Chapter 2

Social Acceptance of Nuclear Power

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Chapter 2

Social Acceptance of Nuclear Power

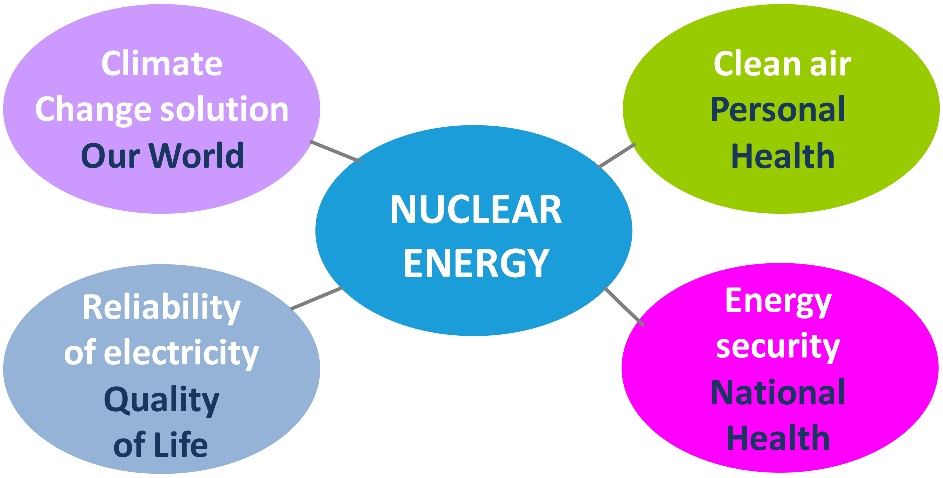
2.1. The Necessity of Nuclear Power

Through the International Nuclear Energy Symposium held in May 2015 in Japan and the research on European countries, some key elements in gaining social acceptance of nuclear power were revealed. First of all, it is important to recognize the necessity of nuclear energy as a stable and economic power source, and to promote people's understanding about it. In particular, nuclear power now expands its role as a low carbon electricity source in terms of greenhouse gas emission reduction. Regarding the safety of nuclear power plants and radiation risks of nuclear power – considered as one of the main issues in gaining social acceptance – it is crucial to provide people with correct information through transparent and simple explanation. A patient dialogue with people is needed.

Based on these findings, we will first describe the necessity of nuclear power (2-1) especially in terms of tackling climate change (2-2). After discussing the approach to communicating the safety of nuclear power plants and radiation risks of nuclear power to the public (2-3), we will introduce a few successful examples of pubic dialogues from the UK, Sweden, and Finland (2-4) then present a conclusion for this chapter (2-5).

According to Ms Agneta Rising, director general of the World Nuclear Association and co-founder / former president of Women in Nuclear, nuclear energy makes four key contributions to the global energy supply: climate change solution; reliability of electricity; clean air; and energy security.

Figure 2-1. Four Key Contributions of Nuclear Energy



Source: World Nuclear Association, presentation in the workshop

1) Climate change solution

The international climate negotiations in Paris held in November and December 2015 produced a global agreement to limit global average temperature increases to below 2 degrees Celsius by the year 2100 compared to the pre-industrial period. The Two Degrees Scenario (2DS) of the International Energy Agency (IEA) requires a major shift to low carbon generation by the middle of this century to prevent a dangerous climate change. This scenario includes 18 percent of global electricity being supplied by nuclear energy by 2050, the largest contribution from any low carbon option. According to Director General Rising, the nuclear industry is ready to deliver more to help tackle climate change and nuclear generation could provide 25 percent of the world's electricity with low carbon generation by having 1,000 gigawatts (GW) of new build by 2050. (This aspect will be detailed in the following section.)

2) Reliability of electricity

Reliability of electricity is crucial for improving and maintaining quality of life. It is especially true in countries expecting high economic growth. Taking China as an example, it is estimated that electricity demand in the country will almost double by 2030. To meet this rapid growth of electricity demand, China has to dramatically expand its capacity of energy sources. China depends mostly on coal, but the country can no longer rely on it considering issues of environment and climate change. It is important to promote low carbon energy sources such as renewables and hydro, and the country has already made substantial effort towards their adoption. However, these energy sources have inherent constraints; intermittent renewables cannot meet the base load energy demand while hydro has geographical limit. These are one of the main reasons why China and many other developing countries are introducing or trying to introduce nuclear energy. As countries with long histories of using nuclear energy such as Finland, Switzerland, and the US can show, nuclear energy can supply reliable electricity and contribute to their economic growth, thereby improving quality of life.

3) Clean air

Around 3 million people worldwide die from respiratory illnesses alone as a result of burning fossil fuels for energy. This is more than 8,000 people every day. This kind of fact escapes most people while the risk of radiation when nuclear accidents occur tends to be emphasised. Nevertheless, it is worth pointing out that nuclear energy contributes to people's health by supplying electricity without polluting air.

4) Energy security

The availability of adequate supplies of reliable and moderately priced electricity is essential for the competitiveness of industries and sustainable economic growth. France is known as the country with the largest nuclear share in its electricity supply. What led the country to choose nuclear energy was the oil crisis that occurred in the 1970s. Supply interruptions and fluctuations in the price of fossil fuels in world markets at that time urged the country to improve its energy self-sufficiency rate. It was also the case in Japan, which has little natural energy sources. Since the Fukushima accident, the country has been experiencing a historically low energy self-sufficiency rate (6 percent) and is trying to improve it by restarting nuclear energy use. Nuclear energy is expected to strengthen the energy security as a quasi-domestic power source.

2.2. Tackling Climate Change

As mentioned in the previous section, the international climate negotiations in Paris held in 2015 produced a global agreement to limit global average temperature increases to below 2 degrees Celsius, and IEA's 2DS requires a major shift to low carbon generation by the middle of this century to prevent dangerous climate change.

The International Atomic Energy Agency (IAEA) has drafted statements regarding the role of nuclear energy in terms of climate change mitigation in light of the Paris Agreement. It states as follows:

> Currently, nuclear is second only to hydro in avoiding carbon emissions to the atmosphere, by avoiding approximately 2 billion tonnes of carbon annually. The IAEA's latest projections for nuclear power in 2030 show an increase in global nuclear power capacity of 2% in the low case and 68% in the high case scenario. The high case assumes changes in country policies towards climate change and continued economic and electricity demand growth, especially in Asia. The contribution toward mitigation from nuclear would need to double from today's level over the next 25 years in order to support the 2˚C scenario. This would require the addition of 20 GW of nuclear power capacity a year, the rate achieved during 1970s–80s. The Paris Agreement calls for climate action that at the same time supports sustainable development. There is strong agreement that nuclear power is a low carbon technology. However, nuclear power is also favorable across many sustainability indicators, an argument that should potentially receive greater attention in the future.

The role of nuclear energy in achieving IEA's 2DS is detailed in the paper '2015 Technology Roadmap: Nuclear Energy' jointly prepared by IEA, the Organisation for Economic Co-operation and Development (OECD) / Nuclear Energy Agency (NEA). Firstly, the Roadmap states in its foreword as follows:

Current trends in energy supply and use are unsustainable. Without decisive action, energy-related emissions of carbon dioxide will nearly double by 2050 and increased fossil energy demand will heighten concerns over the security of supplies. We can change our current path, but this will take an energy revolution in which low-carbon energy technologies will have a crucial role to play. Energy efficiency, many types of renewable energy, carbon capture and storage, nuclear power and new transport technologies will all require widespread deployment if we are to sharply reduce greenhouse gas (GHG) emissions. Every major country and sector of the economy would need to be involved. The task is urgent if we are to make sure that investment decisions taken now do not saddle us with sub-optimal technologies in the long term.

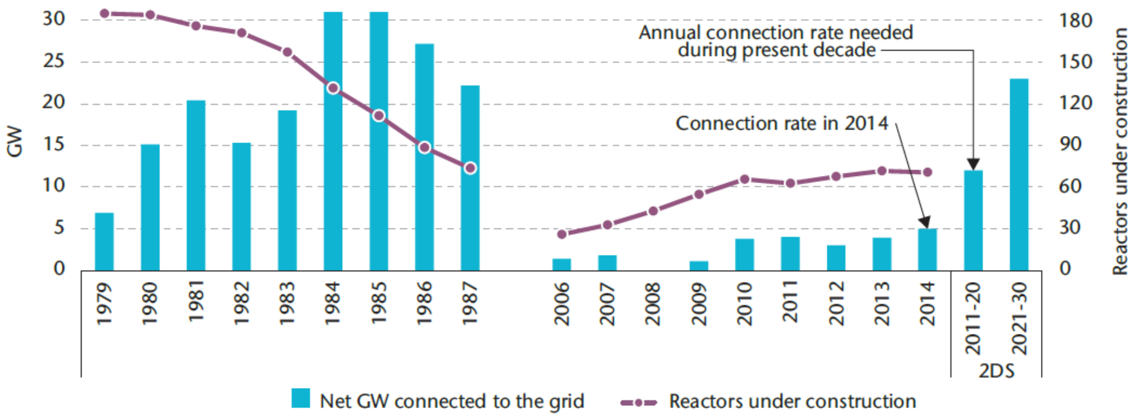
Then, with regard to the expansion of nuclear capacity, the Roadmap projects as follows:

In the 2D scenario, global installed capacity would need to more than double from current levels of 396 gigawatts (GW) to reach 930 GW in 2050, with nuclear power representing 17% of global electricity production. Although lower than the 2010 Roadmap vision of 1, 200 GW and 25% share of generation, this increase still represents a formidable growth for the nuclear industry.

The near-term outlook for nuclear energy has been impacted in many countries by the Fukushima Daiichi nuclear power plant accident. Although the accident caused no direct radiation-related casualties, it raised concerns over the safety of nuclear power plants and led to a drop in public acceptance, as well as to changes in energy policies in a limited number of countries. This, together with an economic crisis that has lowered demand in many countries, and a financial crisis that is making financing of capital-intensive projects challenging, has led to a decrease in overall construction starts and grid connection rates over the last four years.

However, in the medium to long term, prospects for nuclear energy remain positive. A total of 72 reactors were under construction at the beginning of 2014, the highest number in 25 years. According to the 2D scenario, China would account for the largest increase in nuclear capacity additions from 17 GW in 2014 to 250 GW in 2050 and, by 2050, would represent 27% of global nuclear capacity and nuclear power generation. Other growing nuclear energy markets include India, the Middle East, and the Russian Federation. According to 2DS projections, nuclear capacity would either decline or remain flat in most OECD countries, with the exception of the Republic of Korea, Poland, Turkey, and the United Kingdom.

Figure 2-2. Grid Connection Rates and Required Rates to Reach the 2DS Target



Source: IEA/NEA, Technology Roadmap, Nuclear Energy, 2015 edition (page 11)

The Roadmap also makes some recommendations over the next 10 years. Key recommendations are as follows:

- Governments should recognise the value of low-carbon capacity.
- Research and development is needed to support long-term operation.
- Industry needs to optimise constructability of Gen III designs.
- Accelerate development of Small Modular Reactors (SMRs).
- Support development of one or two Gen IV reactors.
- Demonstrate nuclear desalination or hydrogen production.
- Invest in environmentally sustainable uranium mining.
- Continue cooperation and discussions on international fuel services.

- Establish policies and sites for long-term storage and disposal.

As mentioned above, nuclear capacity would either decline or remain flat in most OECD countries according to 2DS projections. However, it does not mean that nuclear power in these countries has no room for improvements; there is a lot to do as recommended in the Roadmap including references for and implications on ASEAN countries introducing or planning to introduce nuclear power.

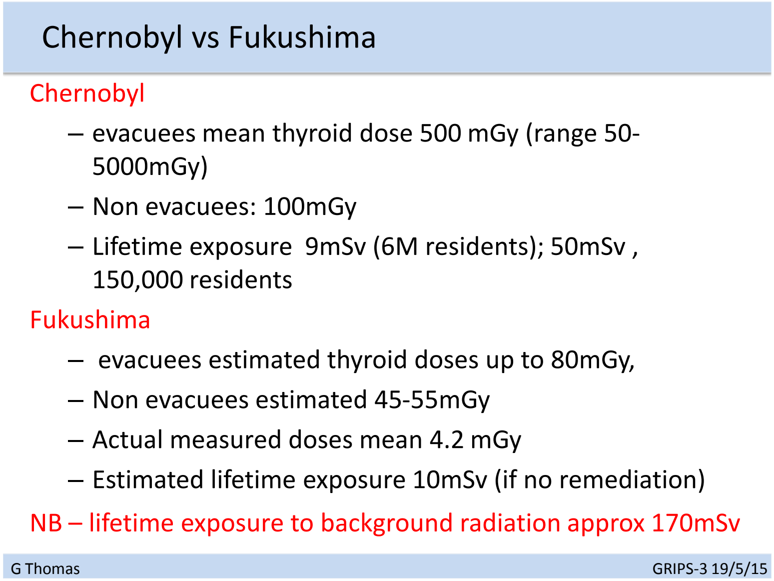
As both IEA and IAEA mention in their reports and statements, each country is free to use any technology including nuclear in mitigating climate change, and has to individually decide which energy mix is optimal for domestic use. However, the fundamental advantages provided by nuclear energy in terms of reduction of greenhouse emissions as well as competitiveness of electricity production and security of supply still apply. As described in the Roadmap: 'The contributions of nuclear energy – providing valuable base-load electricity, supplying important ancillary services to the grid and contributing to the security of energy supply – must be fully acknowledged.'

2.3. How Safe is Safe Enough?

Safety of nuclear power plants and the accompanying radiation risks of nuclear power is considered one of the main issues towards social acceptance. The issue sometimes makes it difficult for governments and utilities to introduce or expand nuclear energy. In Japan, public concern on safety of nuclear energy raised by the Fukushima accident is weighing down the reopening of existing nuclear power plants. It becomes apparent that explaining the risks of nuclear power to the public and gaining social acceptance when there is nothing absolutely safe have become the biggest issues in Japan.

In a discussion related to this issue at the International Nuclear Energy Symposium, multiple experts mentioned the Fukushima accident's impact on public health. Professor Gerry Thomas, an expert in molecular pathology at the Imperial College London, announced an analytical finding that 'the Fukushima accident's impact on thyroid cancer was limited to one-hundredth of the Chernobyl accident's impact' (Figure 2-3).

Figure 2-3. Comparison of Impacts on Thyroid Cancer Between Chernobyl and Fukushima

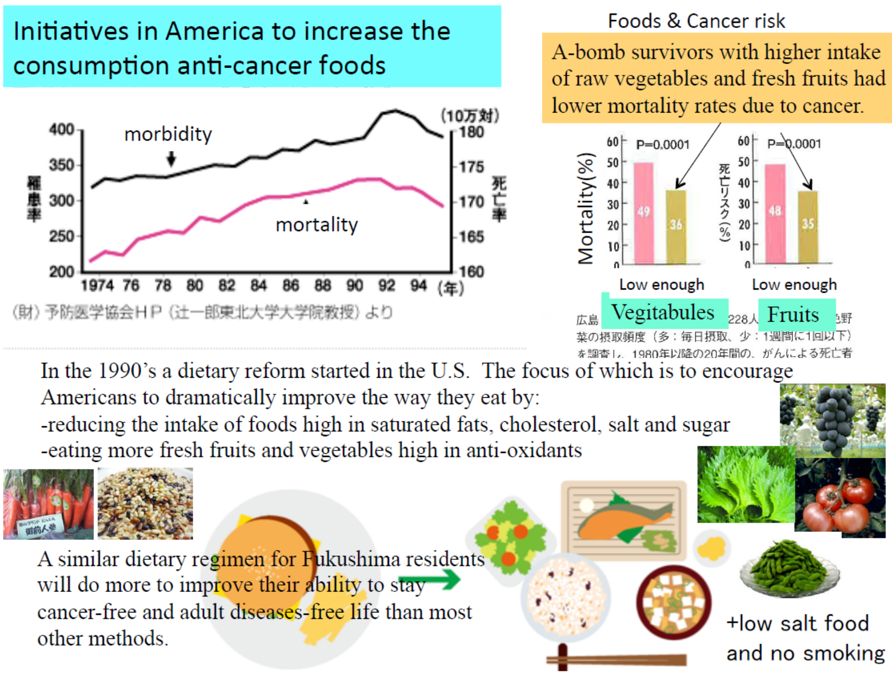


Source: Gerry Thomas, Imperial College London, presentation in the workshop

Dr Kazuko Uno, head of the Interferon and Host Defense Laboratory at the Louis Pasteur Center for Medical Research in Japan, indicated the view that 'the ill fortune of the Fukushima accident was that physicists and biologists were divided over radiation. Problems have emerged from evacuation-related insufficient exercise and stress rather than low-dose radiation.' According to Dr Uno, physicists strongly associate radiation with atomic weapons. Therefore they tend to overreact to the existence of minute amounts of radiation. On the other hand, medical doctors often use radiation in doses exceeding 50 Sv to treat and cure patients. Healthy cells repair themselves on a daily basis. This repair occurs for damages inflicted from all sources including those from radiation exposure.

Dr Uno also introduced an experience when Fukushima residents had been concerned about the risk of radiation in the wake of the accident and explained that lifestyle improvements could mitigate the risk of cancer.. She relayed that she gave a hand massage to a person wanting healing rather than a difficult lecture during her visit to Fukushima and the patient welcomed the massage. Dr Uno also said, ‘When I used a simple experiment to explain about food products that can reduce the risk of cancer, my audience understood my explanation well. For example, A-bomb survivors with higher intake of raw vegetables and fresh fruits had lower mortality rates due to cancer.’

Figure 2-4. Examples of Lifestyle Improvements to Mitigate the Risk of Cancer



Source: Interferon & Hostdefence Res. Lab. , presentation in the workshop

According to experts, the risk of radiation depends on each person’s perception. Therefore, transparent and simple explanation by experts is highly required. However, improving people’s understanding cannot be achieved by experts alone. As such, education of children and the media is very important.

Dr Uno stated that Japan’s education about radiation in high schools or in the universities over the past decades had turned out to be insufficient, noting that many people likened the effects of the Fukushima accident to those of atomic bombing. Relatedly, the connection between the nuclear industry and journalists was also addressed during the panel discussion in the symposium. Journalist Ann MacLachlan said, 'While some journalists have insufficient knowledge about nuclear energy and send wrong information under time pressure, scientists rather than journalists provide exaggerated information sometimes.' In response, Professor Gerry Thomas introduced a British initiative triggered by the Fukushima accident. Noting that the problem was the unavailability of scientists to respond to journalists, Professor Thomas explained that the Fukushima accident had prompted scientists to send their messages more voluntarily and positively. This was because scientists had feared that those other than real experts would receive interviews instead of experts. She also said that as the independence of academic societies and universities is protected in the UK, journalists are now trusting scientists.

2.4. Public Dialogues in European Countries

1) UK

The symposium brought about a common perception that continuing to provide correct information and communications on the safety of nuclear power plants and on radiation risks are required to gain an understanding on nuclear energy by the public. Then, another question emerges: How to communicate with people effectively and efficiently. With regard to this question, we found successful examples from UK, Sweden, and Finland.

We first introduced UK's example. UK has a long history of using nuclear energy. Though it was not difficult for the government and power companies to gain social acceptance in the early days of introduction of nuclear energy, it became more and more difficult as the access to information became easy and people came to know the risks of nuclear energy. Therefore, the government and power companies considered an effective and efficient way of communication. They now have a system of communication called public dialogue.

One example of a public dialogue is Sciencewise. It is funded by the Department for Business, Innovation and Skills, which helps UK policymakers understand and use public dialogue to improve decisions on issues involving science and technology. Since its beginning in 2004, its projects have delivered measurable and acknowledged impacts and benefits to the UK Government and wider society. Public dialogue supported by Sciencewise brings together members from the public, policymakers, scientists, and other expert stakeholders to deliberate, reflect, and come to conclusions on national public policy issues. The Sciencewise approach to the public dialogue is described in the Government's Approach to Public Dialogue (the Guiding Principles).

Public dialogue allows a diverse mix of public participants with a wide range of views and values to:

- learn from written information and experts;
- listen to each other, and share and develop their views;
- reach to carefully considered conclusions; and
- communicate these conclusions directly to inform the Government’s decision-making body.

Good public dialogues can help policymakers and the Government to:

- make better, more robust decisions that reflect public values and societal implications;
- increase legitimacy for tough decisions;
- demonstrate accountability in public investment;
- overcome entrenched positions to enable policies to move forward; and
- gain a rich understanding of public aspirations and concerns that go beyond media headlines or focus groups.

Public dialogue does not:

- remove government responsibility for decision-making;
- rely only on surveys or opinion polls to gather public views;
- seek endorsement of decisions that have already been made; and
- replace other public information or consultation processes.

Sciencewise co-funds and supports a wide range of public dialogue projects to support policymaking in issues involving science and technology.

Figure 2-5. A Wide Range of Public Dialogue Projects

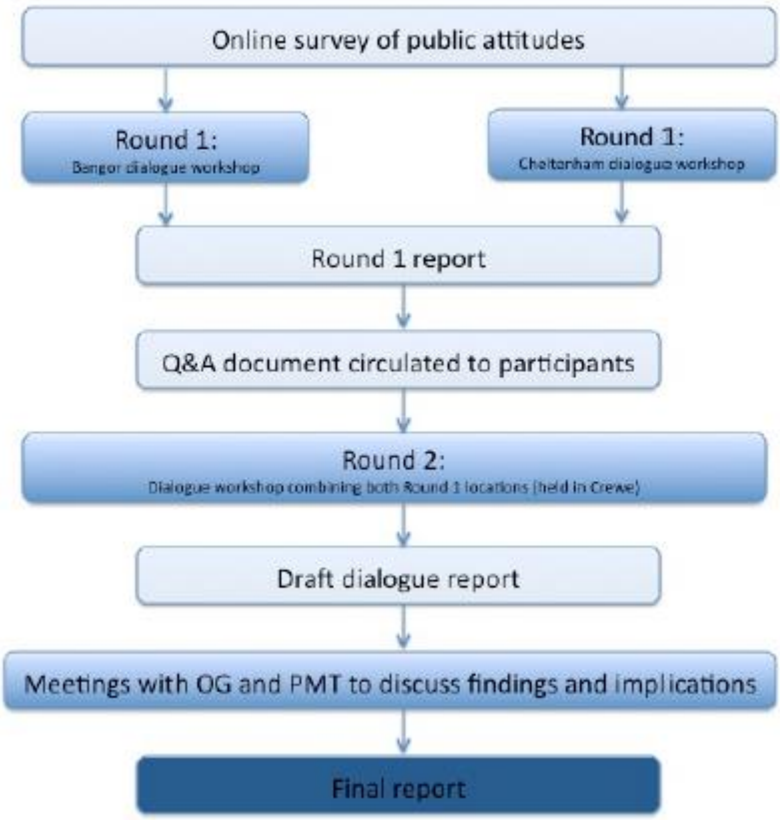
Source: Sciencewise web site.

Public dialogue is conducted even in the highly technical area of nuclear energy such as generic design assessment (GDA). According to records of the dialogue, introduction is as follows:

> The Government has outlined their commitment to a significant expansion in new nuclear in the UK stating that nuclear power, alongside renewable energy sources, will ensure that the UK has enough low-carbon electricity in the future. In 2006, the Government asked the nuclear regulators, Office for Nuclear Regulation (ONR) and Environment Agency (EA), to consider 'pre-authorisation assessments' of new nuclear power stations. The nuclear regulators developed their GDA process in response to this request. GDA enables the regulators to begin assessing the acceptability of safety, security, and environmental aspects of a nuclear power station design, at a generic level, before site-specific applications are made. It provides the regulators with early influence on the design of new nuclear power stations when it is most effective and efficient. It also helps to reduce project cost and time risks for developers as it enables regulatory concerns to be identified and addressed early.

The EA, ONR, and now Natural Resources Wales (NRW), support their GDA process with dedicated communications and engagement staff. This support includes planning and project management, website development, developing communications materials for a range of stakeholders and communities, publishing documents and leaflets, events management, engagement with key stakeholders, graphic design, e-bulletins and advertising, and proactive / reactive media relations. The Environment Agency has consulted previously during GDA of the UK EPR and AP1000. The consultation arrangements included online e-consultation, advertising in local newspapers, posters in libraries around England and Wales and a stakeholder event in Birmingham. The regulators have used the Sciencewise project to explore how they might improve public engagement in GDA.

Figure 2-6. An Example of the Dialogue Process for Generic Design Assessment



Source: Sciencewise, New nuclear power stations, Improving public involvement in reactor design assessments, August 2015

One example of the dialogue process and its key points are as follows:

- Online survey of public attitudes: The survey of 401 people in England and Wales was the first step in the overall dialogue process. Its aim was to inform the design of the local dialogue.
- Round 1 dialogue workshops in two locations: A total of 41 members of the public (unrelated to those taking part in the online survey) took part in Round 1 workshops – 22 in Cheltenham, UK on 17 January and 19 in Bangor, Wales on 31 January. These workshops were designed as introduction to the topic and context of GDA, including the role of the regulators.
- Round 2 dialogue workshop, with participants from both locations: 18 participants (9 from the Bangor workshop and 9 from the Cheltenham workshop) took part in the Round 2 workshop, held in Crewe, UK on 21 March 2015. This workshop was designed to provide opportunities for deeper exploration of key issues, responses to a range of communication and consultation materials, and development of recommendations on future public engagement.
- Meetings with independent Oversight Group and Project Management Team to discuss findings and implications.

To meet dialogue objectives, the process was focused on three key questions:

- How do members of the public want to be involved in the GDA process?
- What do people need to know (what are their concerns/interests?) How can nuclear regulators address their concerns/interests as part of the GDA process?
- What can we do to help improve people's trust in us and confidence in our decisions as nuclear regulators?

Both the framework and the procedure of the dialogue will also be useful when considering the way to gain public acceptance in ASEAN countries.

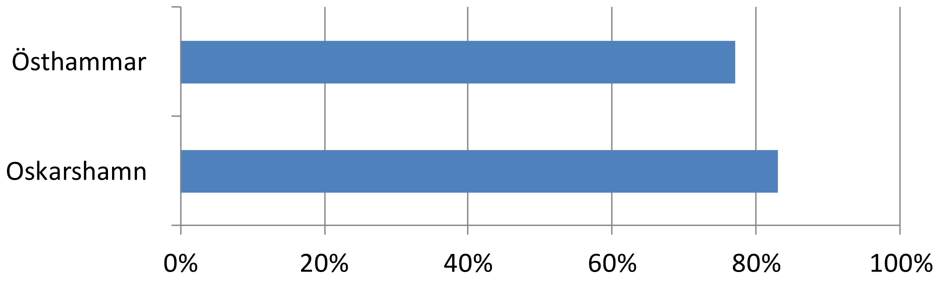
2) Sweden and Finland

Sweden and Finland are successful examples of the public dialogue process especially in the site selection process of the spent fuel repository.

In Sweden, Östhammar was chosen as the site for the spent fuel repository in 2009 although the search began long before that. SKB (Svensk Kärnbränslehantering AB), the organisation responsible for the site selection, had been assembling knowledge about Sweden's bedrock since the middle of the 1970s. Typological surveys of different areas were carried out between 1977 and 1985. During the process, SKB learnt valuable lessons about the importance of a positive response to its plans from the local population. Protests and demonstrations took place many places and against SKB's drills. Therefore, when the site identification process began in 1992, SKB chose to base it on voluntary responses.

Then, pilot studies were made in six municipalities including Östhammar. At the same time, the Geological Survey of Sweden (SGU) was conducting survey studies of the whole of Sweden that showed that there were potentially suitable sites in other municipalities. Finally SKB chose to undertake thorough site investigations with trial drillings in Östhammar and Oskarshamn. The site investigations lasted for 5 years, from 2002 until 2007. They involved studies on the geology, hydrology, ecology, and social impact. In both municipalities, there is strong local support for a future spent fuel repository. Transparent dialogue with local communities and other stakeholders was the key to build support. After Östhammar was chosen, Oskarshamn received funding to compensate for missing out on the opportunities of hosting the repository.

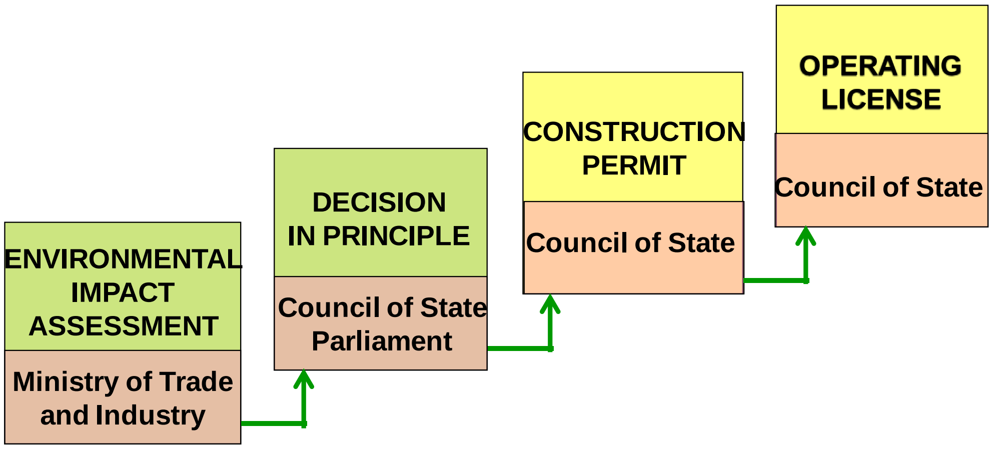
Figure 2-7. Local Community Support for Repository



Source: World Nuclear Association, presentation in the workshop

Similar to Sweden, Finland took a long and step-by-step process in site selection. From 1983 to 1985, a screening study of the entire area of Finland was conducted and from 1986 to 1992, preliminary site investigations were conducted. Then, from 1993 to 2000, detailed site investigations and an environmental impact assessment procedure were carried out for four sites including Olkiluoto in Eurajoki. Throughout the selection, an open and transparent decision-making process was conducted, taking all concerns into account. Simultaneously, continuous participatory processes both at the local and national level were conducted and became important to the success. (In Finland, there is a four-step licensing process [Figure 2-8], namely: environmental impact assessment, decision in principle, construction license, and operation license). Finally, Olkiluoto was chosen as the site and in November 2015, the Finnish government granted a license to Posiva, the operator of the final repository, for the construction of a final disposal facility for spent nuclear fuel, a first time for the world.

Figure 2-8. Four-Step Licensing Process



Source: Kaija Kainurinne, Finland, presentation in the workshop

2.5. What is Necessary to Gain Support from the Public?

Through the chapter, topics such as 'how to gain social acceptance' has been discussed and a few successful cases in public dialogues have been introduced. However, the discussion is not so simple in the sense that a mere introduction of the system of public dialogue that were successful in some countries would necessarily lead to gaining support from the public in other countries. This is pointed out in a research of European countries by a European researcher with a nuclear industry experience of more than 40 years and business development exposures in several Asian countries and European countries such as Turkey, Jordan, and Brazil. According to him, the role of a public communication body is as follows:

> Communication in nuclear project is really an important issue. Developed countries have set up different ways to cope with this issue depending on their cultural and structural ways of doing things. For example, in the USA, public hearings are fully integrated within the country's acceptance process. Will such public communication bodies be efficient? I would argue that except for highly democratic countries such as the USA or UK, public communication done by institutional bodies does not work and ends up with very poor results while costing a lot of money. Even in USA or UK, it can be argued that such processes are significantly extending the construction phase of nuclear projects and

> putting substantial pressure on the operators during the operation phase. In developing countries, it must be said that public communication is viewed as a necessary tool that is sometimes required by the financial community to justify early investment. But fundamentally, most citizens of such countries do not participate and are not using the information for their own benefit.
>
> So in summary, these public communication bodies are failing. Another reason is that people are not part of the decision making process, or that only a very small number of people have hijacked the overall communication, and are trying to impose their main ideology. See for example the green way of handling technical issues. The real importance is for the nuclear community to be accepted by the overall community. You need to bring people with you, to educate them, and to show them the benefits arising from such projects. You have to bring confidence that you know what you are talking about, that you are able to deal with people's concerns, and that you can provide them with the benefits of nuclear technology.

Based on such recognition, he answered the question 'how to significantly improve the public acceptance of nuclear energy' as follows:

> It is somehow difficult to provide a single, simple, and generic answer applicable to every country either developed or under development. Obviously, each country has its own cultural process and solution which can be applied to one country, which cannot be used in another country due to its background. One major element is to use a bottom-up approach rather than a top-down one, which is currently the application method used in all countries nowadays.
>
> What does that mean? It means that any solution for increasing the public acceptance level should be designed to meet the public expectations, and not be imposed from the top to the public. This is particularly true in democratic

developed countries. For developing countries, the main impulse shall be given from government agencies in a rather autocratic way. This is the way nuclear energy is implemented in Turkey or in Viet Nam.

Therefore, it is considered that implementing structures such as CLI as only a very preliminary step and totally insufficient. It is fundamental that implementing a nuclear plant on any site should directly benefit local people in bringing jobs, income, local economy growth, education, etc. This means that the vendor, the operator, the utility, and local administration agencies have to be assigned the responsibility of setting a strong partnership with the local population to make the nuclear plant the key factor for developing local economy and education. It is thus suggested that this partnership be managed by the local population in order to make sure that local constraints and objectives are fully met.

Without such local economic development, there will be no definite public acceptance at the local level, at the regional level, or obviously at the national level. Getting public acceptance at the local level does not automatically imply getting public acceptance at either regional or national levels, but it is a good starting point. It should not be forgotten that people care about jobs, job security, and improving their wealth fare. So meeting these objectives should be much better than relying on administrative structures such as CLI.

In conclusion, these three key points to gain social acceptance were crafted based on the International Nuclear Symposium and the research on European countries:

- To promote understanding on the necessity of nuclear energy as an economically efficient energy source that is effective in preventing climate change;

- To continue to provide correct information and communications on radiation risks and the safety of nuclear power plants; and
- To conduct patient dialogues with people, making sure they understand that nuclear facilities will develop the local economy.