW – the installed capacity of the power plants and cogeneration plants belonging to the PGE Capital Group (this places PGE in twelfth position on the list of Europe's biggest power generation companies).

PGE's production is concentrated in 4 large power plants:

- ✓ Belchatow, the largest power plant in Europe (lignite, 4320 MW)
- ✓ Turow (lignite, 2088 MW)
- ✓ Dolna Odra (coal, 1984 MW)
- ✓ Opole (coal, 1492)

According to the PSE S.A. CEO (Zadroga, 2008), the Polish power sector today is facing major challenges. It must ensure Poland's energy security and meet the challenges of the country's growing economy, while meeting increasingly strict environmental standards. In response to the new challenges and requirements, the PGE Group is embarking on activities in the field of new power technologies. These activities include participation in the Clean Coal Platform, as well as preparation of the Nuclear Energy Development Program in Poland. The good financial performance (2007 EBITDA of PLN 4.7 billion) reported by the companies of the PGE Group in recent years has been made possible by our business being focused on building value.

TAURON Wytwarzanie S.A. (previously Południowy Koncern Energetyczny S.A.)

It is at present one of the largest power industry companies in Poland and has an installed capacity of 5,000 MW. The company's share in the national production of electrical energy is around 14% and around 16% in heat production for the local market in 2009. (TAURON Wytwarzanie S.A., 2011).

The company forms part of the Tauron Group, one of Poland's biggest business entities. In 2007, PKE's consolidated revenue amounted to PLN 3.6 billion (€805 million), with a net profit of PLN 137.6 million (€31 million). (EnerCee, 2011)

The TAURON Group is a major player in the Polish power sector and a guarantor of energy security in Poland. The Group's area of operations covers almost 20 percent of Poland's territory. Its core businesses include coal mining as well as electricity generation, distribution and trading. The TAURON Group's corporate strategy until 2020 is to achieve systematic growth of business, both in Poland and abroad. (TAURON, 2011)

- ✓ Total assets - PLN 22 billion.
- ✓ Achievable electrical capacity - approx. 5.4 GW.
- ✓ Achievable thermal capacity - approx. 3.2 GW.
- ✓ Electricity supplied to over 4 million clients.
- ✓ Distribution grid - 17 percent of Poland's territory.
- ✓ Employment - over 28 thousand people.
- ✓ Over 90 companies linked by equity.

The core business activity of TAURON Wytwarzanie S.A. includes, (TAURON Wytwarzanie S.A., 2011):

- ✓ Generation of electrical energy
- ✓ Transmission and distribution of electrical energy
- ✓ Production and distribution of heat.

PSE-Operator SA

(Polskie Sieci Elektroenergetyczne Operator SA). PSE-Operator S.A. is the transmission system operator (TSO) of the Polish Power System. It performs the aforementioned function within the scope and in the manner prescribed by the binding legal regulations, and in accordance with the conditions stipulated in the decision by the President of the Energy Regulatory Office (ERO). PSE-Operator S.A. manages power transmission network, which enables the transmission of electricity to all regions of Poland. (PSE-Operator S.A., 2007)

Its only shareholder is the Ministry of Treasury. Until 2007, PSE Operator was a part of the PSE Group (now: Polska Grupa Energetyczna). The subject of the PSE Operator S.A. activity is to provide the services of electricity transmission in compliance with the required criteria of the security of the Polish Power System operation. (EnerCee, 2011).

The major objectives of PSE-Operator S.A. operation, according to its annual report (PSE-Operator S.A., 2007) include:

- Assurance of secure and economic operation of the Polish Power System (PPS) as a part of the common European power system, considering the requirements of synchronous operation and asynchronous connections.
- Assurance of the necessary development of the domestic transmission network and cross-border connections.
- Provision on market basis of the transmission capacities for the cross-border exchange purposes.
- Creation of technical infrastructure for the operation of the domestic wholesale electricity market. The restructuring of the sector led to the creation of two large companies, PGE and PKE.

From these three companies, Polska Grupa Energetyczna S.A. has been the chosen utility for the Polish Nuclear plant project and currently is considering several reactor designs. Poland's government expects to begin construction of its first nuclear power plant in 2016 and has targeted 2020 as the commercial date of operation for the first plant. (Nuclear Street Team, 2011)

6.3.3. Current Authorities

The regulatory framework for the Polish energy sector was defined in the Energy Law Act of 10th April 1997 [EL] developed with particular consideration to its conformity with the European Union law, among others, with Directive 2003/54/EC. (Energy Regulatory Office., 2008)

The principal regulator in the energy sector is the **Energy Regulatory Office [ERO]**, who's President is appointed by the Prime Minister for a 5-year term, and is responsible for the

realization of tasks in the scope of fuel and energy management control as well as promotion of competition, granting licenses, approving tariffs and settling disputes (EnerCee, 2011).

The Functions of the Regulator there are following (Energy Regulatory Office, 2006):

- Procedures for approval of by-laws and Its registration with state bodies;
- Confidential information;
- Public hearings as one of the forms of regulator's activities
- Licensing

Moreover, the Energy Law Act established the main goal of the president as follows (Energy Regulatory Office., 2008):

- Balancing the interests of energy undertakings and energy consumers
- Counteracting negative impacts of monopolistic practices for the sake of durable and sustained energy security
- Promoting a competitive market in the areas in which it is economically justified
- Improving of the economy competitiveness and environment protection against negative impacts of energy-related processes

Regarding nuclear energy On January 13 2009, the following resolution was adopted by the Republic of Poland government:

“ To ensure the national energy security, and taking into account the economic development, a Polish nuclear power program shall be developed and implemented. The draft of such program shall be developed and submitted to the Council of Ministers by the government's plenipotentiary; this program shall determine the nuclear power plants' number, size and possible sites. Moreover, the government obligates the National Treasury Minister to ensure that PGE Polish Energy Group SA shall cooperate on the program's development and implementation. “(National Atomic Energy Agency, 2011)

In the Act of 29 November of 2000 on Atomic Energy Law it was stated that the nuclear safety and security should be treated together with radiation protection and radiological monitoring of the environment. (Ministry of Economy of Poland, 2011). Behind such a solution there is an understanding that safety and security of nuclear materials and facilities should be treated as a secondary issue originating from the protection against radiation, since in all cases the hazard potentially caused by any nuclear technology is related to biological effects of ionizing radiation. Due to this consideration, in Poland there is only one joint legal approach to all aspects of radiation protection and nuclear safety, but also the state control in that area is executed by a single governmental regulatory authority: **The National Atomic Energy Agency (NAEA)**

The National Atomic Energy Agency is the governmental agency established by the statute conferred by the Minister of environment and it is directed by the President of the NAEA. The president is a central organ of governmental administration in charge of nuclear safety and radiological protection. He is responsible for the coordination and control of activities to the

research and safe use of the nuclear energy, safeguards the nuclear material, storage of radioactive waste, education and information of the public, as well as international co-operation in this matter.(Nuclear Legislation in the OECD Countries, 2008)

6.4.Nuclear Power

Poland has had a 40 year history with nuclear power. The first plans for the construction of a Polish nuclear facility date back to 1971 when the government debated on building a plant either in Żarnowiec or Kłempicz. The reasons behind the location of these plants reflected favorable hydrological, seismic, geological and demographic conditions in these two areas. These facilities were initially scheduled to be brought on line in the year 2000. However, with a lack of social acceptance for such an investment on Polish territory in the wake of the Chernobyl disaster of 1986, these plans were tabled. More recently, the concept of adding nuclear power to the Polish energy mix was revived in 2005 and has been subsequently included in the nation's overall energy policy strategy as an alternative of power generation to move away from heavy dependence on coal and imported gas, and to reduce CO₂ and sulfur emissions .(NuclearAssociation, 2011)

Moreover, the country's existing power plants need urgent modernization but analysts say that will not be enough to meet expanding energy demand. Poland has traditionally been a net electricity exporter, mostly to Czech Republic and Slovakia, but recent years has seen a reduction in export levels as domestic demand continues to grow, and the country looks set to become a net importer unless capacity additions are made.(NuclearAssociation, 2011)

Social resistance to nuclear power has lessened, and local communities are actively competing for power plant installations in their regions as such plant development is viewed as an opportunity for employment creation. (Nyga, 2011).

Polish energy policy to 2030 includes a set of basic targets. Among them are:

- ✓ Improvements in energy efficiency.
- ✓ Improvements in overall energy security.
- ✓ A wider use of renewables, particularly biofuels.
- ✓ The development of competitive energy and electricity markets.
- ✓ A limitation of the negative impacts of energy usage on the environment.

For the fulfillment of these objectives and policies, Poland knows that it is necessary to start reducing the energy consumption, which constitutes the cheapest way towards an energy security policy, and this can be gotten through the innovation in technologies in favor of energy efficient systems. As well as for guaranteeing the energy security, renewable methods can enlarge the energy mix, where Nuclear plants development is presented as an opportunity that provides electricity independence and reduction in the emissions as it is required by the EU standards.

6.4.1. Financing Nuclear Energy Generation

For Poland the construction of the first nuclear power plants will be a unique project, which will set the example for those that will come in the future. Being the first one gives this project

a high importance and the entire environment around it, regulators, suppliers, construction, decommissioning etc. have to be well set and defined to ensure effective operation of the nuclear power sector in Poland

One of the most important aspects to carry out the project is defining the financing methods and entities involved in it. The development of the regulatory, organizational, educational, research and other types of infrastructure will require significant financial expenditures. The construction of nuclear power plants is a long-term and costly process.

According to the “The Polish Nuclear Energy Program” (Ministry of Economy of Poland, 2011), expenditures will be incurred both by the project owner responsible for the first nuclear power plants and by the government agencies. Due to the fact that the government is the pioneer of this project, and the strategic importance of this nuclear power for the national security, a company with a direct or indirect majority interest of the State Treasury is expected to be the project owner responsible for the first nuclear power plants with the installed capacity of about 6,000 MW. This is the reason why PGE Polska Grupa Energetyczna S.A. (Polish Energy Group) will be appointed as the project leader with respect to the construction of the first nuclear power plants in Poland, and it is the only Group in the power sector planned to be kept under the control of the State Treasury.

The availability of sources of financing, both domestic and international, is an important factors that affect nuclear power plant construction project due to high cost of such a project, the duration of a construction process and the cost of capital.

Following the “The Polish Nuclear Energy Program” the options considered by the Polish State to construct a power plant are:

- international financial institutions
- export credit agencies
- international banks
- by use of a financing solution provided by the seller (supplier).

International financial institutions that can provide financing for large projects include the European Bank for Reconstruction and Development (EBRD) or European Investment Bank (EIB).

As a second option, knowing that the current environment of the global economy is characterized by limited fluidity of international sources, export credits have become a solution. Export credits are special financial instruments that, for example, enable a foreign buyer of exported goods or services to defer payment or obtain collateral or guarantee. These instruments are usually connected with governmental support solutions such as government credits, insurance of export credits, subsidies to export credits interest or other types of official support. Their task is to stimulate exports of goods and services by guaranteeing long-term financing on attractive conditions.(Ministry of Economy of Poland, 2011)

In addition, given the scale, complexity and high level of risk of the investment project, it is necessary for the state to play an active role in supporting the project owner’s activities by

securing financial aid with the use various support measures – such as State Treasury. (Ministry of Economy of Poland, 2011)

Definitely for Poland the complete involvement and support of the government as well as the strengthening of the utility and operator, are key for this first step to the development of the nuclear industry in the country.

6.4.2. Suppliers

Poland's PGE, the main domestic investor, was expected to launch a tender for selecting the firm which will supply nuclear technology for the two 3,000 MW plants in September. The process should be completed by mid-2013. Firms under consideration are French companies Areva and EDF, GE Hitachi, and Toshiba's US-based unit Westinghouse. (Trudelle, 2011).

While this is taking place, GE Hitachi Nuclear Energy is developing alliances with local suppliers in order to consolidate its supply chain and integrate polish construction and engineering expertise to its offer. GE Hitachi Nuclear Energy is looking for continuing to grow the local and global supply chain capabilities to help PGE successfully complete its first nuclear power plant projects.

With Poland evaluating two GE Hitachi Nuclear Energy (GEH) reactor models for the country's first nuclear power plant projects, GEH announced on July 28, 2011 that it has signed a memorandum of understanding (MOU) with Warsaw-based engineering firm Energoprojekt Warszawa, S.A. (EW) to discuss the feasibility of partnering on future reactor projects. The MOU with Energoprojekt Warszawa is the latest in a series of preliminary agreements that GEH has signed with Polish suppliers as the government prepares to develop Poland's first two nuclear generating stations to diversify the country's energy supplies. Under the new MOU, both companies will explore how EW could provide specific engineering services to GEH for the potential development of new nuclear power plants in Poland. (Nuclear Street Team, 2011)

“Energoprojekt Warszawa, S.A. is pleased about the potential cooperation with GE Hitachi Nuclear Energy on the Polish nuclear plant construction”, said Andrzej Patrycy, president and managing director of Energoprojekt-Warszawa S.A. “This initial action shows the future possibility of creating jobs and cooperation related not only to Polish suppliers of fixtures, construction and installation works, but to Polish planning and engineering during the plant's construction process.” (Nuclear Street Team, 2011). Polish utility Polska Grupa Energetyczna S.A. is still considering several reactor designs for the projects.

Other preliminary project development agreements signed by GEH with local suppliers include:

- GE Hitachi Nuclear Energy said in September 2011 that it and Fluor Corp. will jointly bid on a nuclear power plant construction project in Poland. GE Hitachi said Fluor would be its engineering, procurement and construction partner under the memorandum of understanding between the two companies. The financial terms were not disclosed. (The Associated Press, 2011)

- With the Institute of Atomic Energy in Poland (POLATOM), a research institute located in Świerk that advises the government on nuclear energy issues in March 2011. (Nuclear Street Team, 2011)
- January 2011 (Nuclear Street Team, 2011):
 - Stocznia Gdansk, a leading Polish shipyard, for the potential manufacturing of nuclear components for GEH.
 - RAFAKO S.A., Europe’s leading boiler equipment manufacturer, for the potential manufacturing of nuclear components for GEH
 - Gdansk University of Technology, West Pomeranian University of Technology, Szczecin University, and Koszalin University of Technology.

May 2010 with global engineering services firm SNC-Lavalin Polska. (Nuclear Street Team, 2011)

6.4.3. Uranium and Nuclear Fuel

Deposits of uranium are globally dispersed, most of them located in politically stable countries, so the risk of becoming dependent on one source (supplier) is negligible. For many years, the price of uranium had been low causing stagnation in exploration of new deposits. Currently, uranium price has grown which resulted in more intense uranium exploration, while at the same time made it possible for some formerly unprofitable and closed mines to be re-opened and exploited.(Ministry of Economy of Poland, 2011)

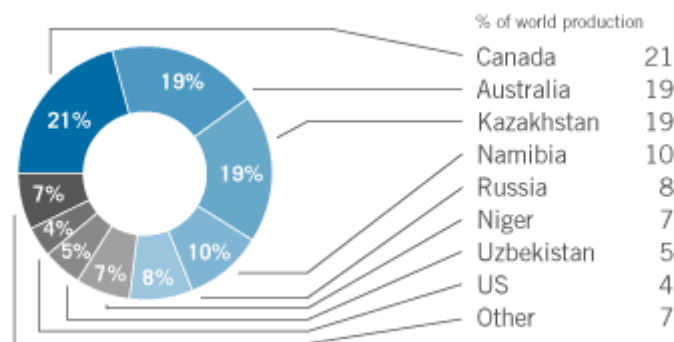


Figure 6-1 World Uranium Production (Comeco, 2008)

Identified uranium ore deposits in Poland contain from 250 up to 1,100 ppm⁶ of uranium, whereas much profitable very low-grade mines which nowadays make the mining unprofitable since much more cheaper uranium can be purchased abroad,. However, while discussing the strategic aspects of the developing of the nuclear plant project, it should be kept in mind that Poland has its own uranium deposits and it may use them in future.

Regarding the nuclear fuel, Poland will not manufacture it and will buy it from world suppliers that are part of the Euratom Treaty that states the rules of uranium supplies for the EU member states. It is planned to be like this for the first 5 to 10 years of NPP operation as it has become a global practice. In addition, nowadays the fuel market is well developed and Poland

will not be in risk of becoming dependent on foreign suppliers. However, Poland will consider building its own fuel cycle facilities in the future. (Ministry of Economy of Poland, 2011)

6.4.4. Social Acceptability

In the World Energy Council congress held in Montreal, the Commissioner of the government of Poland on Nuclear Energy and the Energy Market Agency presented the Nuclear Power Program for Poland: Objective, Framework Program and Basic Challenges report, which covered the current process of the country on its way for the construction of a Nuclear plant, in which they showed the society reaction and opinion about it. Poland has a specific situation when undertaking the present program of nuclear energy development. This is because the precious experience in launching the nuclear option in Poland in 1980s has failed. The failure was caused mainly by obligatory implementation of the soviet technology which, after the Chernobyl accident, threatened the Polish society and also politicians, although NPP Zarnowiec, being that time under construction, had a different type reactor. Also the fall of the old political system and centrally planned economy made unable completion of the plan. Since that time the public opinion in Plant has been totally against nuclear energy until recently. (Trojanowska & Duda, 2010).

Results from a multinational public opinion poll indicate that people around the world are growing more supportive of nuclear energy in line with their access to information on it. A separate poll also shows increasing support in Poland. (World Nuclear News, Polls show growing support for nuclear, 2009)

In Poland, with its power sector almost totally based on domestic coal and lignite, it would be rather difficult to convince fully miners' trade unions. Although, the energy policy until 2030 foresees the coal and lignite based electricity generation at the level amounting to 100 – 110 TWh per year for the next 20 years which will be also a great challenge for the mining sector. This is because the competitiveness of domestic coal on its international market drastically falls down and the development of coal option would need a growing import of that energy carrier. International obligation to reduce the CO₂ emission imposed on the Polish power sector also means huge investment in clean coal technology. These facts additionally indicate on the need of the nuclear power development.

Improving public acceptance of nuclear energy will be an important task of the governmental and local administration. Luckily, local authorities become more and more in favor of building NPPs on their territories as they see many advantages of such investments. Generally, they expect a boost of the local economy, especially reduction of unemployment. Public acceptance will grow once the government assures compensation for living in the proximity of NPPs. Almost 74% of the population definitely agrees with the initiative of compensation. This should be in a form of lower electricity prices, employment priorities, free vacation or free medical care for kids. (Trojanowska & Duda, 2010).

A recent public opinion poll in Poland also shows that public approval for the construction of a nuclear power plant in the country is growing. The survey, conducted in early March by GfK Polonia on behalf of the *Rzeczpospolita newspaper*, shows that 40% of the 1000 Poles questioned support the construction of a nuclear power plant, with 42% opposing. A similar

poll conducted in January showed that 33% supported building a plant, while 56% were against the move. Analysts cited in Polish media said that the increase in support is due to the public becoming more aware of the country's dependency on Russia in meeting its energy needs. (World Nuclear News, Polls show growing support for nuclear, 2009).

Opinions about nuclear energy have been surveyed by CBOS - Centrum Badania Opinii Społecznej (Public Opinion Research Center) for nearly 24 years and in this space of time public opinion about building nuclear power plants in Poland was undergoing changes. Shortly after the Chernobyl disaster, the supporters of building nuclear power plants constituted only less than a third of all the respondents (30%). The group of undecided Poles was similarly numerous (31%). With the approach of 21st century the number of people who did not know what to think about this issue significantly fell. The first survey in the new millennium was conducted in 2006 and it showed that the number of opponents was highest ever (58%). However, from then on, the figure started steadily to fall. It reached its peak in 2009 when, for the first time, there were more people who favored the idea to build power plants in Poland than there were opponents of this motion. (CBOS, 2011)

According to the surveys realized by CBOS, between 1987 and 2008 the opponents of nuclear power clearly outnumbered those ready to accept it.

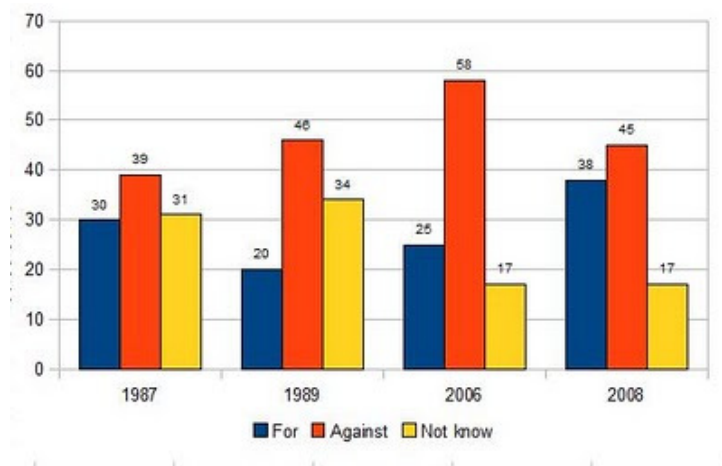


Figure 6-2 Public opinion in Poland (TNS Opinion and Social, 2010)

Since 2008, the opinion seemed to be shifting. According to different surveys, there is either a small majority in favor, or a small majority against the Polish nuclear program. As far as the public opinion is concerned, the issue is undecided. (TNS Opinion and Social, 2010).

The change in public mood can be also seen in the report Europeans and Nuclear Safety published by the Eurobarometer in March 2010. Poland is among the countries, where more than a quarter of the population (25% - 30%) supports an increase in the use of nuclear energy. Even though as many as 50% of the respondents agree that *the risks of nuclear power as an energy source outweigh its benefits*, while only 38% thinks the opposite, there is a visible shift in the opinion. In 2006 only 26% tended to think that there are more benefits than risks

involved. The rise of 12 percentage points is the biggest one in Europe, with Ireland (+10pp) and the Czech Republic (+9pp) coming next. (Trojanowska & Duda, 2010).

The results of the latest research disturb the trend that could have been noticed so far. Presently, and after Fukushima's accident, the majority of the surveyed people are against building nuclear power plants in Poland (53% - a 14 point increase since 2010). (CBOS, 2011)

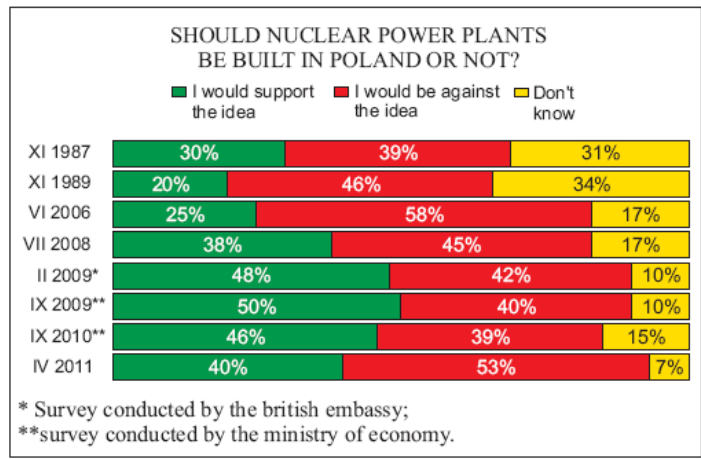


Figure 6-3 Social Acceptance in Poland along the years. (CBOS, 2011)

Opinions about whether it is potentially possible to build nuclear power plants that are safe for the neighborhood are divided. There are 46% of respondents who express their skepticism on this subject and nearly as many believe (43%) that the recent technological advances have enabled people to construct safe nuclear power plants.

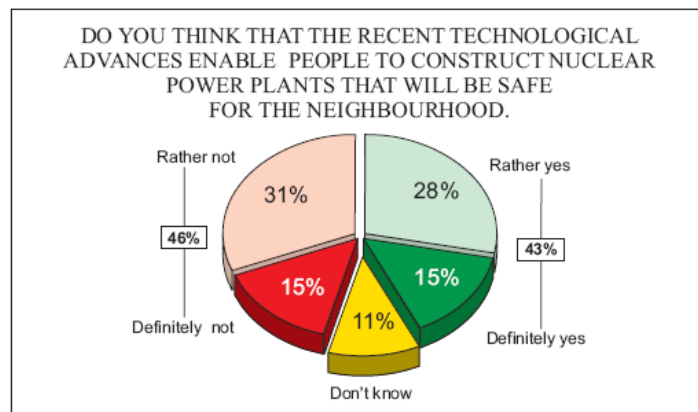


Figure 6-4 Polish opinion about safety, according to the new technology. (CBOS, 2011)

The majority of respondents (69%) think that even the most modern safety measures will not protect Poland against uncontrollable accidents that might ultimately lead to a disaster in a nuclear power plant.

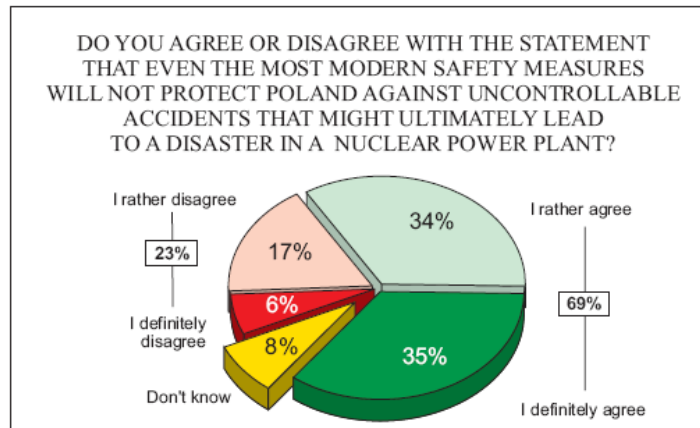


Figure 6-5 People's opinion about modern safety measures. (CBOS, 2011)

Finally, according to the words of the Commissioner of the government of Poland on Nuclear Energy and the Energy Market Agency during the World Energy Council congress held in Montreal, the public acceptance will depend very much on the scope of information provided in the mass media showing different aspects of energy supply, particularly the consequences of not going nuclear when the coal based energy becomes extremely costly because of its ecological impact, especially when external costs are considered. It should be shown that the option based on very costly renewable energy sources whose rational resources are limited, or gas fired plants with high predicted prices of this energy carrier, will lead to unacceptable burden to the economy and households. (Trojanowska & Duda, 2010).

6.5. Proposed model according to the characteristics

The stakeholders that are involved in the construction of the nuclear plant in Poland according to what was described above are shown in Figure 6-6:

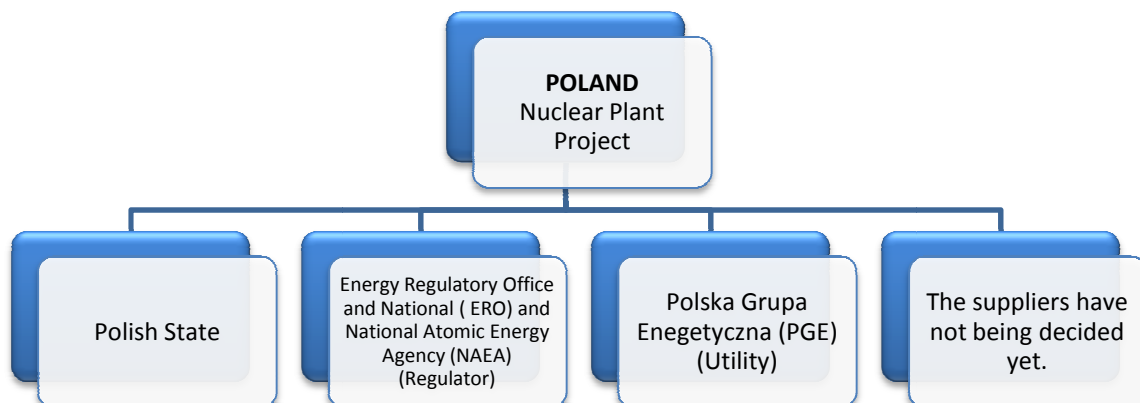


Figure 6-6 Stakeholders Present in Poland's Nuclear Plant Project

In chapter 5, after analyzing the six countries there were chosen five characteristics to define the different models. Having described Poland economic, politic and energy industry background, the characteristics are the following:

- 11. Degree of development:** Poland is currently an emerging country. After they started to be ruled by a democratic government, following the policies of free market and industry privatization, they are having an economic strengthening which could be demonstrated by the fact that it was the only country in the EU that presented an economic growth during the 2009 period of crisis. This reality has helped to increase the investment and to the development of new projects for the well being of the country.
- 12. Wealth of the Country (Government capability):** Poland's GDP (12,271 USD) is among the highest of the developing countries previously analyzed that might be interested in the construction of Nuclear power plant. This value has been increasing in the past years, which allows the country to think about investing in a megaproject such as a nuclear plant.
- 13. Degree of control of the government over the enterprise sector (free market or regulated market):** Since 1990, Poland has been working with a free market policy which opens the possibilities to the foreign direct investment and gives the opportunity to the companies to be independent as they support the local development.
- 14. The role of the energy authority in the country "As is":** As it was described, the only authority in the energy sector in Poland is the Energy Regulatory Office, which is in charge of giving the licenses, generating the policies and monitoring the companies' performance. However, Poland counts with a National Atomic Energy Agency that right now is working with radiation protection and radiological monitoring of the environment and according to the state, it should also work with the nuclear safety and security. Both entities are both dependent on the government.
- 15. Private or Public companies in the energy sector:** Nowadays, Poland continues with the privatization of the companies, in order to increase the economic capability of the country, however as a government decision, around twenty companies belonging to the energy and infrastructure sectors will remain in state ownership, this includes the utility PGE.

According to what was stated before, the model that better suits the relationships and interactions between the principal stakeholders in the construction of the nuclear plant in Poland is the French-Korean model which was described as:

Model of a Stakeholders configuration that will work in a developed country with an organized and wealthy government that possesses a strong link between it and the energy providing companies. A country where the roles of every entity (utilities and regulators) are precisely defined. Having specific power and functions that will not cross the boundaries of one another, even if they are all dependent on the government.

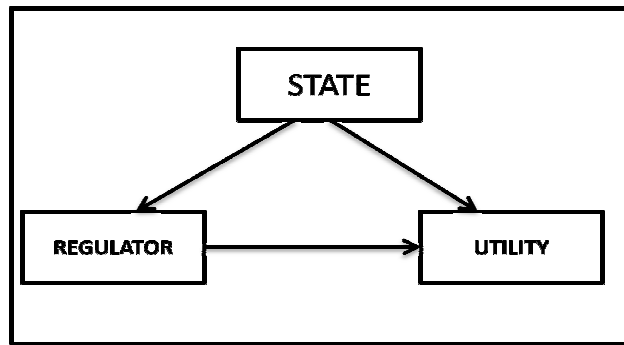


Figure 6-7 FRANCE and KOREA MODEL

As described in the model, Poland economy is getting stronger, the government should work side by side with the utility to develop the nuclear plant. At the same time there is the positive aspect of having the community in favor of the construction project.

The map suggested by this thesis to be applied in Poland is one where the Government is for now the main actor.

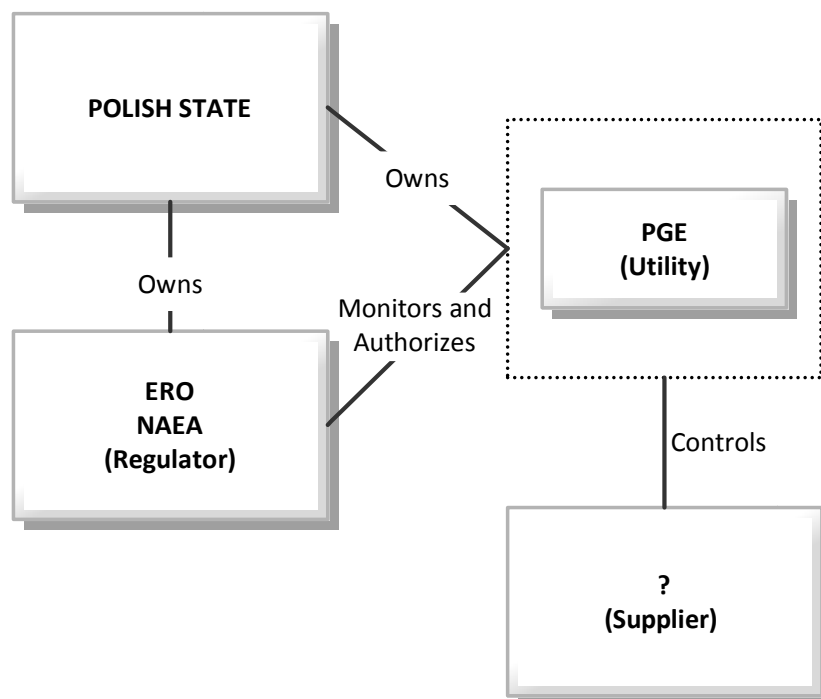


Figure 6-8 Mapping of Stakeholders in Poland

The Polish State is the main Stakeholder by being the one proposing the project and identifying the high necessity of building a NPP. Their purpose includes long-term energy security, electricity production economics as well as the need to maintain the Polish economy's competitiveness; which gives them all the reasons to push, maintain and finance the project. As owners of the utility PGE, the State is easily in control of the processes and plays an important role during all the life cycle of the plant. At the same time, the authorities, being part of the Government, would exert a high influence in the decisions made by the utility and

the supplier, by controlling all the steps of the process and guaranteeing the well execution in accordance to the law and the security policies.

With this configuration and the characteristics that has every stakeholder, can be given the attributes to the main actors, being the Polish State the definitive stakeholder, as it possesses the **urgency**, **legitimacy** and **power**, for the same reasons explained above. The authorities (ERO and NAEA) have the **legitimacy** as they are supported by the law and look for the security and safety of the society; as well as the **power** of interfering in case of existing any threat to the agreements and regulations. The utility has the **legitimacy** by having all the permits and rights to execute the project and the **urgency** of building it on time and according to its budget and estimations. Finally the suppliers have the **urgency** of being selected and getting the contract.

It is important to highlight that this analysis can change if the basic characteristics that described the model changes. That could be in the case of a change in the economic activity of Poland, if the country decides to privatize the utility, if there is a major event that demands extreme measures and could alter the power distribution among the stakeholders, among others.

7. CONCLUSIONS

After performing an intensive research on stakeholders in megaproject, having studied six different countries to understand their stakeholder configuration, and developing 3 models to recognize the relationship between them, this work has reached to the following answers for the research questions:

Q5) Why a nuclear plant project's scope and objectives can be affected by its stakeholders?

Stakeholders are the group of individuals that are somehow involved and have interests in the development of a specific project. Moreover, they are the suppliers of economic means, policies, laws, permits, knowledge, materials, among others, for the execution of any project. The higher the number of stakeholders involved, the higher becomes the complexity of their management and therefore the project itself. These stakeholders' interests and expectations can make them exert their power in order to achieve their own objectives. This acts have an impact in the scope of the project that changes along the lifecycle of the project. Therefore the importance of each type of stakeholder is different in each of the stages of the project, and as a consequence all of the stakeholders have to be taken into account for the decision making process.

As it is stated in chapter 4, nuclear plants are defined as megaprojects due to their high complexity, high amount of time and money involved and impact in society. Any change made in the project due to a requirement, a major force decision, an event or accident, can drastically affect the budget and the time of the project.

Nuclear plant projects are a concern of the State, reason why, the government plays a definitive role as it was affirmed in the comparison between the six countries analyzed. Any decision made by the government can change the direction of the nuclear industry in a country. United Kingdom decision of not provide economic support to the nuclear projects, ended up in the introduction of EDF as owner of the actual nuclear plants, which once were owned by a local utility (British Energy). After Fukushima the state had to intervene by shutting down all reactors that could represent a threat, until they are inspected. In France, the ASN ordered a construction stop at the EPR Flamaville site for a few weeks in order to ensure improved documentation and implementation of quality standards for concrete, welding, and steel framing.

On the other hand nuclear plants are unique projects in each country. There is not a single plant the same as other, due to the different conditions presented in each country. This gives power to the utilities and the suppliers that already have the technology and knowledge. These stakeholders have a high influence in the construction phase and can use strategies to change or obtain what they want.

Moreover, due to its high impact in the society, a nuclear plant project tends to be affected by the community if they enforce strong protests against the cause. There are cases where nuclear plants project have not started due to high community pressure on the government. This is what is happening today in Japan after the Fukushima accident. The community

disagreement has increased and the industry is in a delicate process of trying to demonstrate the security and safety of the industry before the country's eyes.

These examples show how one stakeholder can change the course of a project, no matter the dimensions or the power behind it. The success of the construction of a nuclear plant can highly depend on the right involvement of the stakeholders. Due to its condition of megaproject, the impact in time (delays) and money (budget) that the stakeholders' influences can make are of great relevance and require a whole management approach.

Q6) Which are the most important stakeholders in a Nuclear Plant Projects? Which are the most influential according to the countries studied?

The table above shows the group of stakeholder that may be involved in a nuclear plant project.

ECONOMIC	SOCIAL
<ul style="list-style-type: none"> ▪ Facility Owner ▪ Funding Entities ▪ Government ▪ Local Authorities ▪ Elected Officials ▪ Trade Unions ▪ Waste Manager ▪ Decommissioning manager ▪ Nuclear Industry 	<ul style="list-style-type: none"> ▪ General Public ▪ Local Communities ▪ Media
ENVIROMENTAL	TECHNICAL
<ul style="list-style-type: none"> ▪ Regulators (environmental) ▪ Neighboring countries ▪ Pressure Groups 	<ul style="list-style-type: none"> ▪ Regulators (Nuclear safety) ▪ Researches and Scientists ▪ Contractors ▪ Operation Staff ▪ Waste Manager

After the investigation of the nuclear industry in the six countries, and comprehending how was the interaction of the stakeholders in the process of the construction of a Nuclear plant, it was decided that the most important stakeholders were:

- ✓ **Government:**
- ✓ **Authority**
- ✓ **Utility**
- ✓ **Suppliers**
- ✓ **Community**

The government represents the leading head of the configuration except for the countries of Finland and USA. The state is in charge of using the authority as a tool to maintain the security

and safety of the industry and protect the community an environment. In the case of USA and Finland the authority is the one that guides the industry of course supported but not ruled by the government. For the countries of France and Korea the government is also the owner of the utility becoming the most influential stakeholder for them. For Japan and UK, the utilities are private and the government enforces its power over the authorities. The suppliers all depend on the decision of the utility while the community is a stakeholder that can become dangerous in the moment of the construction if they are not well dealt with since the beginning of the project.

Having this said after the country analysis and the definition of the role of the stakeholders, the principal and most influential stakeholders at the moment of the construction of the nuclear plant are the **Government, the utility and the authority**. The suppliers and the community depend on the execution and decisions of these three to be able to make part of the stakeholder configuration of each country.

Q7) Why and which are the factors that make the stakeholders configuration different in each of the studied countries?

By describing the background of the nuclear industry in each one of the countries it was seen that the conditions were different. Korea for example entered this industry when it was still a developing country meanwhile the rest were already developed. Finland and USA are countries with a very strong authority that since the beginning established strict policies and found the means to enforce them impeccably. France and Korea are countries in which the state owns the utility while in Japan and UK the utilities are private. These differences led to three models proposed based in the links and relationship of the main stakeholders: the State, the Utility and the authority. The characteristics that answered how could be the relationship between these stakeholders where the following:

- ✓ **Degree of development:**
- ✓ **Wealth of the Country**
- ✓ **Degree of control of the government over the enterprise sector**
- ✓ **The role of the energy authority in the country As-IS**
- ✓ **Private or Public companies in the energy sector**

The degree of development and the wealth of the country can tell us if the country will have the means to invest in this kind of projects and if the government would have the conditions to enter as a money provider if it is required. The degree of control of the government in the enterprise sector gives an idea of how could be the relationship of the government and the utility. Even if the utility is a foreign one, in a country where the government controls the enterprise sector it will tend in some way to control this utility. This relationship can be also defined analyzing how public or private is the energy sector in the country at the moment. Depending on the size and importance of the energy company in the country, the economic means can be given only by the utility without needing the help of government involvement in this aspect. Finally the role of the authority in the energy sector as-is working at the time is an start to realize how should be set the authority for the nuclear industry.

Q8) Which should be the stakeholder configuration of a country that wants to develop a Nuclear Plant Project?

The stakeholder configuration of a newcomer country interested in joining the nuclear industry has to be guided by the recognition of their own characteristics and the comparison of them with the already found in the proposed models. This thesis looks for providing a tool that allows the interested country to compare their own parameters with the five characteristics defined in the chapter 4: (1) Degree of development; (2) Wealth of the Country; (3) Degree of control of the government over the enterprise sector; (4) The role of the energy authority in the country As-IS; (5) Private or Public companies in the energy sector.

In this sense, after analyzing the background and current state of the energy industry, the involvement of the government in the project and the role of the authorities, the newcomer can identify their stakeholders relationships with one of the three models in which were grouped the six countries studied.

For the specific case of Poland, which was the selected country to apply this argument, the definition of the five characteristics led to the conclusion that the model that better suits the relationships and interactions between the stakeholders in the construction of the Nuclear plant is the France and Korea model. Poland could use the experience of these two countries to base its stakeholder configuration as well as apply all the lessons learned by them in the generation of their nuclear industry.

As done it was done for Poland, another country could use these models in order to get a guide to generate their own stakeholder configuration.

8. LIST OF ACRONYMS

ACRONYM	MEANING
ANS	American Nuclear Society
ASN	Autorité de sûreté nucléaire
BNFL	British Nuclear Fuel Company
CBOS	Centre for Public Opinion Research
CEA	Commissariat à l'Énergie Atomique
CHUDEN	Chūbu Electric Power Company
EBRD	European Bank for Reconstruction and Development
EDF	Électricité de France is the main French Utility
EIB	European Investment Bank
ERO	Energy Regulatory Office.
EW	Energoprojekt Warszawa
GE	General Electric
GEH	GE Hitachi Nuclear Energy
GNF	Global Nuclear Fuel
GPRF	Provisional Government of the French Republic
H.N	Horizon Nuclear Power
HYNEC	Hyundai Engineering and Construction
IAEA	International Atomic Energy Agency
JAEC	Japanese Atomic Energy Commission
KEPCO	Kansai Electric Power Company
KEPCO	Korean Electric Power Corporation
KHNP	Korea Hydro & Nuclear Power
KINS	Korean Institute of Nuclear Safety
KNF	Korean Nuclear Fuel
MEST	Ministry of Education, Science and Technology
MKE	Ministry of Knowledge Economy
MNC	Multinational Company
MOU	Memorandum of Understanding
NAEA	National Atomic Energy Agency
NDA	Nuclear Decommissioning Authority
NISA	Nuclear and Industrial safety Agency
NPP	Nuclear Power Plant
NPP	Nuclear Power Plant
NRC	Nuclear Regulatory Commission
NSC	Nuclear Safety Commission
NuG	NuGeneration
OCNS	Office for Civil Nuclear Security
ONR	Office of Nuclear Regulations
OPEC	Organization of the Petroleum Exporting Countries
PGE	Polska Grupa Energetyczna
PSE	Polskie Sieci Elektroenergetyczne Operator S.A.
RDT	Resource Dependence Theory

SSE	Scottish & Southern Energy
STUK	Radiation and Nuclear Safety Authority
TEPCO	Tokyo Electric Power Company
TSO	Transmission System Operator
TVO	Teollisuuden Voima
UKAEA	UK Atomic Energy Authority
UKSO	UK Safeguard Office
WNA	World Nuclear Association

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