

NPP Mochovce - Units 3 and 4 - *Case Study*

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Basic Project Information

Project Title	Completion of units 3 and 4 of Nuclear power plant (NPP) Mochovce
Location	Mochovce, Nitra self governing- region, Slovakia, Europe
Purpose	Meeting of the national demand for electricity, energy security and self-sufficiency in Slovakia
Scope	The completion of the third and fourth unit of nuclear power plant Mochovce.
Total Project Value	EUR 2.775 bn estimated at November 2009, later estimation is EUR 3,7 bn
Project Status (i.e.. initiation, planning, construction, operation, dismantling)	Completion of 3 and 4 unit of Nuclear power plant (NPP) is under construction
Contractual Framework (e.g. fixed price, cost-plus etc.)	Slovenské elektrárne (SE) are responsible for the construction. 34% of shares of SE belongs to Fund of National property and 66 % to ENEL Produzione SpA. ENEL is the main financier of the construction
Relevant Physical Dimensions (e.g. height, width, volume, length)	Units 3 and 4 in Nuclear Power Plant Mochovce are under construction. Completion of the unit 3 – 2014, unit 4 – 2015

MEGAPROJECT Stakeholder Identification (Internal)

		Stakeholder Category	Case-Study	Comments (e.g. maturity, previous experiences of stakeholders, skills, influence on project)
Internal	Supply-Side	Client	Slovenské elektrárne, a.s.	Largest producer of energy in Slovakia
		Financiers	Private financing: Enel, financing the construction from the cash flow of Slovenské elektrárne	The experience of large European power operator
		Sponsors	n/a	
		Client's Customers	SEPS (Slovenská elektrizačná a prenosová sústava) – Slovak power grid operator	
		Client's Owners	34% National property fund of the Slovak Republic 66% ENEL Produzione SpA. It is largest shareholders in March 2011: Ministry of the Economy and Finance of the Italian Republic 31.24% of the shares , Blackrock Inc., which owns 2.74% of the shares, Natixis S.A., which 2.07% shares.	
		Other internal supply-side categories (please specify)	Category	Case-Study

Takeover of Slovenské elektrárne by ENEL

- The takeover of Slovenske elektrarne by ENEL was motivated by acquiring in-house nuclear plant construction experience, which was missing to this transnational company. Since it was not possible to buy only nuclear power plant Mochovce, ENEL agreed to buy 66% of the Slovak utility Slovenske Elektrarne (SE) in February 2005 for € 840 m. The deal was completed in May 2006.
- For this reason ENEL had also made the agreement with EDF on participation on construction of NPP Flamanville in France. Enel hoped that this expertise would be useful for building the first new nuclear unit in Italy, which should have started in 2013 with the perspective that 25% of Italy's electricity would come from nuclear power by the year 2030.
- The condition for takeover by ENEL of Slovak generation company, Slovenske Elektrarne was the commitment that ENEL would complete two partly-built nuclear plants of Russian design (Mochovce 3 and 4).

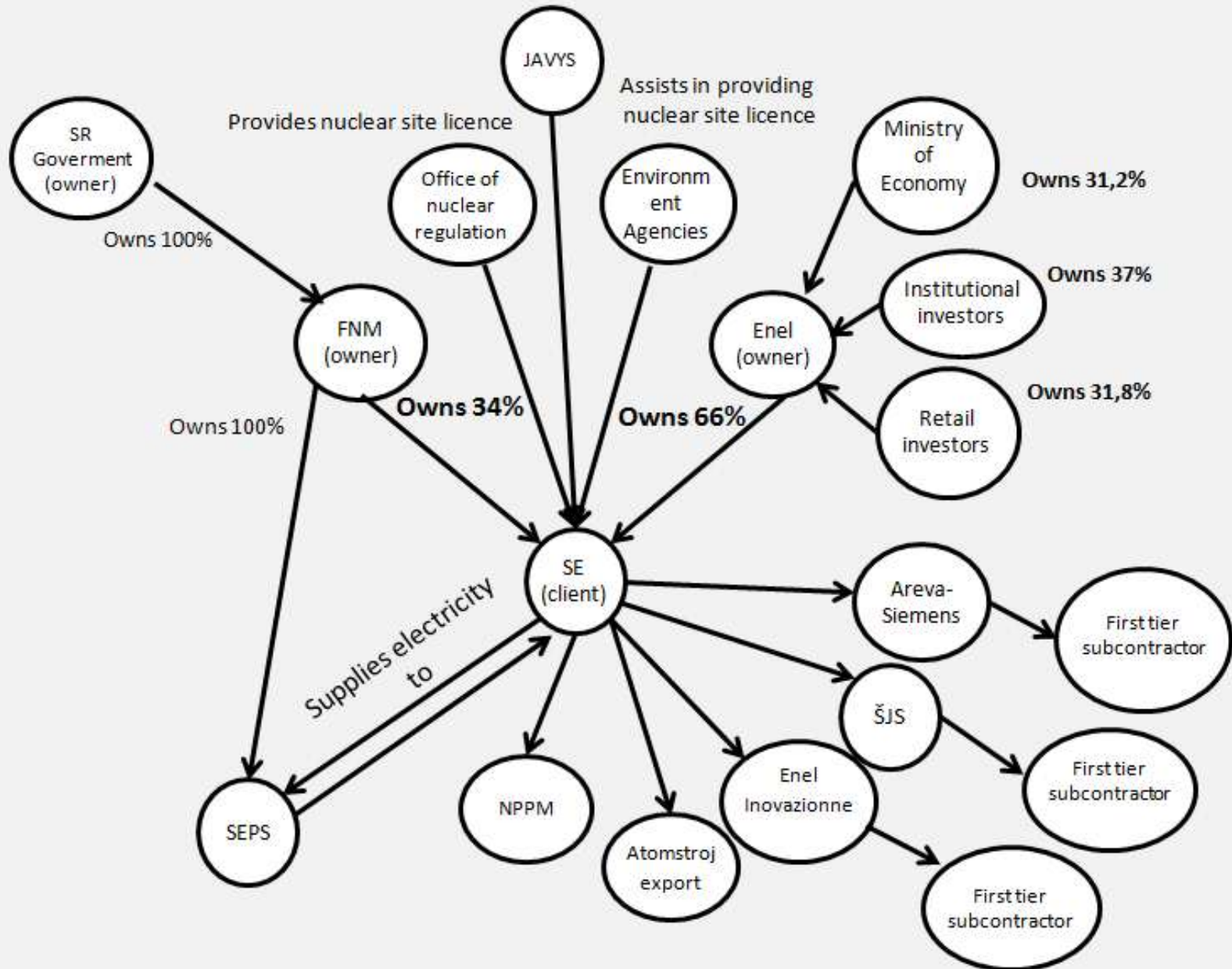
MEGAPROJECT Stakeholder Identification (Internal)

		Stakeholder Category	Case-Study	Comments (e.g. maturity, previous experiences of stakeholders, skills, influence on project)
Internal	Demand Side)	Principal Contractor	Architect Engineer: Slovenske elektrarne - Enel	
		First Tier Contractors	Main Contractors: Nuclear Island: Škoda Jadrové strojírenství (ŠJS), Atomstrojexport, VUJE, Enseco (Evaluation of reliability and operational efficiency in the stages of commissioning, operation and decommissioning of sources of energy and heat. Design of electrical equipment), Inžinierske stavby Košice, PPA, Rolls Royce Conventional Island: Enel (EPCM Contractor), Skoda Power, Brush, ZIPP Main Instrumentation and Control: Areva-Siemens	
			VUJE (Nuclear Power Plants Research Institute), JAVYS (Nuclear and Decommissioning Company), SEPS (Slovak Electricity Transmission System)	
		Second Tier Consultants	Individual companies within Slovakia, Poland, Czech, Hungary Individual worldwide companies	
		Professional Services Providers	Areva-Siemens, NPPM (Nuclear power plant maintenance)	

MEGAPROJECT Stakeholder Identification (External)

		Stakeholder Category	Case-Study	Comments (e.g. maturity, previous experiences of stakeholders, skills, influence on project)
External	Public	Regulatory Agencies	Úrad jadrového dozoru Slovenskej republiky (Nuclear Regulatory Authority of the Slovak Republic), URSO, MŽP (Ministry of Environment), MH (Ministry of Economy), International atomic energy authority (IAEA), Environment agency, International Atomic Energy Authority	
		Local Government	Nitra Self - Governing Region, Levice district – Tlmače, Kalná nad Hronom, Starý Tekov, Veľký Ďur, Malé Kozmálovce, Nový Tekov	Positive economic impact in region
		National Government	Slovakia, Italy, Austria, Czech Republic, Poland, Russia	
	Private	Local residents	Individual residents, Levice, Tlmače, Kalná nad Hronom, Starý Tekov, Veľký Ďur, Malé Kozmálovce, Nový Tekov	Positive impact on the area, unemployment decrease
		Local Landowners	Individual landowners	The value of property will increase
		Environmentalists	Greenpeace, Environment agency	
		Conservationists	Greenpeace, State nature conservancy (Štátna ochrana prírody Slovenskej republiky),	
		Archaeologists	The Monument office of SR, Local authorities	Greenfield, improbable to find something

MEGAPROJECT Stakeholder Relationship Maps



MEGAPROJECT External Stakeholder Attitude Analysis

External Stakeholder	External Stakeholder's Attitude to this Project	External Stakeholder's Influence on project	Impact of Project on External Stakeholder
Greenpeace, Environment agencies, Austrian goverment	Highly Unfavourable	Ability to lobby at government organizations, civil disruption, and also to exert the pressure on banks in order to provide the provision of credit line for the project	Opposition to this type of project is their raison d'être
Local residents and landowners	Concerned about risk but also welcoming new jobs and potential property boom	Votes for local government and national government-- Based on several surveys of public opinion the completion of the third and fourth unit is supported by more than two thirds of Slovakia's population (and more than 87% of the population in the 10 km zone around the plant	Potentially (and v. remotely) substantively harmful but in reality it may make significant improvement to standards of living
Local Business Organisations	Very happy to see new business opportunities but want to see these available locally	General ability to lobby government (especially local)	if successful may increase growth substantially
Local goverment	Very favourable and supportive	None identified	Long term sustainability in region

Nuclear power plants in Slovakia

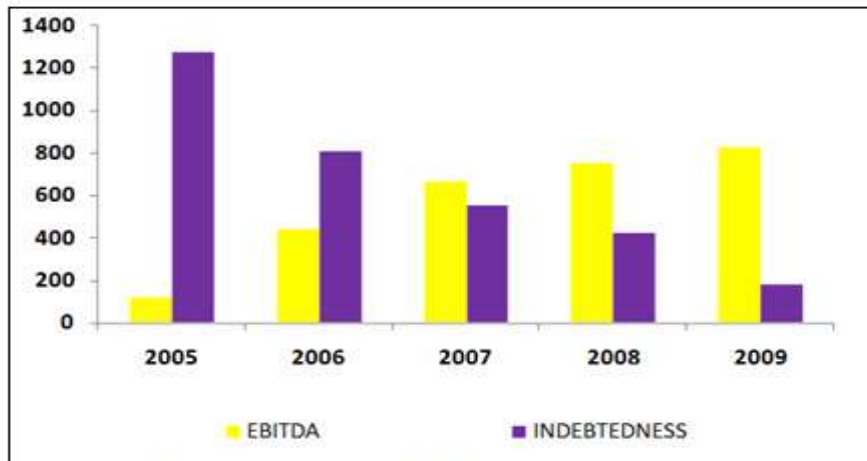
In 1999, nuclear reactors produced 47% of Slovakia's Electricity



MEGAPROJECT Project Processes

Time Management Processes	<p>Completion of NPP Mochovce - units 3 and 4</p> <p>Completion of the third and fourth unit of NPP Mochovce was planned in 2012 and 2013. This would be the largest private investment in the history of the Slovak Republic. Performance of each unit will be a 440 MW. Slovenské elektrárne began with the completion of units 3 and 4 by formal opening of construction works on November the third, 2008. In this process the German, Italian, French, and Russian companies take part. Slovak power plants has contracted the suppliers for the completion of the third and fourth unit of nuclear plant Mochovce totaling 2.63 bn euros. Closed contracts represents more than 94% of total investment. Company Termostav - Mráz, Inc. with base in Košice will also participate in completion and it will provide thermal isolation for third and 4 unit.</p> <p>The transfer of the reactor pressure vessel of the fourth unit of nuclear power plant was realized at the beginning of December 2011. The pressure vessel was finally deposited into the reactor pit, where it will be operating. This is a key component of nuclear power plant, which is located in the active zone of the reactor, the overall height is 14.1 meters and weighs over 215 tons. Pressure vessel for third unit was mounted in 2010.</p>
Cost Management Processes	<p>The construction of NPP Mochovce was funded by state resources until 1991. By the end of 1991, about 19 billion of Czechoslovak crowns were invested into the project. In the early nineties, lack of resources greatly influenced the construction of NPP Mochovce. The third and fourth units were reported to be only 40% and 30% complete when work was halted on them at the beginning of Nineties.</p> <p>The only way to continue the construction was searching for funds abroad. In September 1995, the government approved a model of financing of units 1 and 2. It was agreed that the completion will be carried out within the range of the original design and the original contractors. Contracts with suppliers and credit institutions were signed in 1996 where the government agreed to take over loan guarantees for the completion of Units 1 and 2.</p>

COST MANAGEMENT PROCESSES – the reality and plans in 2008



Graph 1 EBITDA and Net debt development

Table 1 Total costs in construction of the NPP Mochovce

Units	1&2	3&4
Start of construction	1986	1987
Grid connection	1998/1999	2012/2013
Total costs of construction (mil. €)	1.930	2 775

Table 2 History of capital costs related to the construction of the NPP Mochovce

	Invested costs (till 2005)	Total costs (2006)	Total costs (2008)
Capital costs (mil. €)	659 (129)	2.058 (1.394)	3.419 (2.755)

Source: Chren, J.: Lessons learned from completion of nuclear power plant EMO 3,4 Case Study. Geneva, November 24, 2010.

Cost Management Processes

In October 2004, the Italian national utility ENEL acquired a 66 percent stake in Slovenské elektrárne (SE) and, as part of its bid, proposed to invest nearly €2 billion in new nuclear generating capacity.

In 2007 the feasibility study has been completed. The result was positive but the timescale to complete NPP Mochovce 3 and 4 slipped. By 2007, the expected completion date was 2012 when the contracts for completion were expected to be signed in mid-2008. Obtaining finance became a problem. In 2007, a consortium of nine banks agreed to provide ENEL/SE with a €800m 'revolving credit' facility over seven years. However, in 2008, under pressure from Greenpeace, three banks, ING, Banca Intesa and Erste Bank, refused to allow the credit facility to be used for the completion of Mochovce, then projected to cost €1.7bn. ENEL/SE was forced to issue a statement that it would finance completion of the plants from internally generated cash.

The process was further delayed in September 2008 by a Slovak government decision to require ENEL/SE complete a new Environmental Impact Assessment (EIA). As the consequence of the delays, some of the contractors has augmented their prices

The European Commission also became concerned in May 2008 that the designs were not adequately safe. The Commission has expressed the concerns that the facility is not meeting the objectives of the Euratom Treaty," provided the utility "bring(s) the design in line with the existing best practices" including the protection against external attack. Based on such opinion, the new safety measures were implemented.

Not long ago CWZ/JAVYS proposed to build another NPP unit at Bohunice site, expected to come on-line in 2020. As a result of that a surplus of base-load power might be available and this could force down the price ENEL/SE would receive for the output of NPP Mochovce 3 and 4. Such situation would mean the reduced profits or even losses for ENEL/SE

Cost Management Processes

In Eighties the planned cost of construction of Units 3 and 4 represented EUR 1.3 bn. In 1992 construction works on the completion of Units 3 and 4 were stopped. One reason was the lack of funds. The works on Units 3 and 4 were recommenced in 2007, which raised the costs to 3.4 billion euros. At that time it was expected that the completion of Mochovce NPP - units 3 and 4 will be EUR 3 bn, where the equity financing would represent EUR 2.2 bn. And EUR 500 million will come from foreign sources. Since the financial performance of the SE at that time was positive, the equity financing seemed to be a good option. When ENEL took over SE the forecast completion date for the reactors was 2011-12. ENEL was expected to finalize a feasibility study in April 2007 and then to take a final decision whether or not it would invest in the units.

The stress tests in post-Fukushima period and the implementation of the results has caused another delays and cost overruns in the project. The following changes were added to design of NPP:

- *Severe accident consequence mitigation;*
- *Seismic reinforcement;*
- *Enhancement of plant protection to area events (flooding, fire, etc);*
- *Plant instrumentation and control and human machine interface;*
- *Protection from high energy pipe breaks;*
- *Minimization of radioactive wastes.*

The management and verification of the design works are being performed by Slovenske elektrarne through a dedicated Engineering Team which consists of specialists from NPP Mochovce 3-4, NPP Mochovce 1-2, NPP Bohunice and from Enel SpA. For the technical activities, Slovenske elektrarne is assisted by an international engineering consultant. In order to ensure that the revision of basic design is performed by implementing the best applicable safety practices, SE has also set up a Safety Board, composed by 6 leading national and international experts in nuclear safety, which is aimed at providing guidelines as well advice on all subjects concerning safety.

Such a large scale changes could not have impacted the substantial raising of the cost of completion of units 3 and 4.

Quality management Processes

An important part of safe operation of NPP Mochovce is also practical training of operators of nuclear power plant, especially in dealing with transient and emergency situations in a simulator. It is a computer model that monitors the activity of NPP with a defined accuracy and in the real time simulates the behavior of the equipment in a plant. Simulator allows to perform all work activities during the training that can be controlled from nuclear power plant control room.

Supplier of representative full-scope simulator for the 3 and 4 units at NPP Mochovce is an American company GSE Power Systems. Currently, the construction works of the simulator are complete, titanium-zinc facade with thermo-isolation also with communication and landscaping. The supply company will be responsible for the design and engineering, procurement, manufacturing, factory testing, delivery to site, installation, startup and commissioning of a complete hardware and software that is necessary to realize the operation of simulator of units 3 and 4 of NPP Mochovce.

Revision of the design after the stress tests:

In order to ensure that the revision of basic design is performed by implementing the best applicable safety practices, SE has also set up a Safety Board, composed by 6 leading national and international experts in nuclear safety, which is aimed at providing guidelines as well advice on all subjects concerning safety.

Communications management Processes

The Slovak government organizes presentations and visits to nuclear sites.

Public information material like brochures, newspapers and advertisements are widely distributed to many people for maximum effect. Public meetings and hearings are organized for each nuclear facility, and are considered very important, in particular for the citizens of cities and villages on the route from the Treatment Centre to the Mochovce repository. Conferences and seminars about nuclear issues happen once a year, and public opinion surveys showed that the population is interested in getting more details about the repository. The authorities concluded that the transfer of information plays an essential part in the establishment of public trust, but it is not enough. Communication between the public and representatives of the waste management organization is also vital for the success of the enterprise. The issue of compensation to host communities can not be forgotten, and the research in many areas of risk acceptance has shown that people are more willing to accept the risk if it is controllable.

MEGAPROJECT Project Performance

Aspects of Performance Concerned with Doing the Project Right

	Original Targets and changes to targets	Actual Achievements Against Targets
Performance relating to time	Completion of the unit 3 – 2014, Completion of the unit 4 - 2015	The targets will not be achieved in time, because of stress tests and design changes
Performance relating to cost	EUR 3 billion	The expenditures for completion will be substantially overrun. Some technology for completion was bought 20 years ago and had to be conserved, guarded, and in some cases replaced, which generated the additional costs. The new post-Fukushima design changes will also demand more financial sources
Performance related to achieving specification		The specifications were changed many times during the last 20 years in order to meet the requirements of the safety and technology progress. Status of completion as per the original design: Civil part 70% , Mechanical part 30% , Electric and I&C 1% .

Aspects of Performance Concerned with Doing the Right Project

Stakeholder or Stakeholder Grouping	Original Aims of Project Involvement and Changes to these Aims	Achievement of these Aims
Municipalities that are not in larger distance from Mochovce than 20 km	They want to obtain the unchanged volume of compensation	So far EUR 1,71 million is granted by SE every year
Employment in region	A major factor for the regional development: completion of the first and second unit of nuclear plant Mochovce, which meant influx of young people - nuclear experts - in this region, which was initially strongly agricultural. Construction of Mochovce brought about number directly or indirectly induced investments (e.g. new hospital in Levice, construction of new flats, as well as all related services and infrastructure). Construction of the third and fourth unit also means new job opportunities for people from the region, as well as from more distant parts of Slovakia or abroad.	

MEGAPROJECT Project Environment

Political Environment

In 1992, all work on the third and fourth unit for lack of money stopped, and experts began to preserve equipment. At that time the third and fourth units were reported to be only 40% and 30% complete. Work started on first and second unit, however, continued albeit with interruptions. In 1995 the Slovak government approved the financial model of financing of the first two units of Mochovce NPP.

The first reactor become fully operational in 1998. Two years later, the second unit was put to the operation. The gross output of each unit in 2008 was increased from the original 440 to 470 MW. As a condition of accession into the [European Union](#) (2004) Slovakia was forced to deactivate two reactors at the V-1 plant in Jaslovské Bohunice. The first reactor was shut down at the end of 2006, the second on the last day of 2008. A provision in the accession treaty allowed for reactivation in case of emergency.

The [Russia-Ukraine gas dispute](#) in January 2009 disrupted natural gas supplies and electricity generation. On January 10, 2009 the Slovak government decided to urgently restart the reactor shut down just days before. Eventually, the reactor was not started.

This is one of the most important projects, present and future. Project of the third and fourth unit of Mochovce nuclear power plant is the largest private investment in the Slovak Republic since its creation. Slovak power plants invested in the completion of construction approximately 3 billion EUR over five years. Already about 80% of contracts were signed with the Slovak and Czech companies.

In addition to the pulse for economic development at present, the completion of these units will contribute significantly to the energy security of Slovakia in the future. Already the production of one unit covers about 12% of electricity consumption in Slovakia.

MEGAPROJECT Project Environment

Political Environment

Nuclear energy is an important part of the energy package of Slovak Republic. The share of nuclear energy on total energy consumption is around 35 %. Nuclear power plants have significant proportion of producing the electricity. In 2007, 55 % of electricity was generated at nuclear power plants in Slovakia. After 1998 and 2000, when the first two units of the Mochovce were completed (EMO 1, 2), Slovakia has become self-sufficient in electricity production by 2006 and part of the strategic commodities exported. Change occurred after the shutdown of unit V1 nuclear power plant in Jaslovské Bohunice (EBO V1) in 2006 and in 2008 - Slovakia has again become an importer of electricity. Such a situation motivated the Slovak republic to complete and launch units 3 and 4 in Mochovce (EMO 3.4), which should enable Slovakia to become again self-sufficient in electricity production. All Slovak governments since 1989, considered the nuclear energy is the most important part of the energy package and none of them did expect to fully replace nuclear energy with other sources. Document Energy Security Strategy of Slovak Republic (ESS SR) is the current framework document, which was approved by the Government on 15th October 2007 with the perspective to 2030. One of the key information at the beginning of ESS SR refers to the fact that the EU is unable to guarantee the energy security of its members. Therefore in the competence of the Member States remains setting energy policy and particularly the determination of the energy mix. The energy mix of EU 27 is composed of 14.4% nuclear energy. Particular attention government pays to the nuclear energy. "Nuclear Illustrative Program" is also part of the Energy Policy for Europe - which together with the European Council and their Action Plan on energy policy became the basis for energy policy in the short - and medium term.

MEGAPROJECT Project Environment

Political Environment – support for pro-nuclear technologies

In all post-communist countries of Central Europe there is virtually no political opposition to nuclear energy. If one can speak of political parties with antinuclear orientation in these countries, then those are marginal formations scoring low in elections; in addition, if they gained parliamentary seats, they did so, according to analysts, by articulating other themes. The dominant political parties in these countries are pro-nuclear.

The general attitude towards nuclear energy in the countries studied was explored by Eurobarometer in 2009. Eurobarometer asked whether the share of NPPs in the production of electricity should change. Great support for increasing the share or maintaining it at the present level was witnessed in all post-communist countries even after disaster in Fukushima.

Czech Republic, Slovenia, Hungary and Poland are dominantly pro-nuclear, whereas neither in Austria nor in Germany would find today a relevant political actor offering an alternative to the moratorium on NPP construction.

MEGAPROJECT Project Environment

Specific political events impacting on the project

Rethinking construction of nuclear power plant strategy by ENEL

2012 was not ideal year for ENEL. The difficulties in Italian markets followed by difficulties in foreign markets. In December 2012 the Italian government decided to withdraw from the project to build a nuclear power plant unit number 3 "Flamanville" - the first in France to block the reactor EPR. The announced to the public the reasons - the rising cost of nuclear power unit, and unfortunate post Fukushima referendum in Italy.

Before the accident in Fukushima Berlusconi government was prepared to abolish the Chernobyl legislative ban on nuclear power plant construction. In order to make this process legitimate, the national Italian referendum was organized. But the vote in Italy was held in June 2011, against the background of the events at Fukushima. The result meant the failure for the supporters of nuclear energy, since for the abandonment of nuclear power plants voted 94.1% who came to the polls.

MEGAPROJECT Project Environment

**Specific political events impacting on the project
Austrian resentment of Slovak nuclear power plant program**

Relations with Austria

For Austria the nuclear power euphoria was typical for Sixties. They had started construction of nuclear power plant Zwentendorf, which was expected to be completed in 1976. But during 1975 the protest movement was developed and half of the population was against the operation of nuclear power plants. The referendum in 1977 has forbidden commissioning Zwentendorf plant. The disaster at Three Miles Island in 1979 and Chernobyl catastrophe further strengthened anti-nuclear power plant opposition in Austria. Moreover the nuclear power plant agenda enabled to join political forces that were against the former premier minister Bruno Kreisky.

Currently support of nuclear power in Austria by the public is the lowest in the whole EU. Anti-nuclear stance is also typical for Austrian parliament and government, while Parliament is in their views more radical, more approaching to public attitude. (Pavlikova 2011).

In the section on foreign policy of Austria expressed concern over the "nuclear renaissance". Austria will by all means protest against the presentation of nuclear energy as a safe and sustainable form of energy and will strongly advocate for the proliferation - and the form of a multilateral system of controlling access to nuclear fuel. Austrian politicians and media promote a strict anti-nuclear policy, not only on its territory, but also in relation to other countries, especially neighbors and try to promote anti-nuclear the concept at European Union level.

Before 1989, Austria had no real possibility to influence nuclear policy of states that were behind the Iron Curtain, however the situation has changed later and Austria began to oppose very strongly the development and operations of nuclear power plants in Slovakia and the Czech Republic, since these facilities are located not far from the Austrian borders, and in the case of serious disaster it would be impossible to protect the Austrian citizens.

MEGAPROJECT Project Environment

Specific political events impacting on the project Austrian resentment of Slovak nuclear power plant program

Against the completion of Mochovce Austria stood out as very active at international level – she for instance managed to unit the allocation of credit for completion of the European Bank for Reconstruction and Development (EBRD) in Nineties in 20th century. The Austrian anti-nuclear power activists from Greenpeace and Global 2000 occupied the Slovak Embassy in Vienna in May 1998 and demanded all the technical documentation for NPP Mochovce. (Böck, Drábová, 2005) The pressure from the activists was also focused on banks providing the credit for completion of third and forth unit of EMO Mochovce, and I some cases they succeeded in way that the banks refused to provide the credits for completion.

The 2011 crash of Fukushima plant in Japan has caused renewed growth anti-nuclear tendencies. Austria at the end of March 2012 decided to undertake the action against Czech and Slovak Republic in front of the European Court of Justice (ECJ). It was part of new action plan adopted by Austrian government in the document "International rethinking of nuclear power to renewable energy and energy efficiency", which was approved on March 3, 2011 (Rehfus, 2011). The program aims to promote the closure of nuclear power plants across the European Union, through extensive campaigns and cooperation with other anti-nuclear oriented countries. For many years the European authorities closely monitored the safety of the nuclear reactors in Czech and Slovak Republics, as well as in other new European countries, which was quite fruitful approach leading to many changes that had led to implementation of many safety measures. However European Union has never shared the extreme opinions of Austrian politician to the development of the nuclear power stations. So when Vienna provincial government sued Slovakia for the completion of third and fourth EMO units in 2011, it did not succeed. (Viedeň neuspela..., 2011).

The Slovak-Austrian controversies regarding the operation of Nuclear power plant in Mochovce are likely to continue in future, even though the safety standards were significantly augmented. Otherwise there are no real problems among both countries, which have otherwise the friendly relations; many Austrian companies operate in Slovakia, and the intensity of mutual advantageous economic relations is growing.

MEGAPROJECT Project Environment

Economic Environment

In times of economic recession, this investment is a huge stimulus to the national economy. It also indirectly involves several thousand people who provide infrastructure for the project, most of them from Nitra region.

A recent study by BDO states that every euro invested in the completion of two units of Mochovce creates Slovakia GNP growth of € 2.36. Nearly 10 years after completion of the first and second units, the region renewed its industrial infrastructure. During the seven years of completion there were created 9,400 direct, indirect and induced jobs. During the years of operation has to be new blocks Mochovce directly employs about 960 people.

Nuclear type power plants belong to low carbon technologies (and in fact, greenhouse gas emissions are running at close to zero), so the construction of two new nuclear units will significantly contribute the fulfillment of the commitment of Slovakia to reduce CO₂ emissions by 2020. Each reactor VVER 440 will save about 3.7 million tons of CO₂ each year. Otherwise this greenhouse gas will flow to air from coal-fired power plants.

Based on the document ESS SR, the final consumption of electricity represents about 20.7% share of total energy consumption and until 2030 is expected to rise to 22.8%. This increase is consistent with the expected growth of the economy, while reducing the energy consumption. In connection with this fact it is quite a significant factor in the expected increase in energy prices. Production costs of nuclear energy in comparison with coal and gas resources are less sensitive to price changes. This is mainly so because in the world there is a sufficient number of uranium deposits and it is possible to diversify the vendors.

MEGAPROJECT Project Environment

Economic Environment

From an economic point of view it is important to know that „that equivalent amount of heat contained in coal is 7 to 8 times more expensive than nuclear fuel. Price of brown coal is 11 times more expensive than nuclear energy and price of natural gas is 20 times more expensive than the nuclear energy. The operation of nuclear power plant is therefore at least in economic terms more favorable than production of electricity from brown coal or fossil fuels, although the initial investment is much higher. The strategy also keeps in mind the possibility that the price of uranium will grow dynamically in the future and the privileged position will be given to countries that have this material.

In this case the government of Slovak Republic does not exclude the possibility of restart of mining uranium in Jahodná localities, Huta Novoveská, Kluknava, Kálnica - Selec. With this policy is also linked the necessity of amending the relevant laws and strategic documents, allowing for maximum protection of the environment. Another rather significant fact is that the uranium is not imported from politically unstable countries, and it is possible to buy and maintain stocks for a longer period than in case of oil, or gas. All these factors speak in favor of using more nuclear energy and to plan and build additional nuclear power plants from economic and political point of view.

MEGAPROJECT Project Environment

Economic Environment – Fukushima accident

The challenges which nuclear safety and its governance face were highlighted in the accident at the Fukushima reactors in Japan following the earthquake and the tsunami in March 2011.

Fukushima accident on March 2011 was a series of equipment failures, nuclear meltdowns and releases of radioactive materials at the Fukushima I Nuclear Power Plant, following the Tōhoku earthquake and tsunami. This event highlighted the challenges which nuclear safety and its governance face. The lessons from the accident has shown that nuclear reactors must be protected even against accidents, which have been assessed as highly improbable. The most important reason Fukushima accident were the faulty design, insufficient backup systems, human error, inadequate contingency plans, and poor communications.

The European Union reacted on Fukushima accident by ordering the comprehensive and transparent risk and safety assessment ("stress tests") and to propose by the end of 2011 any improvements that may be necessary. Although based on the stress tests, national regulators concluded that there are no technical reasons requiring the shutdown of any NPP in Europe, nevertheless, practically all NPPs are expected to undergo safety improvements, as hundreds of technical upgrade measures have been identified. These measures include additional mobile equipment to prevent or mitigate severe accidents, the installation of hardened fixed equipment, and the improvement of severe accident management, together with appropriate staff training measures. The costs of additional safety improvements were estimated to be in the range of €30 million to €200 million per reactor unit in 2011.

Based on the necessity of realizing stress tests, implementing additional safety measures, ENEL has substantially delayed the completion of third and fourth block of NPP, while demanding additional EUR 800 million for the completion

MEGAPROJECT Project Environment

Economic Environment – New Mochovce Reactors Held Up by Budget Dispute

The ENEL's Slovenske elektrarne requested for additional funding of NPP Mochovce from Slovak budget raised the resentment from the Slovak government. The government declined the request for the second time on May 28 2013 and ENEL threatened to stop the construction works. The missing agreement on raising the budget may endanger the completion of the entire project, in which Czech companies are taking part. The costs of completion of the units 3 and 4 have increased to EUR 3.8 bn from the originally estimated EUR 3 bn. This would endanger jobs in the construction and cause a fall of tax revenues to the state budget, SE said. The investment in the completion of the 3rd and 4th units of Mochovce represents a significant contribution to the growth of the Slovak economy. The government would however like to force Slovenské elektrárne to complete the project, under the threat of sanctions. The construction has already been delayed.

Originally, the two units were to be completed in the course of last year and this year. According to available information, they should complete in 2014 and 2015 at the earliest. According to Enel, the delay has been caused partly by additional measures aimed at enhancing the plant's safety, which ensued from stress tests. Owing to the delay of the launch of the two new reactors, the state loses dividends from SE's profits. The third and fourth units could collect per year, according to the planned volume of production at current prices, more than EUR 300 million. Part of this amount would be through dividends could have been received also by the state budget.

Specific Economic Events impacting on the project

The new production capacity in Mochovce will become the next great stabilizing element in our energy system and it guarantees stable and secure supply of electricity.

Placing third and fourth unit of Mochovce into operation in 2014 and 2015 will replace fossil fuel burning in the Central region of Slovakia. It is expected that this would reduce the volatility of electricity prices for households and industry on the Slovak market.

MEGAPROJECT Project Environment

Feasibility study

The feasibility study solves essential issues related to the feasibility of the completion of the third and fourth unit project financing and the return of funds. Appropriately specified key contributions/benefits from the investor point of view and analyzes in detail possible risks of the project. The technical part of the study analyzed focused on current conditions on the electricity market within Slovakia and in the adjacent region, the current state of the SE-MO34, the investments necessary for the completion, as well as the elementary technical and security solutions. The feasibility study expected the completion date of NPP Mochovce 3 and 4 in 12/2008 and 12/2009.

Study presented by Deloitte&Touche in 2002 analyzed the completion as a project for independent power producer (hereinafter IPP) i.e. like the most conservative variant in terms of their financial evaluation.

Based on the financial estimates and forecasts, which used wide range of tools and techniques of project financing, Deloitte&Touche prepared financial model and financial forecast with below mentioned conclusions:

- *Company SE MO34 as IPP can be successfully designed and financed as sole project;*
- *Company SE MO34 as IPP has sufficient cash flow, to fulfill their liabilities and cover operational costs;*
- *Cash flow of the company as IPP provides adequate assurance in respect to the debt service obligations incurred from the financing agreements;*
- *In general, the company SE MO34 as IPP seems like a profit making company, whereby the return of equity seems to be significantly higher than the average level in comparable projects within Europe;*
- *The internal rate of return (IRR) of the project is calculated around 18,61% for the whole life cycle of the project / 40 years.*

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Feasibility study

Positive aspects of completion:

- ✓ Valid building permission
- ✓ Utilization of constructed objects and side accommodations
- ✓ Compensation for the decommissioning of energy capacity till 2010
- ✓ Boost for whole economy in Slovakia
- ✓ Utilization of experienced staff (the construction of the nuclear power station in Slovakia has started 50 years ago and since that many experts with practical experiences have been developed)
- ✓ Evaluation of financial expenses
- ✓ Higher economic efficiency in long-term period compared to comparable resources
- ✓ Employment and regional development
- ✓ High level of usability of supplied components and equipment
- ✓ High level of safety after the revision of former project
- ✓ Optimization of completion costs, approximately EUR 1 mil./MW installed

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Feasibility study

Completion of the NPP Mochovce will have significant impact within the region:

- ✓ Stabilizing economy and economic growth
- ✓ New working opportunities, indirect impact on community development
- ✓ Increase of tax revenues for municipalities
- ✓ Housing development
- ✓ Use of waste heat for community
- ✓ Reduction of negative environmental impact and increase the efficiency and economy of the NPP Mochovce operation
- ✓ Company SE EMO 3&4 as Independent power producer - IPP can be successfully designed and financed as sole project,
- ✓ Company SE EMO 3&4 as IPP has sufficient cash flow, to fulfill their liabilities and cover operational costs,
- ✓ Cash flow of the company as IPP provides adequate assurance in respect to the debt service obligations incurred from the financing agreements,
- ✓ In general, the company SE EMO 3&4 as IPP seems like a profit making company, whereby the return of equity seems to be significantly higher than the average level in comparable projects within Europe,
- ✓ The internal rate of return (IRR) of the project is calculated around 18.61% for the whole life cycle of the project / 40 years.

MEGAPROJECT Project Environment

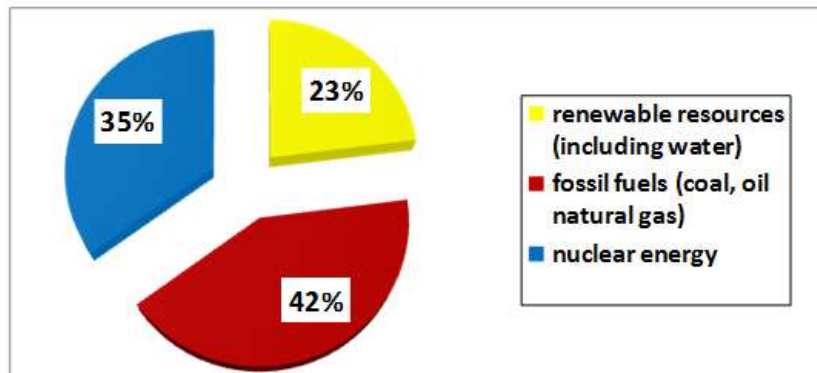
<p>Sustainability</p> <p>Comments on the relationship of the project to issues of sustainability</p>	<p>Completion of third and fourth unit of the nuclear power plant will be the largest private investment in the history of Slovakia.</p> <p>Slovenské elektrárne invests EUR 3 billion by 2013 in the construction of Mochovce NPP units 3 and 4.</p> <p>Further investments were concluded with the modernization and power up-rate of existing units in Bohunice NPP (EUR 0.5 billion) and Mochovce NPP power up-rate.</p> <p>The Strategic Plan involves also full hydro automation and modernization of the existing hydro units, introduction of biomass in the fleet of thermal power plants (Vojany and Nováky) and development of renewables - mainly photovoltaic and small hydro power plants.</p> <ul style="list-style-type: none">✓ <i>This completion is one of three nuclear power plant currently being built in EU</i>✓ <i>Third unit will be put into operation in 2014 and fourth unit in 2015</i>✓ <i>Each unit with performance 440MWe</i>✓ <i>Non nuclear part contractor: ENEL Ingegneria e Innovazione</i>✓ <i>Contractor of control and management system: Areva-Siemes</i>✓ <i>Up to 2/3 of work was carried by Slovak (local) companies</i>✓ <i>Communication strategy of the completion is based on transparency and therefore more than 2/3 of Slovak population and more than 87% of the population in the 10km zone around the plant supports the completion.</i>
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MEGAPROJECT Project Environment

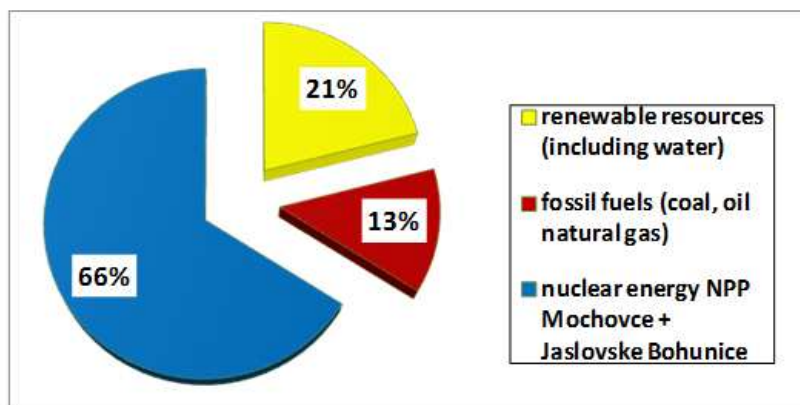
Sustainability

Comments on the relationship of the project to issues of sustainability

The share of electricity generated from nucleus in Slovakia is 66% Nuclear energy sector remains an important and stable part of the energy mix for Slovakia, the EU and further extension of the nuclear power generation will enable to reach the commitment of Slovakia to reduce „greenhouse" gases emissions by at least 20% by 2020.



Share of electricity generated from nucleus in Slovakia



Share of electricity generated from nucleus in the European Union

Source: SE, a. s., 2012

MEGAPROJECT Project Environment

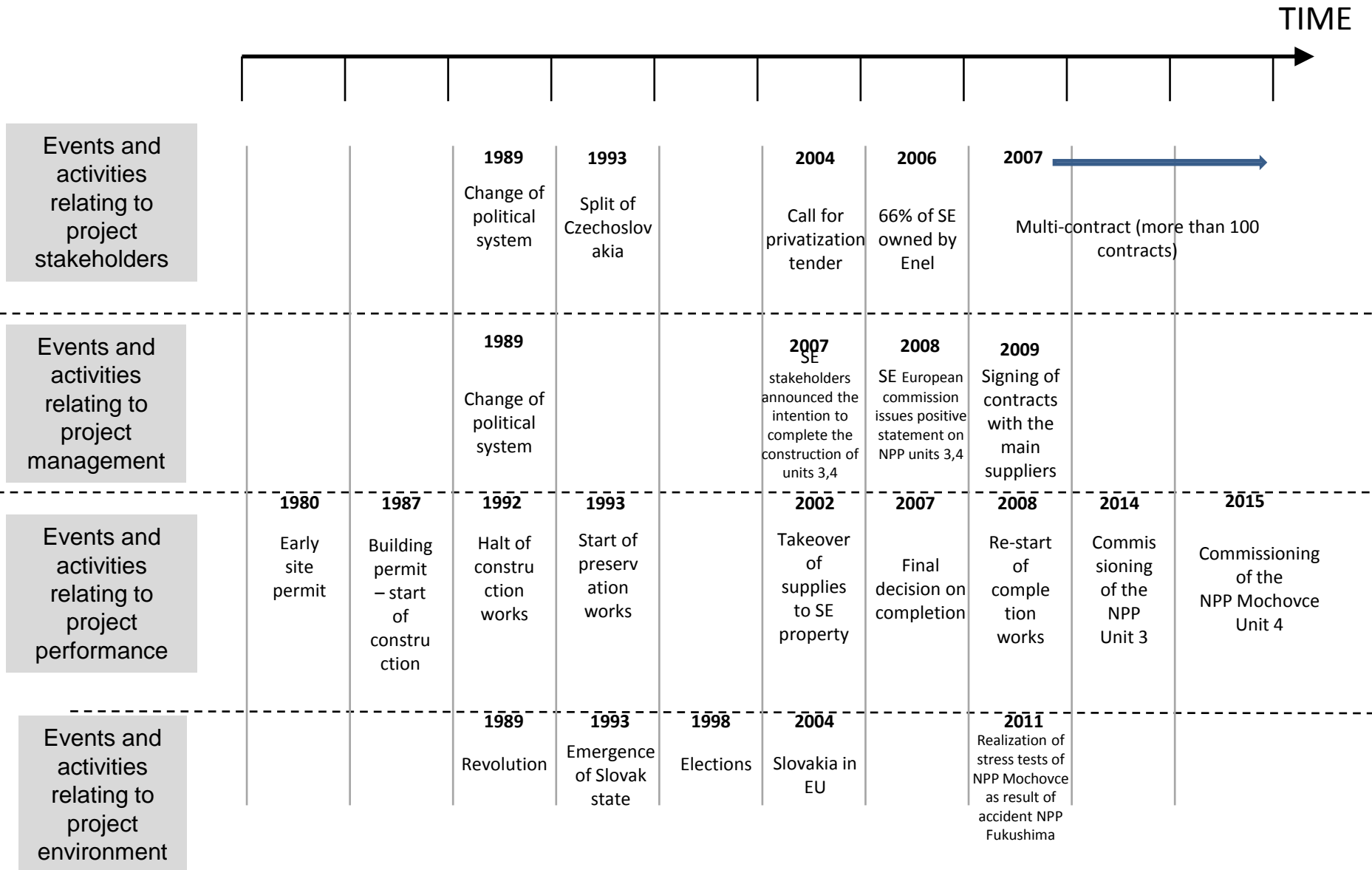
<p>Sustainability</p> <p>Comments on the relationship of the project to issues of sustainability</p>	<p><i>Land impact</i></p> <p>NPP Mochovce covers an area of 301.99 ha, thereof built up area spread on 49.81 ha and the rest of the area are other sites including 22.78 ha of woods.</p> <p>Under operation of NPP Mochovce is also another 44.37 ha of land within 15 villages neighboring with the NPP Mochovce whereby majority of this land is using for special purposes of the NPP. The completion of NPP Mochovce -unit 3 & 4 does not create any additional land requirements.</p>
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Construction schedule of the third and fourth unit of NPP Mochovce

1980	Start of construction	Site permit
1987		Building permit – start of construction
1992	Halt of construction works	Halt of construction works
1993		Start of preservation and protective works
2000		Approval of the NPP Mochovce 3&4 Strategic preservation maintenance and protection plan by the Nuclear Regulatory Authority (NRA)
2002		Takeover of the supplies in the property of Slovenské Elektrárne
2007		Realization of feasibility study
February 2, 2007	Continuation and planned completion of the project	Slovenské elektrárne stakeholders announced the intention to complete the construction of units 3&4
July 15, 2008		European Commission issues positive statement on NPP Mochovce - units 3&4
August 14, 2008		NRA approved NPP Mochovce 3&4 design modifications and prolonged the building permit by Dec 31, 2013
November 3, 2008		Inauguration of the re-start of construction works
2009		EIA process for NPP Mochovce 3&4 operation (public participation)
June 11, 2009		Signing of contracts with the main suppliers
April 30, 2010		Ministry of Environment issues its Final Statement on the EIA Report
September 5, 2010		Installation of unit 3 reactor pressure vessel
2011		Realization of stress tests of NPP Mochovce units (that were not planned) as the result of accident NPP Fukushima
March, 2012		Decision on delay of commissioning NPP Mochovce - units 3&4
2013-2014		Commissioning of NPP Mochovce - units 3&4 (the original date 2014 -2015)

Source: Table elaborated based on SE, a. s., 2012

MEGAPROJECT Project Key Events and Activities Timeline



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