PETROAMAZONAS

Corporate Master Plan
EOR/IOR Strategies - Implementation

FRANCISCO PAZ V.

OSWALDO MADRID B.





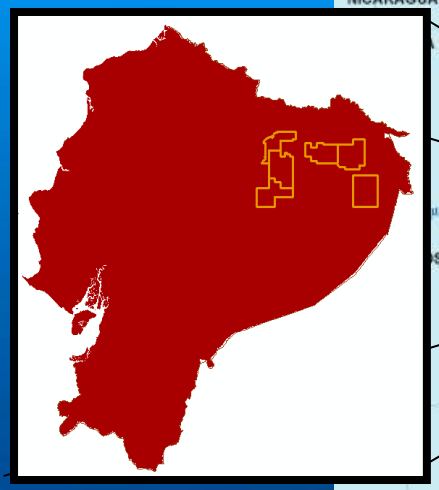


Agenda

1 Background
2 Objectives
3 Methodology and Analysis
4 Results
5 Corporate Strategies Plan
6 Conclusions and Recommendations



Ecuador Location

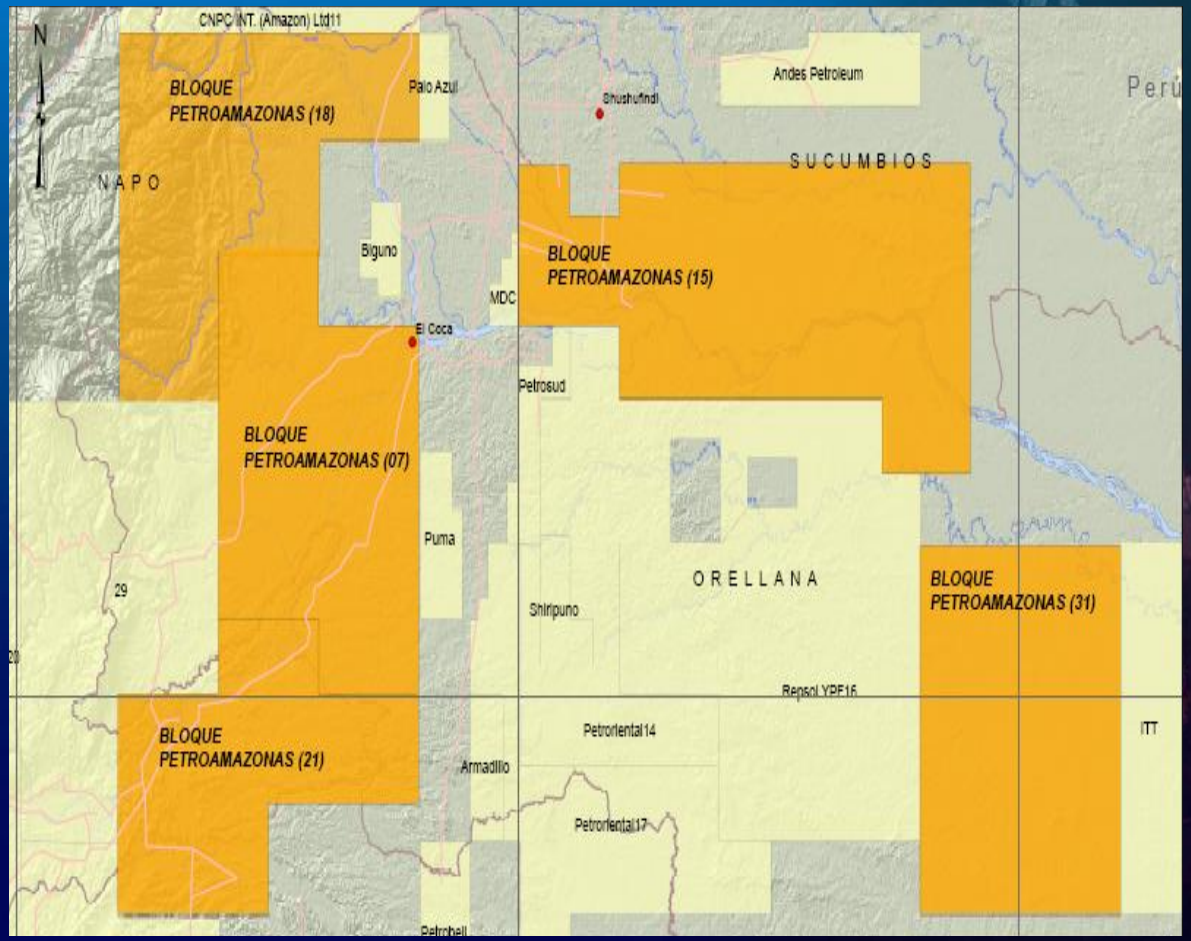




PETROAMAZONAS

Petroamazonas EP Location





PETROAMAZONAS

1 Background



- **Business Objectives.**
- **Intrinsic Uncertainties Estimation**
- **Correlations**
- **Size of the Opportunity HC. Vol.**
- Brainstorming.
- Variables of decision, Analysis of dependencies and Decisions Matrix
- Modelling of uncertainties associated to decisions
- Generation of Portfolio
- Management of Portfolio: Identification of the best development scenarios in terms of time, (importance and feasibility).
- Economic evaluation (Cost estimates Class V)
- Size of Opportunity for the selected scenarios in terms of time.
- Plan for Mitigation of Risks and Plan for short term development with its business alternatives

STAGE I

STAGE II

1 Background

Short Term R Crit.			Incremental Medium Term			Incremental Long Term		
CAMPO	POES (R.Crit)	PORCENTAJE	CAMPO	Inc. POES (P50-RCrit)	PORCENTAJE	CAMPO	Inc. POES (OCrit-P50)	PORCENTAJE
EDÉN YUTURI	1,040,950,056	63%	YURALPA	185,153,179	60%	YURALPA	166,597,579	59%
INDILLANA	448,088,722		OSO	146,570,445		OSO	143,373,469	
OSO	328,108,443		COCA-PAYAMINO	128,541,514		COCA-PAYAMINO	132,121,204	
PALO AZUL	327,402,237		INDILLANA	84,739,376		INDILLANA	89,313,430	
LIMONCOCHA	321,474,574		PALO AZUL	52,082,251		PALO AZUL	52,464,958	
YURALPA	273,822,879		LIMONCOCHA	49,757,656	29%	LIMONCOCHA	62,029,975	
YANAQUINCHA ESTE /AGUAJAL	230,816,430	28%	EDÉN YUTURI	46,037,177		EDÉN YUTURI	55,292,670	31%
COCA-PAYAMINO	213,753,582		GACELA	35,327,878		APAIKA NENKE	63,530,009	
NASHIÑO	189,126,305		APAIKA NENKE	37,235,122		PATA	63,059,179	
YANAQUINCHA OESTE	182,694,726		PATA	29,041,382		GACELA	35,804,410	
APAIKA NENKE	173,484,400		NASHIÑO	24,213,024		NASHIÑO	24,996,087	
PAÑACOCHA	117,155,957		MONO	23,489,216		MONO	25,269,838	
YANKUNT /PALMAR OESTE	111,065,231		LOBO	20,148,884		LOBO	21,513,680	
GACELA	70,531,381	9%	YANAQUINCHA OESTE	19,815,699		YANAQUINCHA OESTE	23,947,286	
MINTA	61,529,209		MINTA	18,989,973	11%	MINTA	24,681,620	
MONO	49,342,299		YANAQUINCHA ESTE /AGUAJAL	17,672,141		YANAQUINCHA ESTE /AGUAJAL	20,398,411	11%
LOBO	48,152,522		PAÑACOCHA	15,059,431		PAÑACOCHA	24,102,116	
PAKA SUR	37,515,478		YANKUNT /PALMAR OESTE	14,043,623		YANKUNT /PALMAR OESTE	16,493,408	
YANKUNT / PALMERAS NORTE	25,245,005		JAGUAR	10,592,708		JAGUAR	10,994,477	
QUINDE	21,673,071		OBE	10,156,659		OBE	20,698,917	
PATA	16,470,631		YANKUNT / PALMERAS NORTE	7,028,542		YANKUNT / PALMERAS NORTE	7,679,616	
OBE	15,810,099		PAKA SUR	4,502,032		PAKA SUR	5,536,875	
JAGUAR	14,752,449		QUINDE	4,463,222		QUINDE	5,298,963	
YANKUNT / TUICH	13,232,371		YANKUNT / TUNTIAK	1,574,093		YANKUNT / TUNTIAK	2,105,576	
DUMBIQUE	5,801,755		PAÑAYACU	1,278,146		PAÑAYACU	1,777,350	
PAÑAYACU	3,189,009		YANKUNT / TUICH	1,039,472		YANKUNT / TUICH	1,138,077	
YANKUNT / TUNTIAK	3,008,377		DUMBIQUE	787,852		DUMBIQUE	1,080,652	
YANAHURCO	533,800		YANAHURCO	155,848		YANAHURCO	263,774	

OOIP – Development Fields (MM STOB)

4,519

1,003

1,106

PETROAMAZONAS

1 Background

Short Term R Crit.

CAMPO	(R.Crit)	
EDÉN YUTURI	239,959,652	
INDILLANA	101,532,079	
PALO AZUL	92,296,193	
COCA-PAYAMINO	74,759,093	
LIMONCOCHA	74,346,495	63%
YANAQUINCHA ESTE /AGUAJAL	54,855,605	
OSO	46,259,559	
YANAQUINCHA OESTE	38,186,199	
YURALPA	34,696,967	
APAIKA NENKE	23,289,737	
NASHIÑO	22,706,667	
YANKUNT /PALMAR OESTE	22,288,885	
OBE	15,810,099	
PAKA SUR	15,267,912	29%
PAÑACOCHA	15,258,899	
MONO	12,543,252	
MINTA	11,672,345	
GACELA	11,409,172	
YANKUNT / PALMERAS NORTE	5,193,927	
LOBO	4,255,412	
QUINDE	3,471,559	
YANKUNT / TUICH	2,598,008	
PATA	2,394,836	
JAGUAR	1,740,828	
DUMBIQUE	1,133,122	
YANKUNT / TUNTIAK	600,903	
PAÑAYACU	375,493	
YANAHURCO	170,742	8%

Incremental Medium Term

CAMPO	(P50-R. Crit)	
OSO	31,266,356	
PALO AZUL	30,092,088	
EDÉN YUTURI	22,103,079	
YURALPA	21,407,262	
INDILLANA	18,561,167	59%
COCA-PAYAMINO	11,796,903	
LIMONCOCHA	10,908,888	
NASHIÑO	10,308,167	
OBE	10,156,659	
APAIKA NENKE	8,137,596	
PATA	4,906,601	
YANAQUINCHA ESTE /AGUAJAL	4,686,930	
YANAQUINCHA OESTE	4,588,890	31%
MINTA	3,592,157	
YANKUNT /PALMAR OESTE	3,096,534	
PAÑACOCHA	2,344,249	
MONO	2,213,413	
LOBO	2,184,104	
YANKUNT / PALMERAS NORTE	1,612,380	
PAKA SUR	1,531,598	
GACELA	1,494,896	
QUINDE	802,078	
JAGUAR	489,977	
YANKUNT / TUNTIAK	316,592	
YANKUNT / TUICH	300,584	
DUMBIQUE	261,351	
PAÑAYACU	191,381	
YANAHURCO	49,000	10%

Incremental Long Term

CAMPO	(O.Crit-P50)	
PALO AZUL	45,564,875	
OSO	44,438,588	
COCA-PAYAMINO	32,373,529	
EDÉN YUTURI	25,204,811	
INDILLANA	22,088,516	
OBE	20,698,917	63%
YURALPA	20,164,873	
NASHIÑO	17,410,599	
LIMONCOCHA	13,706,359	
APAIKA NENKE	12,606,458	
PATA	10,882,297	
YANAQUINCHA OESTE	5,702,177	
YANAQUINCHA ESTE /AGUAJAL	5,181,989	28%
MINTA	4,647,260	
MONO	4,480,014	
YANKUNT /PALMAR OESTE	3,695,785	
LOBO	3,057,017	
PAÑACOCHA	2,903,126	
GACELA	2,204,601	
YANKUNT / PALMERAS NORTE	1,901,605	
PAKA SUR	1,887,989	
JAGUAR	980,531	
QUINDE	971,219	
YANKUNT / TUNTIAK	425,563	
DUMBIQUE	346,063	
YANKUNT / TUICH	340,814	
PAÑAYACU	263,120	
YANAHURCO	85,411	9%

Total Primary Reserves– Development Fields (MM STOB)

929

209

304

1 Background

Short Term R Crit.

CAMPO	RES-REM. (R.Crit)	PORCENTAJE
EDÉN YUTURI	65,728,916	60%
YANAQUINCHA ESTE /AGUAJAL	42,526,025	
YANAQUINCHA OESTE	32,071,619	
OSO	28,629,247	
APAIKA NENKE	23,289,737	
NASHIÑO	22,706,667	
LIMONCOCHA	21,404,555	29%
YANKUNT /PALMAR OESTE	20,579,435	
PALO AZUL	20,098,232	
OBE	15,810,099	
COCA-PAYAMINO	14,021,063	
PAÑACOCHA	13,909,358	
MINTA	11,672,345	11%
PAKA SUR	6,919,811	
YANKUNT / PALMERAS NORTE	4,089,827	
YURALPA	4,026,712	
QUINDE	3,394,869	
YANKUNT / TUICH	2,455,588	
PATA	2,394,836	
MONO	2,103,317	
GACELA	1,345,600	
DUMBIQUE	688,866	
YANKUNT / TUNTIAK	570,476	
LOBO	312,860	
JAGUAR	298,571	
YANAHURCO	170,742	
INDILLANA	0	
PAÑAYACU	0	

Incremental Medium Term

CAMPO	Inc. Res. Rem. (P50-Rcrit)	PORCENTAJE
OSO	31,266,356	59%
PALO AZUL	30,092,088	
EDÉN YUTURI	22,103,079	
YURALPA	21,370,083	
INDILLANA	16,864,247	
COCA-PAYAMINO	11,796,903	32%
LIMONCOCHA	10,908,888	
NASHIÑO	10,308,167	
OBE	10,156,659	
APAIKA NENKE	8,137,596	
PATA	4,906,601	
YANAQUINCHA ESTE /AGUAJAL	4,686,930	
YANAQUINCHA OESTE	4,588,890	
MINTA	3,592,157	10%
YANKUNT /PALMAR OESTE	3,096,534	
PAÑACOCHA	2,344,249	
MONO	2,213,413	
LOBO	2,184,104	
YANKUNT / PALMERAS NORTE	1,612,380	
PAKA SUR	1,531,598	
GACELA	885,105	
QUINDE	802,078	
JAGUAR	489,977	
YANKUNT / TUNTIAK	316,592	
YANKUNT / TUICH	300,584	
DUMBIQUE	261,351	
PAÑAYACU	171,654	
YANAHURCO	49,000	

Incremental Long Term

CAMPO	Inc. Reservas Rem. (O.Crit-P50)	PORCENTAJE
OSO	44,438,588	63%
PALO AZUL	45,564,875	
EDÉN YUTURI	25,204,811	
YURALPA	21,172,926	
INDILLANA	22,088,516	
COCA-PAYAMINO	32,373,529	
LIMONCOCHA	13,706,359	30%
NASHIÑO	17,410,599	
OBE	20,698,917	
APAIKA NENKE	12,606,458	
PATA	10,882,297	
YANAQUINCHA ESTE /AGUAJAL	5,181,989	
YANAQUINCHA OESTE	5,702,177	
MINTA	4,647,260	
YANKUNT /PALMAR OESTE	3,695,785	8%
PAÑACOCHA	2,903,126	
MONO	4,480,014	
LOBO	3,057,017	
YANKUNT / PALMERAS NORTE	1,901,605	
PAKA SUR	1,887,989	
GACELA	1,714,703	
QUINDE	971,219	
JAGUAR	980,531	
YANKUNT / TUNTIAK	425,563	
YANKUNT / TUICH	340,814	
DUMBIQUE	346,063	
PAÑAYACU	263,120	
YANAHURCO	85,411	

361

Remaining Reserves @ 31/12/2010 – Development Fields (MM STOB)

304

209

PETROAMAZONAS

1 Background

Short Term R Crit.

PROSPECTO	POES (R.Crit)	PORCENTAJES
WEST B7	77,031,420	62%
JATUNPAMBA	66,549,409	
SAN ROQUE OESTE	33,043,522	
BALSAYACU	24,441,196	
MINGO	19,080,808	27%
OCHENTA SUR	12,862,019	
PAÑACOCHA(M1)	11,433,404	
GUATZAYACU	10,457,275	
SINCHI	9,117,568	
PALMAR ESTE C	9,115,225	
PASHURI	8,701,603	
CONCORDIA CENTRO	8,443,246	
PUSCUYO	8,029,508	11%
GUACAMAYO	6,049,318	
WAPONI	5,850,391	
DAYUNO	5,486,887	
GACELA SUR	2,187,587	
JUMANDI	2,179,433	
CHICHICO	1,569,670	
JAGUAR SUR	1,351,015	
PUYUNO	1,105,873	
CHUCURILLO	808,851	

Incremental Medium Term

PROSPECTOS	Inc. POES(P50-Rcrit)	PORCENTAJE
WEST B7	221,020,949	61%
JATUNPAMBA	180,025,142	
WAPONI	113,667,760	
BALSAYACU	63,998,934	
MINGO	60,285,485	31%
OCHENTA SUR	42,886,376	
GUACAMAYO	39,995,496	
PAÑACOCHA(M1)	26,950,636	
SINCHI	26,713,233	
PASHURI	26,495,928	
PUSCUYO	24,624,709	
GUATZAYACU	24,574,787	
CONCORDIA CENT	21,746,012	
DAYUNO	18,033,424	8%
PALMAR ESTE C	13,982,340	
SAN ROQUE OEST	13,121,206	
GACELA SUR	6,386,208	
JUMANDI	6,223,419	
CHICHICO	4,617,899	
JAGUAR SUR	4,066,515	
PUYUNO	3,191,961	
CHUCURILLO	2,382,359	

Incremental Long Term

PROSPECTO	Inc. POES (O.Crit-P50)	PORCENTAJE
WEST B7	310,582,184	64%
JATUNPAMBA	197,948,756	
GUACAMAYO	125,495,203	
WAPONI	79,285,363	
BALSAYACU	74,389,723	
MINGO	71,171,720	27%
PASHURI	43,086,182	
PUSCUYO	40,638,470	
PAÑACOCHA(M1)	37,509,054	
PALMAR ESTE C	37,209,598	
SINCHI	37,004,391	
CONCORDIA CENTRO	34,770,088	
GUATZAYACU	34,372,343	
SAN ROQUE OESTE	28,250,224	9%
OCHENTA SUR	21,683,988	
DAYUNO	21,468,579	
GACELA SUR	8,092,637	
JUMANDI	7,533,625	
CHICHICO	5,772,846	
JAGUAR SUR	5,190,780	
PUYUNO	4,053,558	
CHUCURILLO	3,015,411	

OOIP – Exploratory Prospects (MM STOB)

325

945

1229

PETROAMAZONAS

1 Background

Short Term R Crit.

CAMPO	Recursos (R.Crit)	PORCENTAJE
JATUNPAMBA	21,303,240	65%
BALSAYACU	7,830,212	
SAN ROQUE OESTE	7,557,709	
OCHENTA SUR	6,486,078	
WEST B7	6,161,985	25%
WAPONI	2,341,058	
PASHURI	2,293,522	
PUSCUYO	2,137,757	
PALMAR ESTE C	1,993,459	
CONCORDIA CENTRO	1,761,078	
MINGO	1,512,428	10%
GUACAMAYO	1,216,177	
PAÑACOCHA	924,969	
GUATZAYACU	837,250	
SINCHI	728,877	
DAYUNO	434,495	
JUMANDI	173,703	
GACELA SUR	173,447	
CHICHICO	125,638	
JAGUAR SUR	107,154	
PUYUNO	87,766	
CHUCURILLO	84,535	

Incremental Medium Term

CAMPO	Inc. Recursos (P50-Rcrit)	PORCENTAJE
JATUNPAMBA	57,781,135	66%
BALSAYACU	20,380,781	
WEST B7	17,602,484	
OCHENTA SUR	11,006,041	
GUACAMAYO	8,365,780	24%
WAPONI	7,087,189	
PASHURI	7,060,918	
PUSCUYO	6,556,839	
MINGO	4,780,873	
CONCORDIA CENTRO	4,357,892	
PALMAR ESTE C	3,768,327	11%
PAÑACOCHA	2,920,536	
SAN ROQUE OESTE	2,674,340	
SINCHI	2,128,462	
GUATZAYACU	1,934,591	
DAYUNO	1,432,548	
GACELA SUR	501,853	
JUMANDI	488,805	
CHICHICO	365,781	
JAGUAR SUR	322,613	
PUYUNO	252,940	
CHUCURILLO	248,375	

Incremental Long Term

CAMPO	Inc. Recursos (O.Crit-P50)	PORCENTAJE
JATUNPAMBA	64,053,517	61%
GUACAMAYO	30,590,529	
WEST B7	24,533,132	
BALSAYACU	24,196,367	
PALMAR ESTE C	12,691,365	30%
PASHURI	11,860,844	
PUSCUYO	11,036,515	
WAPONI	10,749,692	
OCHENTA SUR	9,877,177	
SAN ROQUE OESTE	7,290,979	
CONCORDIA CENTRO	7,254,444	
MINGO	5,710,790	9%
PAÑACOCHA	4,816,994	
SINCHI	2,922,403	
GUATZAYACU	2,723,669	
DAYUNO	1,724,010	
GACELA SUR	653,304	
JUMANDI	604,711	
CHICHICO	456,931	
JAGUAR SUR	416,311	
PUYUNO	324,759	
CHUCURILLO	324,564	

Prospective Resources – Exploration (MM STOB)

66

162

235

PETROAMAZONAS

1 Background

Short Term R Crit.			Incremental Medium Term			Incremental Long Term		
EDEN YUTURI	66,715,907		EDEN YUTURI	16,368,647		INDILLANA	18,738,565	
INDILLANA	24,434,579		INDILLANA	15,562,081		EDEN YUTURI	18,622,713	
OSO	22,313,985		LIMONCOCHA	11,858,252		OSO	17,346,906	
YURALPA	22,001,738		YURALPA	10,964,931		LIMONCOCHA	14,337,015	
COCA PAYAMINO	19,456,658	60%	OSO	10,961,188		YURALPA	13,373,033	
LIMONCOCHA	15,776,994		OBE	7,841,699		COCA PAYAMINO	8,774,589	59%
PALO AZUL	13,402,938		NASHIÑO	7,661,350	63%	OBE	8,083,858	
OBE	10,689,996		APAIKA NENKE	7,547,437		APAIKA NENKE	7,868,023	
NASHIÑO	10,231,392		PALO AZUL	6,776,620		PALO AZUL	7,683,853	
APAIKA NENKE	10,230,662		YANAQUINCHA OESTE	6,428,239		NASHIÑO	7,680,518	
YANAQUINCHA ESTE/ AGUAJAL	8,940,062		COCA PAYAMINO	5,243,614		YANAQUINCHA OESTE	7,227,908	
YANAQUINCHA OESTE	8,253,470	30%	YANAQUINCHA ESTE/ AGUAJAL	4,860,831		YANAQUINCHA ESTE/ AGUAJAL	5,833,513	
YANKUNT /PALMAR OESTE	5,275,855		YANKUNT /PALMAR OESTE	3,951,798	27%	YANKUNT /PALMAR OESTE	4,542,540	32%
GACELA	4,859,224		MINTA	2,715,741		MINTA	2,838,738	
MINTA	3,722,475		LOBO	2,384,370		LOBO	2,492,704	
LOBO	3,145,546		MONO	1,788,039		GACELA	2,485,799	
MONO	2,845,275		PAKA SUR	1,711,827		MONO	2,382,491	
PAÑACOCHA	2,462,320		GACELA	1,652,960		PAKA SUR	2,042,332	
PAKA SUR	2,359,030		PAÑACOCHA	1,342,554		PAÑACOCHA	1,758,898	
YANKUNT / PALMERAS NORTE	1,153,737	10%	YANKUNT / PALMERAS NORTE	842,315	10%	YANKUNT / PALMERAS NORTE	872,631	10%

Incremental Reserves for the implementation of IOR/EOR Strategies – Development Fields (MM STOB)

257

127

154

PETROAMAZONAS

1 Background



- **Business Objectives.**
- **Intrinsic Uncertainties Estimation**
- **Correlations**
- **Size of the Opportunity HC. Vol.**
- Brainstorming.
- Variables of decision, Analysis of dependencies and Decisions Matrix
- Modelling of uncertainties associated to decisions
- Generation of Portfolio
- Management of Portfolio: Identification of the best development scenarios in terms of time, (importance and feasibility).
- Economic evaluation (Cost estimates Class V)
- Size of Opportunity for the selected scenarios in terms of time.
- Plan for Mitigation of Risks and Plan for short term development with its business alternatives

ETAPA I

STAGE II

2 Objectives

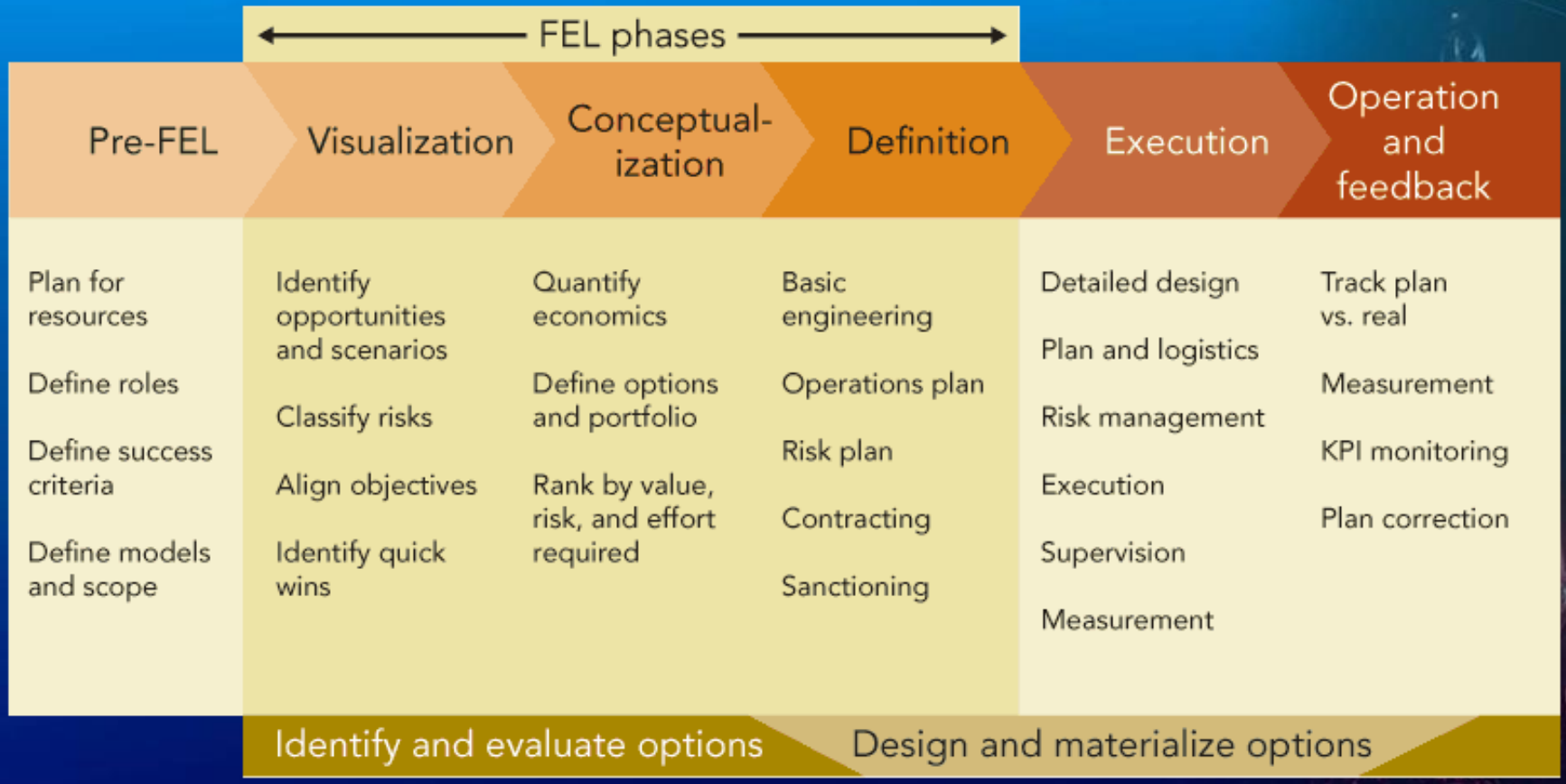
- **Calculate PETROAMAZONAS production profiles associated to the implementation of IOR/EOR strategies for optimization + Inclusion of exploratory prospects.**

- **Define corporate strategies that will permit Petroamazonas EP to achieve its objectives for optimization in the short, medium and long terms.**

- **Calculate a Class V estimate of the investments that will be required during the next 5 years for execution of these projects for optimization.**

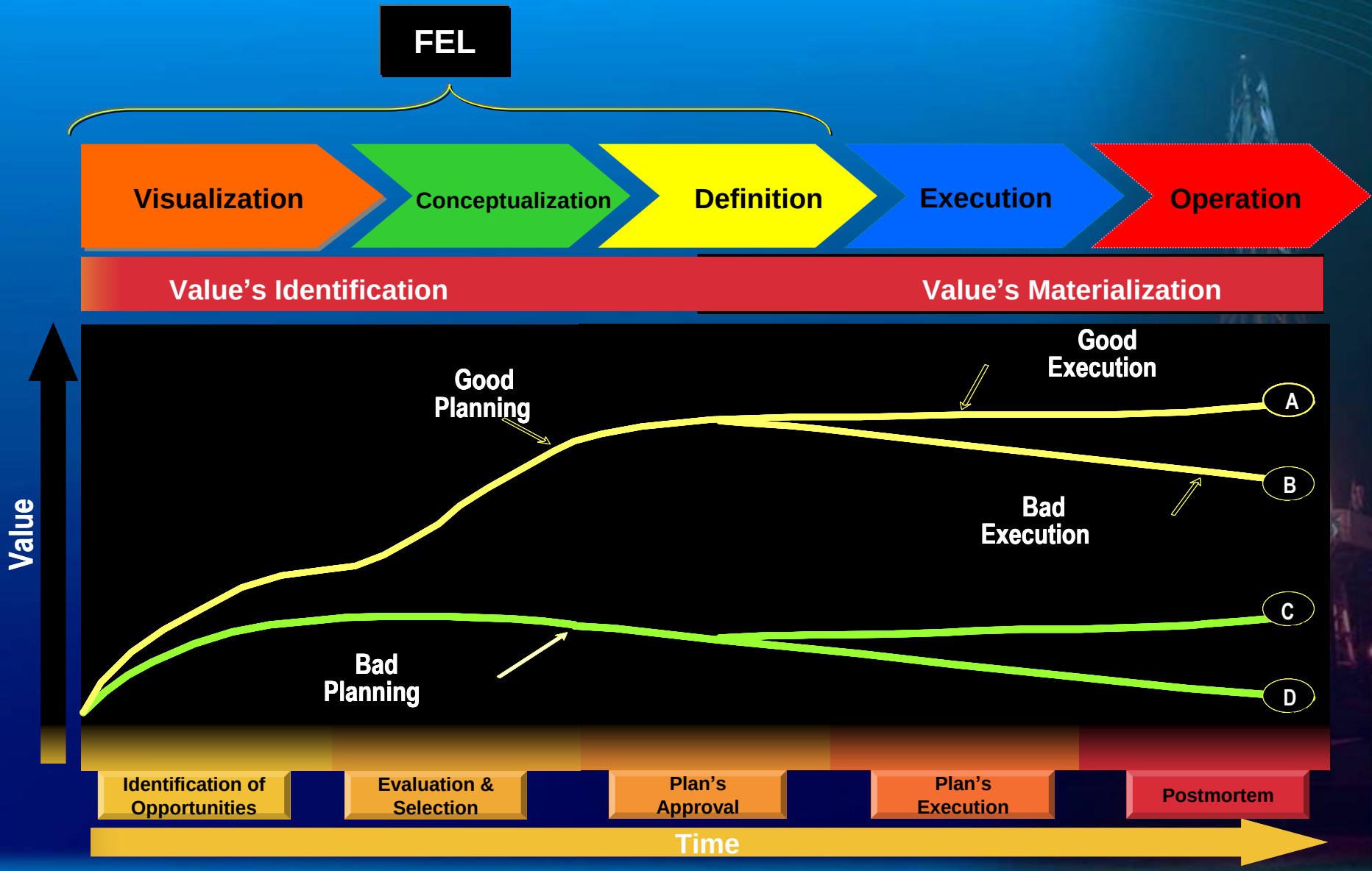
- **Define a route map that will permit PAM EP to achieve a big growth in terms of reserves of HC, as well as also attain an unprecedented level of technological sophistication in Ecuador.**

3 Methodology and Analysis

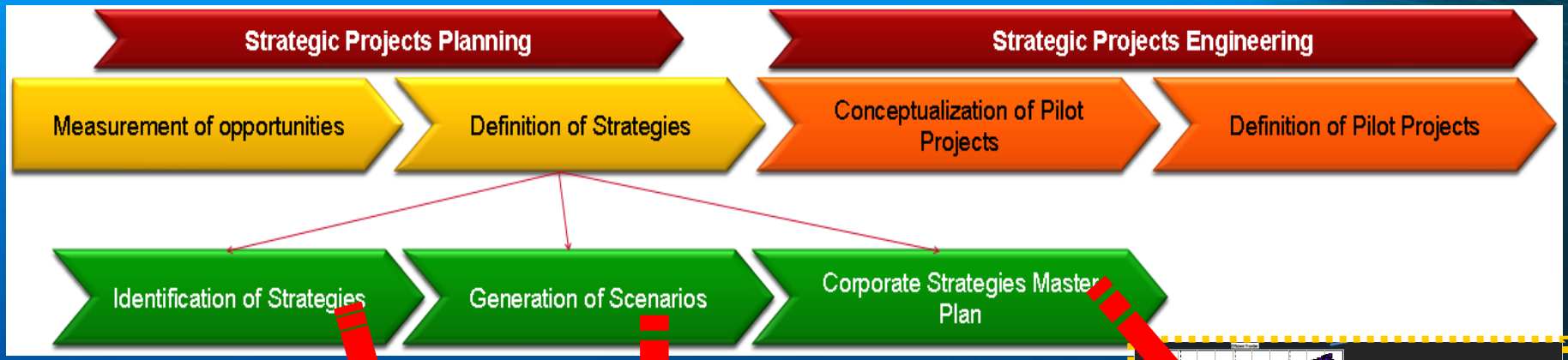


FEL METHODOLOGY

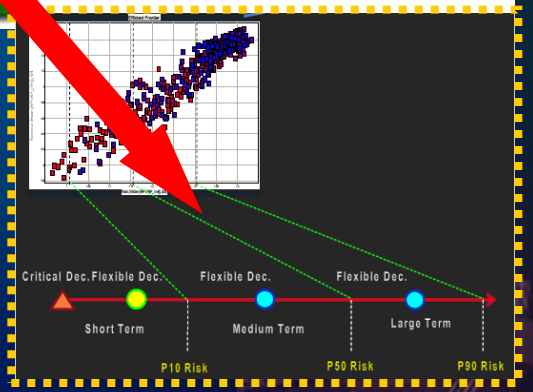
3 Methodology and Analysis

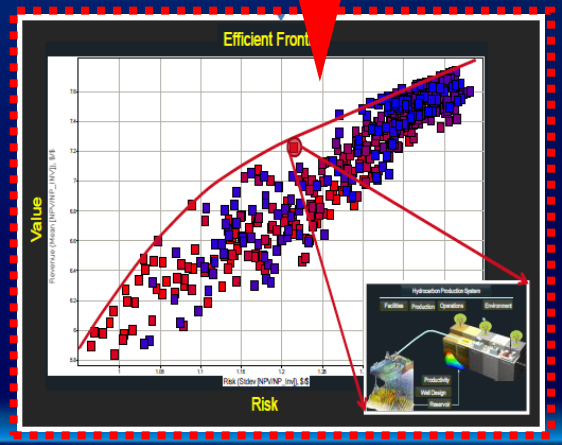


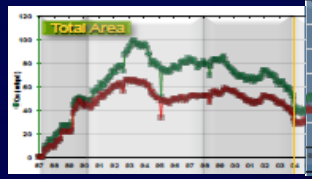
3 Methodology and Analysis

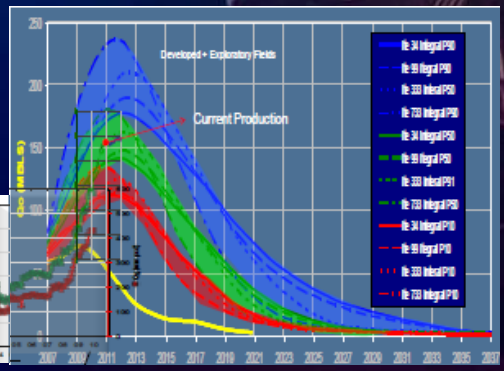


	Category:	Reservoir	Well Design	Prod vity	Transport	Process
	Variable	Development	ype of Wells	Lift M od	T. Transport	Facilities
Options	1	Primary	00 Conventional	ESP	Current	Upgrade Existing
	2	Primary + Sec.	100 No-Conv.	ESP draulic Pump	Current + Repair	New
	3	Primary + Sec. + EOR	70 Conv + 30 No Conv.	ESP draulic Pump	New pipeline	Upgrade + New
	4		50 Conv + 50 No Conv	ESP draulic Pump	Current + New pipe	
	5		30 Conv + 70 No Conv.	ESP draulic Pump	Current + New pipe	
		3	5	5	5	3



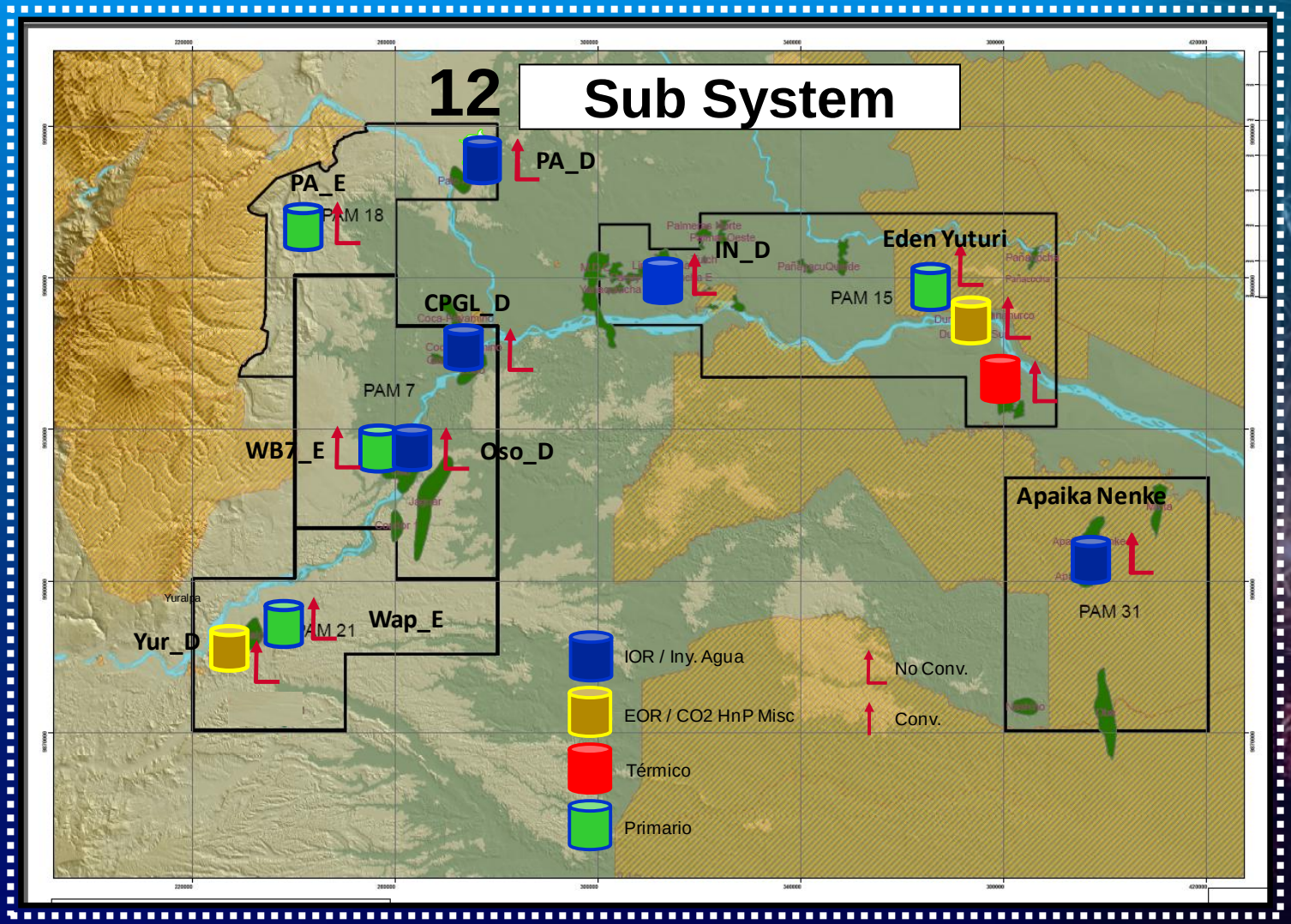






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3 Methodology and Analysis



Integral Exploitation Projects (IEP) – Portfolio PAM EP

3 Methodology and Analysis

Activo	Block	PIE	Recovery Method	Fields/ Reservoir
IN	B15	PIE-IN_D	Primary/ Waterflooding /CO2 H'n'P	Compl. IN (UM+UI, TP, H) LIM (TS ,UI, TP) YAO (UI, TS, TP) YAE (UI, TP)
EY	B12	PIE-EY_T	Termal	EY_M2 ; PAÑ_M2
		PIE-EY_D	Primary/ Waterflooding /CO2 H'n'P	EY (M1, US, UM, UI, TS TP) PAÑ (US, UI)
		PIE-EY_E	Primary	Pañacocha M1 Sur (M1) Guacamayo (M1, UppU) Puscuyo: (M1) Pashuri (M1) San Roque Oeste (M1; UppU; LU; LwT; H)
OY	B07	PIE-OY_D	Primary/ Waterflooding /CO2 H'n'P	OSO (USST,TSST, UHOL, MHOL)
		PIE-OY_D	Primaria/ Inyeccion de agua / CO2 H'n'P	CP (BTSS, USST, UHOL, MHOL) G (TSST, UHOL, MHOL) L_(USST)
		PIE-OY_E	Primary	WB7 (USST)
	B21	PIE-OY_D	Primary/ CO2 H'n'P	YR (H)
		PIE-OY_E	Primary	Waponi (H)
PA	B18	PIE-PA_D	Primary/ Waterflooding /CO2 H'n'P	PA_H
		PIE-PA_E	Primary	Jatunpamba (H) Balsayacu (H) Ochenta Sur (H)
B31	B31	PIE-B31_D	Primary/ Waterflooding /CO2 H'n'P	Apaika Nenke M1

Strategies IOR/EOR applied to every Integral Exploitation Project

Screening criteria for EOR Methods

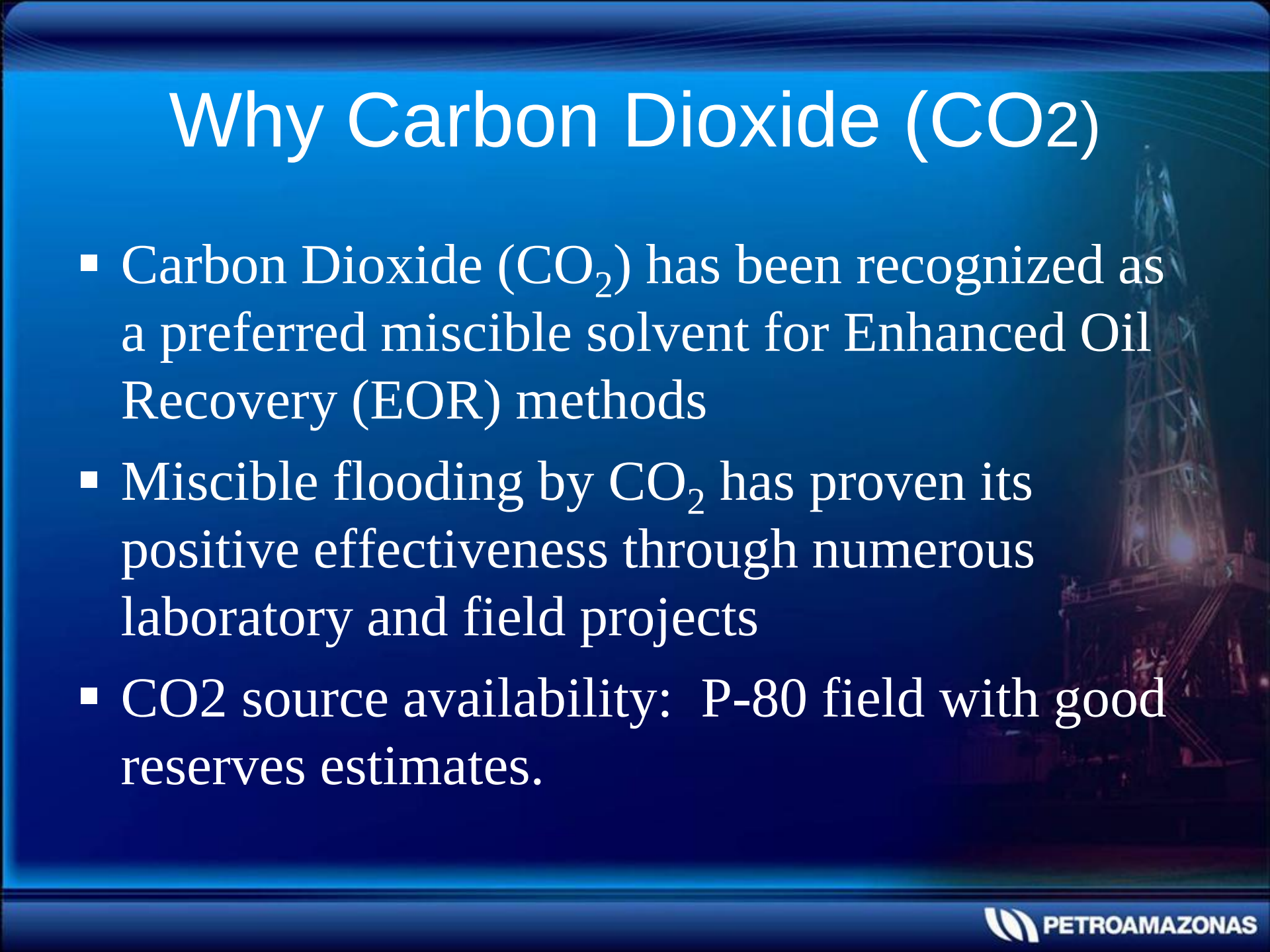
TABLE 3—SUMMARY OF SCREENING CRITERIA FOR EOR METHODS

		Oil Properties			Reservoir Characteristics					
Detail Table In Ref. 16	EOR Method	Gravity (°API)	Viscosity (cp)	Composition	Oil Saturation (% PV)	Formation Type	Net Thickness (ft)	Average Permeability (md)	Depth (ft)	Temperature (°F)
	Gas Injection Methods (Miscible)									
1	Nitrogen and flue gas	>35↗48↗	<0.4↘0.2↘	High percent of C_1 to C_7	>40↗75↗	Sandstone or carbonate	Thin unless dipping	NC	>6,000	NC
2	Hydrocarbon	>23↗41↗	<3↘0.5↘	High percent of C_2 to C_7	>30↗80↗	Sandstone or carbonate	Thin unless dipping	NC	>4,000	NC
3	CO_2	>22↗36↗ [a]	<10↘1.5↘	High percent of C_5 to C_{12}	>20↗55↗	Sandstone or carbonate	Wide range	NC	>2,500[a]	NC
1–3	Immiscible gases	>12	<600	NC	>35↗70↗	NC	NC if dipping and/or good vertical permeability	NC	>1,800	NC
	(Enhanced) Waterflooding									
4	Micellar/ Polymer, ASP, and Alkaline Flooding	>20↗35↗	<35↘13↘	Light, intermediate, some organic acids for alkaline floods	>35↗53↗	Sandstone preferred	NC	>10↗450↗	>9,000↘3,250	>200↘80
5	Polymer Flooding	>15	<150, >10	NC	>50↗80↗	Sandstone preferred	NC	>10↗800↗ [b]	<9,000	>200↘140
	Thermal/Mechanical									
6	Combustion	>10↗16→?	<5,000 ↓ 1,200	Some asphaltic components	>50↗72↗	High-porosity sand/ sandstone	>10	>50[c]	<11,500↘3,500	>100↗135
7	Steam	>8 to 13.5→?	<200,000 ↓ 4,700	NC	>40↗66↗	High-porosity sand/ sandstone	>20	>200↗2,540↗[d]	<4,500↘1,500	NC
—	Surface mining	7 to 11	Zero cold flow	NC	>8 wt% sand	Mineable tar sand	>10[e]	NC	>3:1 overburden to sand ratio	NC

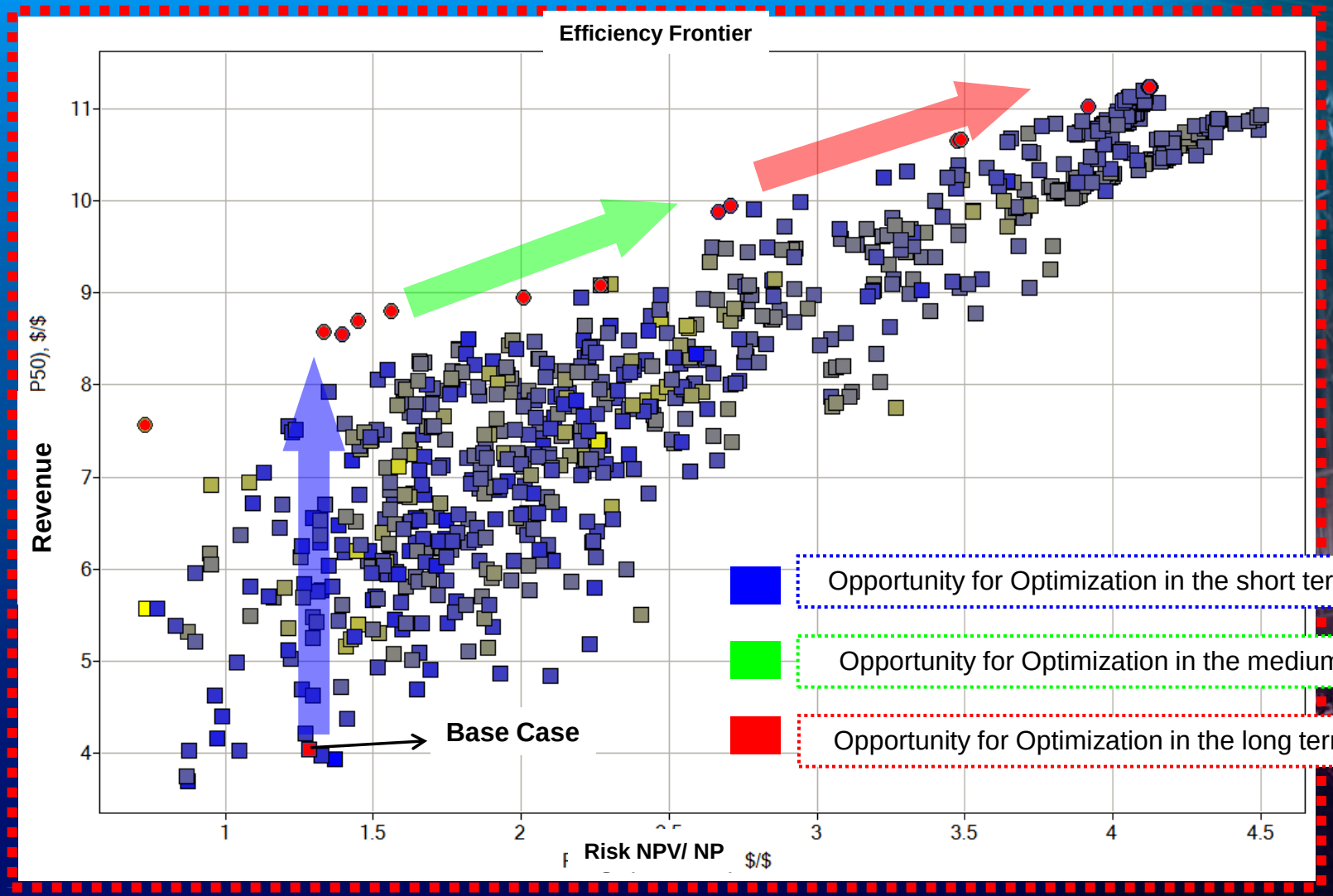
NC = not critical.
Underlined values represent the approximate mean or average for current field projects.
[a]See Table 3 of Ref. 16.
[b]> 3md from some carbonate reservoirs if the intent is to sweep only the fracture system.
[c]Transmissibility > 20 md-ft/cp
[d]Transmissibility > 50 md-ft/cp
[e]See depth

Why Carbon Dioxide (CO_2)

- Carbon Dioxide (CO_2) has been recognized as a preferred miscible solvent for Enhanced Oil Recovery (EOR) methods
- Miscible flooding by CO_2 has proven its positive effectiveness through numerous laboratory and field projects
- CO2 source availability: P-80 field with good reserves estimates.

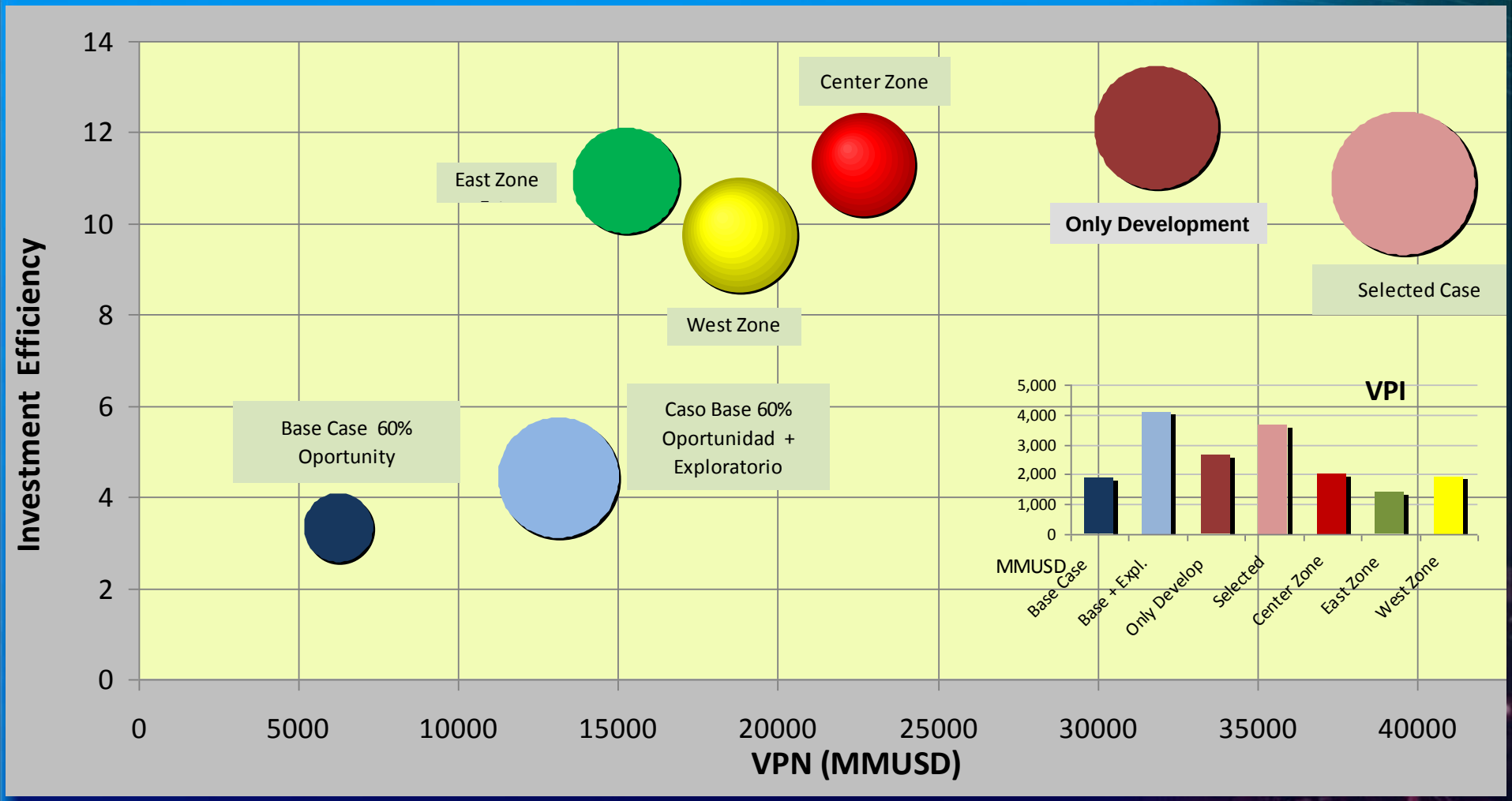


4 Results



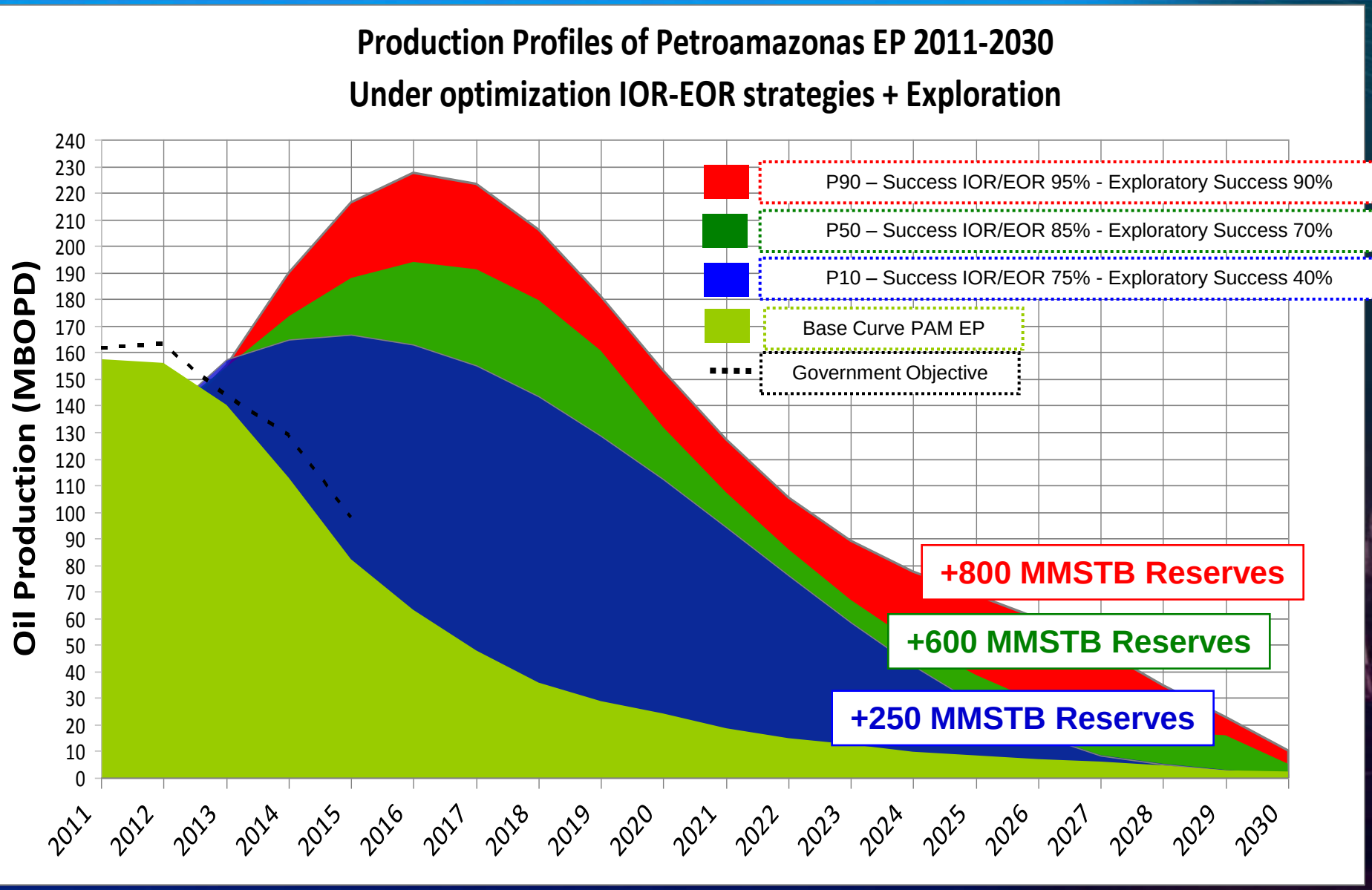
Efficiency Frontier PAM EP

4 Results



Success Impact for IOR/EOR + Exploration in the Economic Indicators of PAM EP

4 Results


Production Profiles of Petroamazonas EP 2011-2030
Under optimization IOR-EOR strategies + Exploration
Oil Production (MBOPD)
240
230
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
P90 – Success IOR/EOR 95% - Exploratory Success 90%
P50 – Success IOR/EOR 85% - Exploratory Success 70%
P10 – Success IOR/EOR 75% - Exploratory Success 40%
Base Curve PAM EP
Government Objective
+800 MMSTB Reserves
+600 MMSTB Reserves
+250 MMSTB Reserves

5 Corporate Strategies Plan

- ✓ **Technological**
  - Processes IOR-EOR for
    - Water injection,
    - CO2 Injection .
    - Thermal
  - Design and construction of wells under non-conventional architecture
  - Integral productivity of wells
  - Optimization of Surface Installations
- ✓ **Process**
  - Conceptualization and design of the recommended scenarios of each EIP (Strategic Integral Plan)
  - Integral Modeling of Asset (reservoir, well, installations)
  - Design and execution of Pilot Projects (CO2, WAG, Thermal)

5 Corporate Strategies Plan

- ✓ **Accelerate the incorporation of new exploration prospects:**

  PA-E, EDY-E, WB7

- ✓ **Promote Organizational Development:**
  - Attracting–Developing Talent:
    - Estimate of 191 professionals for the development and execution of the Strategic Plan
    - Improve professional career plan and accelerated training in medullar disciplines
      - IOR-EOR, Active Integral Model, G&G.
      - Temporary Assignments, Internal Rotation.

- ✓ **Strengthening of the Technological Vision for Exploration and Production :**

  Change in the Technological paradigm.

6 Conclusions and Recommendations

- ✓ The study permitted the definition of the strategies to be followed for the implementation of IOR/EOR process and the accelerated incorporation of exploration prospects.
- ✓ An estimate was made of the opportunities of increasing oil production levels in the order of +84 MBPD (case P10) and of +130 MBPD (case P50) for 2016.
- ✓ The incremental recovery factor is +16% without including exploration prospects and +20% including them.
- ✓ The Portfolio development requires having Cutting Edge Technologies for immediate evaluation and implementation.
- ✓ 190 Specialized Technical Personnel is required for the Plan execution during the coming two years.

6 Conclusions and Recommendations

- ✓Strengthen equipment and initiatives for productivity of the wells at the level of IEP.
- ✓Continue with the integral conceptualization studies of the portfolio of PAM at field and reservoir levels.
- ✓Accelerate the conceptualization of pilot projects to evaluate the IOR/EOR processes at the field level.
- ✓Undertake the studies of CO2 sources.
- ✓Execute the integral plan for organizational development to attract and develop medullar talent for IOR/EOR processes.
- ✓Develop centres of excellence for the optimizations of designs, investments and execution.

Thank you for your attention



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