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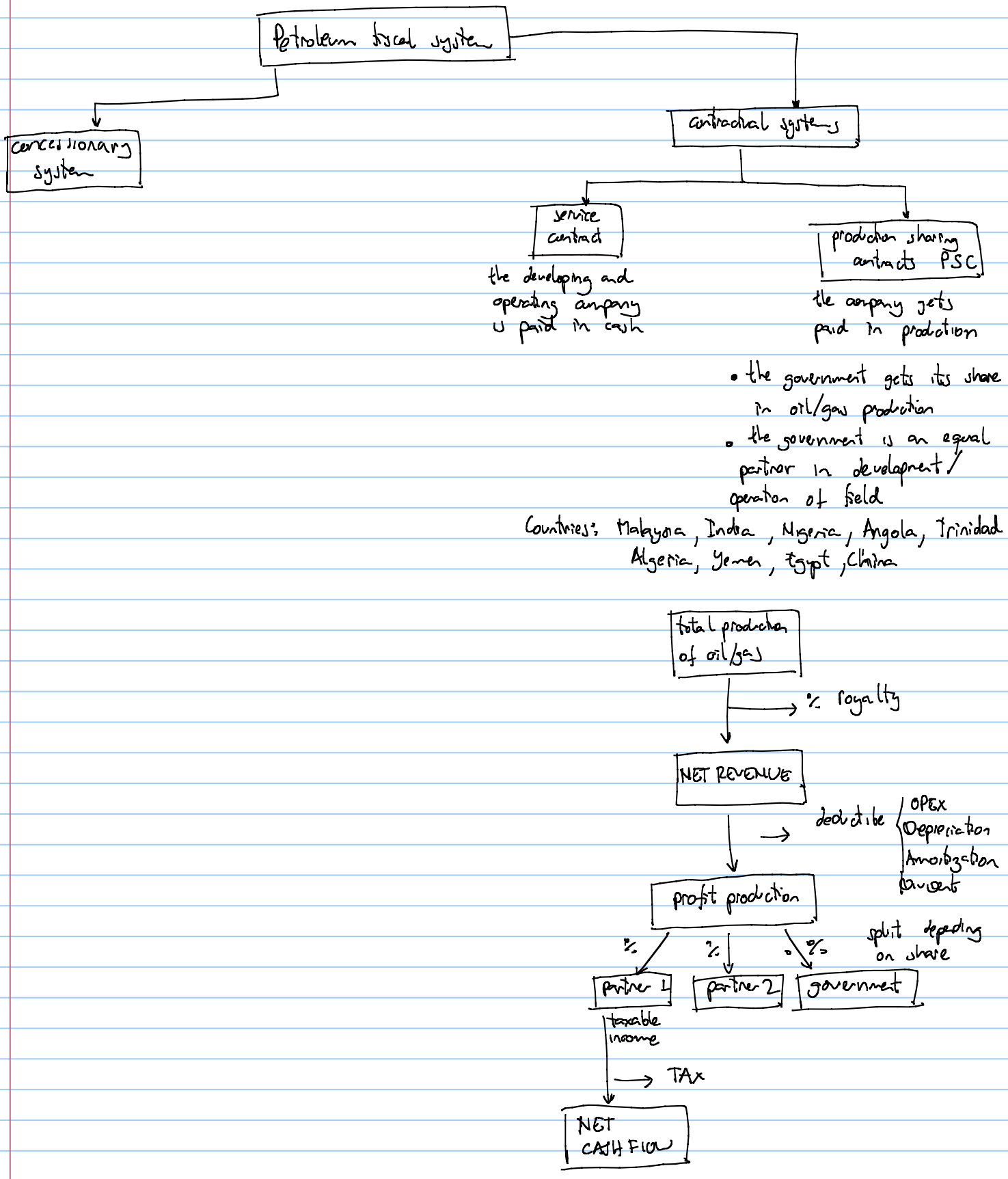

Petroleum fiscal system
concessionary system
contractual system
service contract
the developing and operating company is paid in cash
production sharing contracts PSC
the company gets paid in production
• the government gets its share in oil/gas production
• the government is an equal partner in development/operation of field
Countries: Malaysia, India, Nigeria, Angola, Trinidad, Algeria, Yemen, Egypt, China
total production of oil/gas
% royalty
NET REVENUE
deductibe
OPEX
Depreciation
Amortization
investment
profit production
split depending on share
partner 1
partner 2
government
taxable income
TAX
NET CASH FLOW

Net Present Value (NPV) { there must be a minimum of information to be able to compute NPV

project start: year 0

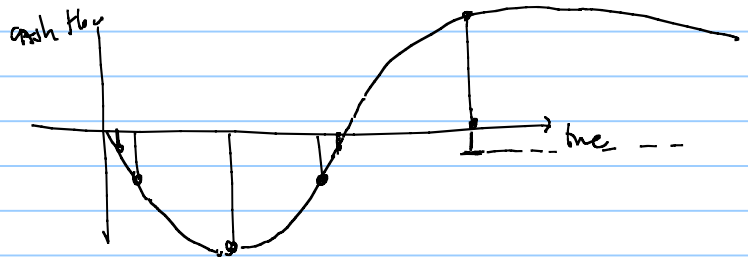
end of project year	CAPEX [usd]	DRILLEX [usd]	OPEX [usd]	ROYALTIES TAXES [usd]	q_o	USD/bbl	Revenues [usd]	CASH FLOW [usd]	discounted CASH FLOW
1			0		0			CF_1 = REVENUES − EXPENSES	$\frac{CF_1}{(1+i)^1}$
2			0		0			CF_2	
3			0		0			CF_3 10	
.			0		0				
.			0		0				
			(OPEX$_1$		q_0				
.			OPEX$_2$		q_0				
.					q_0				
N									Σ( )

N ← total number of years

$\frac{CF_1}{(1+i)^1}$ ← year measured from project startup

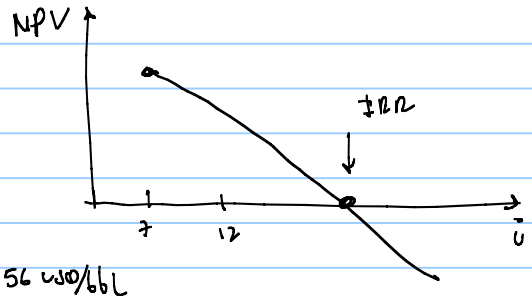
i ← discount rate (inflation)

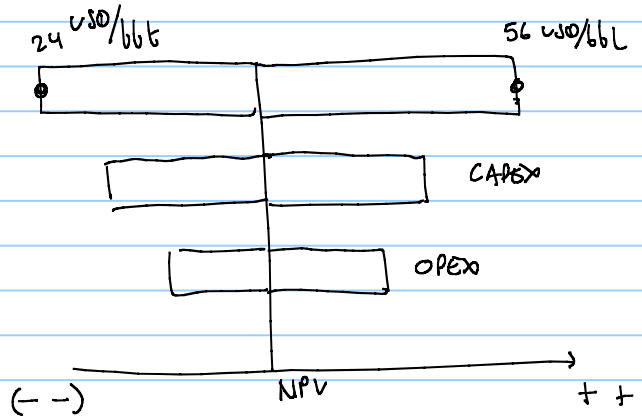
$$NPV = \sum_{j=1}^{N} \frac{CF_j}{(1+i)^j}$$



i depends on company { 6 – 10%

IRR internal rate of return is "i" that gives NPV = 0





take points from an existing plot:

https://automeris.io/WebPlotDigitizer/

Quantifying uncertainty using Monte-Carlo method

Probabilistic estimation of hydrocarbon volumes / total recoverable reserves

suggestion: read Hebron PDO

5 RESERVE ESTIMATES

5.1 Introduction

This section presents the range of hydrocarbon-in-place and recoverable resource estimates for the resources targeted in the initial development phase of the project. In-place and recovery estimates for the remaining resources are provided in Section 6.8 – Contingent Developments.

Oil in place: N, OOIP, IOIP
(OOIP: original oil in place; IOIP: initial oil in place)

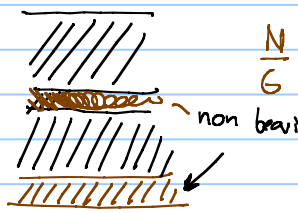
G, OGIP, IGIP

$\frac{N_{pu}}{N} = F_{Ru}$ ultimate recovery factor

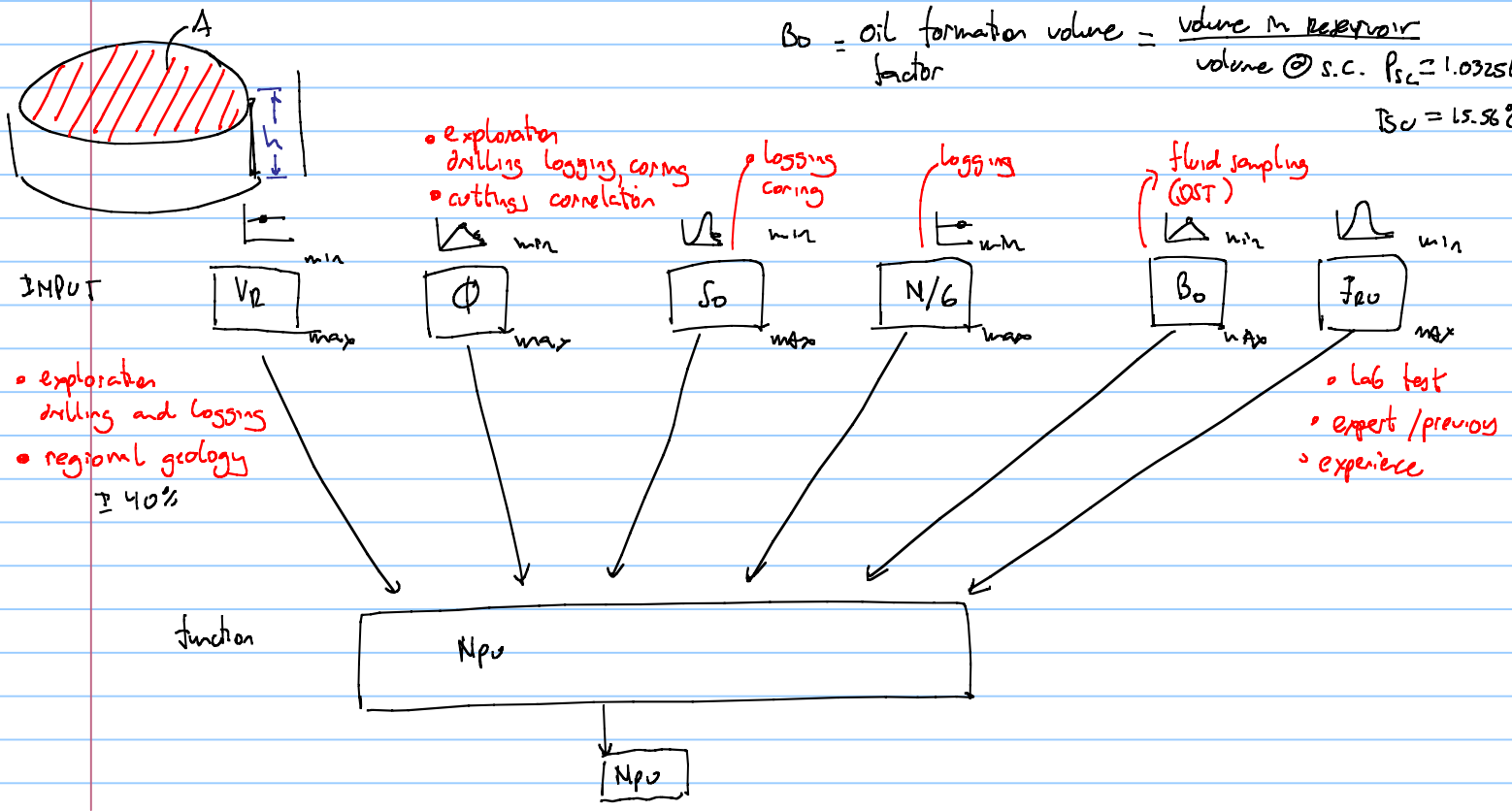
$F_{Ru} = \frac{G_{pu}}{G}$

$N_{pu} = TRR = \frac{V_R \cdot \phi \cdot S_o \cdot N/G \cdot F_{Ru}}{B_o}$ [Sm^3] [stb]

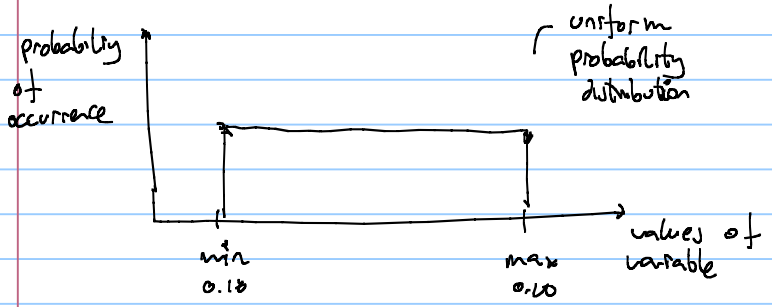
pore volume / total volume $(1-S_w)$; net to gross



B_o = oil formation volume factor = volume in reservoir / volume @ s.c. $P_{sc} = 1.03256 bar$, $T_{sc} = 15.56°C$

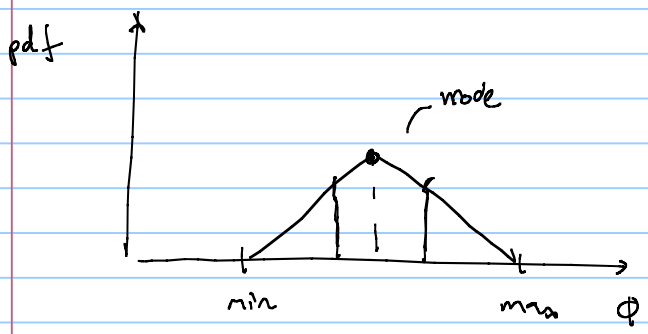


Usually we use a probability distribution function to describe the input parameters that are uncertain

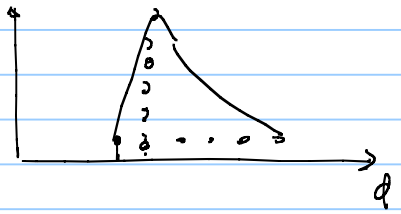


other types

triangle distribution



collecting more field data e.g. more exploration wells



- expert

Monte Carlo – steps

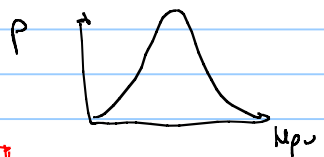
① Take a random sample of each input variable

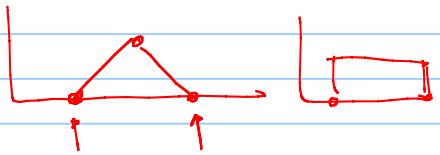
② Compute the N_{PV} (using the equation)

③ if N_{it} iterations $\leq N_{max}$ → else → ④ make frequency diagram (pdf) with the results saved

↓ then

save the result and repeat from ①





input output

nt	Φ [-]	V_R [bbl]	S_o [-]	B_o [bbl/stb]	N/G [-]	F_{RV} [-]	N_{PV} [stb]
1							compute N_{PV}
2							→ N_{PV}
3							
4							
5							
6							