CONCEPT SELECTION IN DEEPWATER BASED ON MCDA METHODOLOGIES

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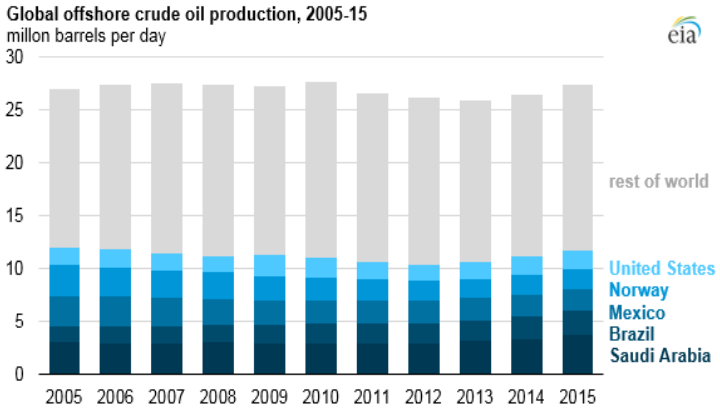
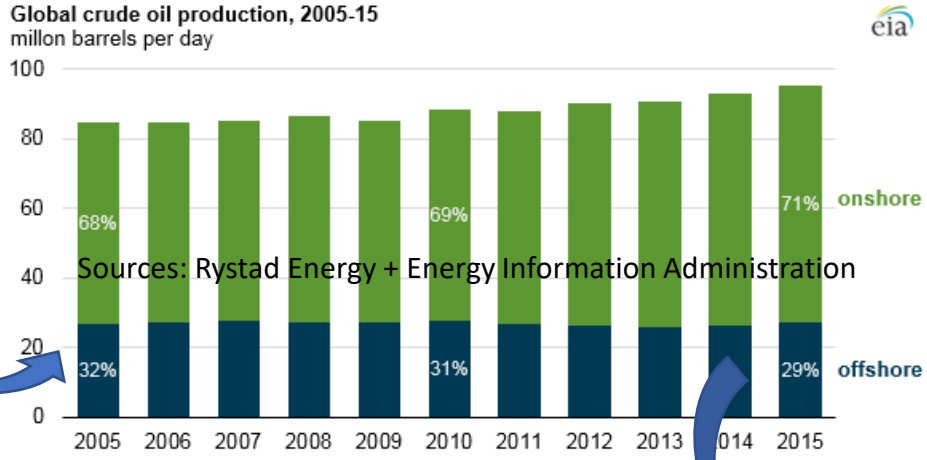
Objective of the work

- Exploring the use of multiple-criteria methodologies for the assessment of host systems in deepwater offshore oilfields (WD 1200 m). The suitability of typical stage-gated sequence to fit into wider project management framework

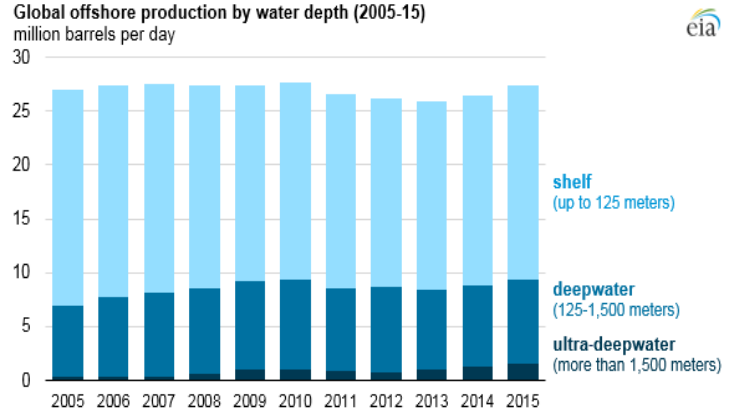
- Explorar el uso de métodos multi-criterio para evaluar sistemas de producción de aguas profundas en áreas marítimas (Lámina de agua 1200 m). Inserción de la secuencia típica de métodos multi-criterio en sistemas de gestion integrada de proyectos de Desarrollo (FEL)

Framing the Offshore Oil Production





Sources: Rystad Energy + Energy Information Administration



Water Depth Range (ww.eia.gov)		
Shallow	Deep	Ultradeep
0-125 m	125-1500 m	+ 1500 m

Field Development – Offshore Technology – What is Concept Selection?

Onshore

Transition to Stand Alone

1st offshore well?

Summerland, CA

The modular approach was kept along the sequence

Shallow Water (Ground-based)

(1947 – First out-of-sight)

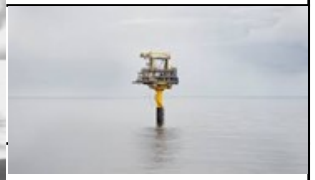
Jacket

Prod Jack-up

BT

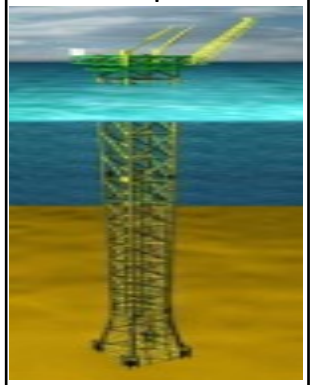
CGB

MFP



Transition Zone to DW

Compliant



DW Jacket

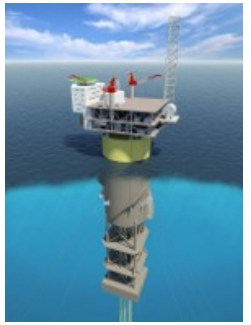
Deep-water

Wet-tree

Dry-tree

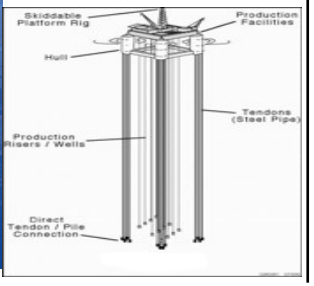
FPSO

SPAR

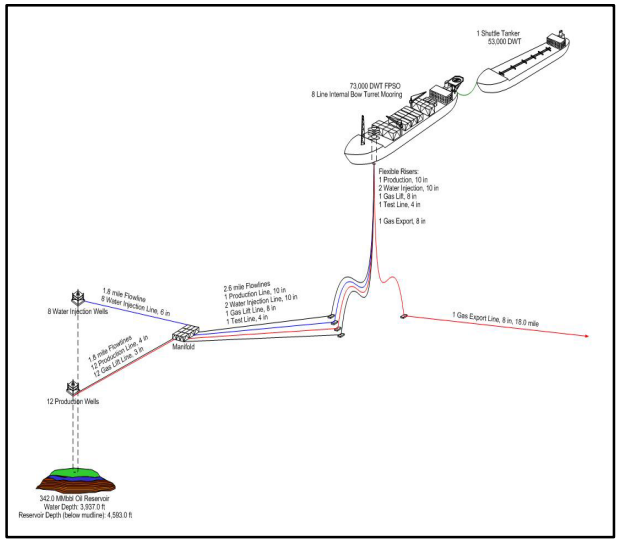


Semi-sub

TLP

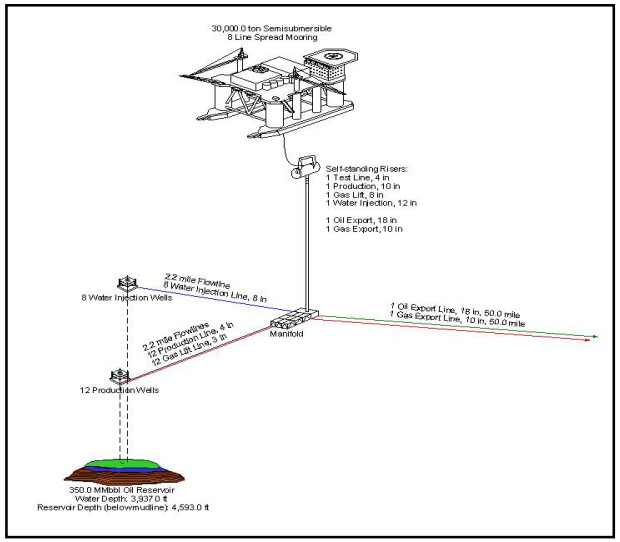


Generation of FD Scenarios

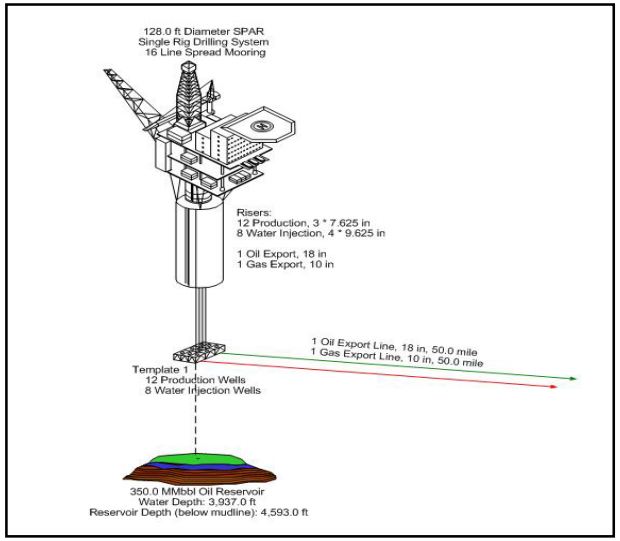


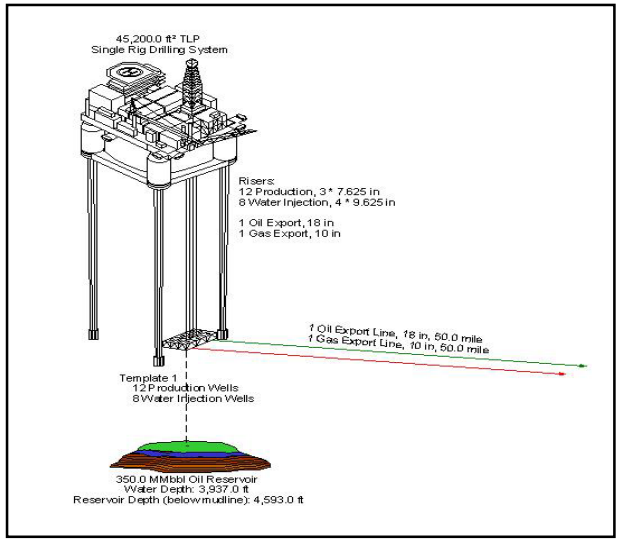
SCE-01 - FPSO

SCE-02 - SEMI



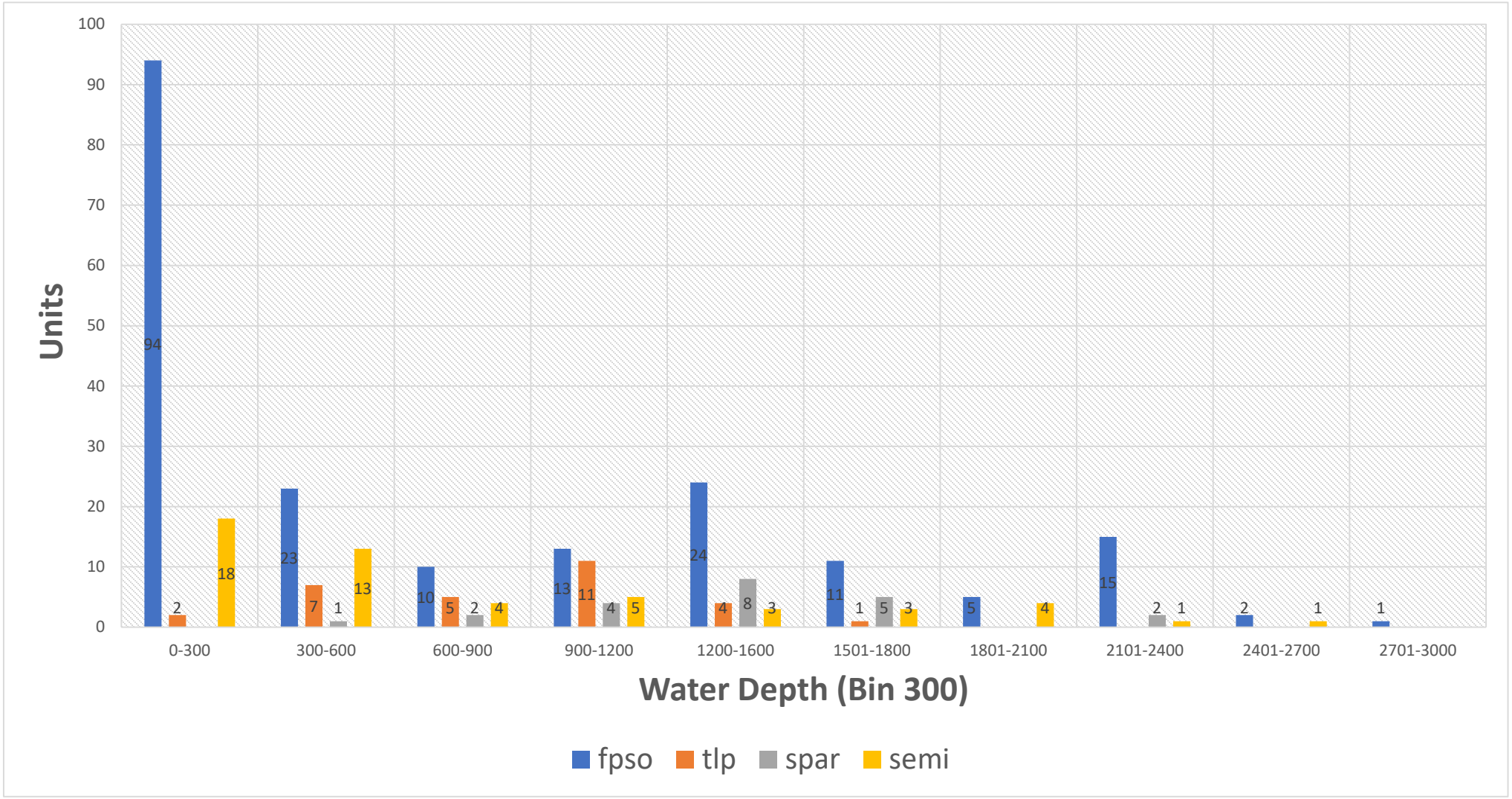
SCE-03 - SPAR



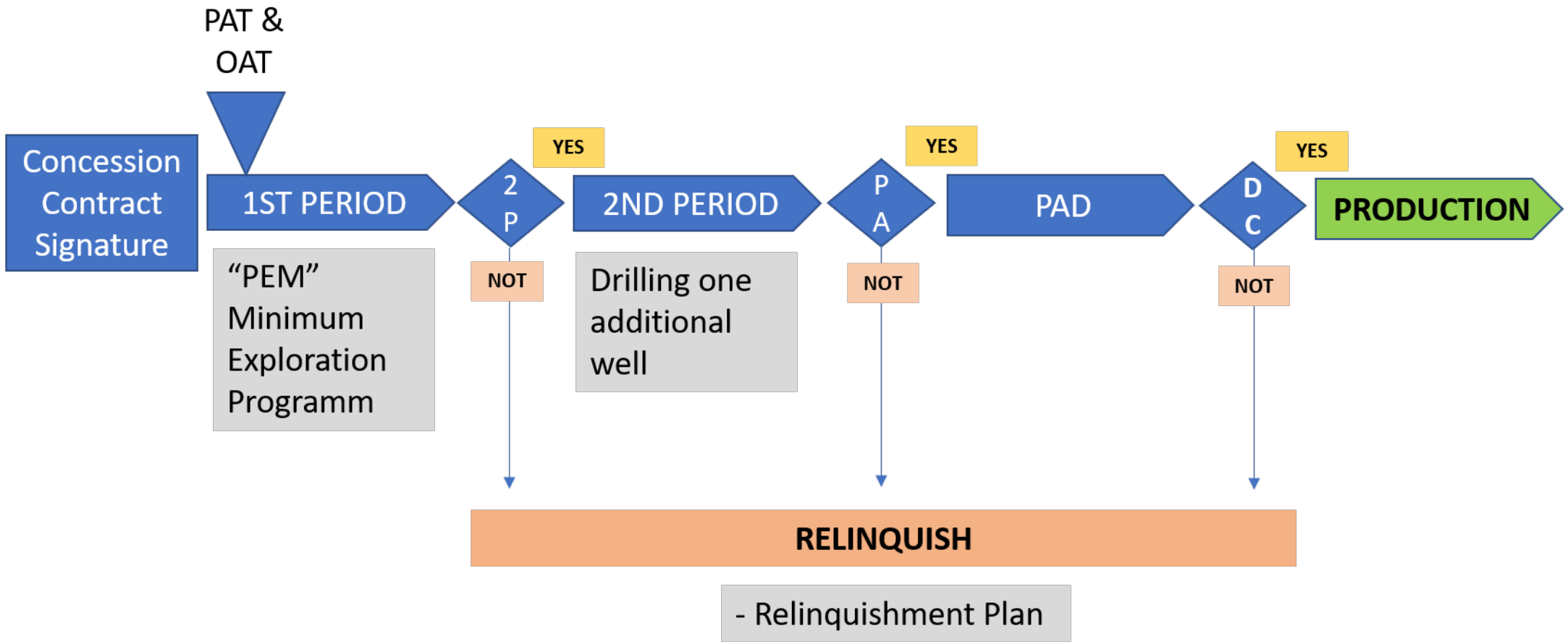


SCE-04 - TLP

Field Development – Floating Units – Breakdown per Water Depth (m)



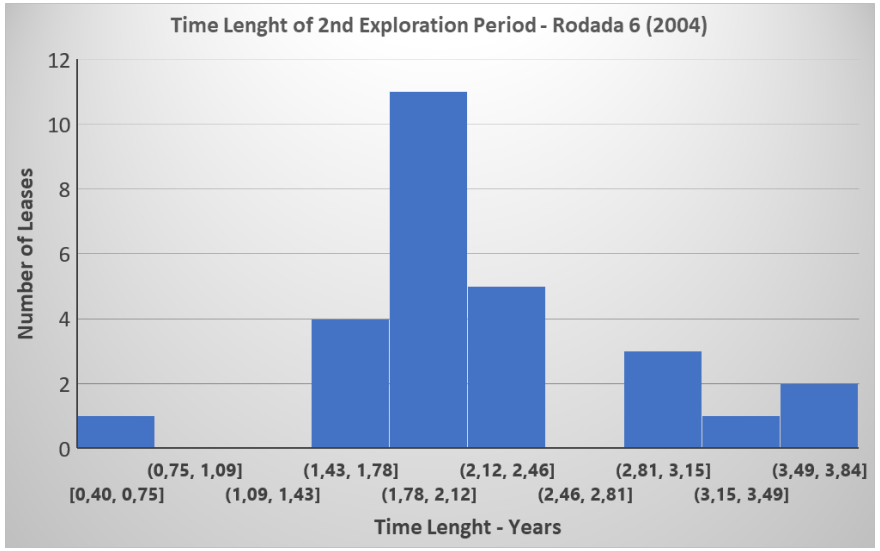
Brazil Typical Exploration Process

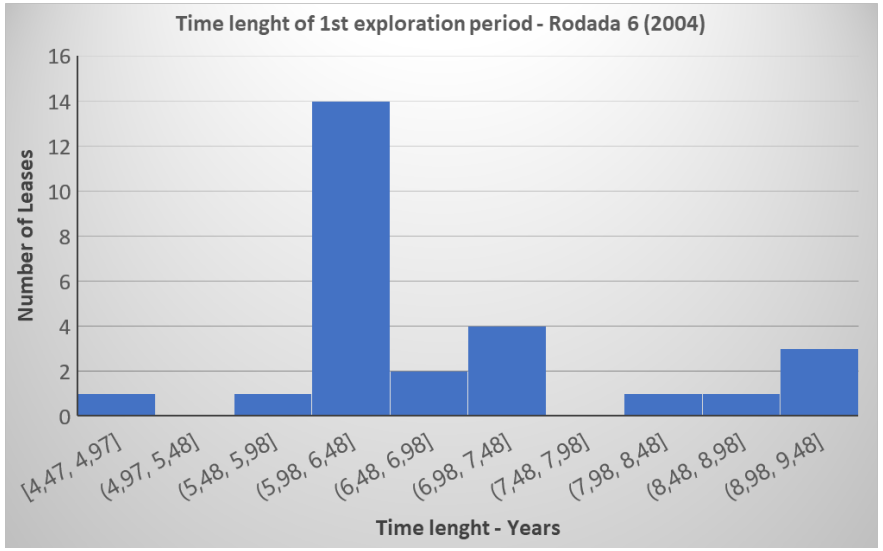


BASED ON ANP TYPICAL EXPLORATION PROCESS

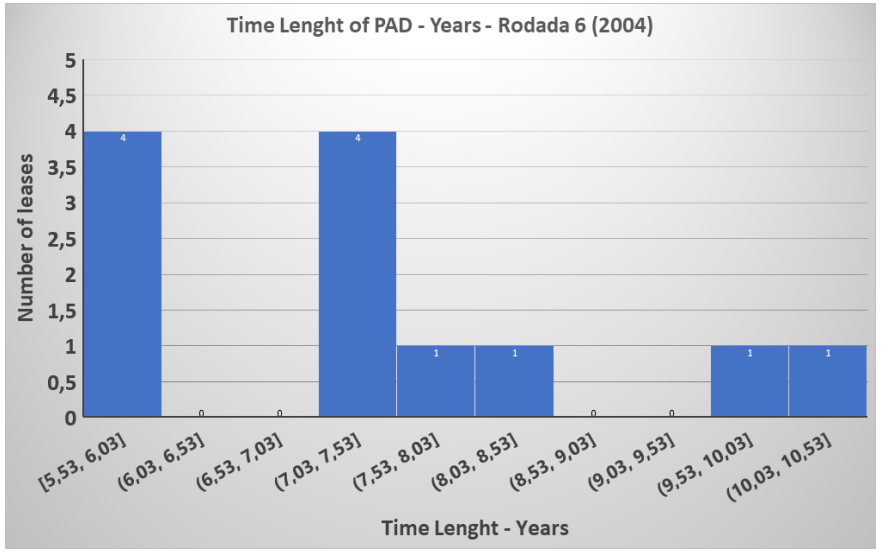
Source: www.anp.gov.br

Typical Exploration Time Length in Brazil (Round 6 - 2004)

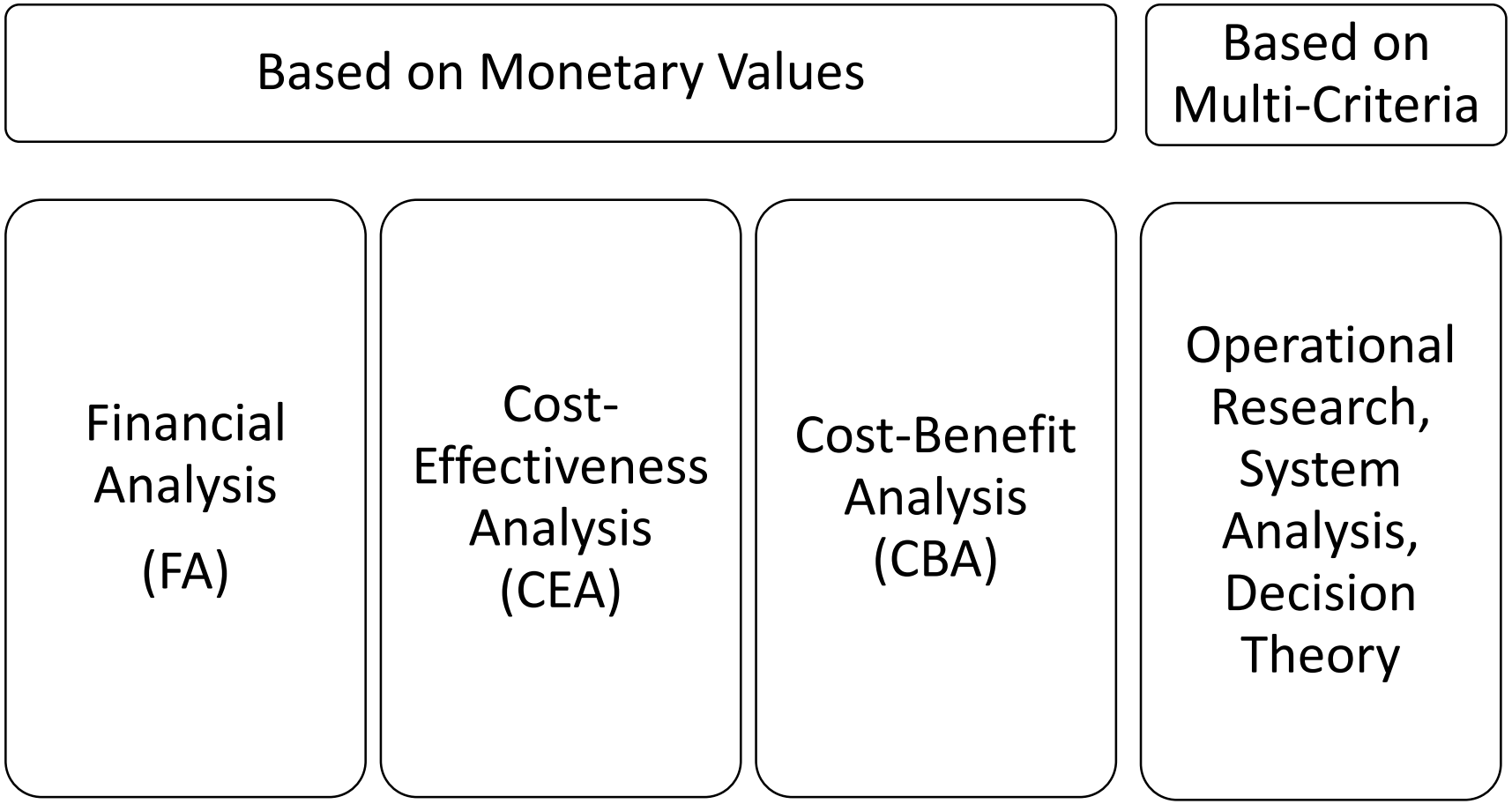




Source: www.anp.gov.br



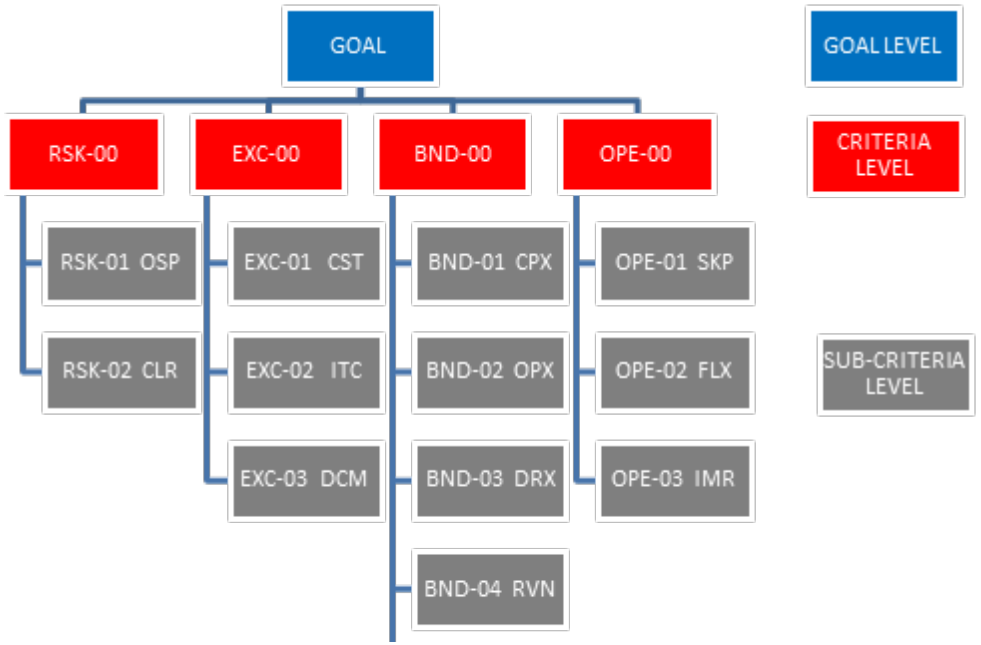
Methodologies for Project Selection



From “Handbook for local communities – UK Government”

Structuring the problem – Criteria Definition

CRITERIA HIERARCHY TREE



GOAL	SELECTING THE BEST CONCEPT FOR THIS PARTICULAR FIELD
RSK-00	**RISK TO ENVIRONMENT AND FACILITIES**
RSK-01 OSP	RISK OF OIL SPIILL IN THE SEA
RSK-02 CLR	RISK OF COLLISION WITH AUTHORIZED VESSEL
EXC-00	**PROJECT EXECUTION**
EXC-01-CST	CONSTRUCTION
EXC-02-ITIC	INTEGRATION, TRANSPORT, INSTALLATION AND COMMISSIONING
EXC-03-DCM	DECOMMISSIONING
BND-00	**BUSINESS DRIVERS**
BND-01-CPX	CAPITAL EXPENDITURES
BND-02-OPX	OPERATING EXPENDITURES
BND-03-DRX	DRILLING EXPENDITURES
BND-04-NPV	NET PRESENT VALUE
OPE-00	**OPERABILITY**
OPE-01-SKP	SEAKEEPING
OPE-02-FLX	OPERATIONAL FLEXIBILITY
OPE-03-IMR	INSPECTION, MAINTENANCE AND REPAIRING

Methodology - Multiple-criteria methodologies - Additive value functions

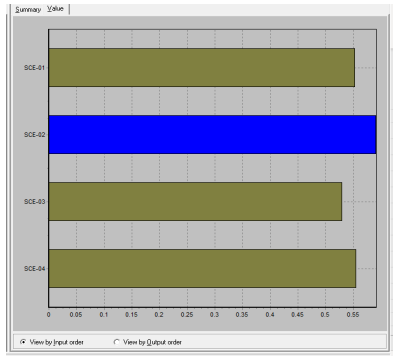
$$\overset{\circ}{v}(x_1, \ldots, x_n) = \sum_{i=1}^{n} \overset{\circ}{v}_i (x_i)$$

Weight Vector 1	Criteria Vector 1		Weight Vector 2	Criteria Vector 2				Weight Vector n	Criteria Vector n		Score
W_1	X_{11}	+	W_2	X_{21}	+	…	+	W_n	X_{n1}	=	T01
W_1	X_{12}	+	W_2	X_{22}	+	…	+	W_n	X_{n2}	=	T02
W_1	X_{13}	+	W_2	X_{23}	+	…	+	W_n	X_{n3}	=	T03
…	…	…	…	…	…	…	…	…	…	=	…
W_1	X_{1n}	+	W_2	X_{2n}	+	…	+	W_n	X_{nn}	=	T0n

Calculation

TICKER	TAG	DESCRIPTION	SCALE	
RSK-01	OSR	OTCR – Oil Spill Assessment (2001)	Global	Reverse
RSK-02	CLR	White Rose Field Development Risk Analysis (2000)	Global	Reverse
EXC-01	CST	Expert judgement	Global	Direct
EXC-02	ITC	Expert-judgement	Global	Direct
EXC-03	DCM	Expert-judgement	Global	Direct
BSD-01	CPX	FieldPlan Software	Global	Reverse
BSD-02	OPX	FieldPlan Software	Global	Reverse
BSD-03	DRX	FieldPlan Software	Global	Reverse
BSD-04	NPV	FieldPlan Software	Global	Direct
OPE-01	SKP	Expert-judgement	Global	Direct
OPE-02	FLX	Expert Judgement	Global	Direct
OPE-03	IMR	Field-Plan Software (Topsides Wet Weight and Subsea Exposed Area)	Local	Reverse

Consolidated Score per Scenario-VIP/OnBalance



Software VIP

Software: OnBalance

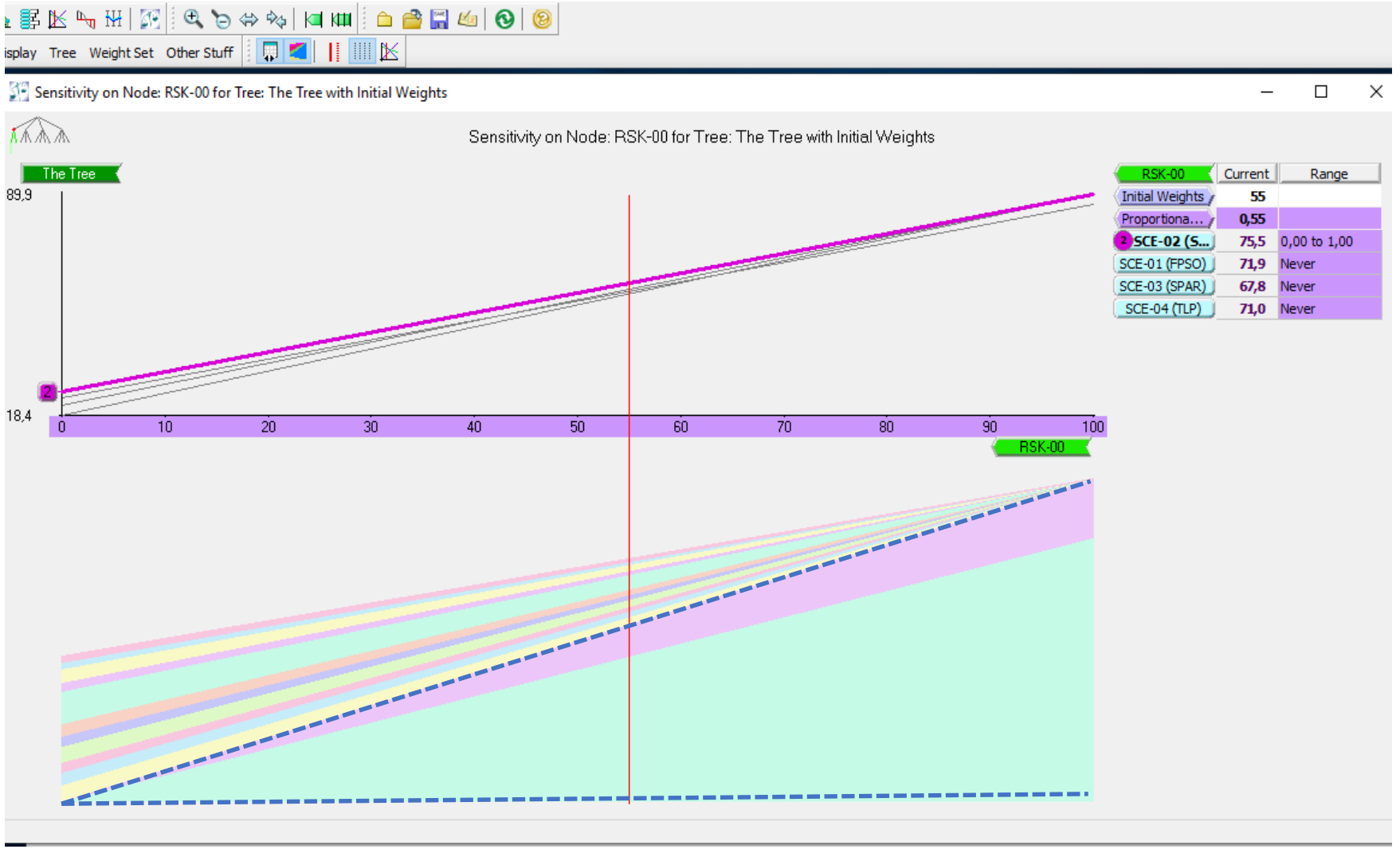
Actions Display Sort Tree Weight Set

Grid for Tree: The Tree Initial Weights

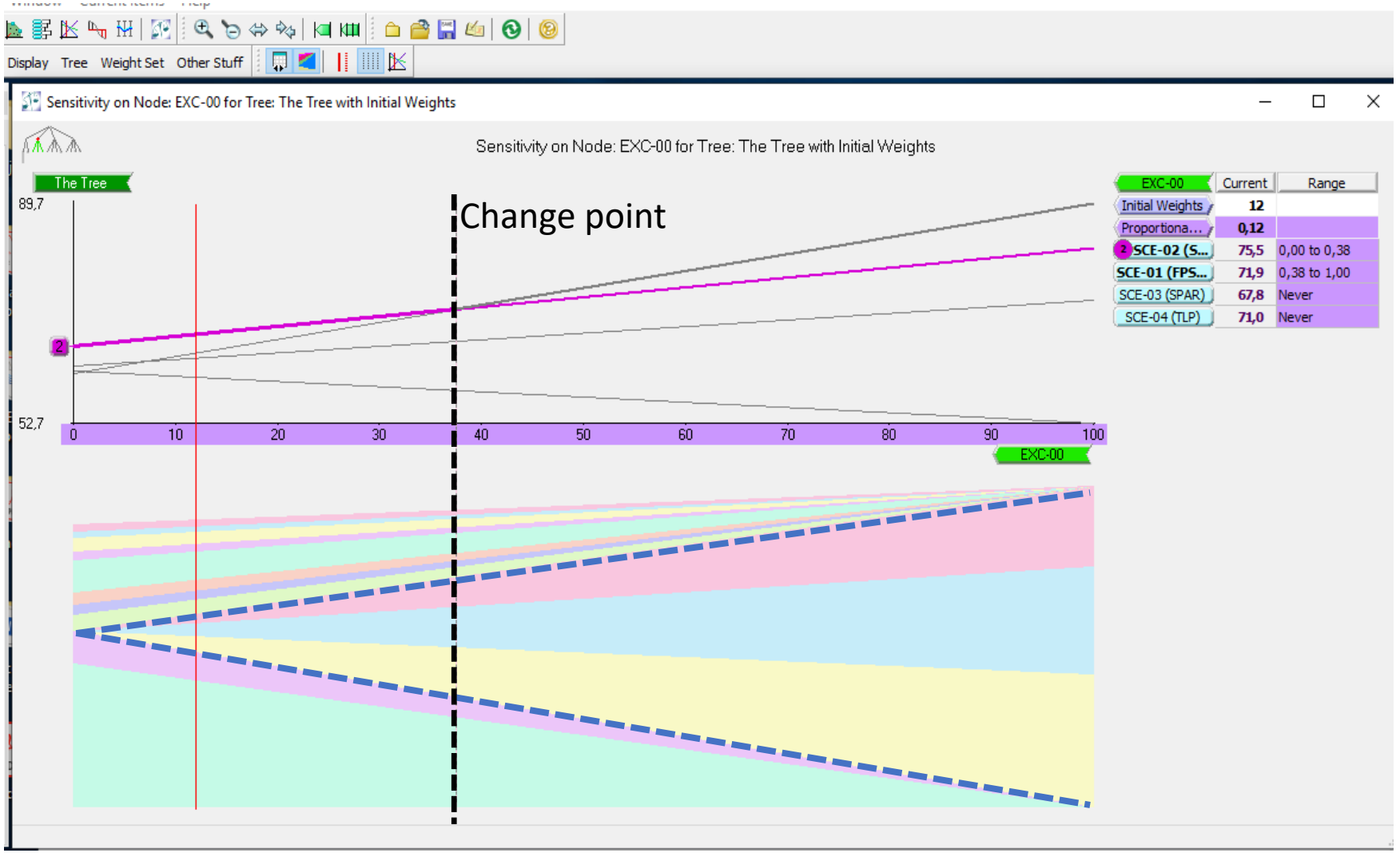
Grid for Tree: The Tree Initial Weights

The Tree	RSK-01...	RSK-02...	RSK-00	EXC-01...	EXC-02...	EXC-03...	EXC-00	BSD-01...	BSD-02...	BSD-03...	BSD-04...	BSD-00	OPE-01...	OPE-02...	OPE-03...	OPE-03...	OPE-00	The Tree	Descriptions
Initial Weights	45	10	55	5	4	3	12	5	3	4	10	22	3	4	2	2	11	100	
Units	Real W...	Real W...		Real W...	Real W...	Real W...		Real W...	Real W...	Real W...	Real W...		Real W...	Real W...	Real W...	Real W...			
SCE-01 (FPSO)	1120,000	0,0183	47,6	69,00	56,00	47,00	10,8	1639	2675	806	3187	6,8	13,00	19,00	5560,000	42700	6,7	72	Concept based on FPSO floating fa
SCE-02 (SEMI)	1650,000	0,0137	49,4	59,00	55,00	48,00	9,9	1721	1962	512	3579	10,1	26,00	18,00	6418,000	223642	6,2	76	Concept based on Semi-submersib
SCE-03 (SPAR)	1890,000	0,0137	49,4	43,00	32,00	45,00	6,3	1432	1531	744	2851	7,3	25,00	19,00	10647,000	189045	4,9	68	Concept based on SPAR floating fa
SCE-04 (TLP)	1850,000	0,0137	49,4	54,00	50,00	45,00	8,8	1481	1534	743	2838	7,2	29,00	19,00	9976,000	189045	5,6	71	Concept based on TLP floating fac

Analysis – Sensitivity to RSK-00 – Dominance Range



Analysis – Sensitivity to EXC-00 – Dominance Range



Conclusion and Recommendation

- There is tight outcome for these four mature technologies
- MCDA are suitable for assessment of different types of host floaters
- Methodology sequence can be embedded into typical Front-end-loading approach for PM
- Criteria weight and definition is key for the assessment
- Future works might include some uncertainty in terms of reserves, production, expenditures and oil spill