

The Recent Overview and Prospects of Nuclear Power Policy and Industrial Strategies in the UK, Italy and Sweden[#]

Tomoko Murakami* Yuji Matsuo** Yu Nagatomi ***

Executive Summary

European countries that had moved away from nuclear energy or frozen the construction of new nuclear power plants have begun to return to the construction due to their pursuit of low-carbon electricity sources, energy security and requirements for replacements for existing nuclear plants. Particularly, we should pay attention to developments in the UK that vowed to launch the construction of new nuclear power plants in its 2007 Energy White Paper, and in Italy and Sweden that have begun to reconsider their legal ban on new nuclear plants. These countries launched nuclear power generation development comparatively in the early stage in the world, and built solid nuclear industry infrastructure, however after that, suspended the construction of new nuclear power plants for energy-related or economic reasons. In view of recent conditions, however, they are trying to reintroduce nuclear energy or expand nuclear energy use. Given these points, the three countries are viewed as symbols of Europe's return to nuclear energy.

In its 2007 Energy White Paper, the UK government offered to take a new look at nuclear power generation as a means to build a low-carbon society. In January 2008, it released a Nuclear Energy White Paper indicating milestones toward commercial operation of new nuclear plants starting in 2017 or 2018. Later, the government proposed the licensing processes, generic design assessment processes of reactor types and received proposals for new nuclear plant sites. In 2009, it is expected to decide on the type of new reactors and some of the potential construction sites.

In Italy, Prime Minister Silvio Berlusconi, committed to resume nuclear power generation, won in an election in April 2008 and announced a nuclear power generation resumption plan in May. In November, legislation to this end cleared the House of Representatives. In February 2009, Prime Minister Berlusconi and French President Nicolas Sarkozy signed an Italy-France nuclear energy cooperation agreement. In response, electric utilities Enel of Italy and EDF of France agreed to build four or more nuclear plants in Italy with the first one planned to start operation in 2020. In April 2009, Italian and Russian nuclear energy firms agreed on their cooperation¹. In May, Japan's Ministry of Economy, Trade and Industry signed a nuclear energy cooperation agreement with the Italian Ministry of Economic Development².

Sweden, which has banned the construction of new nuclear plants as a result of the relevant national referendum in 1980, has begun to indicate its reconsideration of the freeze. On February 6, 2009, the Swedish government released a long-term energy and environmental policy guideline³, in which stated that it might consider replacement of 10 nuclear reactors in operation pending parliamentary approval. However, no specific plan or milestone has been decided on for the replacement just for now. After the

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* Group Leader, Nuclear Energy Group, Strategy & Industry Research Unit, IEEJ

** Senior Researcher, Nuclear Energy Group, Strategy & Industry Research Unit, IEEJ

*** Researcher, Nuclear Energy Group, Strategy & Industry Research Unit, IEEJ

¹ World Nuclear News, April 9, 2009

² A press release from the Ministry of Economy, Trade and Industry, May 25, 2009

³ "A sustainable energy and climate policy for the environment, competitiveness and long-term stability", Swedish Government Offices, February 9, 2009

election in early 2010, some new proceeds might be found.

Electric utilities take the leadership in nuclear power generation development projects in EU countries, which operate beyond national borders within Europe. Their business operations other than the core business of electricity generation and distribution range wide, covering gas supply, resources development and procurement, environmental operations and energy-related consulting. In this sense, it is no longer realistic to analyze electric utilities' strategies from the perspective of nuclear business strategies alone.

For example, EDF, which has cut a deal to cooperate with Italy's Enel in the construction of new nuclear power plants in that country as noted above, has taken part in gas utility operations in Italy, which may be important for an analysis of the French electric utility. EDF is also planning to participate in nuclear power generation in the UK while going ahead with gas utility operations and renewable energy power generation in that country. On top of that, Germany's E.On and RWE are considering participation in nuclear power generation, as a part of their business portfolio combined with renewable energy provision and electric grid networks in the UK. These firms are similar to EDF in that they operate beyond their respective national borders within Europe. Vattenfall, which recently stated putting participation in the UK's nuclear new build market on hold for the next 12-18 months, comments that it will retain a significant interest in the UK energy market, such as coal power with CCS (carbon capture and storage), wind power and electricity network, and will maintain a presence in the UK to monitor developments in nuclear new build as a long shot⁴.

Let's review industries that support the development and operation of nuclear power plants.

While only a few new nuclear power plants have been constructed for nearly 20 years in Europe, a wide range of industries have existed to produce components and provide services for the operation, maintenance, repair and improvement of existing nuclear power plants. The common features of these companies related to nuclear industries in EU countries are that they have carried a major role in the national strategic industries such as air and space, military and so on, and that they are all global players expanding business not only to U.S., Asia but also to emerging economies. Major nuclear power plant vendors for Europe are Areva NP, Siemens and Westinghouse, which have been striving to build supply chains in their business territories. Over recent years, they have deepened relations with relevant UK industries, viewing the UK as a promising market for new nuclear power plants.

Italy, Sweden and Germany as well as the UK are reviewing their nuclear energy policies toward their new nuclear plant construction. Italy had introduced commercial nuclear reactors in the 1960s and terminated these reactors in 1990 and it has no nuclear industry now. However, non-nuclear power plant and heavy machinery manufacturers exist to produce large castings and machines, which potentially become major suppliers for new nuclear plant construction projects.

Sweden is known for its excellent nuclear plant operation and maintenance technology in Europe. Although no new nuclear plant has been constructed since the 1980s, Sweden has uprated and upgraded components for existing nuclear plants. As a result, wide range of industries has thus grown up in Sweden to support existing nuclear plants. As not only Sweden but also the UK and other EU countries proceed with the construction and operation of new nuclear plants, major relevant Swedish companies are expected to expand their presence.

Based on the above, we make points regarding progress in the development of nuclear power policies

⁴ Vattenfall press release, June 1, 2009

and industries in EU countries.

The speed of progress in and the effectiveness of new nuclear development policies promoted in the UK, Sweden, Italy and other countries hold the key to whether nuclear business companies may accept these policies and put them into their business strategies. Rather than the fate of nuclear energy policies, comprehensive energy and environment policies in European countries and the European Parliament are the problem for electric utilities. Their future business decisions depend on whether European countries would sustain their present environmental policies, and devise and implement effective policy measures including those regarding prices of low-carbon electricity and carbon dioxide.

Regarding the nuclear industry, the Areva group has attracted great attention as the only full-cycle nuclear power company in Europe. What is important for the group is whether it could build a solid network for supplying machines, components, system design and installation and other services in line with the future construction of new nuclear plants and the development and expansion of the nuclear industry. Learning lessons from its communications problems with suppliers that have resulted in a delay in the construction of a new nuclear plant in Finland, Areva has been striving to build good relations with potential suppliers in the UK by providing specific milestones toward the new nuclear plant construction.

The width, strength and depth of nuclear industry infrastructure including manufacturing and plant management services are essential for any country that will sustain and expand nuclear power generation. European companies have had a longer history of nuclear power generation development than Japanese firms, deeply related to the public sectors through the national strategic industries and most of all, have had abundant experiences of global business development. Despite a long suspension of nuclear plant construction, relevant European companies have technological strengths in various areas related to nuclear energy, as a result of their sustainable effort of surviving in 1980 and 1990s. In this sense, attention should be paid to their strategic developments as well as policy developments in European countries.

Introduction

As countries and regions in the world step up efforts to work out and achieve greenhouse gas emission reduction goals, European countries are reconsidering their nuclear policies in a bid to promote nuclear power generation. Under such situation, Japan with one of the world's leading nuclear industries is expected to deal in various ways with the firmly established European nuclear industry as its competitor or strategic alliance partner. Therefore, we are required to conduct detailed surveys and analyses of the latest European national policies and build on them to consider Japanese industry's international activities in a timely and detailed fashion.

Given the above, this report:

- (1) Analyzes overseas business strategies of France's EDF, Italy's Enel and Sweden's Vattenfall, and strategies of nuclear-related companies based on nuclear policy developments in the three countries that attract attention in this respect among European countries;
- (2) Analyzes strategies of European companies as markets, competitors and cooperation partners for Japanese nuclear industry; and
- (3) Provides key points and implications for the Japanese nuclear industry's international business development strategy.

1. Business Operations and Strategies of European Electric Utilities

Most European electric utilities operate beyond national borders within Europe. Their business operations other than the core business of electricity generation and distribution are in a wide range, covering gas supply, resources development and procurement, environmental operations and energy-related technology development and consultation. In this sense, it is no longer realistic to analyze electric utilities' strategies from the perspective of nuclear business strategies alone. Behind such situation, European electric utilities have been forced to make difficult business decisions amid deregulation of electricity and gas markets since an early stage, have been expected to achieve aggressive business expansion and business performances above certain levels under shareholders' strict surveillance, and have clinched many merger, acquisition and business integration deals under such situation.

This chapter reviews the features and prospects of business operations and strategies of electric utilities that have close relations with the UK, Italy and Sweden whose nuclear policy developments are attracting particular attention in Europe.

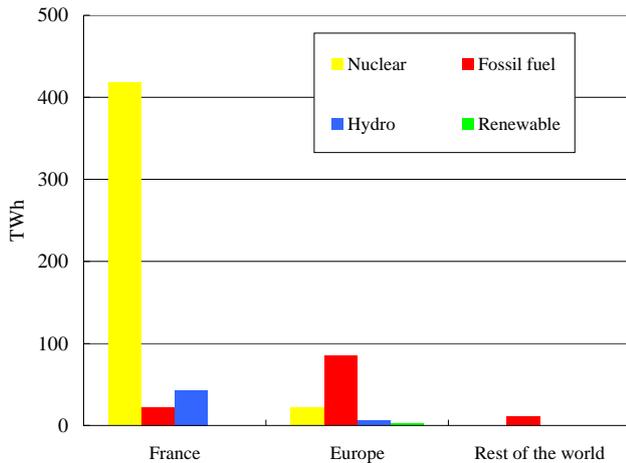
1-1 EDF (Électricité de France)

EDF's greatest strengths include strong nuclear power generation business assets, supply chains and the accumulation of nuclear plant operation experience. Its nuclear power generation facility assets stood at 44.7 billion euros as of January 2006, accounting for some 37% of the EDF group's total assets.

Nuclear facilities accounted for 51.9% of the EDF group's total electricity generation capacity at the end of 2007. Nuclear power generation captured 72.1% of its total electricity output in 2007, indicating a high nuclear power generation share (see Figure 1-1). Therefore, the EDF group has remained immune to fossil fuel price fluctuations and maintained electricity charges at the lowest levels in Europe. The group's CO₂ emissions per kilowatt hour came to 0.145 kg-CO₂/kWh (excluding electricity purchases), far below an EU-wide average of 0.372 kg-CO₂/kWh. Taking advantage of the strength, EDF has put forward a strategy to maintain the capacity utilization rate of 85% for nuclear power plants until 2011 and increase the output of all of its 20 1.3 GW PWR reactors by up to 7% in 2015 to expand annual output by 15 TWh.

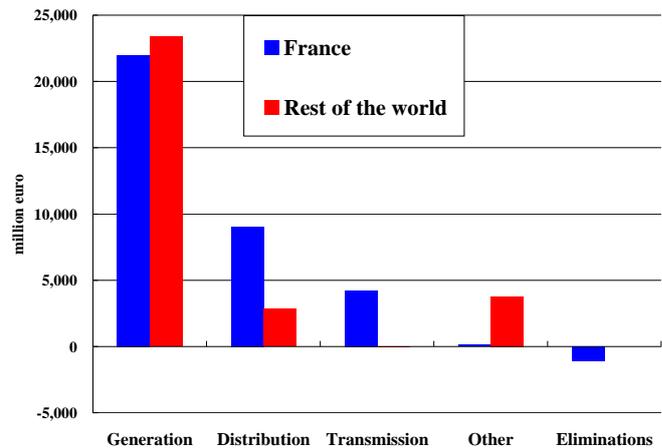
But some risks accompany a rise in the nuclear power generation share and the development in

Figure 1-1 Power generation by fuel in 2007



Source : EDF Group 2007 Annual Report

Figure 1-2 Sales by Sectors in 2008



Source : EDF Group 2008 Financial Report

overseas business. There have been downside risks for profit accompanying unscheduled suspensions of facilities, while huge investment in the past years has deteriorated the EDF's financial profile. A major factor behind the net income decline in 2008 was spending on the BE acquisition in the UK, aiming at the participating in the UK electricity market. Given the planned huge investment in nuclear projects including the ongoing construction of the Unit 3 reactor at its Flammanville nuclear power station, EDF's net income cannot be expected to increase.

Supported by the global renewable energy promotion, the EDF group is going ahead with renewable energy projects. At the end of 2007, the EDF group owned renewable energy power generation facilities for a total capacity of 1,443 MW including 619 MW for wind power generation in the United States and 164 MW for such generation in Italy. It has expanded renewable energy power generation capacity particularly in Italy. At the end of 2008, its capacity in Italy scored a 42.7% jump to 234 MW. Giving wind power generation development in France, the United States, Italy and Spain, EDF plans to introduce wind power generation facilities for a total capacity of 3.3 GW by 2011. EDF is also expected to benefit from gas projects through EnBW in Germany and Edison in Italy, supported by environment-friendly policies in countries as its markets.

Meanwhile, France has fully deregulated its electricity retail market since July 1, 2007. According to France's Commission de régulation de l'énergie (CRE), households that account for 32% of electricity users in France were receiving electricity supply from EDF as of September 2008. The number of households receiving supply from new electric utilities expanded from 6,100 in September 2007 to 288,000 in June 2008, 515,000 in September 2008 and 692,000 in December 2008. At the end of March 2008, 18% of large-scale electricity users that account for 42% of all users were receiving supply from new utilities. Domestic electricity sales in 2008 increased 4.9% from the previous year to 496.9 TWh. In line with progress in deregulation, profit on domestic electricity sales could decline in the future. In overseas markets including the United States and China, electricity demand could decline over a long term under the protracted financial crisis. As shown in Figure 1-2, the power generation and distribution sales in overseas has quite a considerable share among the sales in the group because of expanded international operations. Some of the group companies have plunged into financial crises and become vulnerable to acquisitions by competitors and may fail to gain profit on overseas operations as expected earlier.

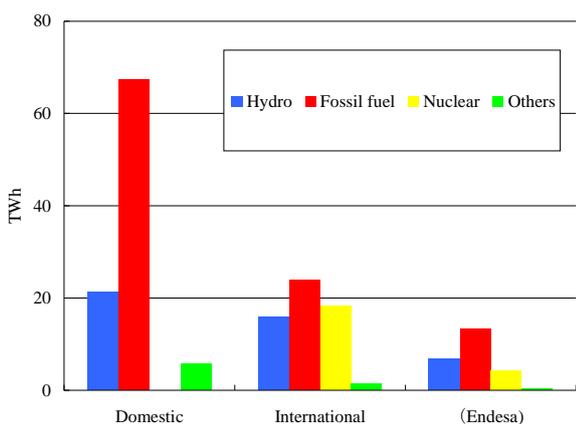
Table 1-1 SWOT (Strength, Weakness, Opportunity and Threat) Analysis of EDF

Strength	Opportunity
<ul style="list-style-type: none"> ➤ Nuclear power generation assets, supply chains, accumulated operation technology base ➤ A high and stable nuclear power generation share 	<ul style="list-style-type: none"> ➤ Gas and renewable energy project development in priority regions
Weakness	Threat
<ul style="list-style-type: none"> ➤ Nuclear power plants' unplanned shutdown risks ➤ Huge investment in nuclear projects and its project delay 	<ul style="list-style-type: none"> ➤ Electricity demand decline on full domestic electricity market deregulation ➤ Economic conditions for domestic and overseas markets

1-2 Enel

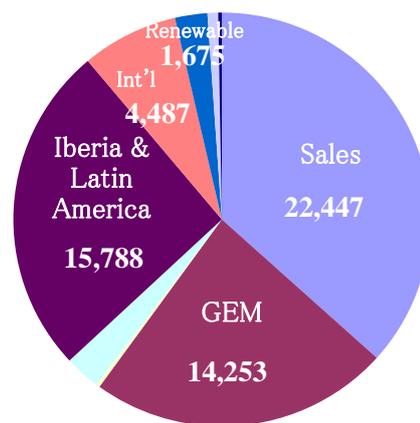
Figure 1-3 shows ENEL's power generation by fuel in 2007. Gas, coal and oil thermal power generation account for about 70% of Enel's electricity generation. The gas and coal portions are almost the same and for any fuel, the share of electricity output is not so large, thus Enel's electricity portfolio is well balanced. In a bid to further improve the electricity portfolio, Enel is about to give priority to expanding nuclear power generation. Legislation for the nuclear power generation resumption has cleared the House of Representatives in Italy and gained support from voters, and by now, it is a great opportunity for Enel to enhance its nuclear operations.

Figure 1-3 Power generation by fuel in 2007



Source : ENEL Group 2008 Financial Report

Figure 1-4 Sales by Sectors in 2008



Source : ENEL Group 2008 Annual Report

For about 20 years since 1990, Enel has not experienced nuclear power plant operations or developed new nuclear power station plans. The lack of nuclear experience accumulation represents its weakness, however, acquisition of SE and Endesa with nuclear power generation facilities may cover some part of the weakness. Enel plans to take part in SE's new nuclear power station project in Slovakia, and also has concluded nuclear cooperation agreements with France, Russia and Japan, planning to cooperate with them in constructing and developing new nuclear power stations. Through these international business development and cooperation deals, Enel has been making steady efforts to restore nuclear know-how. Besides, it also carries the strategic technology development target on carbon capture and storage (CCS), renewable power such as solar power and wind, energy saving and eco-friendly electricity network operation, mainly putting force on development of highly efficient coal power plants.

Although the present Italian regime has vowed to resume nuclear power generation, Italy has a history of substantial nuclear policy changes accompanying frequent government changes. The past developments indicate that any serious overseas nuclear accident could considerably change Italy’s domestic opinions on nuclear power generation. Given the recent developments regarding Italy and nuclear energy, however, Enel is now growingly expected to materialize new nuclear power station construction projects for Italy’s decision to choose nuclear energy as a key electricity source again.

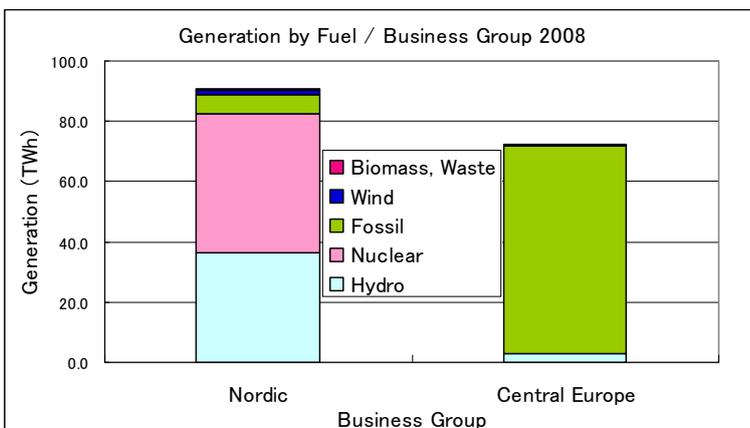
Table 1-2 SWOT Analysis of Enel

Strength	Opportunity
<ul style="list-style-type: none"> ➤ A well-balanced electricity portfolio and a stable customer base ➤ Acquisition of Endesa and SE that have nuclear power stations in operation or under construction ➤ Nuclear cooperation and other relations with France, Russia, Japan etc. 	<ul style="list-style-type: none"> ➤ The present Italian government has vowed to resume nuclear power generation. ➤ Italian polls indicate that a majority of the people support the construction of new nuclear power stations. ➤ European countries are taking a new look at low-carbon energy resources including nuclear power.
Weakness	Threat
<ul style="list-style-type: none"> ➤ Absence of operating experience of nuclear power stations for about 20 years ➤ No specific government plan yet to build new nuclear plants 	<ul style="list-style-type: none"> ➤ Frequent government policy changes may happen.

1-3 Vattenfall

Vattenfall’s greatest strength is a well-balanced power generation portfolio. Its thermal power generation depends primarily on coal that has been relatively stable in prices among fossil fuels. Sweden, where Vattenfall is based, features abundant hydroelectric power stations and in addition, Vattenfall has kept the capacity utility ratio of nuclear power plants at high levels, resulting in sustainable generation output both in hydropower and nuclear. The three electricity sources each account for 20% to 40% of the Vattenfall portfolio so that the utility can remain almost unaffected by fuel price fluctuations. For each type of power generation, Vattenfall has technologies above certain levels and accumulated excellent operation performances, which can call it strength. Figure 1-5 shows Vattenfall’s power generation by fuel in 2008.

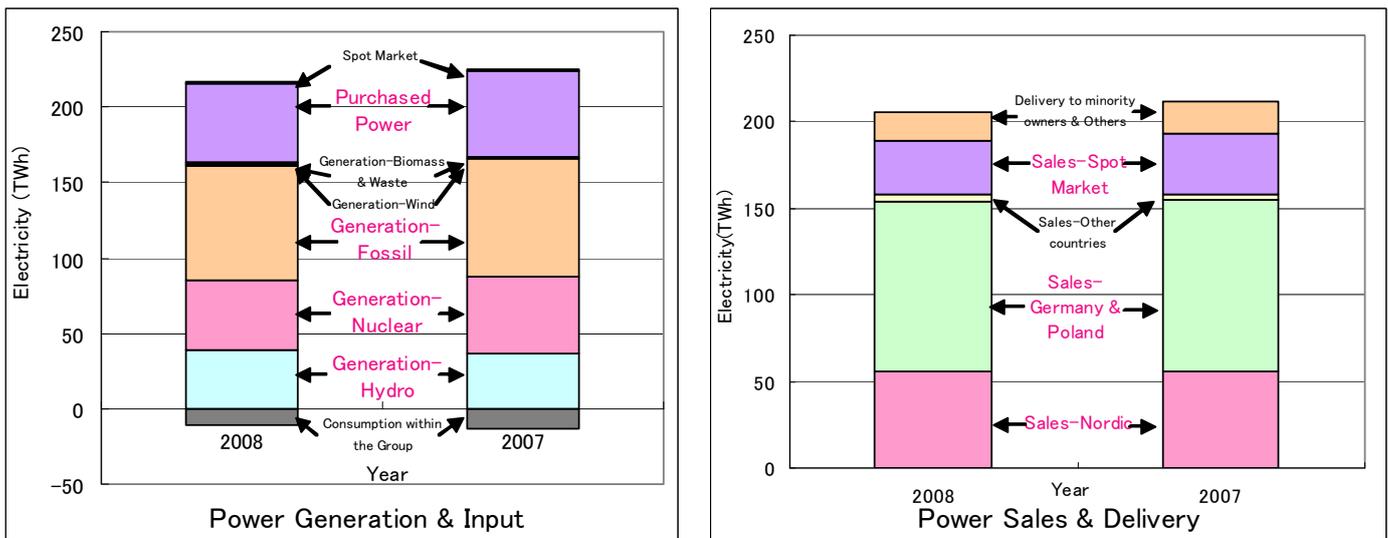
Figure 1-5 Power generation by fuel in 2008



Source : Vattenfall Annual Report 2008

The excellent performance in the profit-sales ratio among European electric utilities would be another strength of Vattenfall. It achieved a profit-sales ratio of 20% in 2008, comparatively high among other electric utilities in Europe, mainly by its excellent trading performance in the Nordic and Central Europe power sales market. As shown in Figure 1-6, the share of sales in spot market is quite high, some 15% of total electricity sales, which is a unique characteristic of Vattenfall.

Figure 1-6 Power input and output balance in 2008



Source: Vattenfall Year-End Report 2008

Based on the technological potential and stable power generation and sales operations, Vattenfall can afford to sustainably tackle the relatively costly development of low-carbon electricity sources including wind power and biomass, as well as the development of innovative technologies such as the CCS, tidal and wave power generation, plug-in hybrid vehicles recently begun with Volvo⁵. Vattenfall with these strengths may benefit from business opportunities emerging from the planned allocation of CO₂ emission allowances for payment, the direction of environmental conservation and the return to nuclear energy development policies in Europe.

Vattenfall's weakness, if any, could be related to governance amid its fast business expansion. Employees of the Vattenfall group have been increasing rapidly. In one year from 2007 to 2008, the number of Vattenfall group employees expanded by some 800. The group plans to triple its power generation capacity by 2030. Its challenge is to allow business decisions and communication within the organization to catch up with the fast expansion speed. Financing for acquisitions and capital investment for the expansion will be another challenge. Regarding these weaknesses, the deterioration of financial and macroeconomic conditions, as seen in the second half of last year, and changes in regulations on corporate acquisitions and capital spending may become risk factors.

Table 1-3 SWOT Analysis of Vattenfall

Strength	Opportunity
<ul style="list-style-type: none"> ➤ A well-balanced electricity portfolio ➤ Excellent operation performances in facility management and power sales market ➤ Technology development capabilities 	<ul style="list-style-type: none"> ➤ Europe's direction of environmental activity and planned allocation of CO₂ emission allowances for payment ➤ Europe's incline to low carbon technology development including nuclear power
Weakness	Threat
<ul style="list-style-type: none"> ➤ Maintenance of governance accompanying fast business expansion ➤ Financing for capital spending and corporate acquisitions 	<ul style="list-style-type: none"> ➤ Fluctuations in electricity and CO₂ prices ➤ Fears of financial and economic deterioration ➤ Changes in regulations on corporate acquisitions and capital spending

⁵ Vattenfall press release, June 1, 2009

2. Business Operations and Strategies of European Nuclear Companies

While only a few nuclear power plants have been constructed for nearly 20 years in Europe, a wide range of industries have existed to produce components and provide services for the operation, maintenance, repair and improvement of existing nuclear power plants. The whole picture of the European nuclear industry is shown on the next page.

Major nuclear power plant vendors that receive engineering and construction orders in Europe are Areva NP, Siemens and Westinghouse⁶. Nuclear plant vendors propose reactor specifications, receive entire plant construction project orders from electric utilities, order components and services from their suppliers as necessary and orchestrate the projects. Among them, Areva is a France-based comprehensive nuclear company that owns nuclear plant and fuel cycle technologies and has put Valinox, Cezus and other major nuclear plant component manufacturers under its umbrella. It has also maintained cooperative relations with major heavy machinery manufacturer Alstom, and over recent years, they have deepened their nuclear business relations. Alstom has undertaken supply of turbines for Areva's nuclear plant supply to such countries as China.

Nuclear plant vendors are building supply chains for nuclear plant projects in other countries than France. They now see the UK as the largest new nuclear plant construction market in Europe, and have been deepening relations with relevant British companies. For example, engineering and manufacturing company Balfour Beatty and Rolls-Royce announced their alliance for EPR construction in December 2008⁷. Along with Doosan Babcock, Rolls-Royce has also tied up with Westinghouse for AP-1000 construction the UK. There are many other companies with high-level technologies in the UK that could become infrastructure for the nuclear industry, including steelmaker Sheffield Forgemasters, heavy machinery manufacturers Doosan Babcock and CAPARO, and system engineering company BAE Systems and so on.

As well as the UK, Italy and Sweden are reconsidering their nuclear policies in a bid to build new nuclear power stations. Italy introduced nuclear reactors for commercial operations by the 1960s, suspended nuclear power generation development and dismantled commercial nuclear reactors in 1990. In the absence of nuclear reactor operations since then, Italy has no nuclear industry now. But it has companies that manufacture large castings and machines for non-nuclear power plants and other heavy machines. They may become major suppliers for future nuclear power plant construction.

Sweden is known for its excellent nuclear plant operation and maintenance technology accumulation among the EU countries. Although no new nuclear plant has been constructed since the 1980s, Sweden has uprated and upgraded components for existing nuclear power plants instead they turn their head to new construction projects or alternative source such as renewable power. A wide range of industries have thus existed in Sweden to support existing nuclear plants. Representative companies in this respect include Sandvik and Studsvik. Among them, Studsvik is a core company supporting Sweden's high-level nuclear plant operation and maintenance technology. As not only Sweden but also the UK and other European countries proceed with the construction and operation of new nuclear plants, these Swedish companies are expected to expand their presence.

Germany, Spain, Belgium, the Netherlands, Switzerland, Finland and other European countries with commercial nuclear power stations have companies to design systems, manage operations and undertake maintenance and repair services for nuclear power stations. They include Spain's ENSA and

⁶ In addition, Russia's AtomStroyExport (state-run nuclear firm Rosatom's group company known as ASE), Canada's AECL and a joint venture of the United States' GE and Japan's Hitachi have already participated or are planning to participate in the European nuclear plant market. But their market shares are smaller than those of the above three companies.

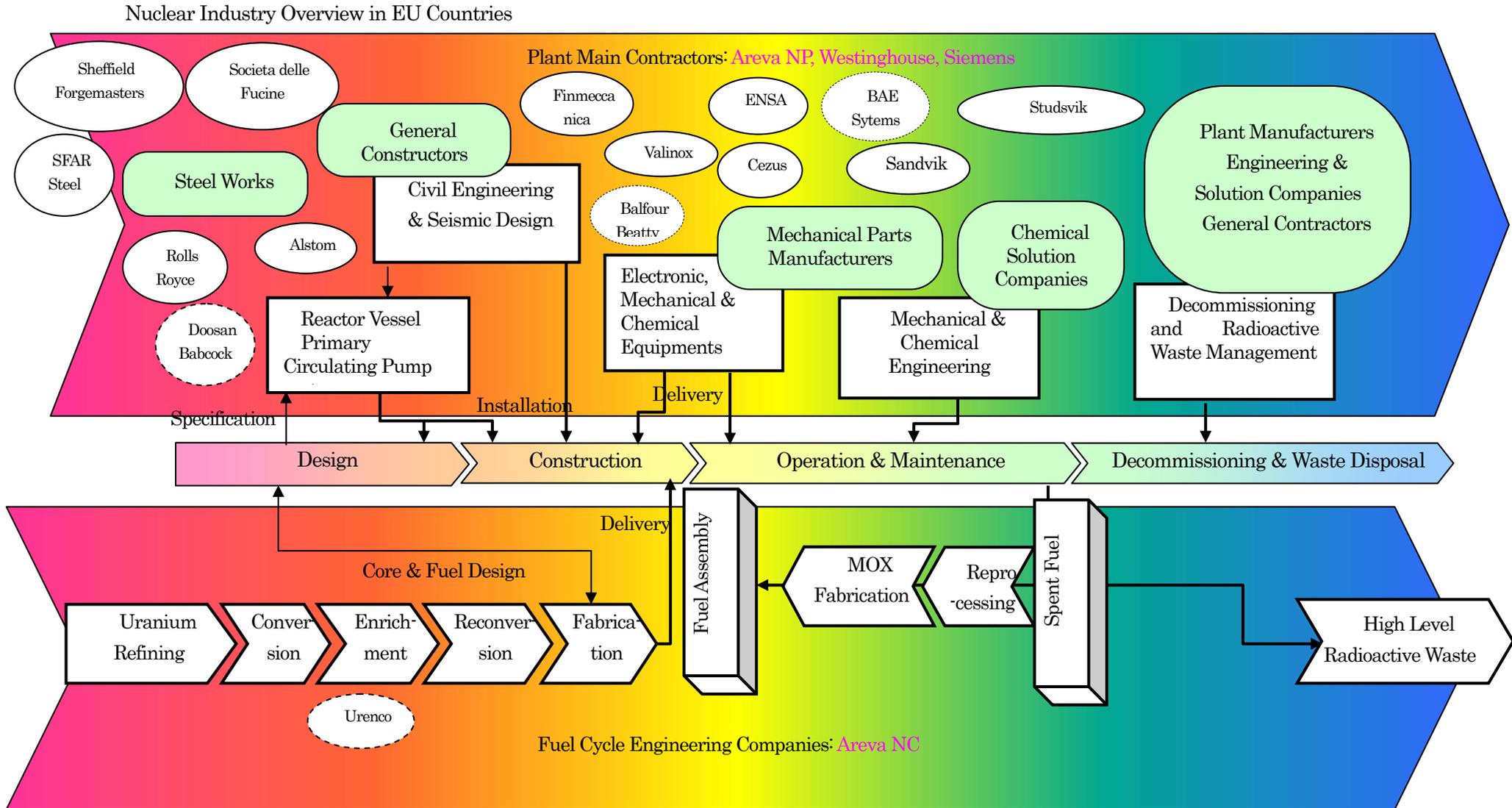
⁷ World Nuclear News, December 4, 2008

Sweden's Asea Brown Boveri AB (Westinghouse Sweden at present), that have also contributed to good performances of nuclear power stations in European countries.

We can point out some features commonly found in these companies; one is that they have carried out a major role in the national strategic industries such as air and space, military and so on. For example, Sheffield Forgemasters has been one of major suppliers of equipments for submarine in the UK military program. The other one is that they are all global players expanding business not only to U.S., Asia but also to emerging economies. Otherwise they would not be able to survive since new nuclear construction market in the EU countries began to shrink in the 1980s.

Based on Europe-wide electric utilities' strategies as reviewed in Chapter 1, this chapter overviews the features and prospects of business operations and strategies of companies that have participated or will participate in the European nuclear industry. After indicating the whole picture of the European nuclear industry on the next page, we would like to overview business operations, strategies and future prospects for Areva NP, Sheffield Forgemasters, ENSA and Studsvik.

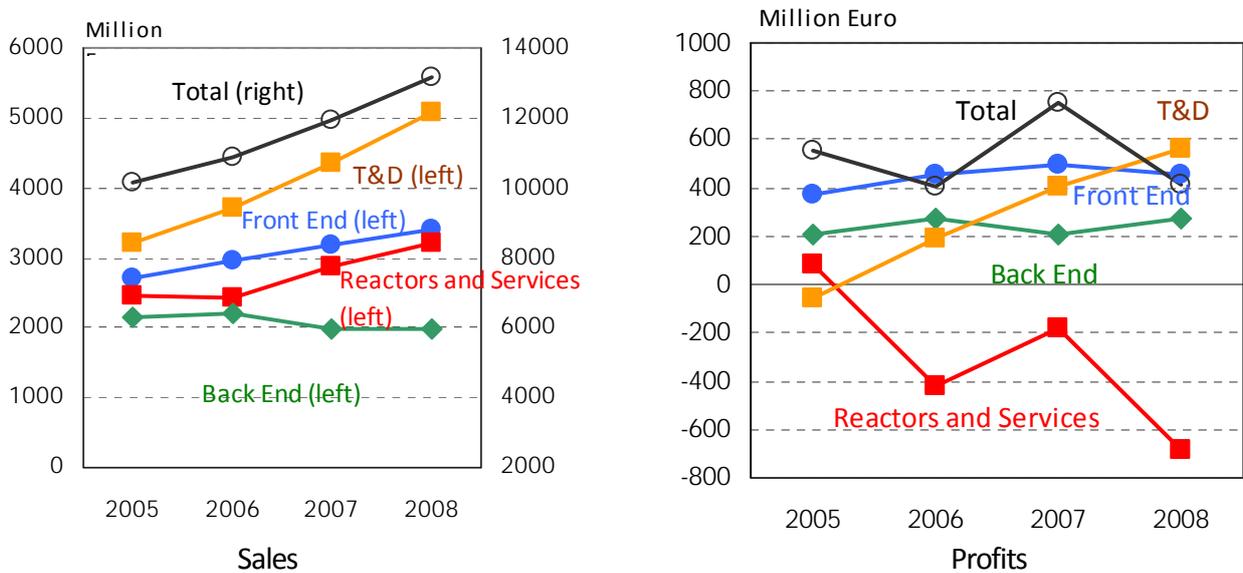
Figure 2-1 Supply Chain and Relevant Companies



2-1 Areva NP

The Areva group's greatest strengths include its high-level technological capabilities and business operations covering from the upstream to the downstream of the nuclear industry. They are linked directly to the strengths of Areva NP as a nuclear plant vendor. The group's rivals include Cameco in uranium production, Urenco and USEC in uranium enrichment, and Toshiba, Mitsubishi Heavy Industries, the GE-Hitachi group and Westinghouse in nuclear reactors. But these rivals are specialized in their respective business areas, failing to cover the complete range of the nuclear industry. The only exceptional rival is Russia's Rosatom, which Areva may view as its greatest rival. Southeast Asian and Middle Eastern countries that are planning to introduce nuclear power generation could select nuclear plant vendors that vertically and sustainably cover the full range of the nuclear industry, with a view to securing stable fuel supply. In this respect, Areva NP could take advantage of its group's integrity to gain a lead on other nuclear plant vendors. The group's coverage of wide-ranging business operations may become an advantage contributing to the diversification of risks. Over recent years, the group's transmission and distribution division (T&D) has expanded operations mainly in Asia in place of its sluggish reactor division. The T&D division is closely linked to the mainstay reactor division and would have been expected to powerfully support the mainstay⁸. Figure 2-1 shows consolidated sales and operating profit in 2008. While the reactor division suffers from the severe operating loss, mainly caused by the project delay in new nuclear in Finland, T&D division has recorded a remarkable increase both in sales scale and in the profit.

Figure 2-1 Sales and operating profits by division



Source: Areva Group : Consolidated Financial Statements in 2008

Another strength of the Areva group is that the group has been highly recognized as a nuclear company representing Europe and has joined hands with EDF, Suez, Total and other leading companies in France to expand overseas. French President Nicolas Sarkozy has stepped up efforts to support the Areva group. He has visited and signed nuclear energy cooperation agreements with Middle Eastern and African countries that are considering introducing nuclear power generation. Such efforts can directly lead the Areva group to obtain nuclear reactor orders. The group features the strategy to take advantage of such

⁸ On June 30, Areva pronounced that it has decided to sell T&D division.

government support for expanding overseas operations. In this sense, Rosatom may be similar to Areva. Given the past history, however, Areva apparently has some advantage over Rosatom.

The persistent research and development of sophisticated technologies under government support is also a major strength of Areva. For example, Areva has undertaken the development of fourth-generation nuclear reactors, new uranium enrichment technologies, spent-fuel reprocessing technologies, and other research and development projects that any private company alone may hesitate to undertake in view of uncertain profitability. Such efforts could lead to a great advantage over a medium to long term.

While Areva has the great strengths as cited above, its noteworthy weaknesses are limited. One weakness emerges from its heavy concentration in the European nuclear plant market. In Asia and North America where nuclear plant markets are expected to expand substantially, Areva is trying to increase its presence while being still inferior to Westinghouse. As the United States and Europe have adopted different structural design standards, Areva's past specialization in the European market could turn out to be a weakness in North America. In Southeast Asian countries, Japanese, South Korean and other Asian companies outdo European and American firms in technological and economic cooperation. A challenge for Areva may be the selection of foreign regions and strategies for its future expansion. In Finland, Areva's new nuclear plant construction project has been delayed on its failure to secure smooth communications with local suppliers and build a solid supply chain. Such failure will be the biggest problem for Areva's future participation in the UK and other new nuclear plant markets.

As Areva undertakes business operations in a great number of areas, it does not necessarily conduct research and development of cutting-edge technologies in all of the areas. For example, Areva plans to build a new centrifuge uranium enrichment plant, while the GE-Hitachi group is about to construct a laser uranium enrichment plant. Such rival technology could make progress to the disadvantage of Areva.

In January 2009, Siemens stated that it would sell its 34% stake in Areva NP that the German company acquired upon the company's founding. Depending on the sale price, the sale could reportedly affect cash flow for Areva. As Areva has huge investment projects including the new uranium enrichment plant construction and the development of the EPR, and ATMEA-1 reactor, Standard & Poor's Rating Services has downgraded Areva's short-term debt rating from A-1 to A-2 with the "negative" rating outlook. On June 30, 2009, Areva has pronounced that it has decided to sell T&D division, which has achieved the most excellent performance within a few years, in order to reinforce its position as a leading company in the nuclear market and to keep investment in the energy market including renewable, while maintaining a healthy balance sheet. Otherwise, some financial crisis might hit the Areva group within a few years.

For Areva with these features, the largest chance is that a rising number of countries are planning to build or replace nuclear plants. With support of the French government, Areva has taken advantage of the chance to drive reactor sales to many countries. It has won an 8 billion euro order for China's Taishan nuclear power plant. As noted above, the presence of many countries considering introducing nuclear plants for the first time provides great business chances to the vertically integrated Areva group that can secure stable nuclear fuel supply. Areva has also given priority to developing renewable energy electricity sources that are expected to make fast progress. It expects to benefit from the synergy of renewable energy development and its electricity transmission and distribution division. Therefore, the future global pursuit of a low-carbon society is expected to provide business chances to Areva.

The largest potential risk for Areva is related to troubles regarding overseas nuclear plant construction, as seen for the Unit 3 Olkiluoto reactor construction project in Finland. Areva has covered losses on the delay in the project with profit at other divisions to prevent the delay from exerting any fatal

impact on its survival. Given this episode, however, similar delays in overseas nuclear plant construction projects are conceivable as a great risk factor.

Another conceivable risk is related to competition from strong rivals. Russia has reorganized its atomic power agency into a new state-run company called Rosatom to expand into overseas markets. Other rivals with advanced technological capabilities include the Toshiba-Westinghouse group, Mitsubishi Heavy Industries and the GE-Hitachi group. Depending on future developments, competition from these rivals may become a major risk factor for Areva’s overseas expansion.

Siemens’s planned sale of its stake in Areva NP could affect Areva’s cash flow. An announcement said that the sale or the termination of the joint venture relationship would not mean any end to their cooperation or any decline in Areva’s influence on the German market. Siemens has already begun to build cooperative relations with Rosatom and is expected to become a rival and a threat to Areva.

Table 2-1 SWOT Analysis of Areva NP

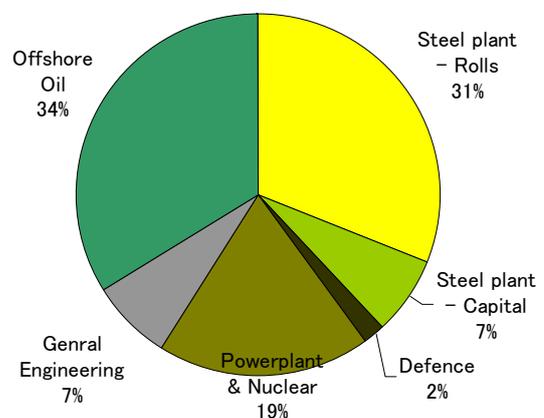
Strength	Opportunity
<ul style="list-style-type: none"> ➢ High technological capabilities and publicity ➢ Vertically integrated business operations covering from the upstream to the downstream of the nuclear industry ➢ France’s national support ➢ Proactive technology development 	<ul style="list-style-type: none"> ➢ Global moves to promote a low-carbon society and nuclear energy
Weakness	Threat
<ul style="list-style-type: none"> ➢ Not so acquainted in the Americas and Asia ➢ Weak business relations with local suppliers in regions where it has never operated ➢ Capital funding problems 	<ul style="list-style-type: none"> ➢ Troubles with overseas expansion (including an unanticipated delay in plant construction) ➢ Presence of strong rivals ➢ Impacts of the termination of the capital alliance with Siemens

2-2 Sheffield Forgemasters International Ltd. (SFIL)

SFIL’s greatest strength is its engineering technology mainly for rolled steel. Regarding nuclear-related products, SFIL has delivered nuclear-related components for the submarine program in the UK and is known as a key supplier of nuclear reactor pressure vessels. SFIL features high technological capabilities and proactive capital spending and is expected to fairly compete with Japan Steel Works in production of large forgings for nuclear equipments if a large press now under planning is completed. Figure 2-2 shows the sales portfolio in 2008. The core businesses are rolled steel, power plant equipments and energy-related products such as offshore oil and so on.

SFIL’s financial profile is uncertain because it is an unlisted company. In 2005, it became insolvent and requested government support. From 2006 to 2007, SFIL tackled its reconstruction through a management buyout. Since SFIL has difficulties in issuing equity shares for its recapitalization, its financial base must be improved to allow continuous, prompt capital spending. SFIL is expected to receive nearly \$450 billion under the UK government’s Grant for Business Investment

Figure 2-2 Sales portfolio of SFIL in 2008



Source: Nuclear Supply Chain Workshop, Derby, March 3, 2009

program for its planned introduction of the large press. By supporting SFIL as UK's largest forging manufacturer, the government apparently intends to have forgings produced domestically for nuclear plants without depending on foreign countries.

When SFIL plunged into insolvency, the director general of the Sheffield City Council stated that SFIL had influences on nationwide and local industries that could not be ignored and that it was playing a key role in restoring technology for the steel industry in the UK. The UK government has apparently acknowledged that nuclear equipment production capacity could become a problem when nuclear power generation expands. Its interests might have coincided with those of SFIL that hopes to continue business operations with local government support. The central and local government support may provide SFIL with not only chances but also the risk that its business strategy could be affected by government policy.

Table 2-2 SWOT Analysis of SFIL

Strength	Opportunity
<ul style="list-style-type: none"> ➤ Technology development capabilities ➤ Confidential relationship with customers ➤ Large forging manufacturing capabilities 	<ul style="list-style-type: none"> ➤ Increasing nuclear power station deals mainly in emerging countries ➤ Increasing deals for larger nuclear power stations
Weakness	Threat
<ul style="list-style-type: none"> ➤ The unlisted company's financial profile is uncertain. ➤ Whether the company could recapitalize itself efficiently is uncertain. 	<ul style="list-style-type: none"> ➤ Possible absence of efficient investment ➤ Possible influences of the British government

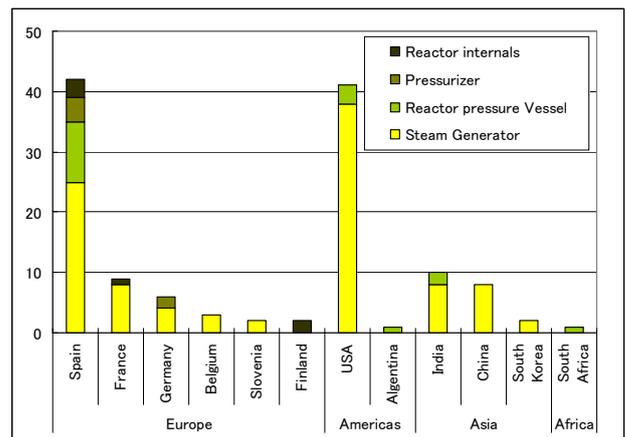
2-3 ENSA (Equipos Nucleares, S.A.)

ENSA (Equipos Nucleares, S.A.) is a Spanish based company, one of the group companies of SEPI (Sociedad Estatal de Participaciones Industriales), a national strategic industrial firm. ENSA's financial base is, therefore, completely governmental. However, the strength of ENSA as a global nuclear equipment manufacturer include abundant orders it receives from all over the world for steam generators, nuclear reactor pressure vessels, pressurizers, reactor internals and primary pipe works. With order backlogs for nearly two years, ENSA is appreciated as a very excellent company. Figure 2-3 shows the recent supply record by component and by country. Business chances are expected to increase for ENSA as global moves to expand nuclear power plant markets have grown with regard to energy security and global warming.

The present Spanish regime has maintained its gradual nuclear plant elimination policy so that there is no nuclear plant construction plan within Spain. A country-by-country breakdown of order receipts indicates that orders from Spain account for the largest share. But the share is limited to around 10%. Overseas orders are far more than domestic ones. Unless the Spanish political situation changes, no substantial growth in domestic orders can be expected and ENSA may continue to focus on overseas markets.

There are some risk factors for ENSA. First, emerging countries could change environmental policies. Second, the recent financial destabilization has slightly increased contract cancellation risks. Third, fast technology innovation for higher value-added products could force ENSA to change designs of large equipments during their construction. ENSA's potential weaknesses include a business efficiency decline

Figure 2-3 Recent supply record by component and by country



Source: ENSA website

attributable to simultaneous business operations in many countries with different business practices and laws. But this problem faces all manufacturers that base their international operations on excellent technologies, not peculiar to ENSA. Unless ENSA make any major mistakes, the globally known company may expand its global operations.

Table 2-3 SWOT Analysis of ENSA

Strength	Opportunity
<ul style="list-style-type: none"> ➤ Governmental financial base ➤ Abundant orders received from all over the world ➤ Excellent manufacturing technologies 	<ul style="list-style-type: none"> ➤ Business chances for nuclear equipments are increasing amid the growing global return to nuclear energy.
Weakness	Threat
<ul style="list-style-type: none"> ➤ A business efficiency decline attributed to multinational operations 	<ul style="list-style-type: none"> ➤ Possible business environment changes including environmental policy changes and financial deterioration. ➤ Technology innovation is so fast for large products as ENSA's mainstay that the firm may be forced to change product designs even during their production.

2-4 Studsvik

Studsvik is an engineering company, founded in 1947 by the Swedish government, and has contributed to excellent performances of nuclear power stations in Sweden and its surrounding countries through chemical water control, material analysis, in-core fuel behavior analysis and other services, as well as relevant software development, and disposal and recycling of nuclear wastes. Business chances will increase for Studsvik as Europe, the United States and Japan build new nuclear power stations and replace equipments at outdated plants. As a rising number of old nuclear power stations in Europe have replaced their steam generators, primary circuit pumps and reactor vessel internals over recent years, chemical water control, material analysis and other services for nuclear plant operations have grown more important. Therefore, Studsvik with strengths in disposal of large low-level radioactive wastes, water chemistry and material analyses will be placed in a higher position.

Studsvik engineers who are well versed in materials and fuel behavior analyses concentrate in Swedish and U.S. offices and make business trips in response to orders from other countries including Japan. A major future challenge for Studsvik may be to secure an appropriate staff size and communications with customers amid its business expansion. Risks include sluggish business performances of electric utilities and primary contractors for nuclear plant construction under deterioration of financial and economic situations, as well as chemical engineering and other rival companies' participation in the nuclear business area. However, these risks are not so large, compared with the above business chances.

Table 2-4 SWOT Analysis of Studsvik

Strength	Opportunity
<ul style="list-style-type: none"> ➤ Abundant and continuous orders received from many countries. ➤ Technological capabilities and abundant research infrastructure (including hot facilities) for water chemistry, materials analysis, fuel behavior analysis and other services 	<ul style="list-style-type: none"> ➤ A global increase in new nuclear power station construction deals and in demand for equipment replacements at old nuclear plants.
Weakness	Risk
<ul style="list-style-type: none"> ➤ Studsvik may have to secure an appropriate staff size and communications with customers in line with its business expansion and multinational operations. 	<ul style="list-style-type: none"> ➤ (Sluggish business performances of electric utilities and nuclear plant makers) ➤ (Rivals' participation in the nuclear business area)

3. Conclusion and Implications

This report has considered and analyzed moves and strategies of electric utilities and nuclear business companies involved in nuclear policies mainly in European countries, especially in the UK, Italy and Sweden, those are planning to build new nuclear power stations.

The speed of progress in and the effectiveness of new nuclear plant construction policies promoted in these countries hold the key to whether nuclear business companies may accept these policies and put them into their business strategies. As well as the fate of nuclear energy policies, comprehensive energy and environment policies in European countries and the European Parliament are the problem for electric utilities. Their future business decisions depend on whether European countries would sustain their present environment-oriented and low-carbon society policies and implement effective policy measures including those regarding prices of low-carbon electricity and CO₂. For Vattenfall that has many coal power stations in a competitive market after deregulation, particularly, electricity market regulations and environment policies of European countries and the EU have direct impacts on business strategies.

Regarding the nuclear industry, some features commonly found in these companies; one is that they have carried out a major role in the national strategic industries such as air and space, military and so on. The other one is that they are all global players expanding business not only to U.S., Asia but also to emerging economies. Among them, Areva group has attracted attention as the only full-cycle nuclear power company in Europe. Important for the group is whether it could build a solid network for supplying machines, components, system configuration services and other services in line with the future construction of new nuclear plants and the development and expansion of the nuclear industry. Learning lessons from its communications problems with suppliers that have resulted in a delay in the construction of a new nuclear plant in Finland, Areva has been striving to build good relations with suppliers in the UK by providing specific milestones toward the new nuclear plant construction. In dealing with equipment manufacturers including Sheffield Forgemasters that produce forgings for nuclear reactor vessels providing a critical path for the nuclear plant construction, particularly, Areva is considering certified supplier and other systems to secure suppliers' strict compliance with delivery deadlines and quality requirements.

As well as companies that provide equipments and engineering services for new nuclear plant construction, the presence and strengths of firms undertaking maintenance of existing reactors and disposal of wastes are important for projecting the future expansion of the nuclear power generation market. In Japan, nuclear plant vendors usually accept electric utilities' requests for plant maintenance and repair, waste disposal and other services and transfer such service orders to engineering solution companies. This is not necessarily the same case with Europe. Studsvik, as taken up in Chapter 2, is a company with excellent technological capabilities that has direct engineering service contracts with electric utilities. The scope of the nuclear industry in Europe is wide and has a potential to expand further. As safe management, maintenance and repair services grow more important in line with the aging of nuclear plants, many companies with excellent technological capabilities in these areas are expected to expand into nuclear plant services and wage fair competition in order to contribute to improving technology levels of and vitalizing nuclear power generation in the world including Europe.

The width, strength and depth of nuclear industry infrastructure including manufacturing and plant management services are commonly indispensable in the world for promoting and expanding nuclear power generation. European companies have had a longer history of nuclear power generation development than Japanese firms. After survival from a long suspension of nuclear plant construction, relevant European companies have technological strengths in various areas related to nuclear energy, and they are potential

competitors and / or powerful alliance partners for Japanese nuclear companies. In this sense, from now and after, attention should be paid to their strategic developments as well as policy developments in European countries.

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Contact: report@tky.ieej.or.jp