POLITECNICO DI MILANO





Flamanville 3 Nuclear Power Plant

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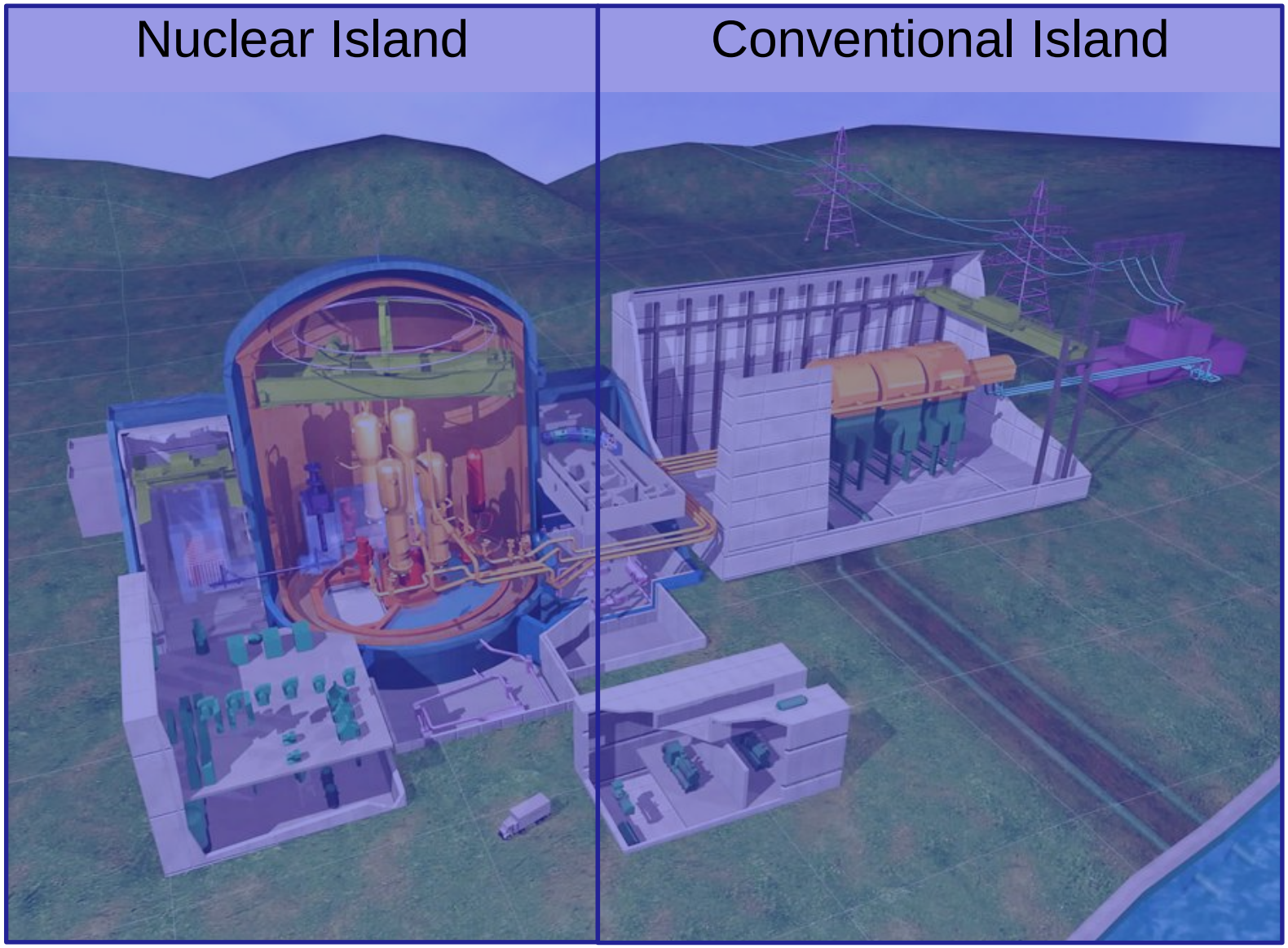
MEGAPROJECT: The Effective Design and Delivery of Megaprojects in the European Union

FLAMANVILLE 3 NUCLEAR POWER PLANT



FLAMANVILLE 3 NUCLEAR POWER PLANT

SECTION 1 - BASIC PROJECT INFORMATION

Project Title	FLAMANVILLE 3 NUCLEAR POWER PLANT (FL3)
Location	Flamanville, Cotentin Peninsula - Manche, France 
Purpose	To build the First EPR Reactor in France. To incorporate the Lessons Learnt from the other EPR (Olkiluoto 3) and demonstrate the constructability of this reactor
Scope	To build the EPR reactor, the ancillary services and connect it to the electrical grid
Contractual Framework	EDF is owner and Architect Engineer. It award contracts to other partner (Areva, Alstom, Bouygues…)
Relevant Physical Dimensions	1650 MWe – 4500 MWth When the project reaches its peak, more than 3000 employees will be working on the site - 15 000 000 hours

SECTION 2 - PROJECT STAKEHOLDERS

		Stakeholder Category	Case-Study	Com
Internal	Supply-Side	Client	EDF (Électricité de France) 87.5% - Enel 12.5%	
		Financiers	Flamanville 3 is being financed from the corporate resources of the EDF and ENEL.	
	Demand Side	Principal Contractor	EDF is owner and Architectural engineer: • Managing the project (quality, schedule, costs, risks, interfaces…) • Fronting the French Nuclear Safety Authority (Responsible of the Nuclear License) • Deciding how contracts are to be shared out, placing and then managing them • Defining technical reference of the plant (general specifications for equipment, for buildings, for the general operation…) • Optimizing the ownership cost by including feedback from French nuclear fleet in the design and operation • Controlling suppliers' detailed studies and equipment manufacturing quality • Controlling on-site construction and commissioning tests	

SECTION 2 - PROJECT STAKEHOLDERS

		Stakeholder Category	Case-Study		Com
Internal	Demand Side	First Tier Contractors	Alstom	Turbine Island It is a large French multinational conglomerate. The company has been awarded of a contract of 350 million Euros for all engineering, procurement, construction and commissioning of the complete turbine island	First time on EPR, Experience in the previous nuclear program
			BOUYGUES	Civil Work French construction company is. In April 2006, Bouygues acquired the French government's 21% stake in Alstom. At 30 June 2011, Bouygues owned 30.74% of Alstom. (Bouygues, 2011).	Second time on EPR, No Experience in the previous nuclear program

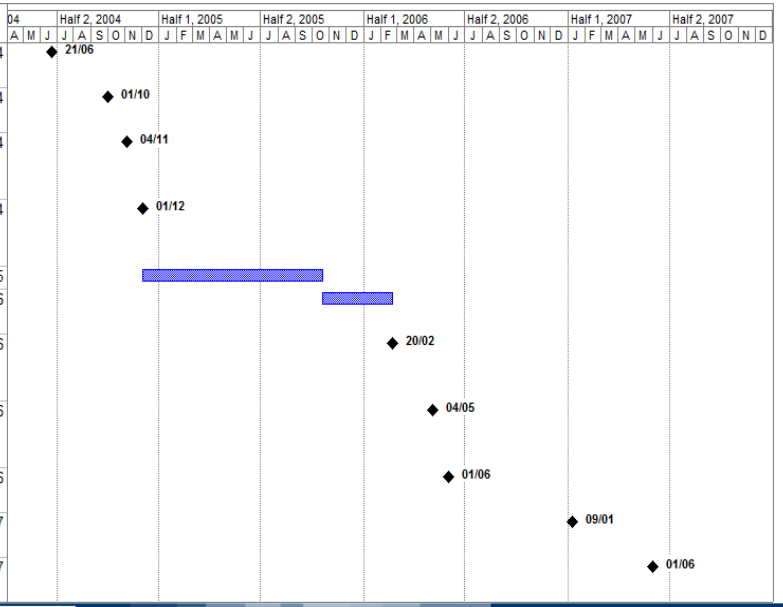
SECTION 2 - PROJECT STAKEHOLDERS

		Stakeholder Category	Case-Study		Com
Internal	Demand Side	First Tier Contractors	Areva	Nuclear Island AREVA SA is a French industrial group owned for more than 90% by the French State (including the shares owned by the CEA). It is divided into three main divisions which cover all the aspects of generating electricity with nuclear technology. Areva NP is one of these divisions. AREVA NP: Is the architect engineering, reactors vendor and main contractor for the nuclear island.	Second time on EPR, Experience in the previous nuclear program
		Second Tier Consultants	Contract management for Flamanville 3 1. 150 main contracts 2. The 20 biggest lots represent about 80 % of the construction budget 3. Contracts for both equipment supply and erection on site 4. Competition for all the lots except for NSSS 5. At the end of 2009, more than 95 % of contracts were signed		

SECTION 2 - PROJECT STAKEHOLDERS

		Stakeholder Category	Case-Study		
External	Public	Regulatory Agencies	ASN (Autorité de Sûreté Nucléaire)	ASN (Autorité de Sûreté Nucléaire) is the French authority responsible for ensuring nuclear safety and radiation protection, in order to protect workers, the public and the environment from risks associated with nuclear activities.	It has a long experience in managing the operations but 15 years has passed since it supervised the last construction
		Local Government	The Local Government has been involved mainly in the "debat publique"		

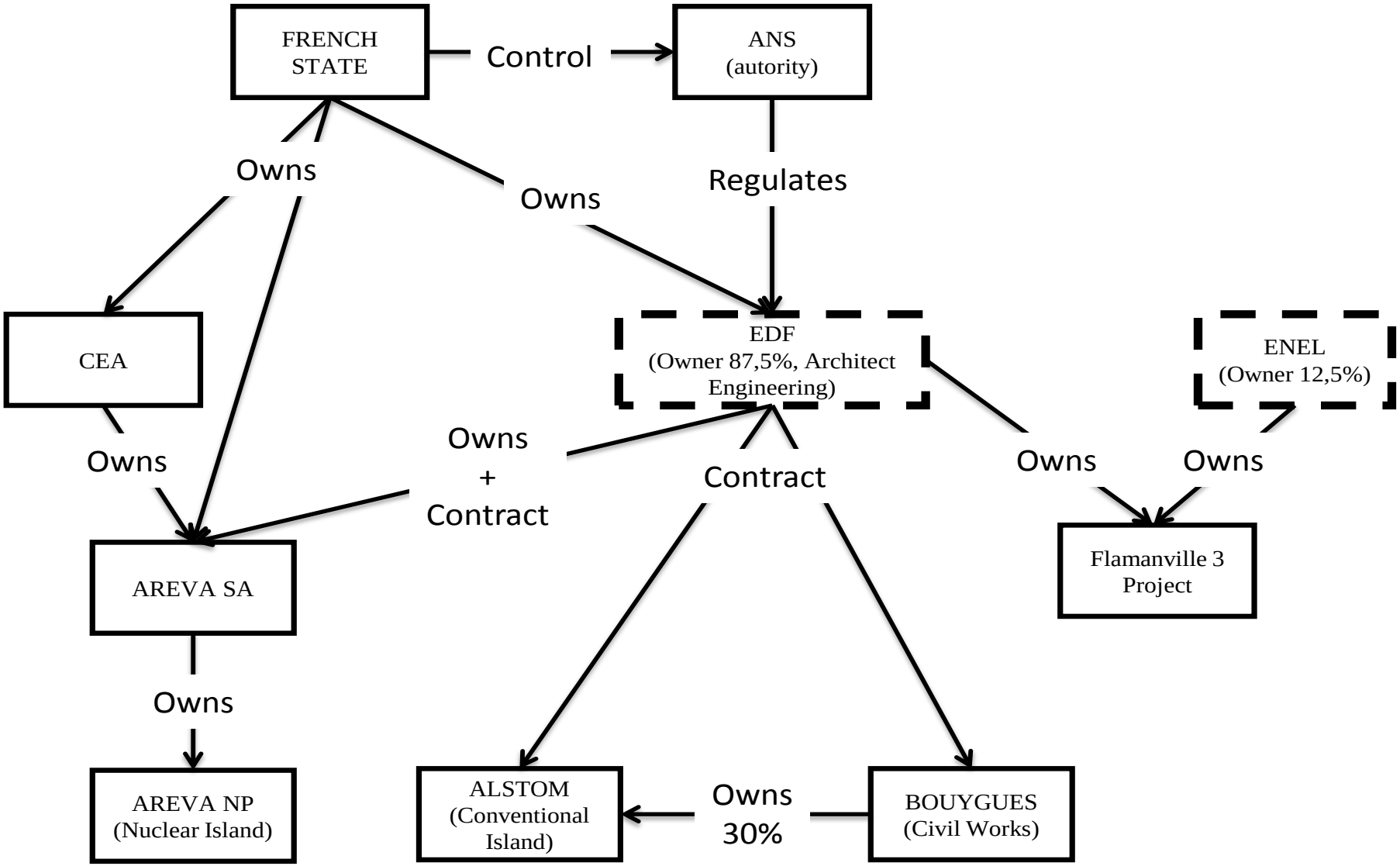
ID	Task Name	Start	Finish
1	EDF Board of Directors decided to build a nuclear reactor EPR	Mon 21/06/04	Mon 21/06/04
2	Board decides to install the EDF EPR reactor at Flamanville	Fri 01/10/04	Fri 01/10/04
3	EDF send the CNDP a dossier to submit the request for Debat Public, in accordance with Article 7 of the Environmental Code L121	Thu 04/11/04	Thu 04/11/04
4	Decision to proceed with the Debat Public and appointing of the special commission Commission Particulaire Debat Public (CPDP)	Wed 01/12/04	Wed 01/12/04
5	Preparation Phase of Debat Public	Wed 01/12/04	Wed 19/10/05
6	Phase of public debate, for a total of 22 meetings	Wed 19/10/05	Mon 20/02/06
7	CPDP write the realazione not binding on the outcome of Debat Public, reporting the requests made to EDF	Mon 20/02/06	Mon 20/02/06
8	EDF Board decides to proceed with the project and adds the agreements made during the debate on access to information for the public	Thu 04/05/06	Thu 04/05/06
9	EDF begins the process of obtaining a building permit	Thu 01/06/06	Thu 01/06/06
10	EDF order Areva to build nuclear island	Tue 09/01/07	Tue 09/01/07
11	Prime Minister signed a decree authorizing the construction of the EPR reactor in Flamanville.	Fri 01/06/07	Fri 01/06/07



SECTION 2 - PROJECT STAKEHOLDERS

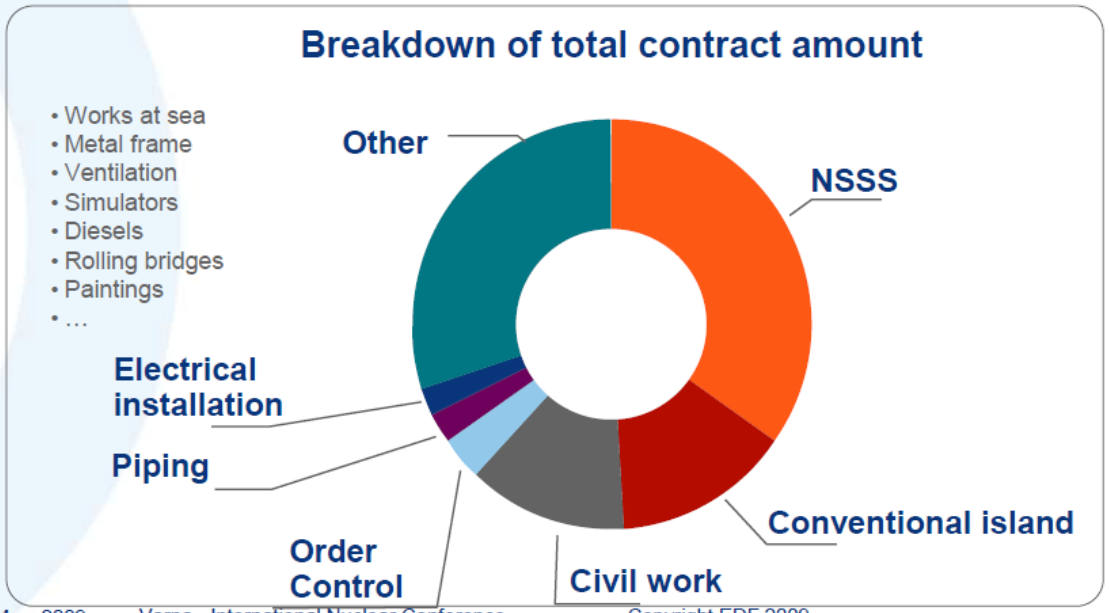
External	National Government	The government controls directly the Authority (ASN), the buyer/utility (EDF), and the most important contractor (AREVA). It owns the CEA and the 85% of EDF shares. Moreover, many other important contractors are French, among them: Alstom and Bouygues. France, as stated by President Sarkozy, aims at becoming a leading exporter of atomic energy. (The World Nuclear Association, Nuclear Power in France, 2011)	The French Government is the entity who owned the two most important players (CEA and EDF) and it was the one who decided to start with the nuclear program since 1973.
	Environmentalist	Greenpeace and other environmental group fight against this project. They tried several times to stop the project. In the 2011 EDF was fined 1.5 million euros (£1.3mn) for hiring a private agency run by a former member of the French secret services to hack the computers of the former head of campaigns for Greenpeace France, Yannick Jadot, in 2006. (The Telegraph, 2011)	

Stakeholder Relationship Maps



Allocation of main contracts

- Around 150 contracts - Systematic competition excluding Nuclear Steam Supply System - NSSS - (Areva NP)
- To date, commitments represent 99% of the total EPR contract amount
- The 6 largest work contracts account for around 70% of the project budget
  - Prices are indexed (reference index)
  - These contracts include sections at lump sum prices and sections at unit prices



21 27 May 2009 Varna - International Nuclear Conference

MEGAPROJECT External Stakeholder Attitude Analysis

External Stakeholder	Attitude to this Project	External Stakeholder's Influence on project	Impact
Regulatory Agencies	Independent	ASN gives its technical option on the acceptability of any civil nuclear installation. The basic regulatory functions ascribed to it are: Licensing (assesses the licensing application and make a decision in terms of technical acceptability), Inspecting (likewise in other countries the regulatory body has the full power to inspect the nuclear site, the manufacturing facilities or any other relevant site even without notification), Regulating and Enforcing actions (using the license as vehicle, e.g. suspension of license, or emitting civil sanctions.	High, ANS exist beside the project since it has to control the other French reactors
Local Government	Supportive	High. The local governments have the following powers: first they give their opinion when a nuclear site is selected close to them. Second they are involved into the public inquiry as stakeholder (the public inquiry complains all "department" that are overlapped by the circle area centered on the nuclear sit and having radios equal to five kilometres plus every "communes" included into the "department"). Furthermore a person appointed by every local governments ("department" and "communes") is appointed to the local information committee (having the function of disseminate information in the vicinity of the site).Every minor authorization concerning the local government decision-making (for example during the licensing process) pass through the local information committee.	Medium. The FL3 project receive a lot of attention from the media and this create a pressure on the politics

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
National Government	Supportive	Very High. Owns the major stakeholders	Medium. The FL3 project receive a lot of attention from the media and this create a pressure on the politics
Local Resident	Supportive	Medium/Low. They receive a lot of money and incentives to accept the project	Medium. It create job positions and provides founds to the local community. There are not direct externalities on the local
Environmentalists	Against	Low. Beside some advertising campaign and demonstrative actions there is not more that they can do	Medium. To stop the construction of nuclear reactors is one of the big ultimate goal of many environmentalists like Greenpeace

MEGAPROJECT Project Management

Client Project Team Size & Structure	
Contractor Project Team Size and Structure	
Sub-Contractor Project Team Involvement	

Project Tools and Techniques

Please √ if present, x if absent , leave blank if unknown

Life-Cycle Costing Approaches ☐ **Project** **t Software** ☐ **Lessons Learnt Transfers** ☐

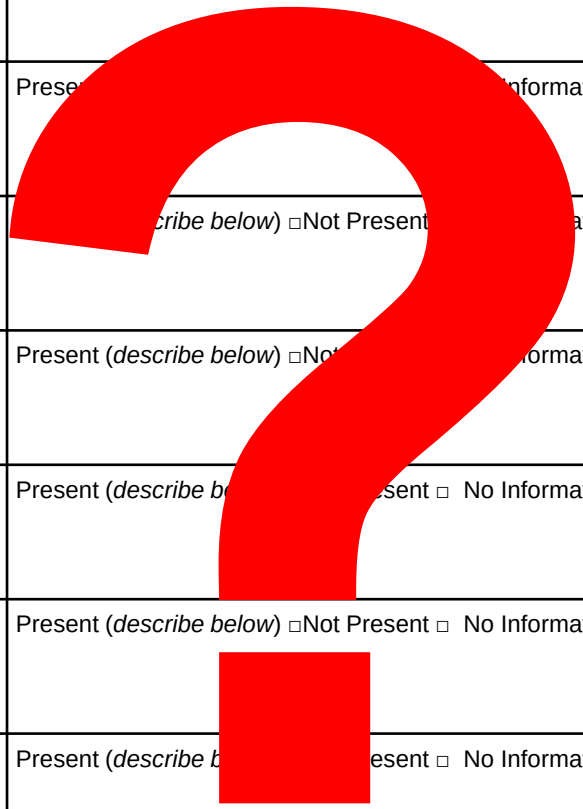
Stakeholder Involvement ☐ **Relati** **anagement Tools** ☐ **Team Building Tools** ☐

Building Information Modelling (BIM) ☐ **Projec** **dge Management Tools** ☐ **Competency framework** ☐

Other Tools and Techniques or More Inform

MEGAPROJECT Project Management

Risk Management Processes	Present (*describe below*) □Not Present □ No Information □
HR Management Processes	Present (*describe below*) □Not Present □ No Information □
Procurement Management Processes	Prese nformation □
Integration Management Processes	cribe below) □Not Present ation □
Scope Management Processes	Present (*describe below*) □No ormation □
Time Management Processes	Present (*describe b* esent □ No Information □
Cost Management Processes	Present (*describe below*) □Not Present □ No Information □
Quality management Processes	Present (*describe b* esent □ No Information □
Communications Management Processes	Present (*describe below*) □Not Present □ No Information □



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	EDF started in 2006 to build the reactor at Flamanville. Fl3 was expected to be connected in 2012. In July 2011 the new official forecast se commercial operations in 2016 (EDF, 2011)	The project is 4 years behind schedule
Performance relating to cost	Fl3 was expected to cost approx. 3.3 billion Euro (2005) In July 2012 the new official forecasts are: 6 billion euros,	There is 2.7 billion of Euro of extra cost (81% of project value)
Performance related to achieving specification		The authority reported several time that the quality was below what is required in the nuclear industry

MEGAPROJECT Project Performance

Aspects of Performance Concerned with Doing the Project Right

Stakeholder or Stakeholder Grouping	Original Aims of Project Involvement and Changes to these Aims	Achievement of these Aims
AREVA / EDF	There were 3 main aims for this project a) To show that the EPR, after the bad experience in Olkiluoto (OL3), can be built at a lower cost and the lessons from OL3 have been learned b) To learn other lessons for the other EPR project c) To provide a New reactor to substitute the aging French Reactors	a) It seems that only few lessons from OL3 have been implemented in this project b) The performance in the Chinese reactors seems to confirm that some lessons have been learned c) This reactor will substitute the aging French Reactors
Environmental group/ Greenpeace	To disturb the construction and possibly to stop the project	Some disturb actions but the project is still going and the majority of the population support it
Bouygues	To apply the lessons from OL3 and to gain experience	It seems going according to the plan
Alstom	To enter the EPR project delivery chain, to gain experience	It seems going according to the plan

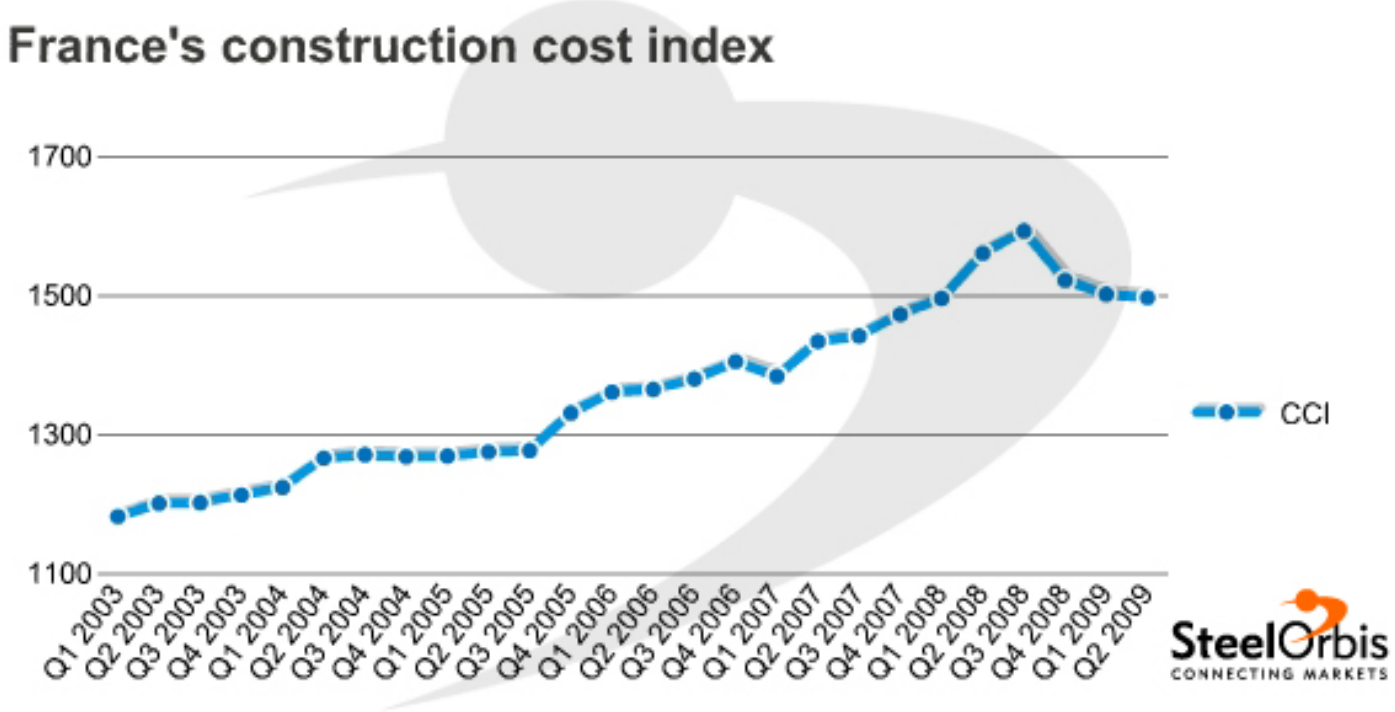
MEGAPROJECT Project Environment
Legal and Regulatory Environment

Legal and Regulatory Project Environment (regionally, nationally and Europe wide)	The legal and regulatory framework is characterized to be "**prescriptive based**", shared into many legal fonts. As result the framework is mostly rigid and complex. The highest level of prescriptiveness and complexity is reached at regulatory level. A peculiar feature of the legal system is the division between three main quasi-independent legal bodies associated to three typologies of nuclear installation: Basic Nuclear Installation (FL3 belongs to this category), Installations classified for environmental protection purposes and Defence related installation.
Specific Legal and Regulatory events impacting on the project	The regulatory functions applied to all French Reactors are characterized to be **highly crafted on a specific family of reactors** (N4). Since the French reactor standard has been replicated over decades the specific licensing decision-making safety criteria were standardized on the same reactor. These criteria mostly complain with deterministic safety criteria (indeed also the probabilistic one has being also crafted on the specific reactor design). **The changing of reactor standard has posed a regulatory and licensing challenge to the regulatory body because of the lack of practice in assessing different reactor technologies** (differently to other oversee regulatory institutions). At the same time, the developing organizations were not sufficiently experienced with this new reactor design. Finally the **linkage between oversee regulatory bodies** (WENRA Western European Nuclear Regulators' Association) **contributed to the discover some safety weakness affecting the EPR** (for example the lack in separating the control system with respect the safety one is in conflict with the defence in depth concept: this problem were also reported by the Finnish regulatory body and British one, respectively STUK and HSE).

Political Environment

Political Project Environment	The political environment was highly supportive. The French president N. Sarkozy is one of the most important supporters of this project.
Specific Political Events impacting on the project	The Fukushima accident pointed out several lessons for the nuclear Industry. Among the other EDF may study the development of mobile diesel generator back up units that could be moved to reactors where power systems and back-up generators have failed

Economic Environment

Economic Project Environment	The nuclear profitability is undermined by the steady low cost of natural gas (the main competitor with the CCGT plants) and the high cost of the commodities.
Specific Economic Events impacting on the project	

MEGAPROJECT Project Key Events and Activities Timeline 2006 -2008

	5/06	7/06	1/07	4/07	12/07	3/08	5/08	10/08	12/08
Events and activities relating to project stakeholders			NSSS ordered from Areva NP	French government issues construction license					
Events and activities relating to project management	EDF decides to proceed with FL3	Site work commenced. **Target construction time 54 months, construction cost €3.3bn excluding finance and fuel**			**First concrete poured**				
Events and activities relating to project performance						**ASN asks EDF to improve work in several areas involving in particular quality control and organization.** Inspection had revealed several problems in the civil construction work, including errors in installation of steel reinforcing bar in the concrete and "inconsistency" between rebar blueprints and the concrete pouring plan. organization for preparing concrete pouring was "insufficient,"	**ASN requires EDF to stop concrete pouring on May 26** (ban lifted June 17). Problems 'show insufficient discipline on the part of the licensee and insufficient project organization'. Welding anomalies found in one of the four bottom pieces of the steel liner of the containment building	ASN told Areva to improve its oversight of forgings after procedures used by Italian subcontractor Società della Fucine were found not to conform to standards.	**EDF acknowledges cost had increased to €4bn** due mainly to inflation, and technical & regulatory changes. Construction schedule claimed still to be achievable
Events and activities relating to project environment									

MEGAPROJECT Project Key Events and Activities Timeline 2010-2011

	01/10	07/10	08/10	10/10	03/11	07/11
Events and activities relating to project stakeholders			ASN asks EDF to modify the architecture of the non-safety instrumentation and control system			
Events and activities relating to project management						
Events and activities relating to project performance	**Unions claim construction is at least 2 years behind schedule**	**EDF confirms delay and announces expected costs are €1.7bn over budget**		Le Figaro reports a further year delay		**The new official forecasts from EDF are: 6 billion euros, about 90% over budget, and commercial operations in 2016**
Events and activities relating to project environment					Fukushima Daiichi nuclear disaster	