

ANNEX III

Nuclear project risk taxonomy

		Sub typologies of risk		Linkage to others typologies of risk		Probabilistic side		Project management perspective			Impact during NPP operation		Impact during decommissioning			
				Code	Risks affected	Affected by risks	Uncertainty	Probability	Time	Cost	Quality	Economic		Financial		
RISK TAXONOMY FOR LARGE NUCLEAR PROJECTS	(\$2.1.6.2.1.) Technical risk [LN]	(\$2.1.6.2.1.1.) Reactor design difficulty [LN]	Difficulty	Level of novelty of the project [LN]	1	4-9,12-14	36	Epistemic uncertainty	High probability to met "complications" during contracting, licensing and project delivering (including commissioning)	Delays/Over budget during the project implementation (exogenous and endogenous it the project implementing organization), including delays and extra cost or plant rework			Defects in building and manufacturing and assembling of NPP elements	Difficulties during Maintenance, operating and incident conditions, possible effect in economic/Financial terms	Possible delays and extra cost during decommissioning	
				Complexity [LN]	2	4-9,12-14	36									
			Scope specification prescriptiveness [N]	3	4-9,12-14	36										
		(\$2.1.6.2.1.2.) Project execution [LN]				Contracting [LN]	4	5-6,12-14,19-29	1-3,32-35,36	Epistemic/ aleatoric uncertainty, endogenous to the Owners' group and RB	High probability to fail in addressing an efficient and effective contract networks	Wide range of impact in sharing responsibilities, project performances constraining depending to the clauses put in place and on the contractual approach adopted				
						Construction [LN]	5	6,12-14,19-29	1-4,32-35,36							
						Commissioning [LN]	6	12-14,19-29	1-5,32-35,36							
		(\$2.1.6.2.1.3.) Operational risks [LN]				Safety related [N]	7	8-9,16-25,37-40	1-3,36	Moderate uncertainty	Low probability of safety related incidents	Vast amount of resources dedicated safety purposes		High level of prescriptiveness during project implementation	Moderate impact during routinely safety activities; vast impact when severe incidents took place: both in economic, financial terms. Especially the image and trust on utility and nuclear institution may be affected by incidents or transparency's lack	Possible effects into the environment
						O&M [LN]	Changes in resources required [N]	8	16-25	1-3,7,36	Endogenous/Exogenous to Operator	Moderate probability, high dependence on plant operating performances (e.g. reliability of components)				
		Changes in output produced [N]	9	16-25	1-3,7,36		Endogenous to the operator									
		(\$2.1.6.2.2.1.) Demand [LN]				Change in demand quantity [N]	10	16-25		Vast uncertainty exogenous to the Operator	Reasonable expectation do electricity demand trend growth (Possible negative demand pecks during economic recession periods)				Vast impact on economic/financial performances	Adverse operational and market scenario may affect the resources cumulated, during NPP operation, dedicated to decommissioning
	Change in demand price [N]					11	16-25	36	Depends on the specific context considered							
	(\$2.1.6.2.2.2.) Resources Supply [LN]	Constr. [LN]			Raw materials [LN]	12	19-29	1-6,32,34-35,36	Vast uncertainty when the experience, maturated by implementing organizations, is low	High probability when the suppliers experience, about the nuclear field and specific project, is low	Delays in delivering the project components, materials and resources	Escalade and extra cost of components, materials and resources	Low quality and defects of equipments, materials and resources			
					Equipment [N]	13	19-29	1-6,32,34-35,36								
					Others resources [LN]	14	19-29	1-6,32,34-35,36								
		Oper. [LN]			Fuel, spare parts and others resources [N]	15	16-25	32,35,36	Endogenous	Low probability, secured by appropriate contracts				Vast impact when the plant shut down		
					(\$2.1.6.2.2.3.) Financial risk [LN]	General [LN]		Tight money [LN]	16	19-29	7-11,15,30-31,36,39,41	The nuclear field is perceived risky, for market investors, due to the high uncertainty associated with the success of nuclear project (considering the whole lifecycle)		Financial impact into the project delivering		
	New liquidity requirements [LN]	17	19-29	7-11,15,30-31,36,39,41												
	High-risk premiums [LN]	18	19-29	7-11,15,30-31,36,39,41												
	Increased nuclear operating exposure [LN]	19	20-29	4-18,20-31,36,39,41												
	Existing debt and need to refinance [LN]	20	19,21-29	4-19,21-31,36,39,41												
	Financial ratio deterioration [LN]	21	19-20,22-29	4-20,22-31,36,39,41												
	Rising cost of debt [LN]	22	19-21,23-29	4-21,23-31,36,39,41												
	Limited & declining cash & equivalents [LN]	23	19-22,24-29	4-22,24-31,36,39,41												
	Weak balance sheets [LN]	24	19-23,25-29	4-23,25-31,36,39,41												
	Underfunded pension plans [LN]	25	19-24,26-29	4-24,26-31,36,39,41												
	Operating organization finance [LN]				High hurdle rate for risky projects [LN]	26	19-25	4-6,12-14,16-25,30-31,36,39,41	Vast uncertainty about the future (considering the whole lifecycle of NPP); risk partly endogenous and partly exogenous to the utility	Probability of utility's credit metrics deterioration mostly depends on the specific nuclear project context. The Government subsidies play a central role	Possible consequences into other project development phase when the utility financial conditions affect the calendar of payments. Such cases may led to delays and extra cost of the project development			Affect the financial success of the the whole project	Adverse financial scenarios may deteriorated the amount of economic resources, cumulated during the operating phase of NPP, dedicated decommissioning	
					Impact of large project [LN]	27	19-25	4-6,12-14,16-25,30-31,36,39,41								
					Debt load and service burden impact [LN]	28	19-25	4-6,12-14,16-25,30-31,36,39,41								
					Capital structure distortion [LN]	29	19-25	4-6,12-14,16-25,30-31,36,39,41								
(\$2.1.6.2.2.4.) Technological [N]				Competitiveness electricity tech. [N]	30	16-29,37-41	36	Vast uncertainty on future electricity generating	Difficult to estimate	Such risks can affect the project performances in a wide range of ways. With this concern, Some of the most important elements are: the public acceptability, regulatory risk and government subsidies						
				Competitiveness nuclear tech. [N]	31	16-29,37-41	36									
(\$2.1.6.2.3.) Socio-political risk [LN]	(\$2.1.6.2.3.1.) Legal-regulatory [LN]			Ineffective regulation [LN]	32	4-6,12-15	36	Vast Epistemic uncertainty for owners group; endogenous to Government and RB	Moderate probability (occidental countries), High probability (developing countries)	Lack in legal, regulatory, right revenues and contract instruments may have a wide range of effects on project development and operator						
				Inefficient regulation [LN]	33	4-6	36									
				Licensing risk [N]	34	4-6,12-14	36,39									
				Inspecting risk [N]	35	4-6,12-15	36									
				Change in regulatory framework [LN]	36	1-9,11-35,37-38	40									
	(\$2.1.6.2.3.2.) Social [LN]				Directly [LN]	37	39-40	7,30-31,36	Vast uncertainty	High probability to met public opposition, especially after Fukushima accident	Wide range of impact on project and developing organizations: mostly depending on: degree of openness and power associated to public inquiries; security measures put in place for avoid opposition problems					
					Indirectly [LN]	38	39-40	7,30-31,36								
	(\$2.1.6.2.3.4.) Political [LN]				Change in supports and subsidies [N]	39	16-29,34	7,30-31,37,38	Vast uncertainty, endogenous to governments	Depends on the Country considered	Wide range of possible consequences, depending on the typology of subsidies, regulation and and agreement re-negotiated or changed					
					Change in regulation [LN]	40	36	7,30-31,37,38								
					sovereignty risk [LN]	41	16-29	30,31								