

BOOK 1

OIL & GAS AND ENERGY GLOBAL ISSUES

A Toolbox to understand the world of Energy
in the Global Economy

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Professor TPA

July 2026





TPA

Sharing Experience

Building bridges between the oil industry and academic circles by delivering technical or business-related presentations by professors or experts.



Main References and Information Sources

Thanks for all courtesy documentation and pictures, in particular:

- Pierre René Bauquis
- UN, World Bank, IMF reports, CIA Factbooks
- IEA and OECD annual reports and statistics, DOE/EIA, IPCC (GIEC)
- BP Energy Outlook
- EI Statistical Review of World Energy
- Global Carbon Project
- PIW, SPE, ASPO, Jean Laherrère, WMK
- IGU, CEA, WNA, Mycle Schneider Consulting, NEA, WCA, IRENA, EWEA, Fraunhofer ISE
- OPEC Annual Stat. Bulletin, WOO
- TotalEnergies, ExxonMobil, Shell, ENGIE, IFPEN
- And other organisations.....



Abbreviations and Acronyms

ADEME	Agence de l'Environnement et de la Maîtrise de l'Énergie	IHS	Information Handling Services
AEO	Annual Energy Outlook	IMF	International Monetary Fund
ASB	OPEC Annual Statistical Bulletin	INSEE	Institut National des Statistiques et des Études Économiques
ASPO	Association for the Peak Oil	IPCC	International Panel for Climate Change
BRGM	Bureau de Recherches Géologiques et Minières	IRENA	International Renewable Energy Agency
CEA	Commissariat à l'Énergie Atomique et aux Énergies Alternatives	LCOE	Levelized Cost Of Electricity
CGDD	Commissariat Général au Développement Durable	NEA	Nuclear Energy Agency
CIA	Central Intelligence Agency	NOAA	National Oceanic & Atmospheric Administration
COP	Conference Of the Parties	NPD	Norwegian Petroleum Directorate
CT	Carbon Tax	NREL	National Renewable Energy Laboratory
DBEIS	Department for Business, Energy & Industrial Strategy	OECD	Organization for Economic Cooperation and Development
DNV	Det Norsk Veritas	OPEC	Organization of Petroleum Exporting Countries
DOE	Department of Energy	PIW	Petroleum Intelligence Weekly
EA	Euro Area	REN21	Renewable Now
ECB	European Central Bank	RTE	Réseau de Transport d'Électricité
EI	Energy Institute	SPE	Society of Petroleum Engineers
EIA	Energy Information Administration	UFIP	Union Française de l'Industrie Pétrolière
ESCB	European System of Central Banks	UN	United Nations
ETS	Emission Trading System	USGS	US Geological Survey
EU	European Union	WB	World Bank
EWEA	European Wind Energy Association now Wind Europe	WCA	World Coal Association
GIEC	Groupe Intergouvernemental pour l'Etude du Climat	WEO	World Energy Outlook
GWEC	Global Wind Energy Council	WEO	World Economic Outlook
IEA	International Energy Agency	WMK	WoodMcKenzie
IEF	International Energy Forum	WMO	World Meteorological Organization
IEO	International Energy Outlook	WNA	World Nuclear Association
IFP EN	Institut Français du Pétrole - Énergies Nouvelles	WNISR	World Nuclear Industry Status Report
IGU	International Gas Union	WOO	World Oil Outlook
IHA	International Hydropower Association		



OIL & GAS and ENERGY GLOBAL ISSUES

A Toolbox to understand the World of Energy in the Global Economy

The Toolbox is updated twice a year and benefits from the contributions of TPA Professors:

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BOOK 1

Projects Economic Evaluation and Investment Decision

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January 2026



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- 5. Project financing: impacts on project monitoring**



PART 1

Projects Economic Evaluation and Investment Decision

1 Introduction: what do we mean by « Project »



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- 2. Capital investment decision: theory and practice**
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- 4. Projects cost monitoring: how to organize it and why**
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What do we mean by « Project »

◆ « Project » is generally an investment program within the portfolio of a company, in accordance with its core strategy:

- Acquisition of new exploration acreage
- Drilling of an exploration prospect
- Oil & Gas Field development
- Pipeline construction
- Refinery construction
- Power Plant construction
- Wind Farm construction
- Solar Farm construction
- Hydroelectric dam construction
- Etc.....

This first category of projects contributes to « internal growth »

◆ « Project » can also mean the « acquisition » of assets from third parties or the acquisition of an other company (often called M and A activities for « Mergers and Acquisitions »)

This second category of projects contributes to « external growth ».



PART 2

Projects Economic Evaluation and Investment Decision

2 Capital investment decision: theory and practice



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1. Introduction: what do we mean by « Project »
2. Capital investment decision: theory and practice
3. Projects costs estimates: estimation and decision process
4. Projects cost monitoring: how to organize it and why
5. Project financing: impacts on project monitoring



Capital Investment Decision Which Economic Criteria?



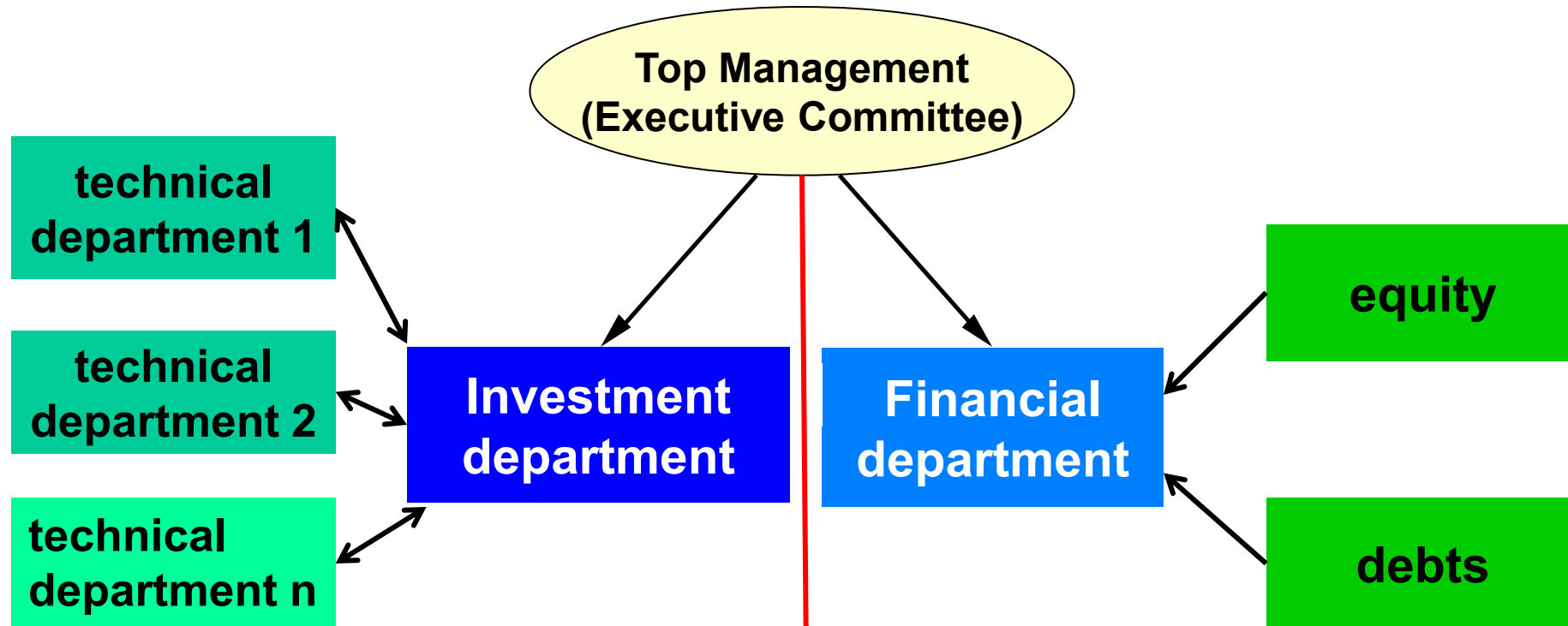
Who decides what, when and how - Basics 1

◆ Investment decision

- What projects to invest in ?
- What assets to purchase ?

◆ Financing decision

- What funds to use ?
- What costs of funds ?



Financing - Basics 2

Corporate finance

- ◆ All projects are assumed to have the same financial structure as the firm's
- ◆ Loans are warranted by the whole of the firm's assets

Project finance

- ◆ The project has a specific financial structure
- ◆ Financiers are not provided with recourse to the firm's general assets. They can only rely on the project's cash flows to be reimbursed.



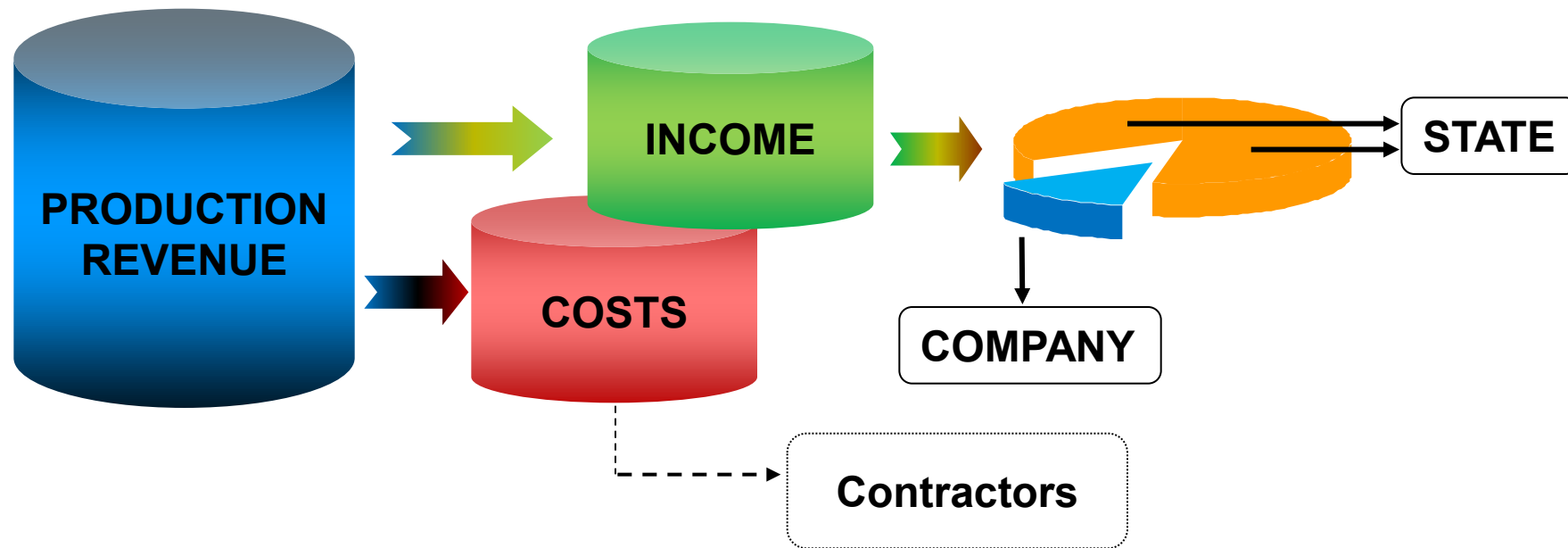
Economic criteria for large capital - Basics 3

- **NET PRESENT VALUE**
- PROFITABILITY INDEX
- **INTERNAL RATE OF RETURN**
- **PAY OUT TIME**
- FINANCIAL EXPOSURE



Fundamental economic and financial factors

$$\text{INCOME} = \text{REVENUE} - \text{COSTS}$$



CASH-FLOW

◆ **CASH-FLOW =**

REVENUS (PRODUCTION x PRICE)

Minus OPERATING EXPENSES (OPEX)

Minus INCOME TAX

Cash-Flow = MBA (Marge Brute d'Autofinancement)

REVENUS

OPEX

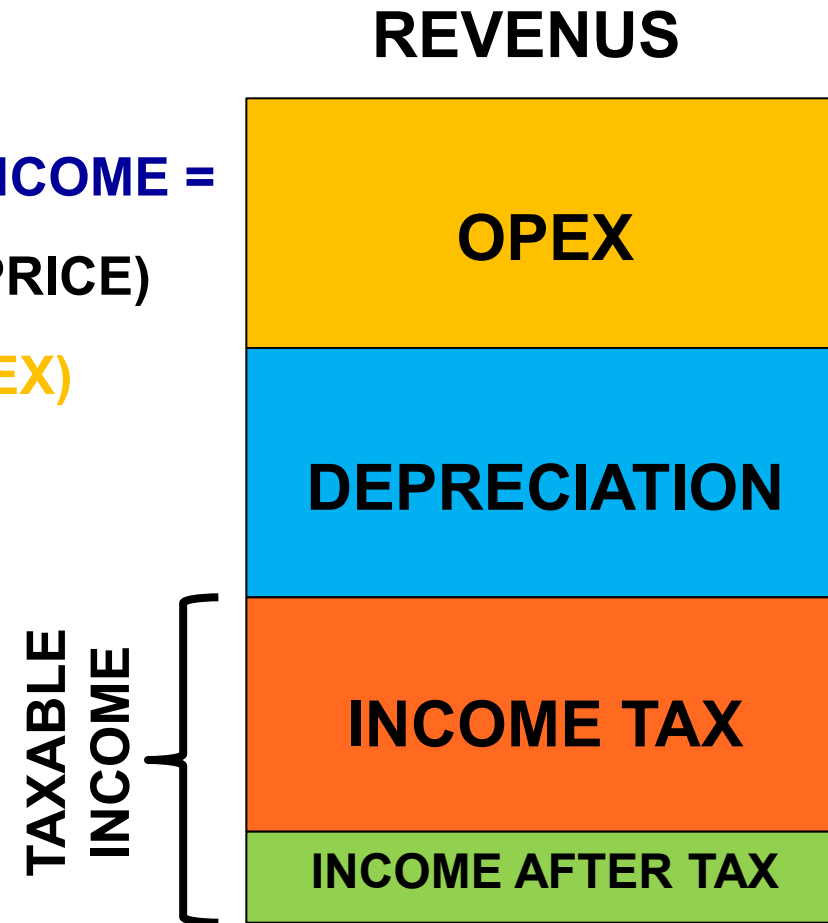
INCOME TAX

CASH-FLOW



INCOME TAX

- ◆ **INCOME TAX BASIS = TAXABLE INCOME =**
REVENUS (PRODUCTION x PRICE)
Minus OPERATING EXPENSES (OPEX)
Minus DEPRECIATION
- ◆ **INCOME TAX =**
TAXABLE INCOME x TAX RATE



NET CASH-FLOW

◆ **NET CASH-FLOW = CASH-FLOW - CAPEX**

REVENUS (PRODUCTION x PRICE)

Minus OPERATING EXPENSES (OPEX)

Minus INCOME TAX

Minus CAPITAL EXPENDITURES (CAPEX)

REVENUS

OPEX

INCOME TAX

CAPEX

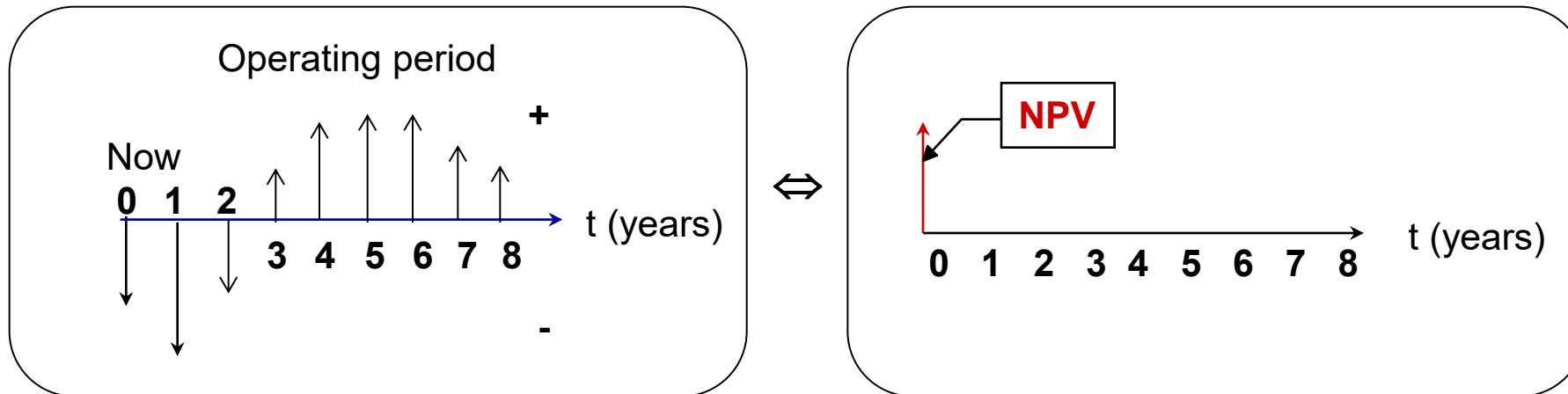
NET CASH-FLOW



NPV : Net Present Value

NPV = Discounted Net Cash-Flow (DNCF)

- ◆ **NPV = amount available now equivalent to all the net cash-flows generated by the project during its lifetime**



- ◆ **NPV = algebraic sum of the discounted Net Cash-Flows (F_k)**

$$NPV(i) = \sum_{k=0}^n \frac{F_k}{(1+i)^k}$$

i = Discount Rate



Discounting (1)

- ◆ THE INITIAL ASSUMPTION OF A PERFECT CAPITAL MARKET
- ◆ FOR A COMPANY WITH A SINGLE SOURCE OF CAPITAL: THE ASSUMPTION OF A PERFECT CAPITAL MARKET IS NOT NECESSARY.
- ◆ MULTIPLE SOURCES OF FUNDS: THE USE OF AN AVERAGE COST OF CAPITAL.



Discounting (2)

- ◆ ASSUMPTION: FUTURE IS KNOWN WITH CERTAINTY
- ◆ THERE IS A SINGLE INTEREST RATE: ANY AGENT CAN LEND OR BORROW ANY AMOUNT AT RATE i .
 - SOMEONE LENDING OUT THE SUM S_0 IN YEAR 0 WILL HAVE:

$S_0(1+i)^n$ in year n

- CONSEQUENTLY, A CASH FLOW F_n IN YEAR n IS EXACTLY EQUIVALENT TO THE FOLLOWING SUM TODAY:

$$PV = F_n / (1+i)^n$$



IRR = Internal Rate of Return

- ◆ IRR = value of the discount rate at which the NPV of the project is equal to 0

$$\text{NPV(IRR)} = \sum_{k=0}^n \frac{F_k}{(1 + \text{IRR})^k} = 0$$

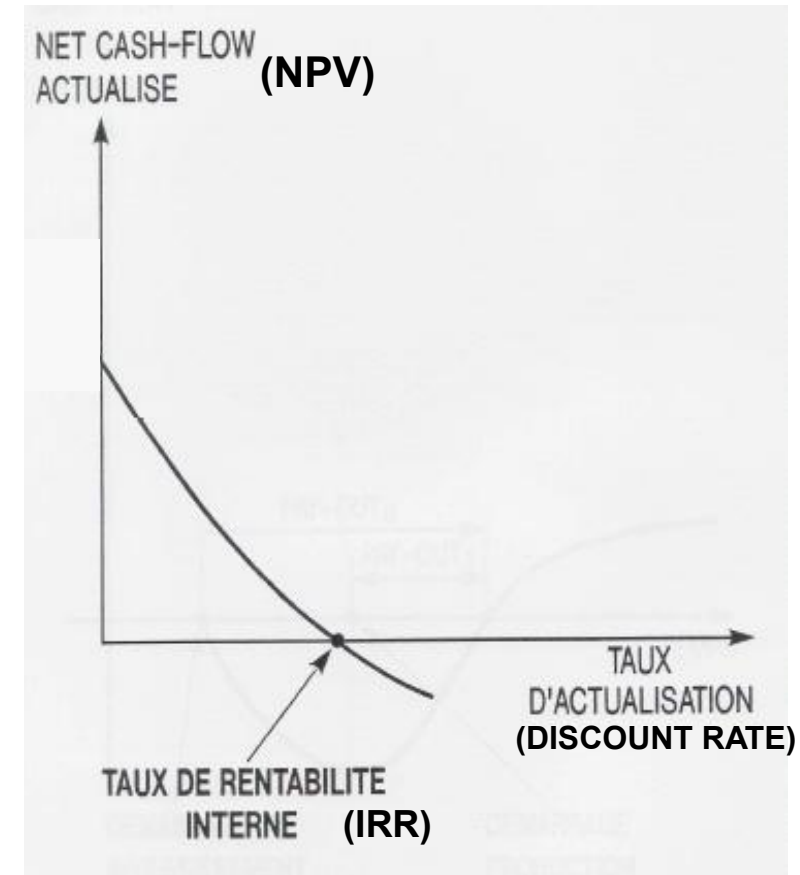
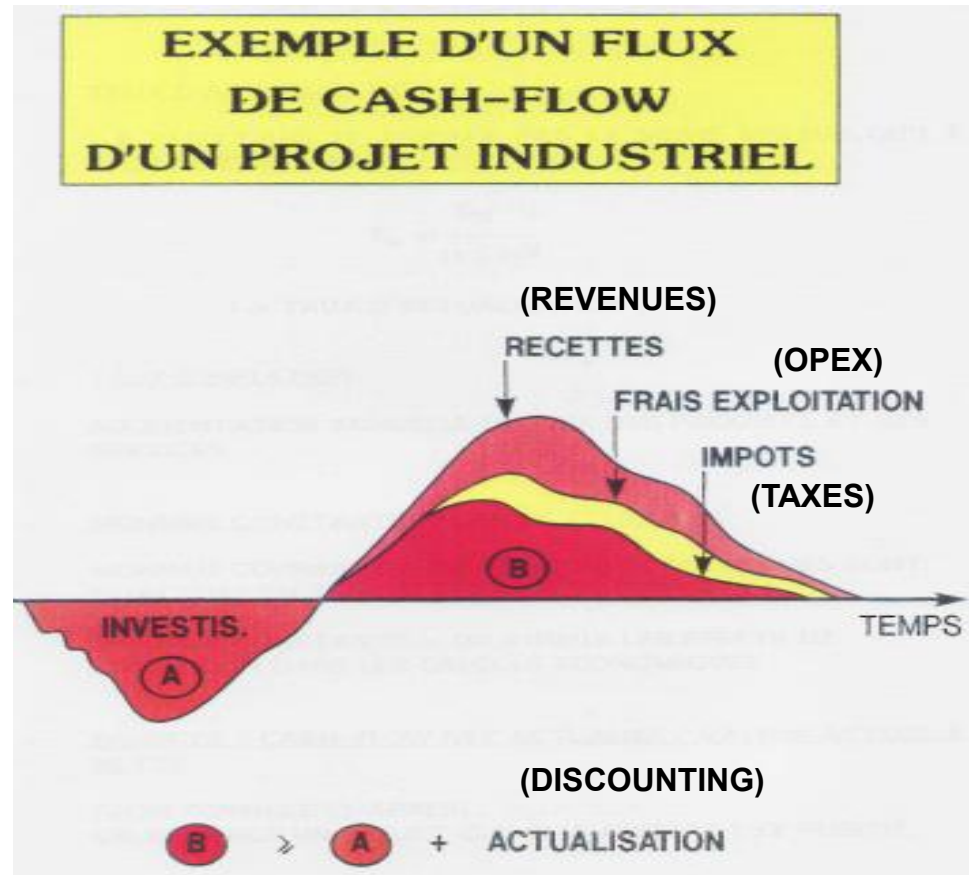
If NPV = 0

The cash receipts from the project are sufficient to:

- pay the operating expenses
- pay the relevant taxes to the host state
- repay the investment outlay
- remunerate it at a rate exactly equal to the discount rate



Net Cash - Flows schedule & Internal Rate of Return for an industrial project



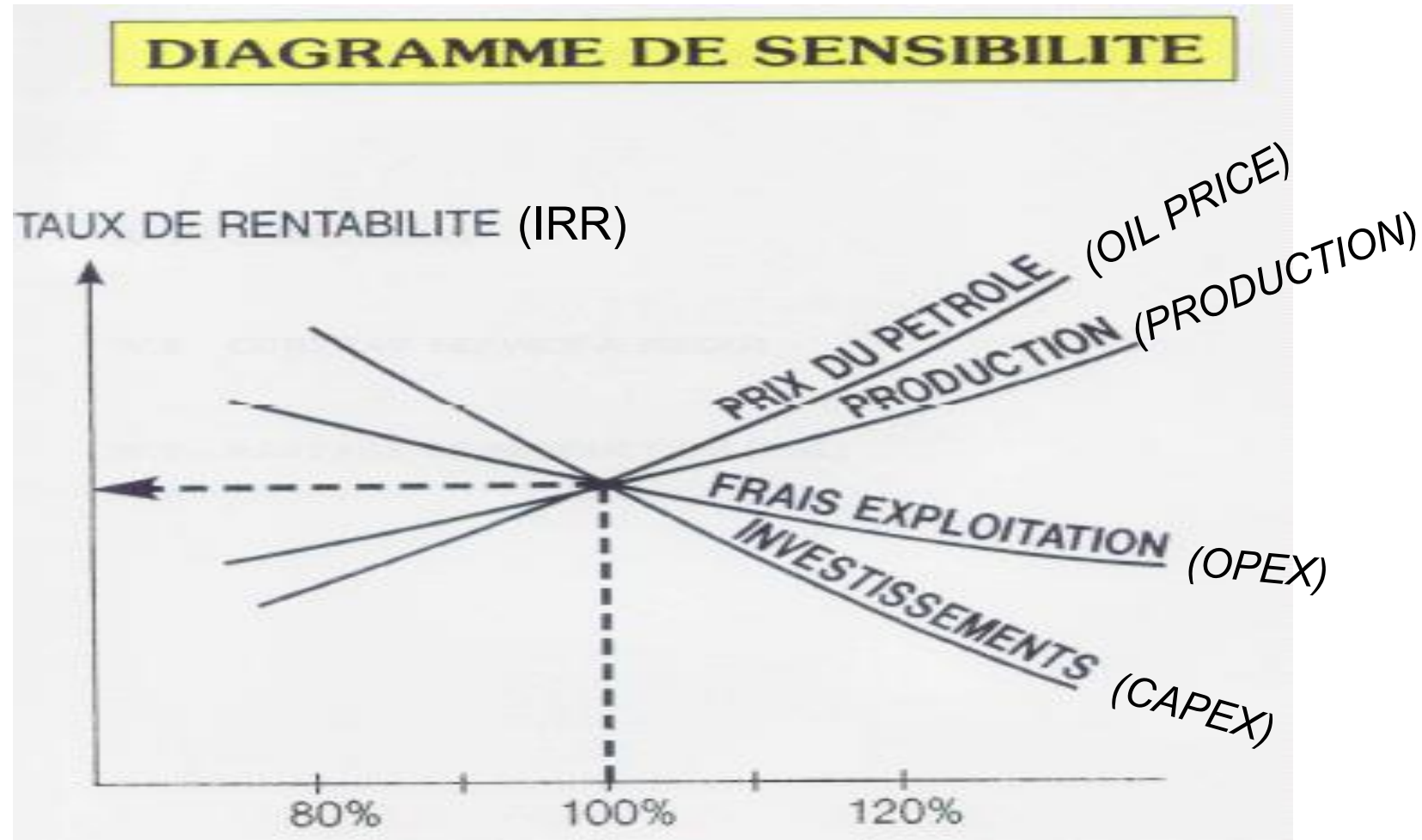
Taux d'actualisation: Discount Rate

Net cash-Flow actualisé: Discounted Net Cash-Flow = Net Present Value (NPV)

Taux de rentabilité interne = Internal Rate of Return (IRR)



Sensitivity Analysis Diagramme



100% corresponds to the Base Case



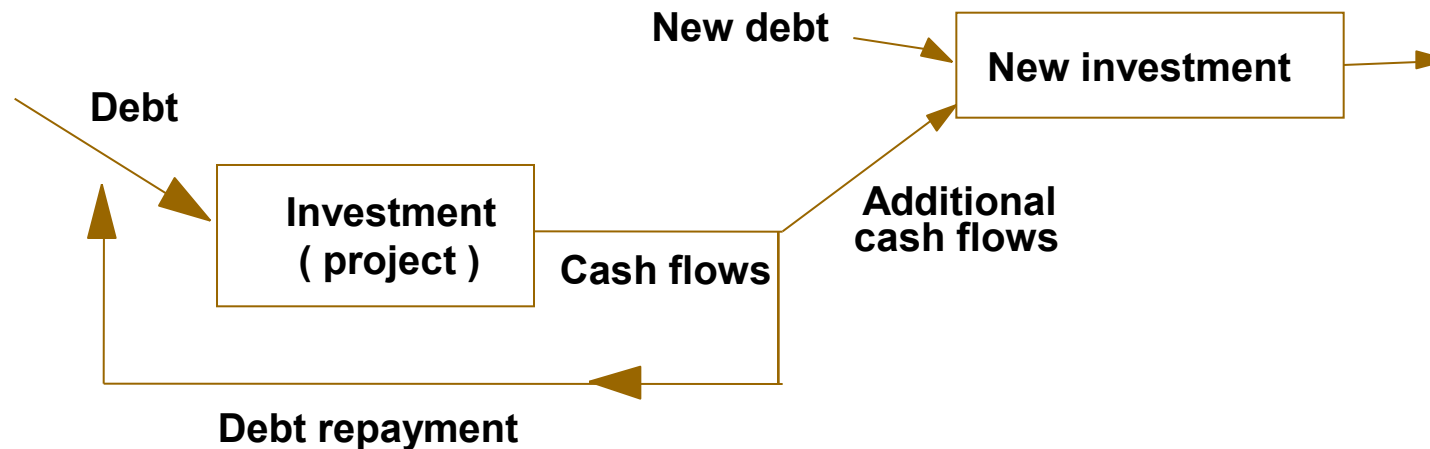
The case of a firm facing a unique source of capital (1)

- ◆ **A PERFECT CAPITAL MARKET: AN UNREALISTIC ASSUMPTION, BUT USEFUL FOR THE PURPOSE OF ECONOMIC CALCULATIONS.**
- ◆ **NEVERTHELESS, THE FIRMS SELDOM USE CAPITAL MARKETS TO LEND OR INVEST MONEY.**
- ◆ **WE HERE CONSIDER A FIRM:**
 - **WITH DEBT THROUGHOUT THE PERIOD CONSIDERED**
 - **WITH UNLIMITED ACCESS TO BORROWING (AT RATE i)**



The case of a firm facing a unique source of capital (2)

- ◆ THIS FIRM WILL FINANCE ITS INDUSTRIAL INVESTMENTS BY BORROWING (THE DISCOUNT RATE IS THE COST OF CAPITAL i).
- ◆ ADDITIONAL CASH FLOWS PRODUCED BY PROJECTS CAN BE USED TO FINANCE NEW INVESTMENTS INSTEAD OF INCURRING NEW DEBT



- ◆ THESE ADDITIONAL CASH FLOWS ALLOW THE FIRM TO SAVE INTEREST RATE i (ON A SAME AMOUNT OF DEBT). THUS THEY HAVE A YIELD EQUAL TO THIS RATE i .



Multiple sources of capital

- ◆ **TO RAISE FUNDS, FIRMS CAN ISSUE NEW SHARES, LOANS, BONDS ...
IT IS ASSUMED THAT :**
 - THE COST OF EACH REMAINS CONSTANT OVER TIME
 - THE BALANCE BETWEEN THEM REMAINS THE SAME
- ◆ **UNDER THESE ASSUMPTIONS, THE MARGINAL COST OF CAPITAL (RELEVANT FOR NEW INVESTMENTS) EQUALS THE WEIGHTED AVERAGE COST OF CAPITAL (WACC).**
- ◆ **THE FIRM'S DISCOUNT RATE IS THEN ITS AVERAGE COST OF CAPITAL.**



The Weighted Average Cost of Capital

- ◆ **COST AT WHICH AN “INVESTMENT DIVISION” CAN OBTAIN FUNDS FROM THE “FINANCE DIVISION”.**
- ◆ **IT ALLOWS A SEPARATION OF FINANCING AND INVESTMENT DECISIONS.**
- ◆ **BY USING AN AVERAGE, WE IMPLICITLY ASSUME A SPECIFIC COST FOR EACH SOURCE OF CAPITAL.**
- ◆ **THIS IS PARTLY DUE TO A DIFFERENT RISK EXPOSURE FOR SHAREHOLDERS AND LENDERS.**
- ◆ **THIS APPROACH SHOULD BE APPLIED TO PROJECTS WHOSE RISK EQUALS THE AVERAGE RISK THE FIRM HAS TO FACE.**



Economics calculations - Methodology

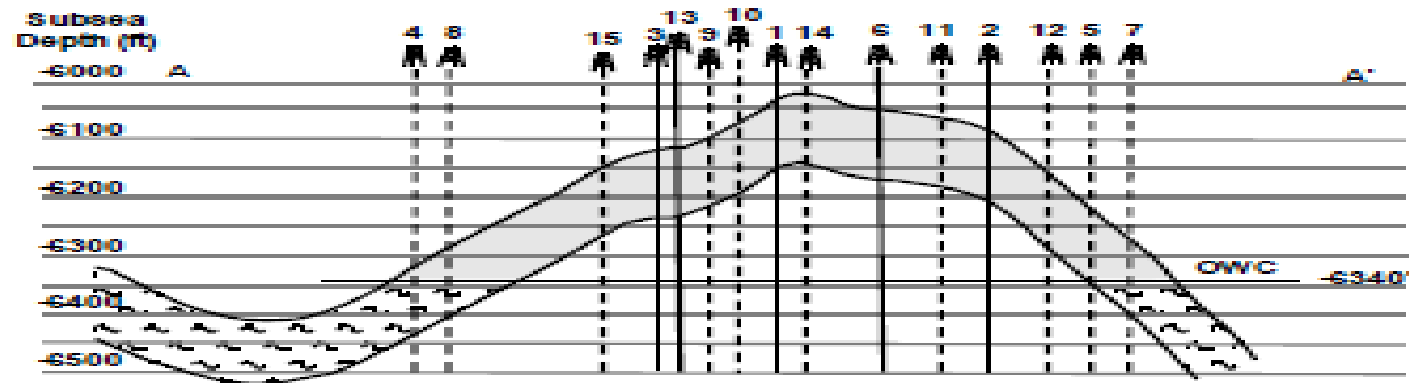
- **The discount rate is the Weighted Average Cost of Capital. Implicitely, it includes the potential political risk.**
- **Calculations are usually made in current money (with an assumption for inflation on costs and prices)**
- **Normally, one assumes the application of notional financial interests to take into account the tax effect of the interests deductibility (Shadow interests)**
- **The NPV and IRR are then calculated on the deflated Net-cash-flows schedule.**



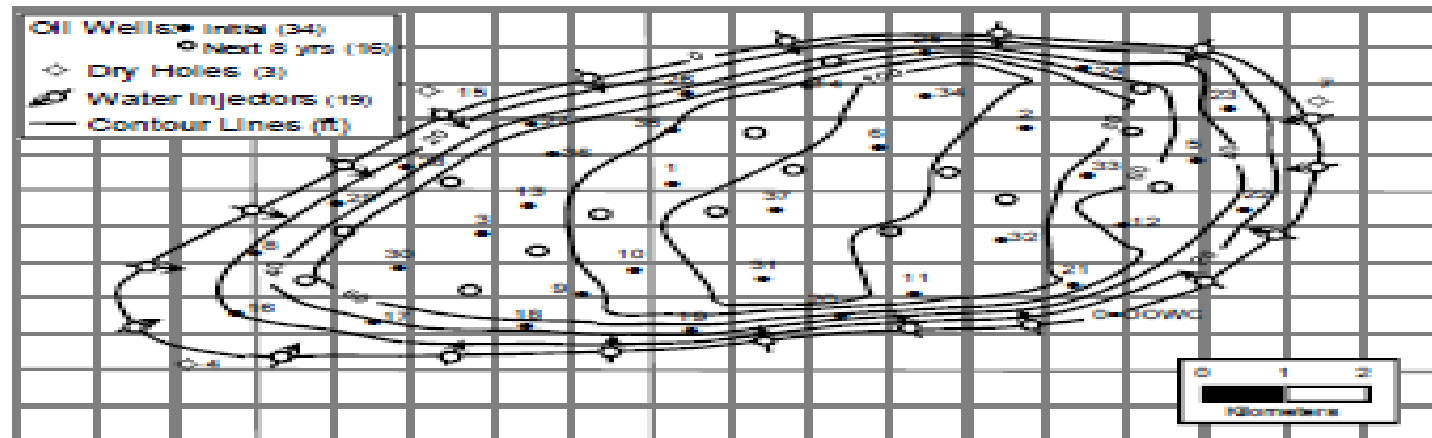
Basic Data for Investment Decision in the Oil & Gas Industry



A typical cross section and isochore map for a petroleum field



(a) Structural Cross Section AA' (not to scale horizontally)



(b) Net pay isochore map and depiction of wells for initial development plan and beyond

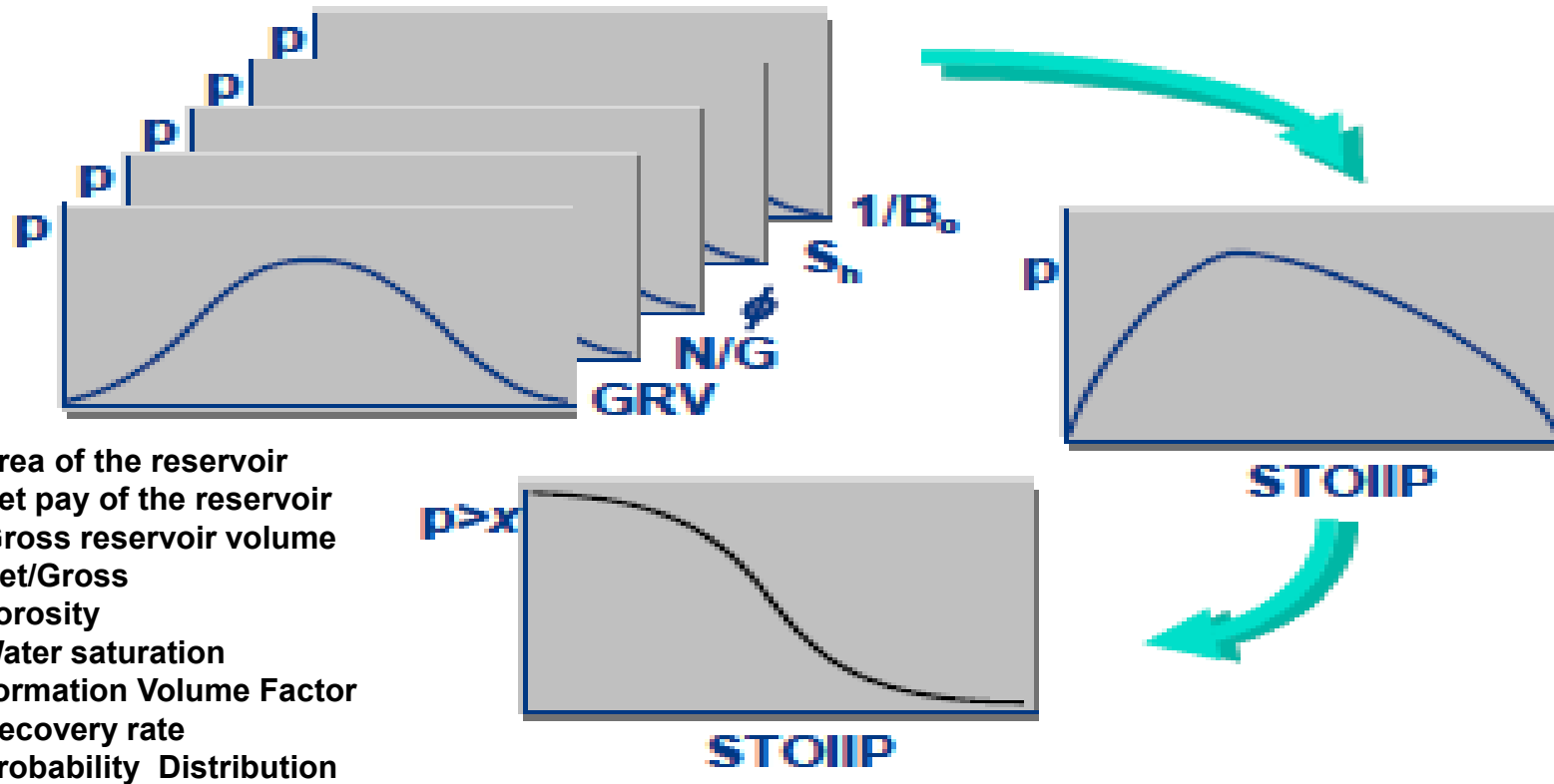


Estimate of recoverable reserves

Petroleum Initially In Place (PIIP) = $S \times h \times \Phi \times (1-S_w) \times 1/B_0$

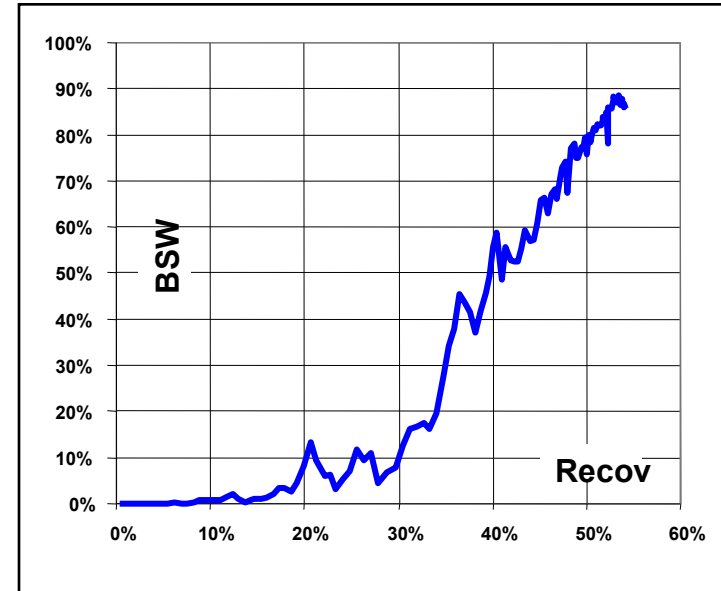
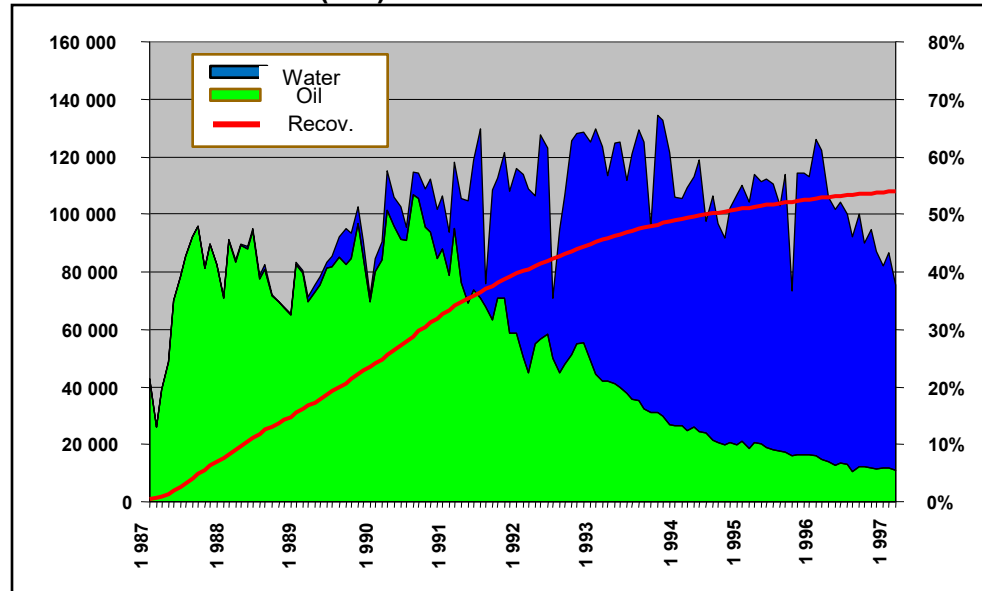
Recoverable reserves = $\tau \times \text{PIIP}$

The reserves calculation can be subject to Monte - Carlo simulation

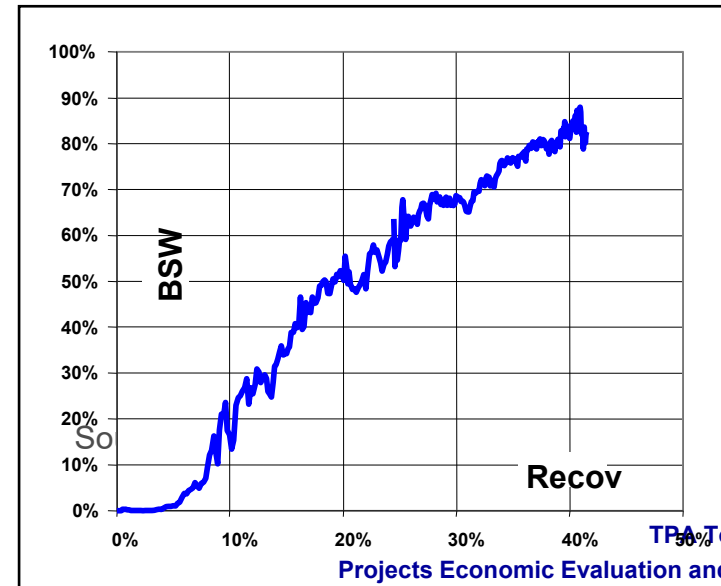
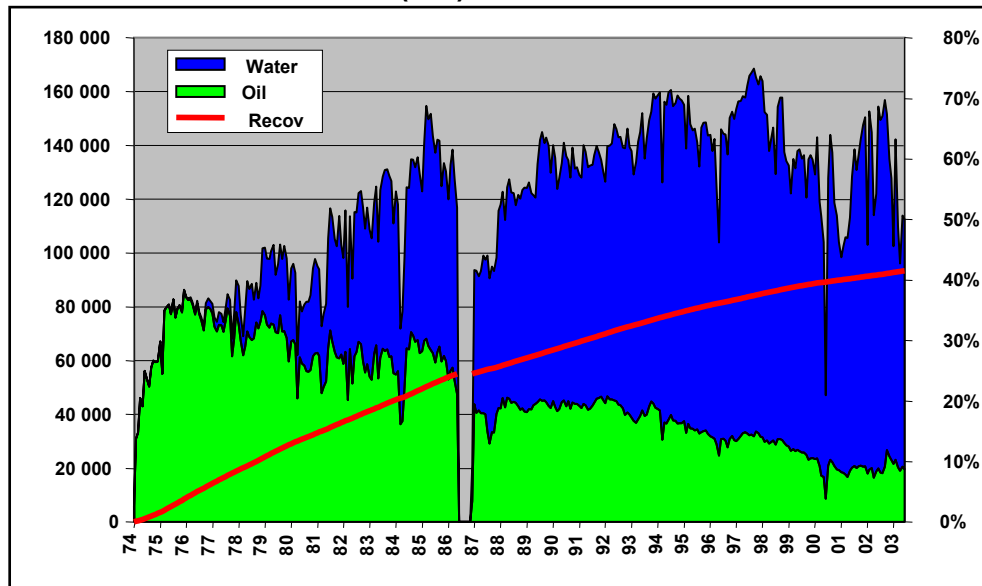


From resources to reserves : production profiles liquids

North Sea clastics (b/d)



Middle East carbonates (b/d)



BSW: Basic Sediment & Water





Contractual aspects The impact of Taxation



The Basics for Oil & Gas E&P Contracts

- ◆ In general, the Natural Resources belong to the Host State.
- ◆ One exception: in the US, the subsoil belongs to the owner of the soil.
- ◆ Before any works, the Company must get the rights to explore and exploit from the Host State.
- ◆ Different procedures for a Contract assignment:
 - 1) Negotiation by mutual agreement
 - 2) International invitation for bidding (Exploration Rounds,....)
 - 3) Transfert of interest in a petroleum field: Approval from the government is necessary



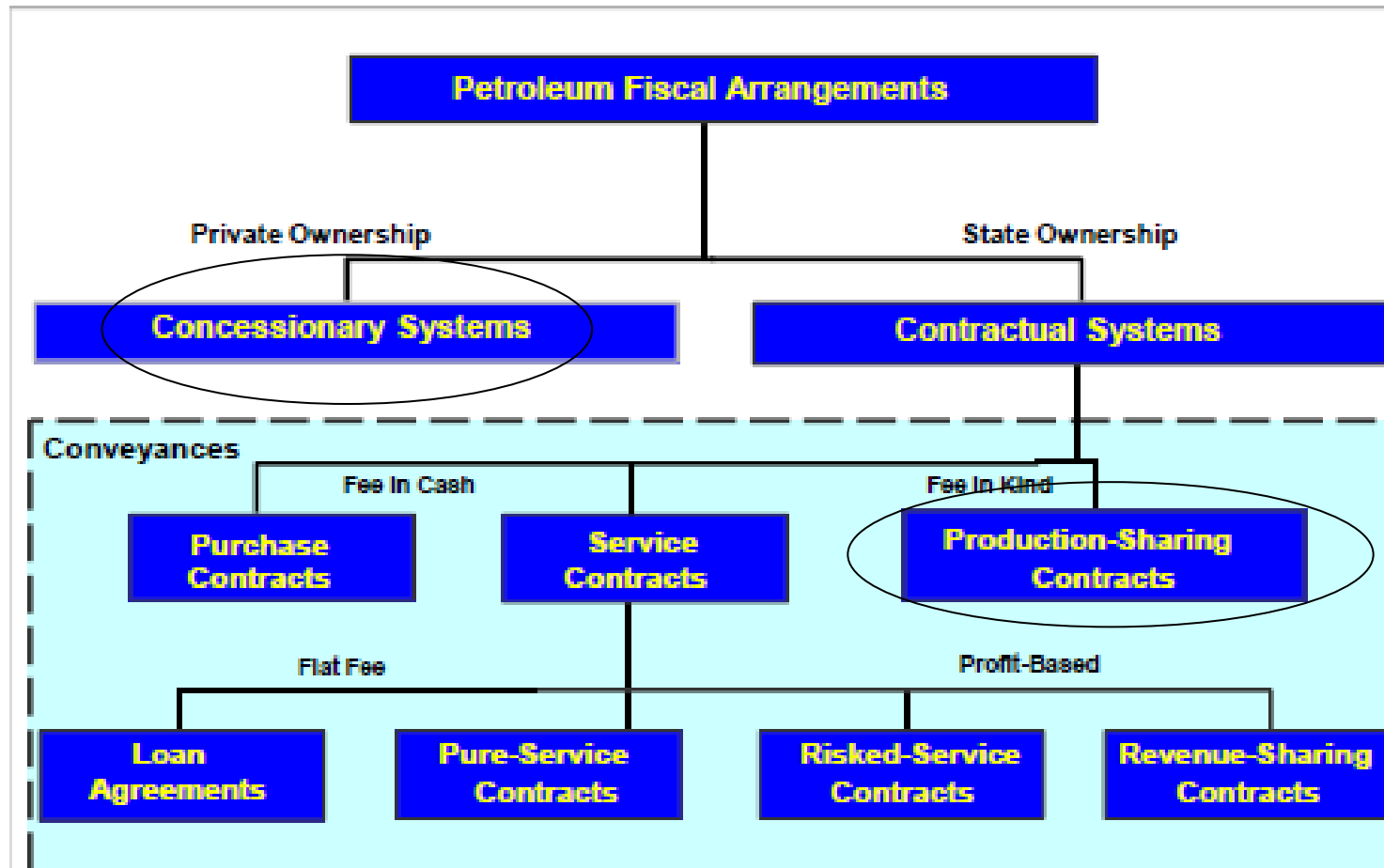
The Basics for Oil & Gas E&P Contracts

◆ Common provisions for Petroleum Contracts

- 1) Definition of the Area
- 2) The different periods of the Contract
- 3) The obligations during the Exploration period (Work Programme,...)
- 4) The obligations during the Production period
- 5) The treatment of Associated Gas



The contractual & fiscal framework



The contractual & fiscal framework

Two main Contracts:

- **The Concession Agreement**
- **The Production Sharing Contract (PSC) or Production Sharing Agreement (PSA)**



The Concession Agreement - Generalities

- **Contract by which the State grants to the Company exclusive mining rights for Exploration, Development and Production.**
- **The Company finances the operations, holds the extracted products, is bound by certain contractual obligations, pays the relevant taxes to the State.**
- **The installations are the property of the Company. At the end of the exploitation, the installations will normally be dismantled.**

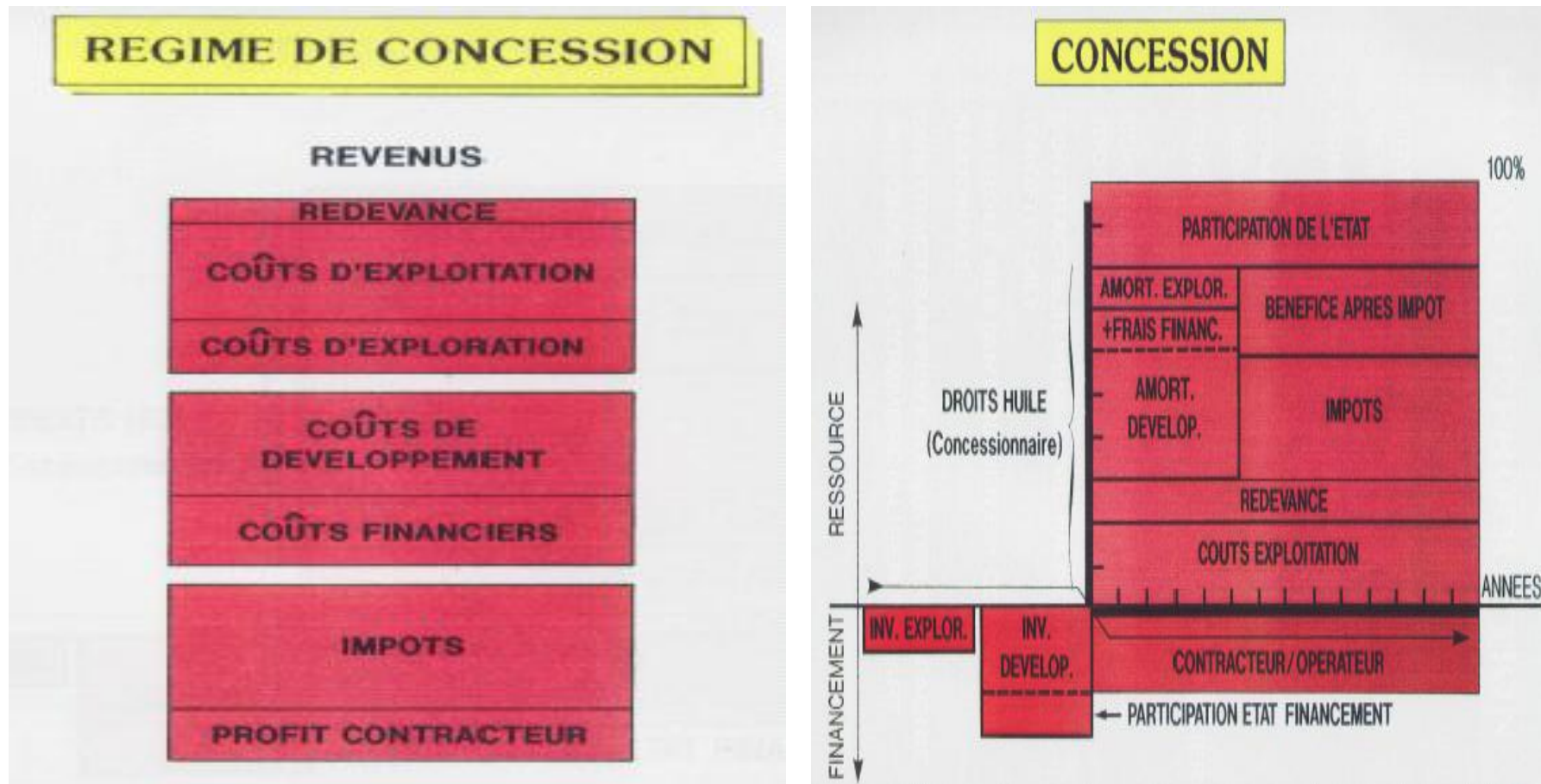


The Concession Agreement – Taxation Rules

- **Payment of a Signature bonus**
- **Payment of Royalties (Redevances) on Production**
- **Payment of Income Tax**



General scheme of a Concession Contract

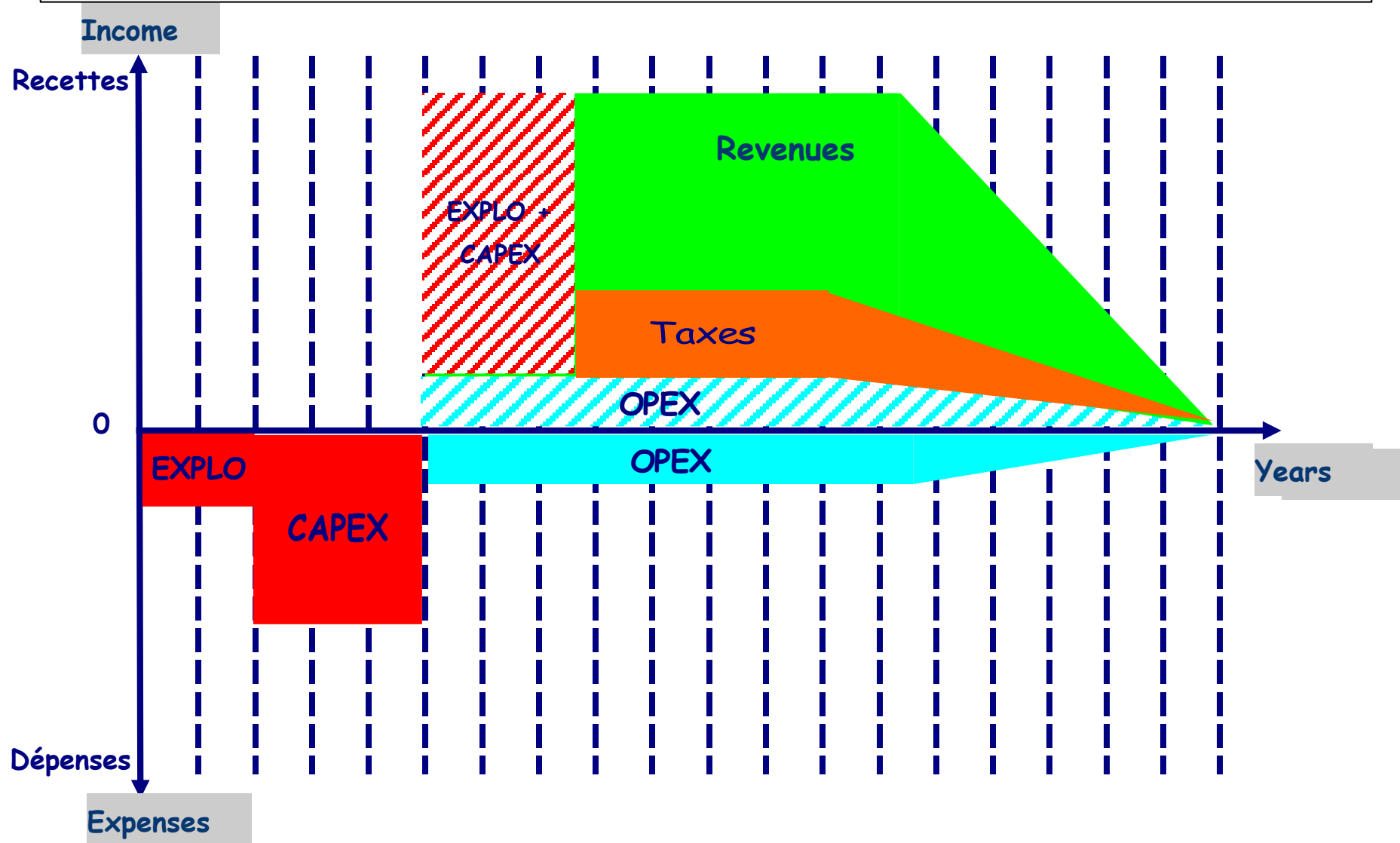


Extract of a presentation to Oil General Managers, Ministers and Civil Servants – Moscow 1991



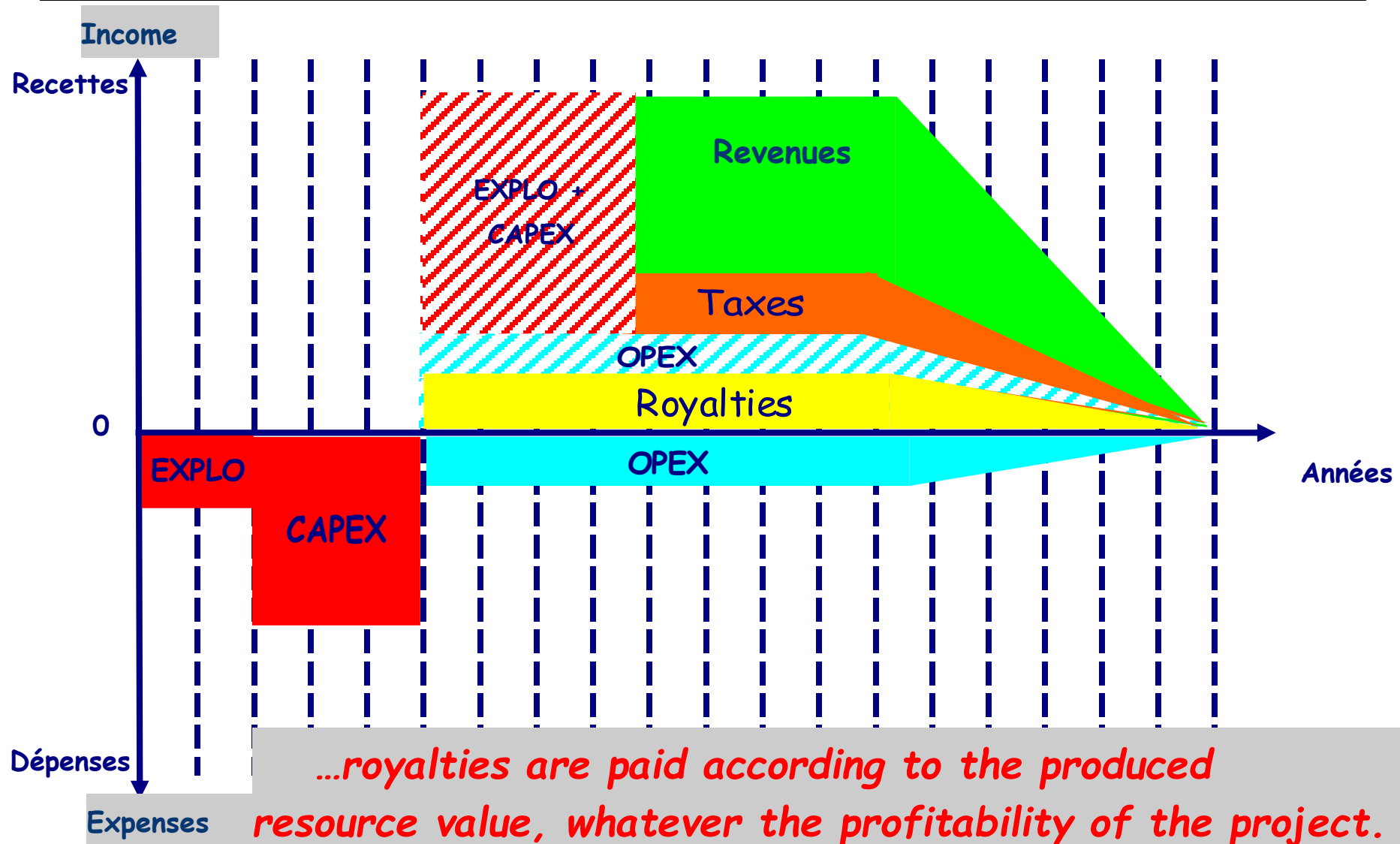
The Concession Agreement – Taxation Rules

Without Royalties



The Concession Agreement – Taxation Rules

With Royalties



Example of Countries Where Concession Contracts apply

- **Most of OECD Countries**
- **Angola (Onshore blocks)**
- **Cameroon**
- **Gabon**
- **Nigeria**
- **Argentina**
- **Brazil**
- **Colombia**
- **Abu Dhabi**
- **Russia,....**



The Production Sharing Contract - Generalities

- **Contract by which the State which keep the ownership of the mineral rights entrusts the Company to explore, develop and extract the resources in exchange for a remuneration in kind (Share of Production). Gas can be kept by the State and be developed by another company.**
- **The Company supports the risk, finances the operations, is bound by certain contractual obligations, pays the relevant taxes to the State.**
- **The installations are the property of the State. The costs are recoverable through Cost-Oil. At the end of the exploitation, the installations will normally be dismantled.**

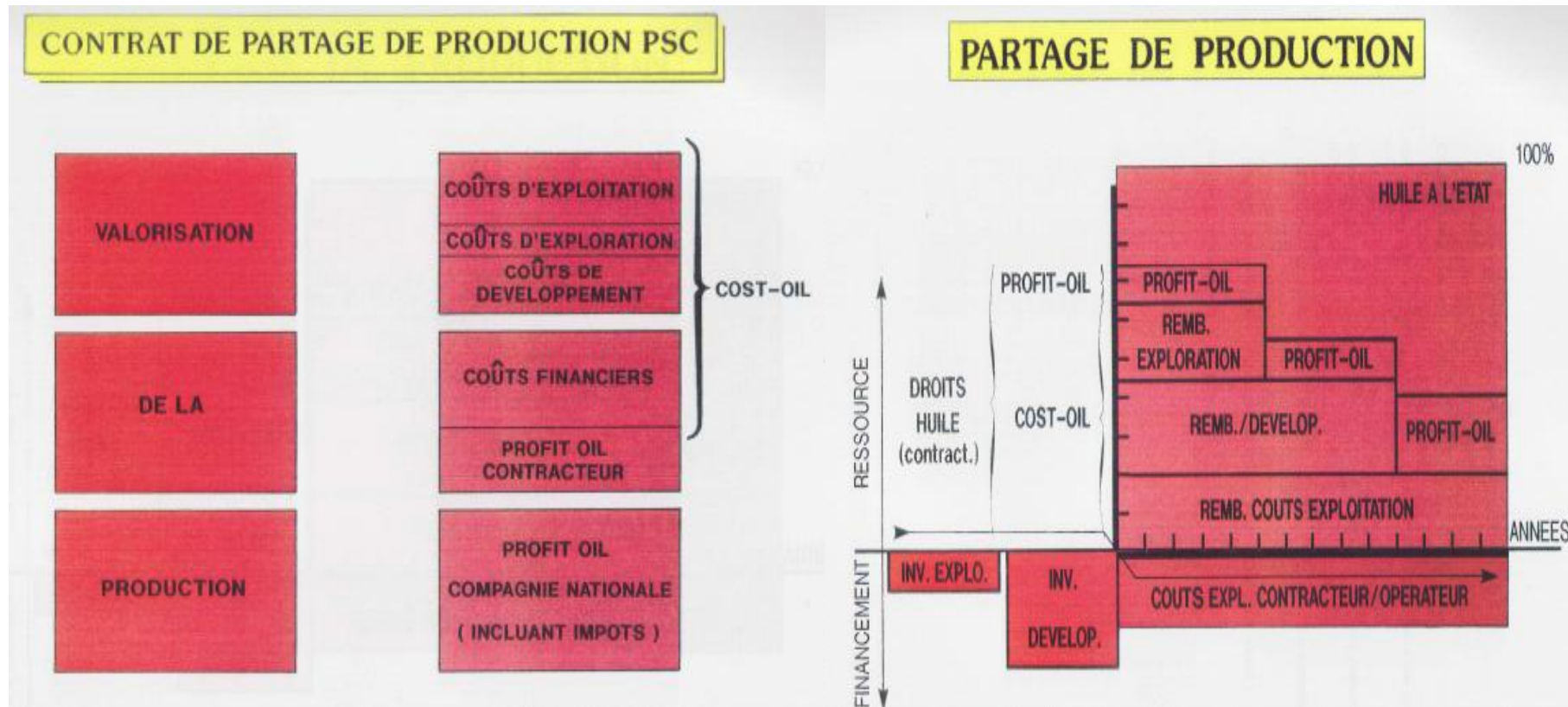


The Production Sharing Contract – Taxation Rules

- **The Cost-Oil covers recoverable expenses of Exploration, Development and Production**
- **The Profit-Oil is the share of Production affected to the remuneration of the Company (Contractor)**
- **Payment of Income Tax either in cash or in kind (Depending upon the structure of the Profit-Oil)**
- **The PSA stipulates the types of expenses which are supposed to be recoverable**



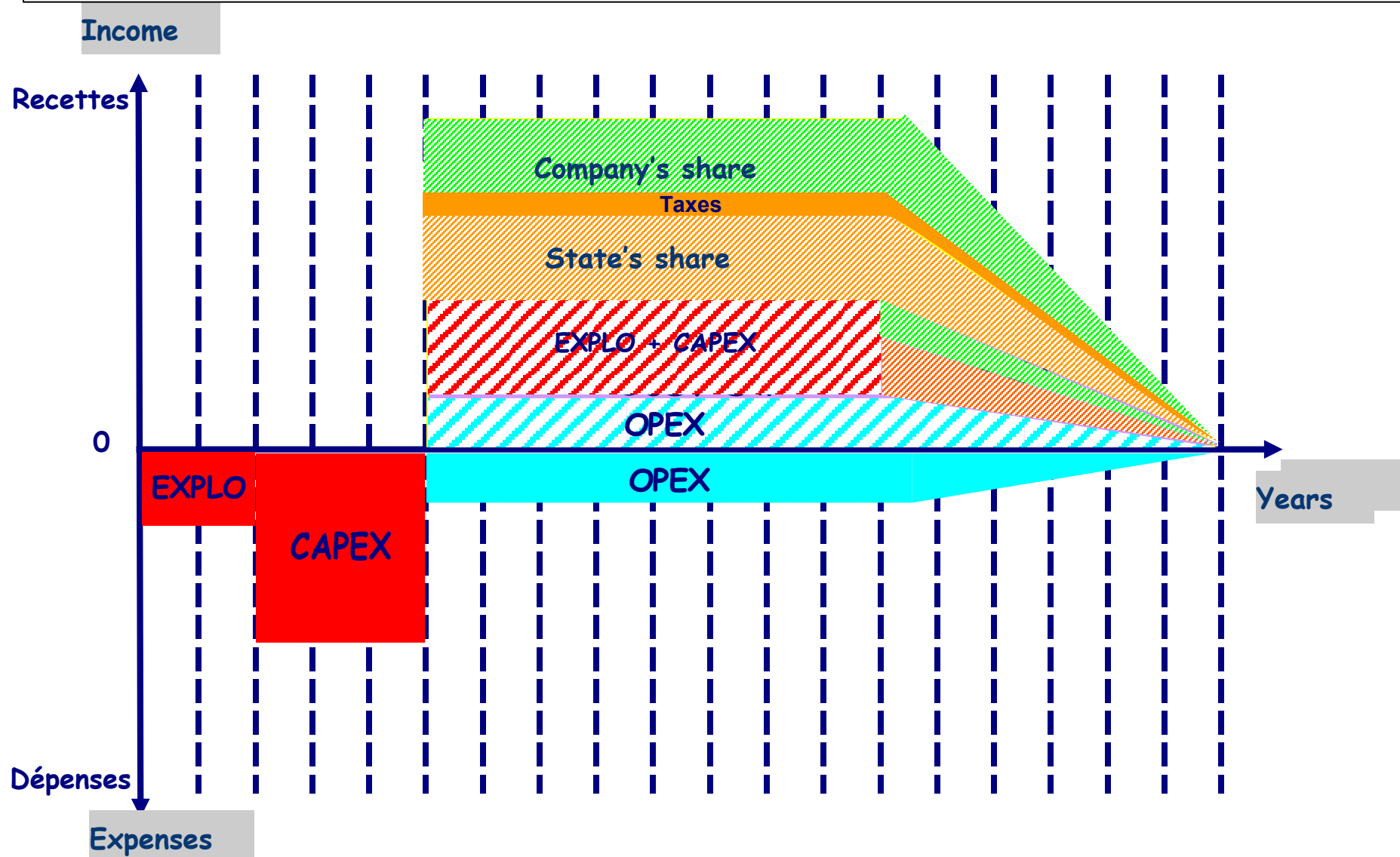
General scheme of a Production Sharing Contract



Extract of a presentation to Oil General Managers, Ministers and Civil Servants – Moscow 1991



The Production Sharing Contract – Taxation Rules



PSA – Price effect (Example - no royalty)
When Oil Price increases, access to Oil for Company decreases

Price of Oil: p

Production: Q

Revenue = $p * Q$

Yearly Cost: C (Opex + Depreciation)

Profit Oil total (\$) = $POt = p * Q - C$

Profit Sharing (%): X for Company, $1-X$ for the State

Profit Oil Company (\$) = $X * POt = X * (p * Q - C)$

Profit Oil State (\$) = $(1-X) * POt = (1-X) * (p * Q - C)$

Profit Oil Company (barrels) = $X * POt / p = X * (p * Q - C) / p$

Profit Oil State (barrels) = $(1-X) * POt / p = (1-X) * (p * Q - C) / p$



PSA – Price effect (Example - no royalty)

When Oil Price increases, access to Oil for Company decreases

$$\text{Access to Oil for Company (barrels)} = X \cdot (p \cdot Q - C) / p + C / p = X \cdot Q + (1 - X) \cdot C / p$$

$$\text{Access to Oil for State (barrels)} = (1 - X) \cdot (p \cdot Q - C) / p = (1 - X) \cdot Q - (1 - X) \cdot C / p$$

Example 1:

Production:
50000 b/d = 18,25 Mb/year

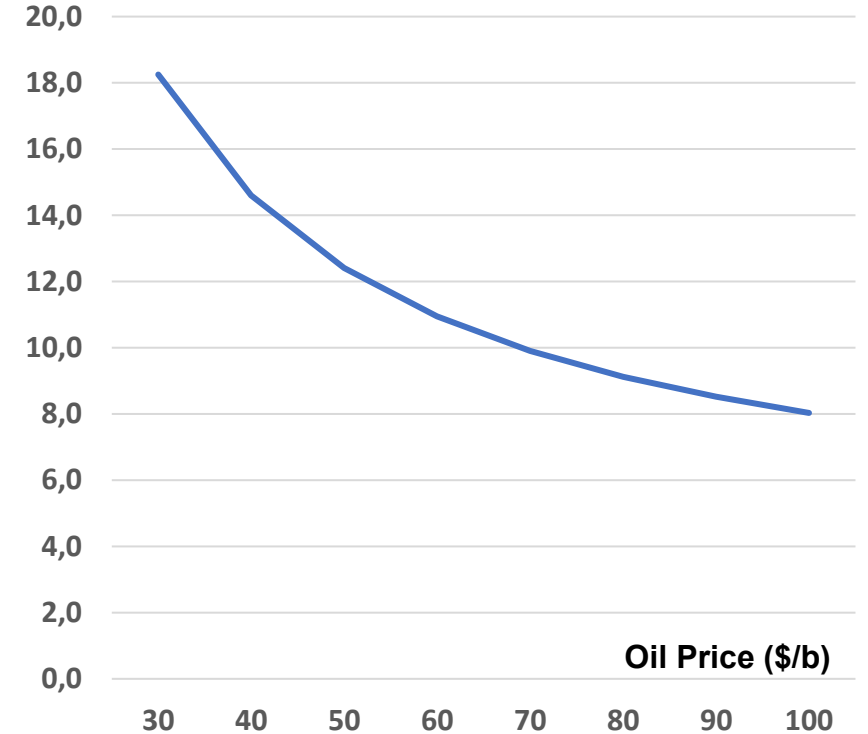
Yearly cost:
30\$/b = 547,5 M\$/year

(Yearly costs consist of
Opex + Depreciation)

Profit Oil split:
Company: 20%
State: 80%

Oil Price (\$/b)	Access to Oil Comp. (Mb)	Total Revenues (M\$)	Cost Oil(CO) (M\$)	Profit Oil (PO) (M\$)	PO Company (M\$)	CO+PO Comp (M\$)	PO State (M\$)
30	18,25	547,5	547,5	0,0	0,0	547,5	0,0
40	14,60	730,0	547,5	182,5	36,5	584,0	146,0
50	12,41	912,5	547,5	365,0	73,0	620,5	292,0
60	10,95	1095,0	547,5	547,5	109,5	657,0	438,0
70	9,91	1277,5	547,5	730,0	146,0	693,5	584,0
80	9,13	1460,0	547,5	912,5	182,5	730,0	730,0
90	8,52	1642,5	547,5	1095,0	219,0	766,5	876,0
100	8,03	1825,0	547,5	1277,5	255,5	803,0	1022,0

Access to Oil (Mb)



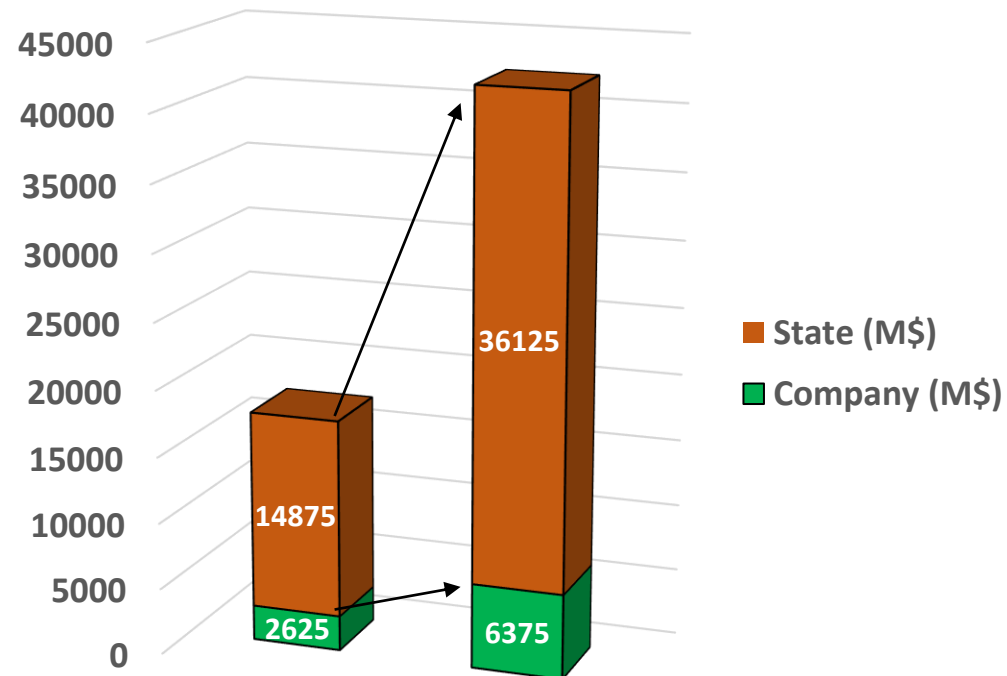
PSA – Price effect (Example - no royalty)

When Oil Price increases, access to Oil for Company decreases

Example 2: PSA applicable to an Oil field – Reserves = 500 Mb

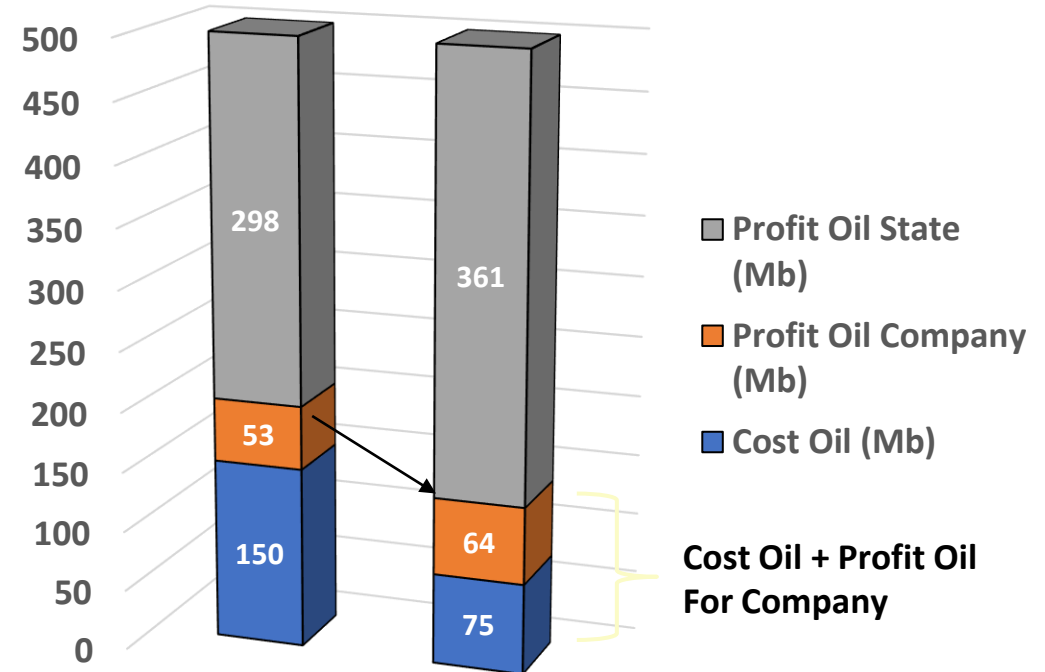
Capex + Opex = 7500 M\$ (15\$/b) - Profit Sharing: Company = 15%/State = 85% - Price of Oil: 50 \$/b and 100 \$/b

(M\$) 50 \$/b 100 \$/b



Profit Sharing

(Mb) 50 \$/b 100 \$/b



Cost Oil + Profit Oil
For Company

Oil Sharing



Example of Countries Where Production Sharing Contracts apply

- **Indonesia**
- **China**
- **Qatar**
- **Syria**
- **Yemen**
- **Egypt**
- **Russia**
- **Kazakhstan**
- **Angola**
- **Brazil,....**

In some countries, both types of Contracts may exist.

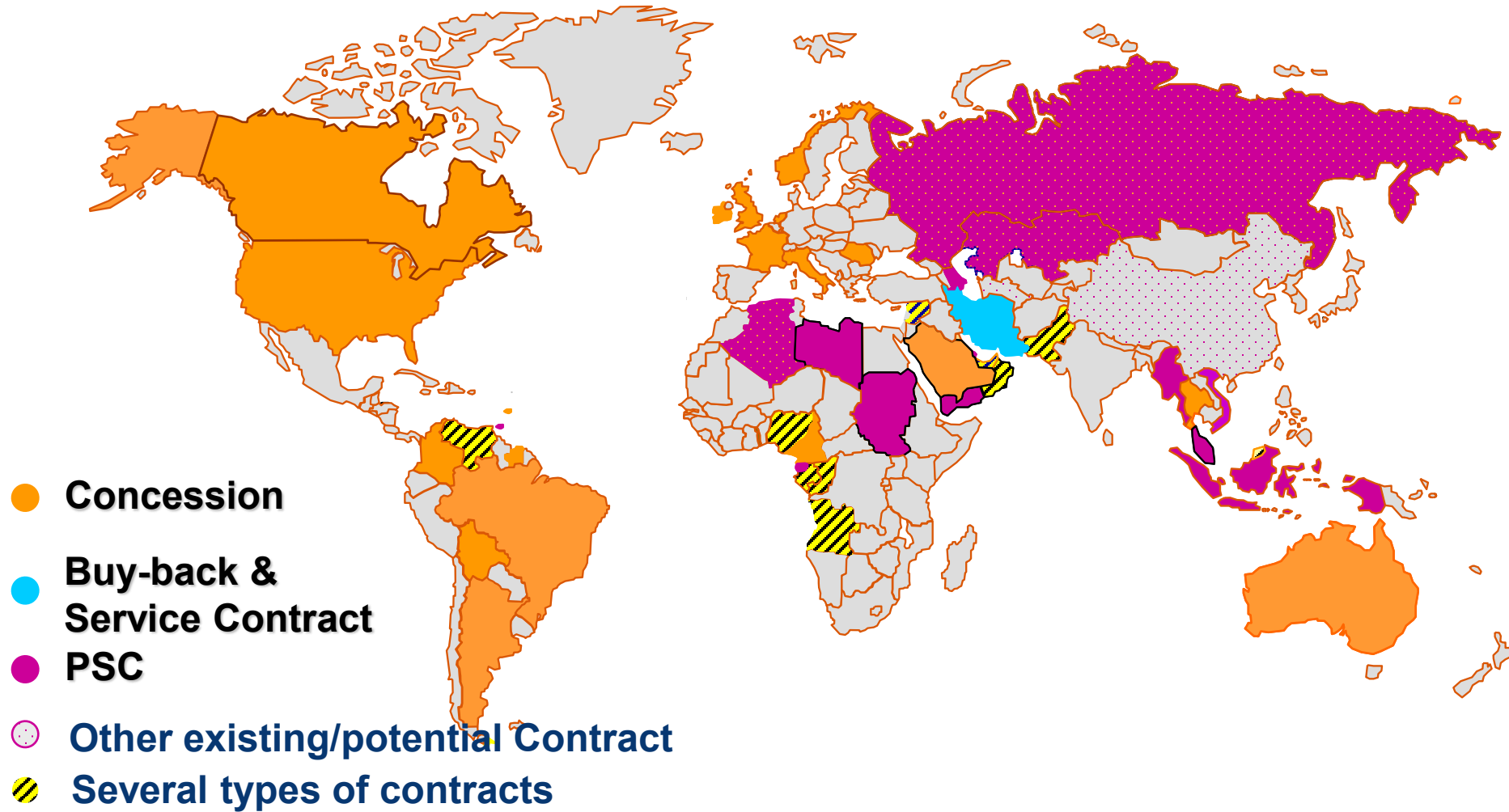


Other Types of Contracts

- **The Service Contract at risk:** The Company finances the Exploration expenses. In case of discovery, the Company finances the Development expenditures, is reimbursed of its expenses from the project's cash-flow and is remunerated in cash.
- **The Buy-Back Contract:** The Company finances the Development and Production expenditures, is reimbursed of its expenses from the project's cash-flow and is remunerated in cash.
- **The Technical Assistance Contract:** the Company finances the Development, is reimbursed of its expenses according to specific conditions and receives a fee.

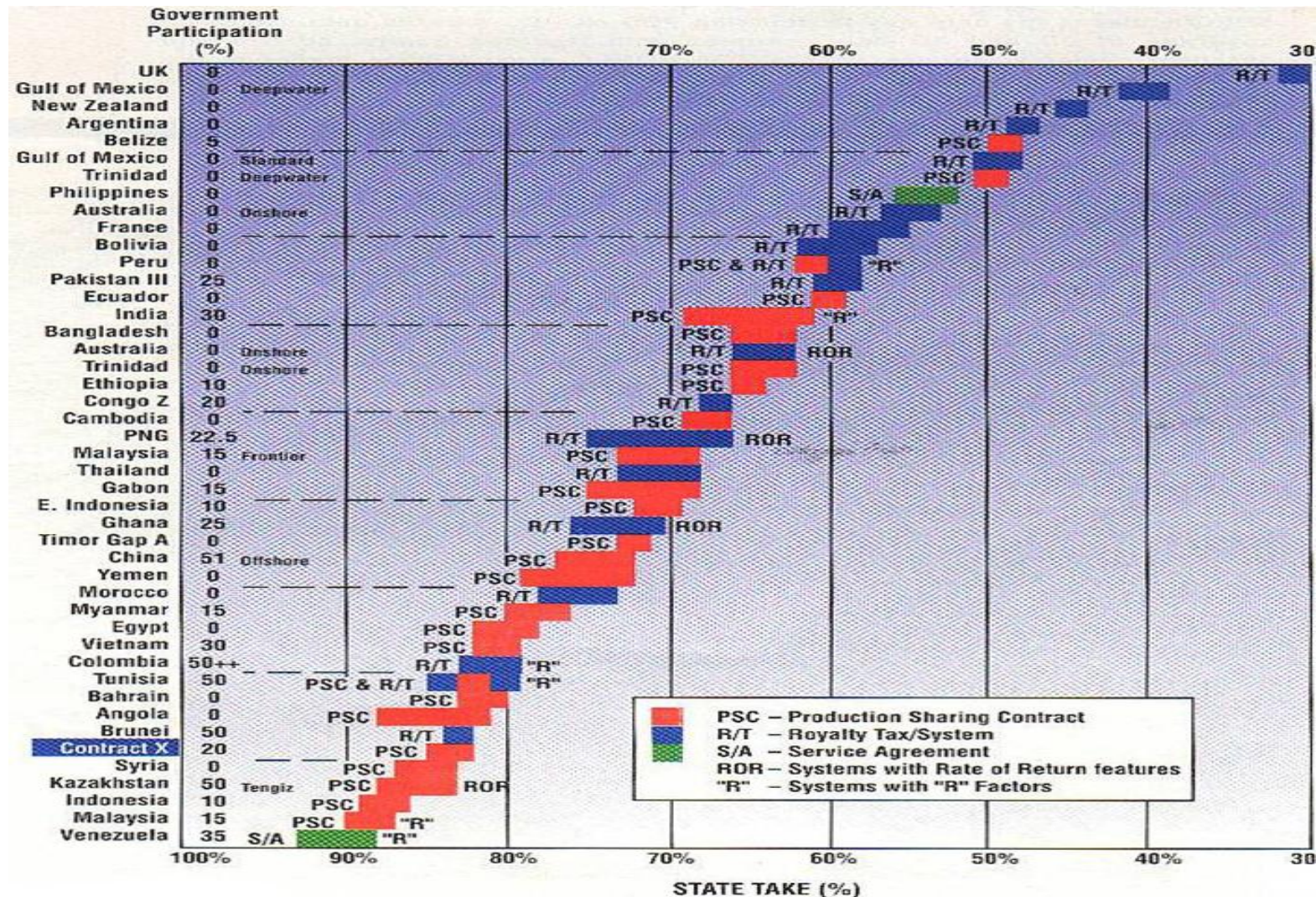


**Contract diversity at Total
(Past and current situations)**



Division of profit worldwide (« state take »)

The figures may change from time to time



Economic calculations, One example



Preliminary Notes

For Oil & Gas projects economic evaluation, assumptions on the level of Reserves is of prime importance.

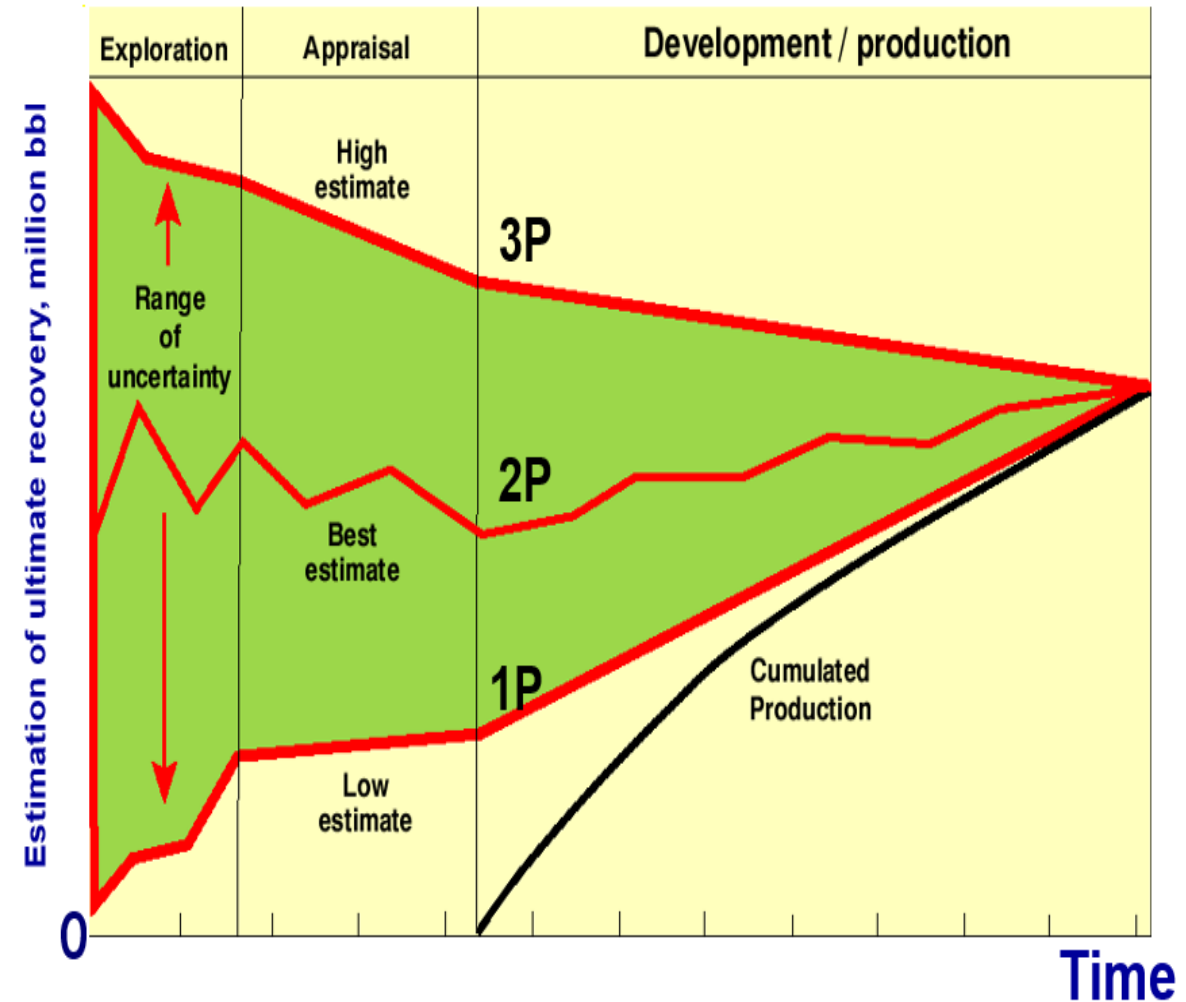
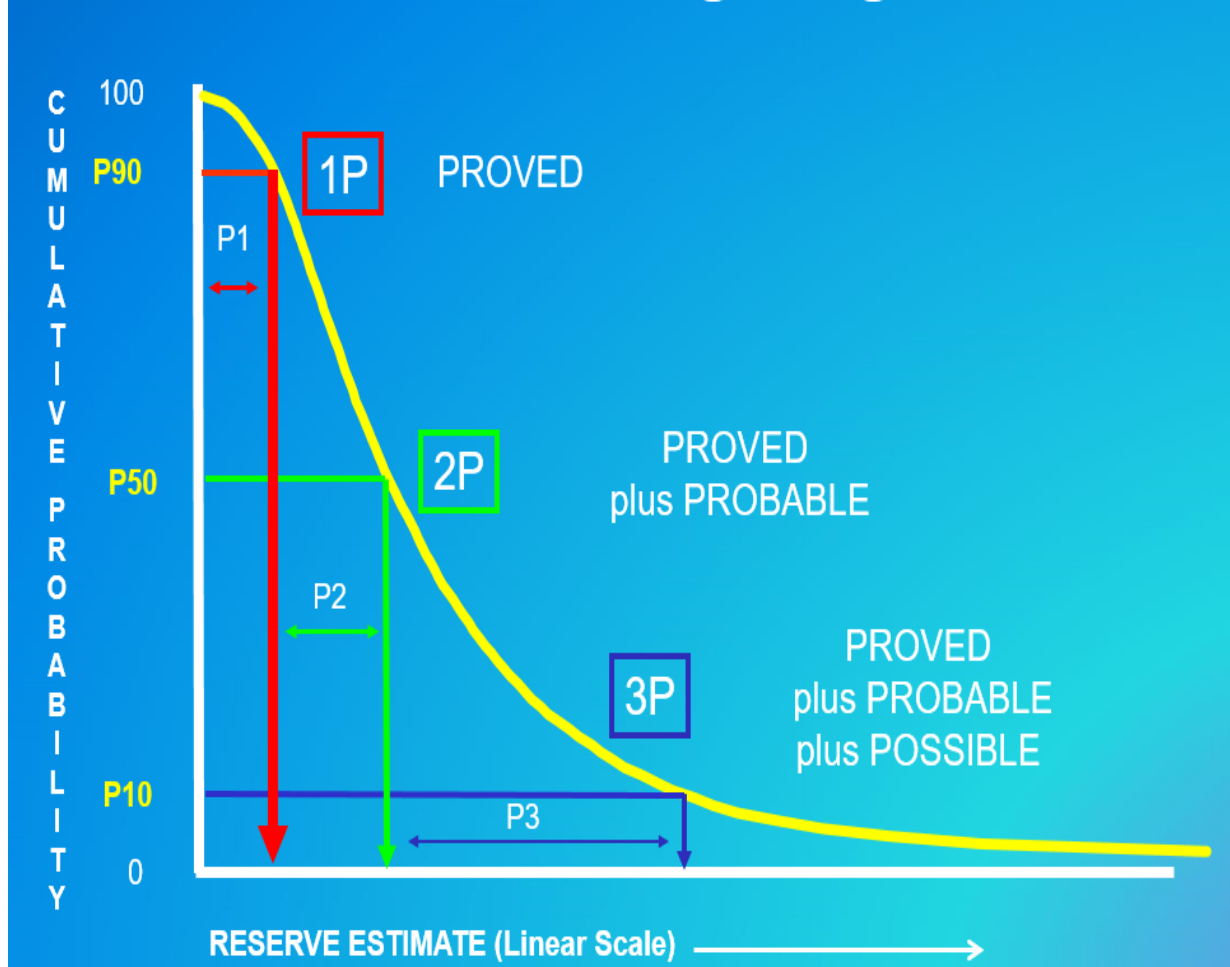
The base case is built on the « 2P » Reserves estimate (Proven + Probable Reserves - see Book 4)

The economic evaluation is also carried out on the « 1P » case (Proven Reserves) in order to check if the project can still be launched in this pessimistic scenario. In the following, the evaluation is made on the 2P case.



Uncertainties on Oil & Gas Fields Reserves

Reserves – Booking categories



Preliminary Notes

Economic results are very dependant upon the assumptions characterizing the economic environment.

In particular, the crude oil price has a prominent effect and it fluctuates very much timewise. For instance, the 2020 Covid-19 sanitary crisis had a strong impact of the world Hydrocarbons demand leading to a fall of the Brent Price down to 20 \$/b at end April 2020. End of July 2020, the Brent Price was 43 \$/b.

Also, beginning 2022, the invasion of Ukraine by Russia has had a strong impact on Oil & Gas prices in 2022 and 2023.

It can be noted that, mid-August 2024, the Brent price was 83 \$/b. End December 2025, it was # 63 \$/b.

During the first semester of 2026, the Iran/US/Israel war drastically upsets the world Oil business and the global Economy (Brent price # 120 \$/b end April 2026). Uncertainties remain for the future.

Geopolitical events together with the implementation of Energy Transition programmes may have strong impact on the Oil & Gas prices for the years to come.

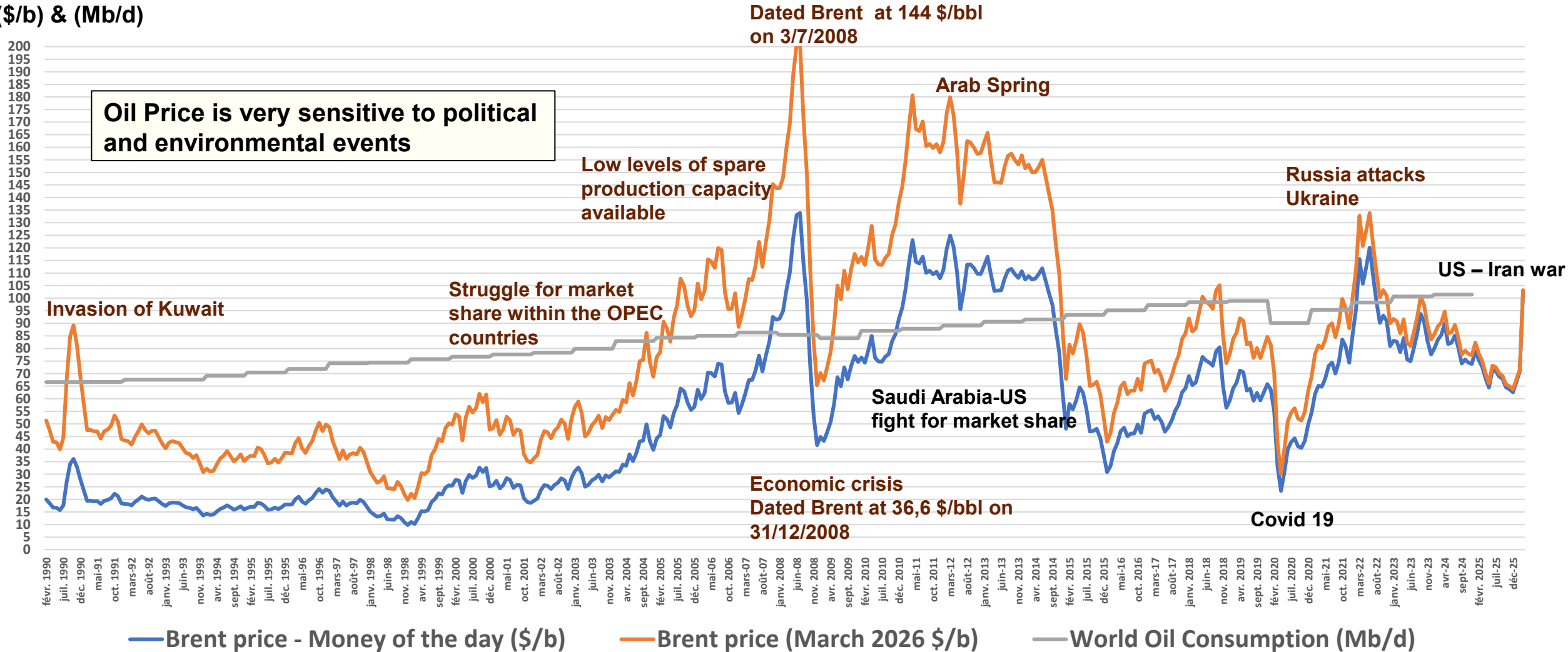
In the following example, the economic analysis is made using a crude oil price of 100 \$/b, which was prevailing in 2013/2014. Also, calculation is made with a crude oil price of 60\$/b, showing the important impact with regards to the volatility of this parameter.



Crude Oil Price and Oil Consumption since 1990 till March 2026

(Monthly Average - Prices are fluctuating within a month)

(\$/b) & (Mb/d)



Source: ChG/Price: Data from EIA Index Mundi – US CPI: Bur. of Labor Statistics
Oil Consumption: EI Stat. Review 2025

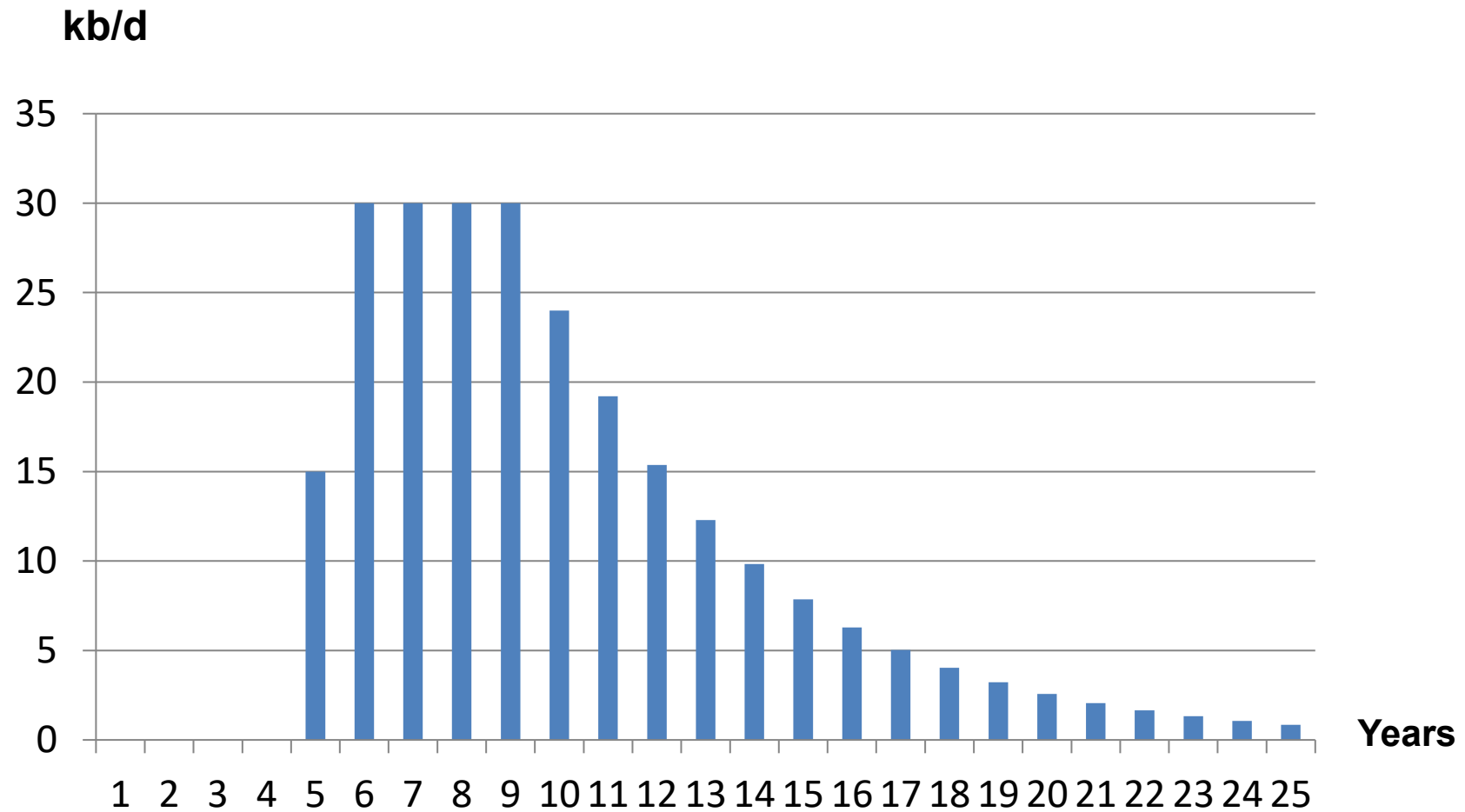


Assumptions (2013/2014 environment)

- ◆ Development of an oil field in the North Sea
- ◆ Reserves # 92 Mb
- ◆ Capex = 1 200 M\$
- ◆ Opex = 40M\$/year + 5\$/b, adjusted at the end of production
- ◆ Energy consumed # 12% of Hydrocarbons production
- ◆ CO₂ price = 25 €/t CO₂
- ◆ Crude oil price = 100 \$/b
- ◆ Inflation = 2% per year
- ◆ Exchange rate : 1€ = 1,35\$
- ◆ Fiscal depreciation on a UOP basis
- ◆ Income tax rate = 70%
- ◆ No shadow interests



Profile of Production



Cash-Flow Schedule 100 \$/b (1)

Year	Production		Remaining Reserves 31/12/n	UOP	Oil Price Cst	Inflation Factor	Oil Price Crt	Revenus Crt	Opex Cst		CO2 Emiss.	CO2 Penalty		EBITDA
	kboe/d	Mboe	Mboe	%	\$/b		\$/b	M\$	M\$	M\$	MT CO2	M\$	M\$	M\$
0			91,8											
1	0,0	0,0	91,8	0%	100,0	1,00	100,0	0	0	0	0,0	0	0	0
2	0,0	0,0	91,8	0%	100,0	1,02	102,0	0	0	0	0,0	0	0	0
3	0,0	0,0	91,8	0%	100,0	1,04	104,0	0	0	0	0,0	0	0	0
4	0,0	0,0	91,8	0%	100,0	1,06	106,1	0	0	0	0,0	0	0	0
5	15,0	5,5	86,4	6%	100,0	1,08	108,2	593	67	73	0,3	9	10	510
6	30,0	11,0	75,4	13%	100,0	1,10	110,4	1209	95	105	0,5	18	20	1084
7	30,0	11,0	64,5	15%	100,0	1,13	112,6	1233	95	107	0,5	18	21	1106
8	30,0	11,0	53,5	17%	100,0	1,15	114,9	1258	95	109	0,5	18	21	1128
9	30,0	11,0	42,6	20%	100,0	1,17	117,2	1283	95	111	0,5	18	21	1151
10	24,0	8,8	33,8	21%	100,0	1,20	119,5	1047	84	100	0,4	15	17	929
11	19,2	7,0	26,8	21%	100,0	1,22	121,9	854	75	91	0,3	12	14	749
12	15,4	5,6	21,2	21%	100,0	1,24	124,3	697	68	85	0,3	9	12	601
13	12,3	4,5	16,7	21%	100,0	1,27	126,8	569	62	79	0,2	7	9	480
14	9,8	3,6	13,1	21%	100,0	1,29	129,4	464	58	75	0,2	6	8	381
15	7,9	2,9	10,2	22%	100,0	1,32	131,9	379	54	72	0,1	5	6	301
16	6,3	2,3	8,0	22%	100,0	1,35	134,6	309	51	69	0,1	4	5	235
17	5,0	1,8	6,1	23%	100,0	1,37	137,3	252	49	68	0,1	3	4	180
18	4,0	1,5	4,6	24%	100,0	1,40	140,0	206	47	66	0,1	2	3	136
19	3,2	1,2	3,5	25%	100,0	1,43	142,8	168	46	66	0,1	2	3	100
20	2,6	0,9	2,5	27%	100,0	1,46	145,7	137	45	65	0,0	2	2	70
21	2,1	0,8	1,8	30%	100,0	1,49	148,6	112	44	65	0,0	1	2	45
22	1,6	0,6	1,2	34%	100,0	1,52	151,6	91	28	42	0,0	1	2	47
23	1,3	0,5	0,7	41%	100,0	1,55	154,6	74	27	42	0,0	1	1	31
24	1,1	0,4	0,3	56%	100,0	1,58	157,7	61	27	42	0,0	1	1	17
25	0,8	0,3	0,0	100%	100,0	1,61	160,8	50	27	43	0,0	1	1	6
Total		91,8			100,0		120,3	11045	1239	1575	4,5	153	184	9287

UOP: Unit of Production

EBITDA: Earnings before Income tax, Depreciation & Amortization

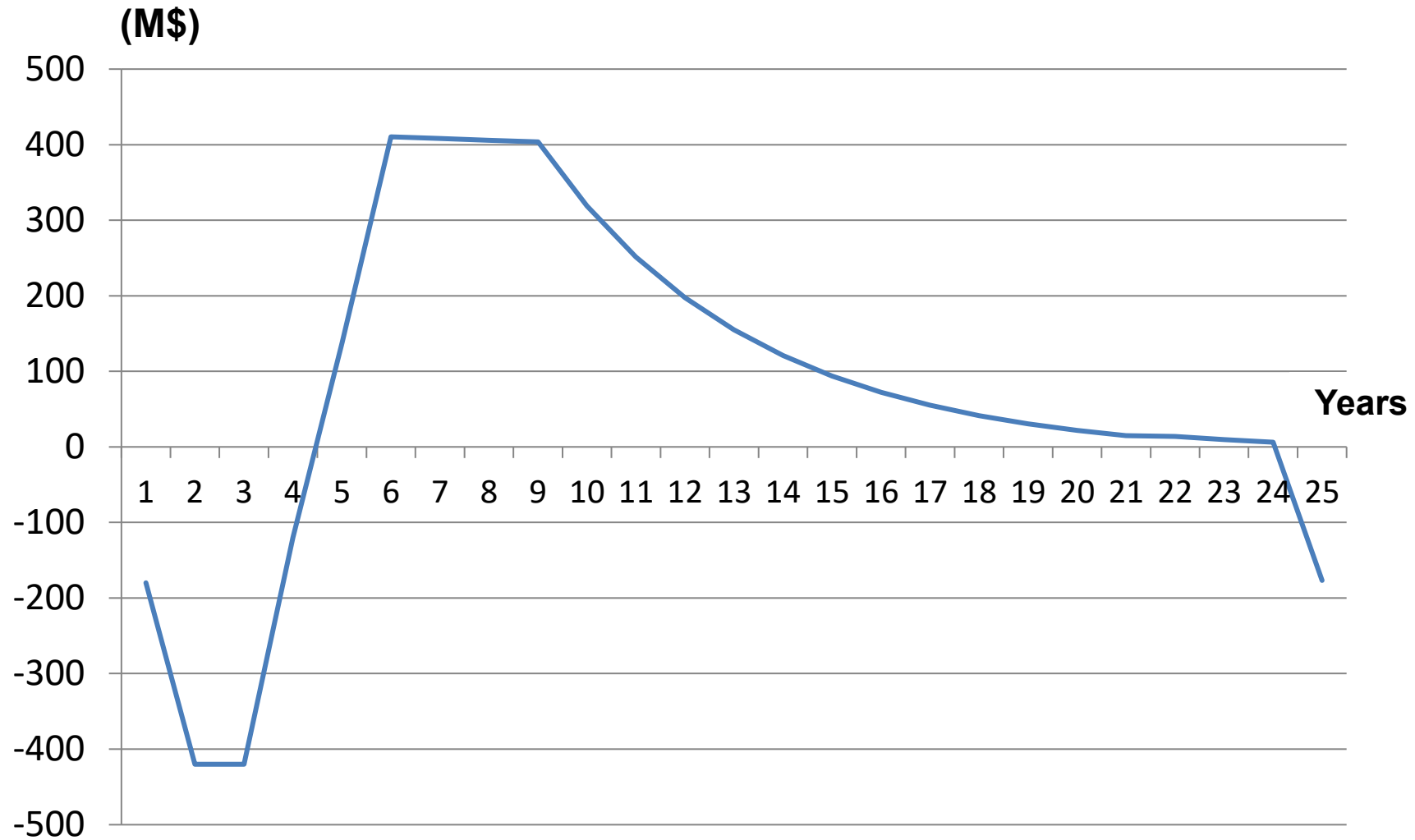


Cash-Flow Schedule 100 \$/b (2)

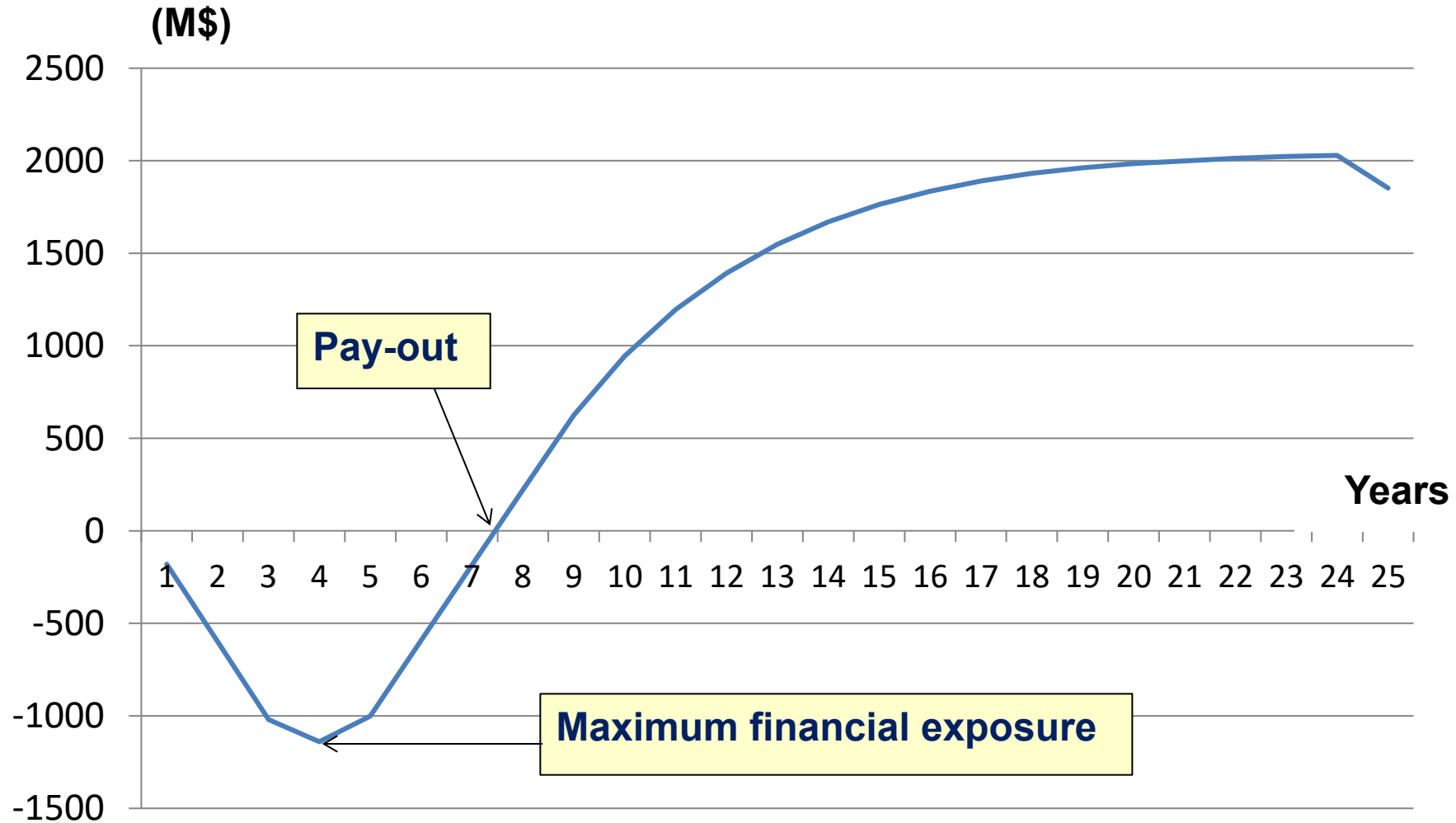
Year	EBITDA	Capex		DDA	Capex	Dismant.		Provis.	Prov. Dism.	Taxable	Income	Cash-Flow	Net Cash-Flow		Cumul.	Discount	DNCF	Net	Profit.
					Net			Dism.	Net	Income	tax				NCF	Factor		Result	Ratio
	Crt	Cst	Crt	Crt	Crt	Cst	Crt	Crt	Crt	Crt	Crt	Crt	Crt	Cst	Cst		Cst	Crt	
	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$		M\$	M\$	%
								290											
1	0	180	180	0	180	0	0	0	290	0	0	0	-180	-180	-180	1,00	-180	0	0%
2	0	420	428	0	608	0	0	0	290	0	0	0	-428	-420	-600	0,93	-389	0	0%
3	0	420	437	0	1045	0	0	0	290	0	0	0	-437	-420	-1020	0,86	-360	0	0%
4	0	120	127	0	1173	0	0	0	290	0	0	0	-127	-120	-1140	0,79	-95	0	0%
5	510	60	65	70	1168	0	0	17	272	423	296	214	149	138	-1002	0,74	101	127	11%
6	1084	0	0	148	1020	0	0	35	238	902	631	453	453	410	-592	0,68	279	270	23%
7	1106	0	0	148	872	0	0	35	203	923	646	460	460	408	-184	0,63	257	277	27%
8	1128	0	0	148	724	0	0	35	169	945	662	466	466	406	222	0,58	237	284	33%
9	1151	0	0	148	576	0	0	35	134	968	678	473	473	404	626	0,54	218	290	40%
10	929	0	0	118	457	0	0	28	107	783	548	381	381	319	945	0,50	159	235	41%
11	749	0	0	95	362	0	0	22	84	632	442	306	306	251	1196	0,46	116	190	41%
12	601	0	0	76	287	0	0	18	67	507	355	246	246	198	1393	0,43	85	152	42%
13	480	0	0	61	226	0	0	14	53	405	284	196	196	155	1548	0,40	61	122	42%
14	381	0	0	49	177	0	0	11	41	322	225	156	156	121	1669	0,37	44	96	43%
15	301	0	0	39	139	0	0	9	32	253	177	124	124	94	1763	0,34	32	76	43%
16	235	0	0	31	108	0	0	7	25	196	137	97	97	72	1835	0,32	23	59	43%
17	180	0	0	25	83	0	0	6	19	150	105	76	76	55	1890	0,29	16	45	42%
18	136	0	0	20	63	0	0	5	15	112	78	58	58	41	1932	0,27	11	33	40%
19	100	0	0	16	47	0	0	4	11	80	56	44	44	31	1962	0,25	8	24	38%
20	70	0	0	13	34	0	0	3	8	54	38	32	32	22	1984	0,23	5	16	34%
21	45	0	0	10	24	0	0	2	6	32	23	22	22	15	1999	0,21	3	10	28%
22	47	0	0	8	16	0	0	2	4	37	26	21	21	14	2013	0,20	3	11	46%
23	31	0	0	7	9	0	0	2	2	23	16	15	15	10	2023	0,18	2	7	43%
24	17	0	0	5	4	0	0	1	1	11	8	10	10	6	2029	0,17	1	3	35%
25	6	0	0	4	0	180	290	1	0	1	1	5	-284	-177	1852	0,16	-28	0	7%
Total	9287	1200	1238	1238		180	290	290		7759	5432	3855	2328	1852			611	2328	



Net Cash-Flows (constant money) - 100 \$/b



Cumulative Net Cash-Flows (constant money) - 100 \$/b



Economic results (100 \$/b)

- ◆ NPV @ 8% = 611 M\$
- ◆ IRR (Constant money) = 16,5%
- ◆ Pay-out: 8 years after start-up of the project
- ◆ Maximum Financial Exposure = 1140 M\$
- ◆ Profitability Index = 1,54



Sensitivity to the Crude Oil Price: 60\$/b & Exchange rate Euro/\$: 1,13

- ◆ Development of an oil field in the North Sea
- ◆ Reserves # 92 Mb
- ◆ Capex = 1 200 M\$
- ◆ Opex = 40 M\$/year + 5 \$/b, adjusted at the end of production
- ◆ Energy consumed # 12% of Hydrocarbons production
- ◆ CO₂ price = 25 €/t CO₂
- ◆ Crude oil price = 60 \$/b
- ◆ Inflation = 2% per year
- ◆ Exchange rate : 1 € = 1,13 \$
- ◆ Fiscal depreciation on a UOP basis
- ◆ Income tax rate = 70%
- ◆ No shadow interests



Cash-Flow Schedule 60 \$/b (1)

Year	Production		Remaining Reserves 31/12/n	UOP	Oil Price Cst	Inflation Factor	Oil Price Crt	Revenues Crt	Opex Cst		CO2 Emiss. Mt CO2	CO2 Penalty		EBITDA Crt
	kboe/	Mboe	Mboe	%	\$/b		\$/b	M\$				M\$	M\$	M\$
0			91,8											
1	0,0	0,0	91,8	0%	60,0	1,00	60,0	0	0	0	0,0	0	0	0
2	0,0	0,0	91,8	0%	60,0	1,02	61,2	0	0	0	0,0	0	0	0
3	0,0	0,0	91,8	0%	60,0	1,04	62,4	0	0	0	0,0	0	0	0
4	0,0	0,0	91,8	0%	60,0	1,06	63,7	0	0	0	0,0	0	0	0
5	15,0	5,5	86,4	6%	60,0	1,08	64,9	356	67	73	0,3	8	8	274
6	30,0	11,0	75,4	13%	60,0	1,10	66,2	725	95	105	0,5	15	17	604
7	30,0	11,0	64,5	15%	60,0	1,13	67,6	740	95	107	0,5	15	17	616
8	30,0	11,0	53,5	17%	60,0	1,15	68,9	755	95	109	0,5	15	17	628
9	30,0	11,0	42,6	20%	60,0	1,17	70,3	770	95	111	0,5	15	18	641
10	24,0	8,8	33,8	21%	60,0	1,20	71,7	628	84	100	0,4	12	14	514
11	19,2	7,0	26,8	21%	60,0	1,22	73,1	513	75	91	0,3	10	12	409
12	15,4	5,6	21,2	21%	60,0	1,24	74,6	418	68	85	0,3	8	10	324
13	12,3	4,5	16,7	21%	60,0	1,27	76,1	341	62	79	0,2	6	8	254
14	9,8	3,6	13,1	21%	60,0	1,29	77,6	278	58	75	0,2	5	6	197
15	7,9	2,9	10,2	22%	60,0	1,32	79,2	227	54	72	0,1	4	5	150
16	6,3	2,3	8,0	22%	60,0	1,35	80,8	185	51	69	0,1	3	4	112
17	5,0	1,8	6,1	23%	60,0	1,37	82,4	151	49	68	0,1	3	3	80
18	4,0	1,5	4,6	24%	60,0	1,40	84,0	123	47	66	0,1	2	3	54
19	3,2	1,2	3,5	25%	60,0	1,43	85,7	101	46	66	0,1	2	2	33
20	2,6	0,9	2,5	27%	60,0	1,46	87,4	82	45	65	0,0	1	2	15
21	2,1	0,8	1,8	30%	60,0	1,49	89,2	67	44	65	0,0	1	2	1
22	1,6	0,6	1,2	34%	60,0	1,52	90,9	55	28	42	0,0	1	1	11
23	1,3	0,5	0,7	41%	60,0	1,55	92,8	45	27	42	0,0	1	1	2
24	1,1	0,4	0,3	56%	60,0	1,58	94,6	36	27	43	0,0	1	1	-7
25	0,8	0,3	0,0	100%	60,0	1,61	96,5	30	27	43	0,0	0	1	-14
Total		91,8			100,0		72,2	6627	1239	1575	4,5	127	153	4899

UOP: Unit of Production

EBITDA: Earnings before Income tax, Depreciation & Amortization



Cash-Flow Schedule 60 \$/b (2)

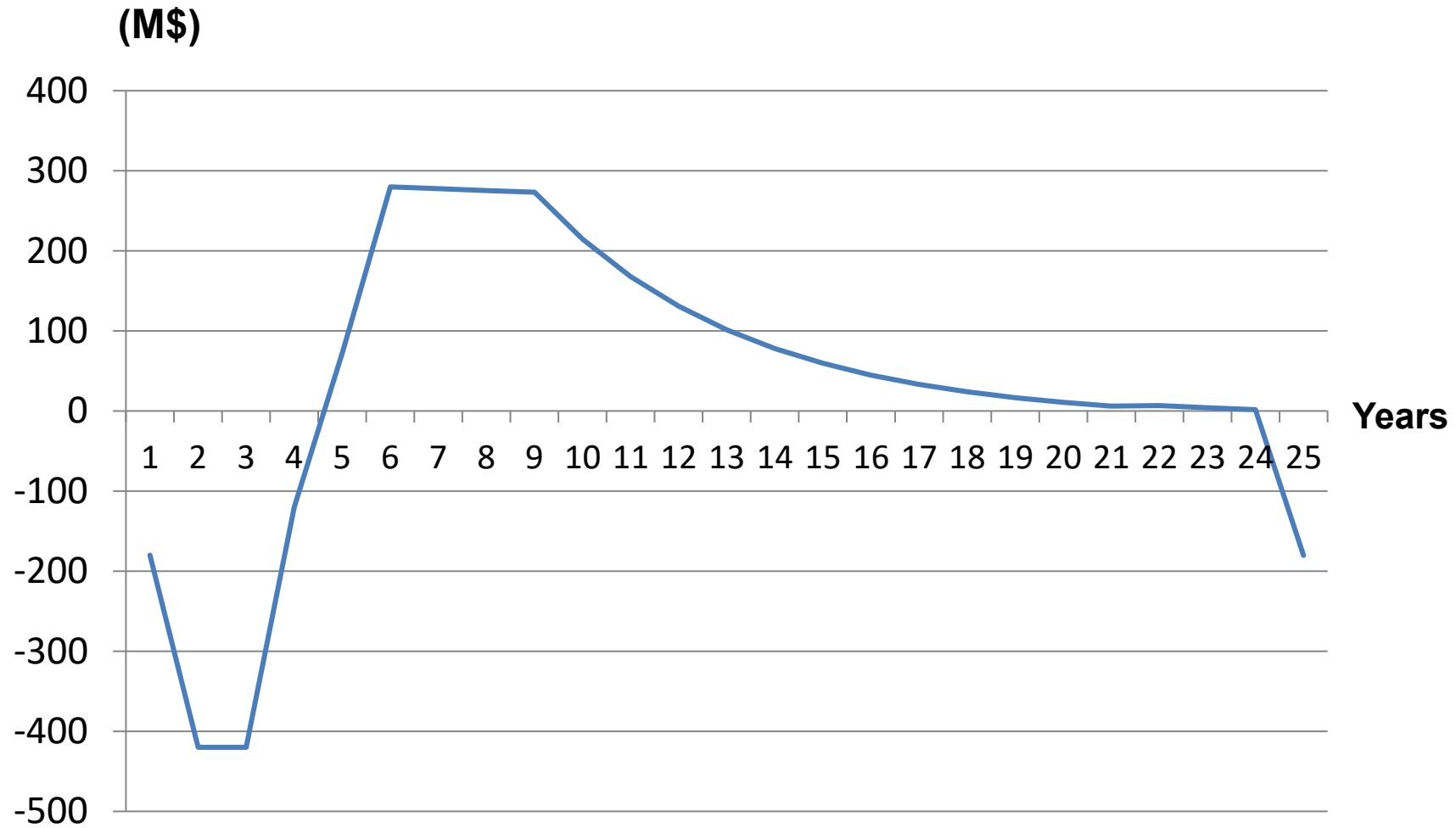
Year	EBITDA	Capex		DDA	Capex	Dismant.		Provis	Prov. Dis	Taxable	Income	Cash-Fl	Net Cash-Fl		Cumul	Discoun	DNCF	Net	Profit
					Net			Disma	Net.	Income	Tax		NCF		NCF	Factor		Result	Ratio
	Crt	Cst	Crt	Crt	Crt	Cst	Crt	Crt	Crt	Crt	Crt	Crt	Crt	Cst	Cst		Cst	Crt	
	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	Mt CO2	M\$	M\$	M\$		M\$	M\$	%
0				1238	0			290	0										
1	0	180	180	0	180	0	0	0	290	0	0	0	-180	-180	-180	1,00	-180	0	0%
2	0	420	428	0	608	0	0	0	290	0	0	0	-428	-420	-600	0,93	-389	0	0%
3	0	420	437	0	1045	0	0	0	290	0	0	0	-437	-420	-1020	0,86	-360	0	0%
4	0	120	127	0	1173	0	0	0	290	0	0	0	-127	-120	-1140	0,79	-95	0	0%
5	274	60	65	70	1168	0	0	17	272	187	131	143	78	72	-1068	0,74	53	56	5%
6	604			148	1020	0	0	35	238	421	295	309	309	280	-788	0,68	190	126	11%
7	616			148	872	0	0	35	203	434	303	313	313	278	-510	0,63	175	130	13%
8	628			148	724	0	0	35	169	446	312	316	316	275	-235	0,58	161	134	15%
9	641			148	576	0	0	35	134	458	321	320	320	273	39	0,54	148	138	19%
10	514			118	457	0	0	28	107	367	257	256	256	214	253	0,50	107	110	19%
11	409			95	362	0	0	22	84	292	205	205	205	168	421	0,46	78	88	19%
12	324			76	287	0	0	18	67	231	161	163	163	131	552	0,43	56	69	19%
13	254			61	226	0	0	14	53	179	126	129	129	101	653	0,40	40	54	19%
14	197			49	177	0	0	11	41	137	96	101	101	78	731	0,37	29	41	18%
15	150			39	139	0	0	9	32	102	72	79	79	60	791	0,34	20	31	17%
16	112			31	108	0	0	7	25	74	52	60	60	45	836	0,32	14	22	16%
17	80			25	83	0	0	6	19	50	35	46	46	33	869	0,29	10	15	14%
18	54			20	63	0	0	5	15	30	21	33	33	24	893	0,27	6	9	11%
19	33			16	47	0	0	4	11	13	9	24	24	17	909	0,25	4	4	6%
20	15			13	34	0	0	3	8	0	0	16	16	11	920	0,23	2	0	0%
21	1			10	24	0	0	2	6	-12	-8	9	9	6	926	0,21	1	-4	-11%
22	11			8	16	0	0	2	4	1	1	10	10	7	933	0,20	1	0	1%
23	2			7	9	0	0	2	2	-6	-4	6	6	4	937	0,18	1	-2	-12%
24	-7			5	4	0	0	1	1	-13	-9	2	2	2	938	0,17	0	-4	-43%
25	-14			4	0	180	290	1	0	-20	-14	-1	-290	-180	758	0,16	-28	-6	-140%
Total	4899	1200	1238	1238		180	290	290		3372	2361	2539	1012	758			45	1012	

UOP: Unit of Production

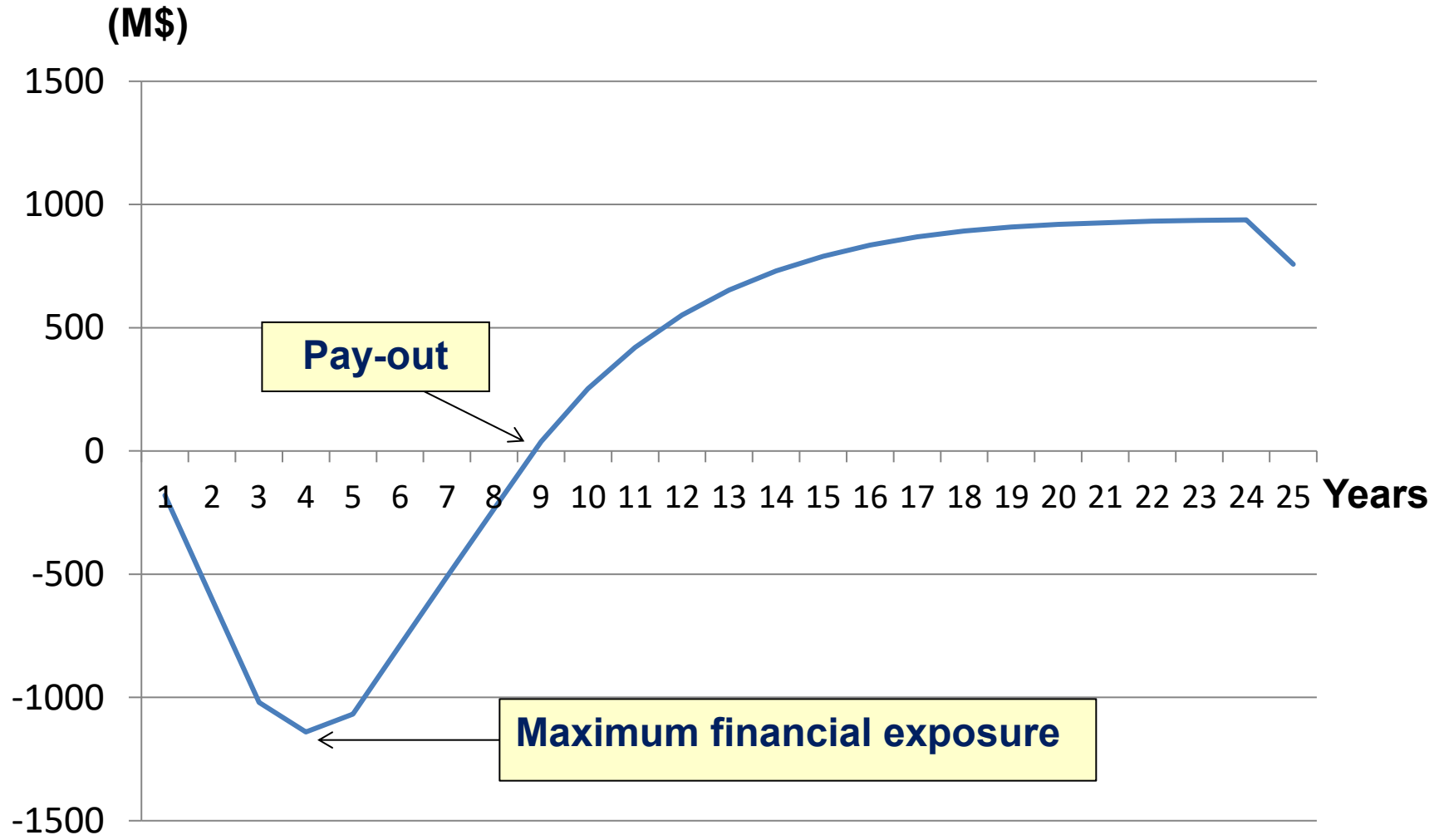
EBITDA: Earnings before Income tax, Depreciation & Amortization



Net Cash-Flows (constant money) - 60 \$/b



Cumulative Net Cash-Flows (constant money) - 60 \$/b

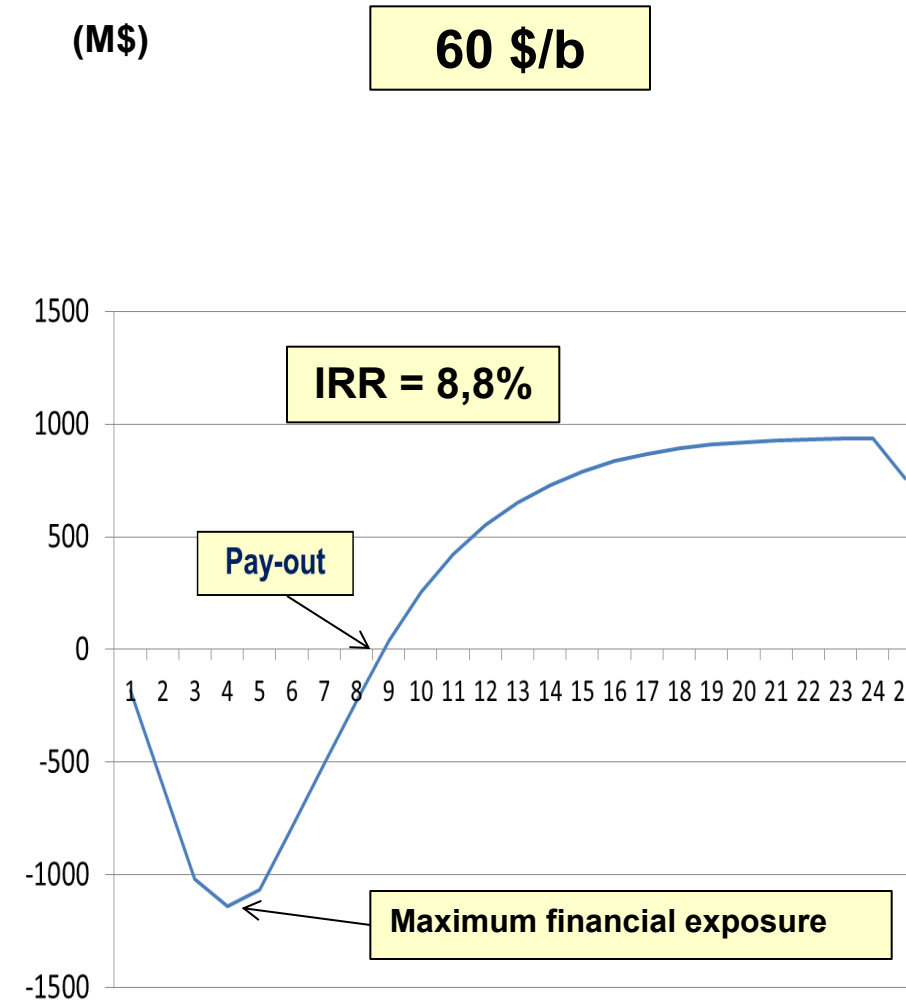
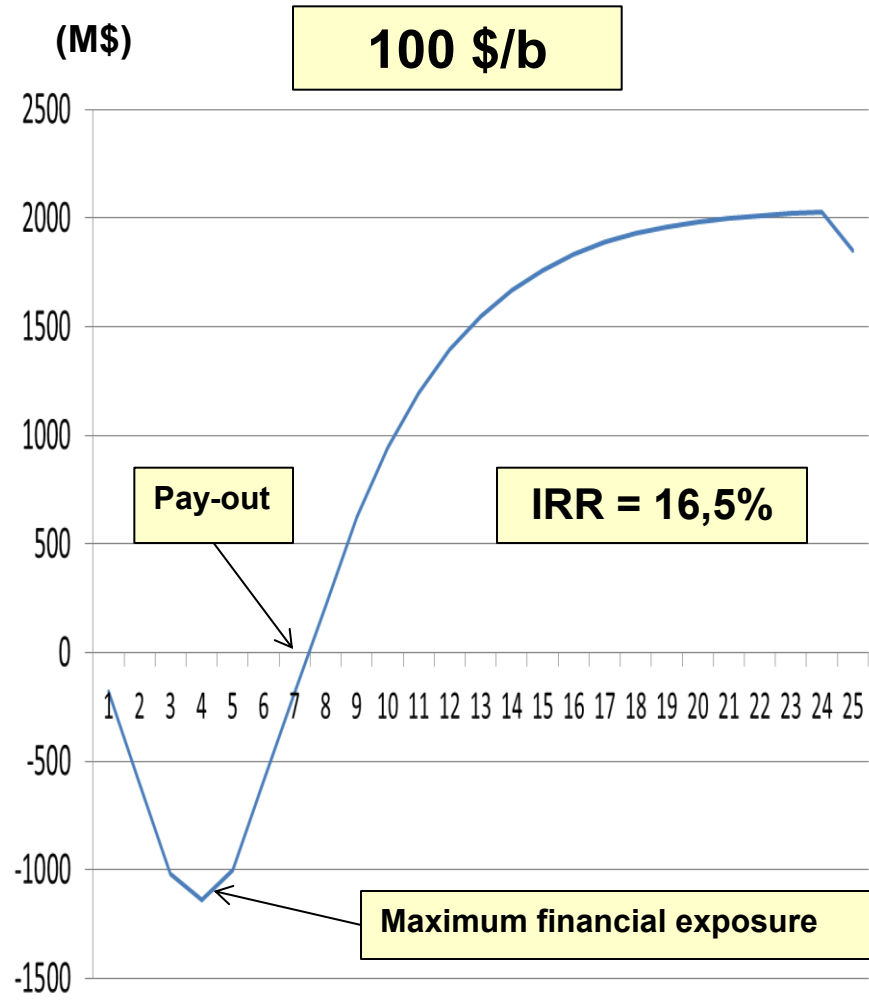


Economic results (60 \$/b)

- ◆ NPV @ 8% = 45 M\$
- ◆ IRR (Constant money) = 8,8%
- ◆ Pay-out: 9 years after start-up of the project
- ◆ Maximum Financial Exposure = 1140 M\$
- ◆ Profitability Index = 0,63



Cumulative Net Cash-Flows



Impact of a long term rupture price scenario with a substantial price decrease Economic results at 45 \$/b

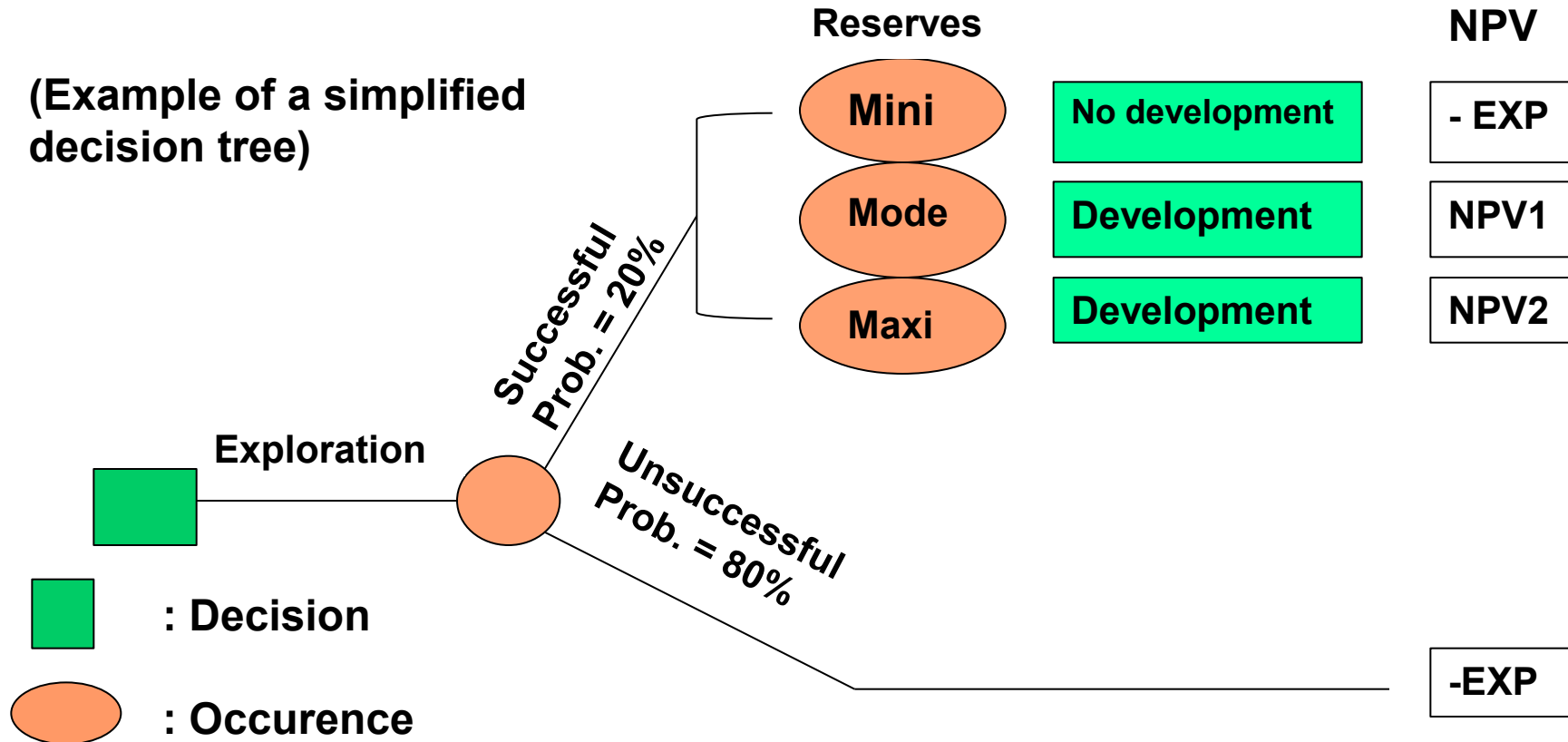
- ◆ **NPV @ 8% = -180 M\$**
- ◆ **IRR (Constant money) # 5%**
- ◆ **Pay-out: 11 years after start-up of the project**
- ◆ **Maximum Financial Exposure = 1140 M\$**
- ◆ **Profitability Index < 0**

Under such price scenario, the project would probably be suspended.



Decision making process for an exploration project

(Example of a simplified
decision tree)

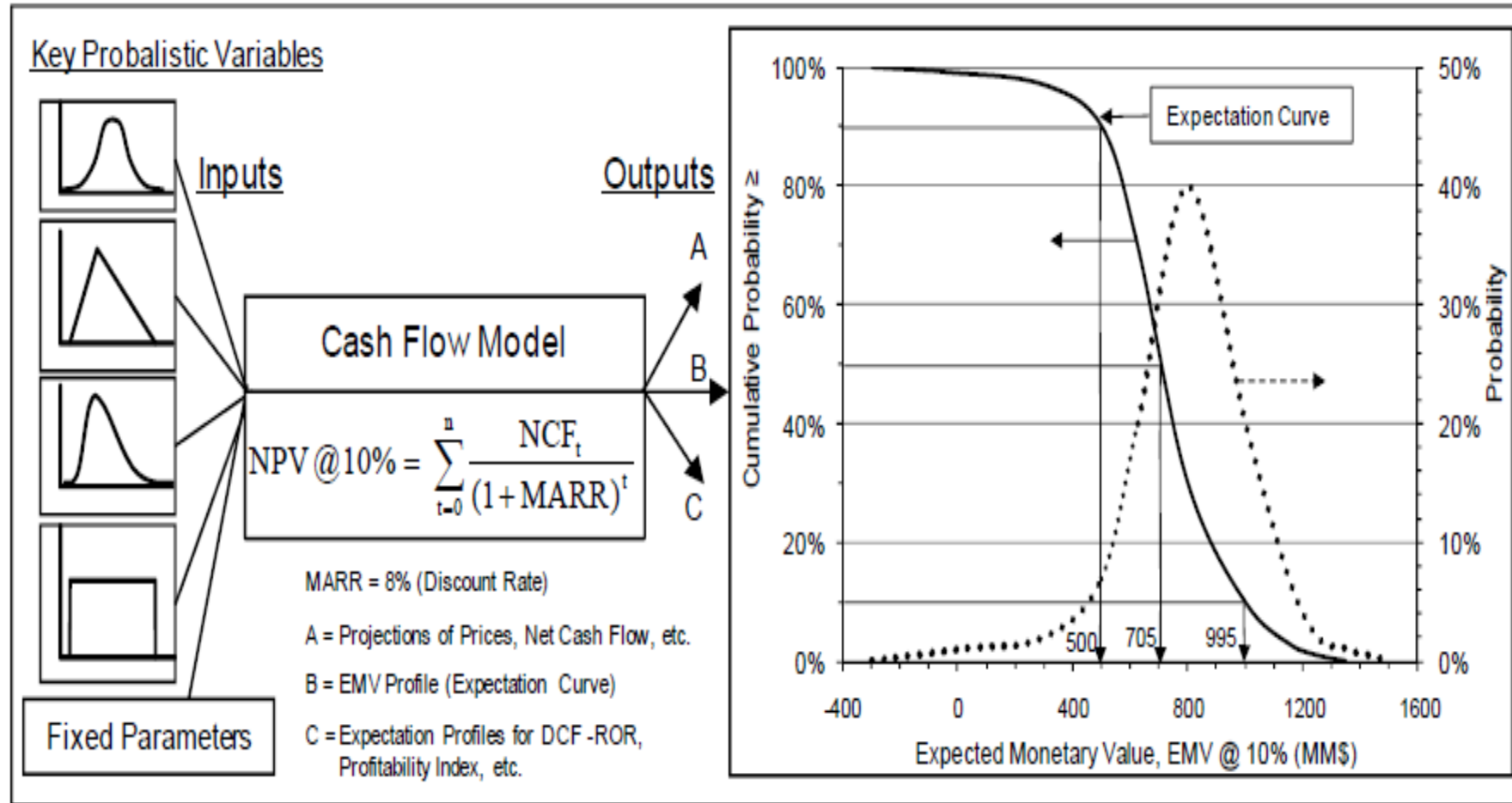


$$\text{Expected NPV (ENPV)} = -0,80 \text{ EXP} + 0,20 \times \frac{1}{3} \times (-\text{EXP} + \text{NPV1} + \text{NPV2})$$

When calculating the NPV, the tax effects must be taken into account



A more sophisticated model: Monte - Carlo simulation



Source: SPE 2011



Carbon Pricing



Oil & Gas and Energy Global Issues in the framework of Energy Transition

A Zoom on Carbon Pricing Carbon price for Economic evaluation



CO₂ Pricing is one essential element to mitigate the effects of Carbon emissions



Business Leadership Criteria

CARBON PRICING

Caring for Climate



THE CLIMATE GROUP



“Let us make sustainability the most powerful lobby...
Become advocates for an effective, well-functioning
carbon market... We must **place a true value on the
cost of carbon** to our economies and our future.
I urge you to work with Governments on this issue.”

— Ban Ki-Moon
United Nations Secretary-General



Source:



United Nations Global Compact

Published by Caring for Climate, an initiative of
the UN Global Compact, UNFCCC and UNEP.
Contact: caring4climate@un.org
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Business Leadership Criteria on Carbon Pricing

The Business Leadership Criteria on Carbon Pricing comprise three distinct but overlapping dimensions: integrating carbon pricing into long-term strategies and investment decisions, responsible policy advocacy, and communication on progress. All three dimensions of the criteria are aligned with limiting the increase in global mean temperature to 2° C above pre-industrial levels.

Consistent with the 2° C global target, companies are invited to indicate alignment with the following criteria:



Set an **internal carbon price** high enough to materially affect investment decisions to drive down greenhouse gas emissions;



Publicly advocate the importance of carbon pricing through policy mechanisms that take into account country specific economies and policy contexts; and



Communicate on progress over time on the two criteria above in public corporate reports.

Source:



United Nations Global Compact

Published by Caring for Climate, an initiative of the UN Global Compact, UNFCCC and UNEP.
Contact: caring4climate@un.org
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Carbon Pricing

Two main instruments:

Emission Trading Systems (ETS) & Carbon Tax (CT)



Emissions Trading System (ETS): How does it work?

- Emissions Trading Systems are managed by a governing jurisdiction that sets a cap on the total level of GHG emissions.
- In order to get an efficient result on the long term, the cap must not be too relaxed, and need to be revised downwards, from time to time.
- The allowances to emit are either auctioned or allocated for free to eligible industrial entities, with the possibility to trade allowances. It is a Cap and Trade (CaT) system.
- The overall emission cap corresponds to the sum of distributed or auctioned allowances.
- The entities involved can buy or sell allowances.
- This creates a market which sets a price for CO₂



Three Mechanisms to reduce emissions

- **Allocated Amount Units (AAU)** allocated to each enterprise in each country, which surplus can be traded through Emission Trading Systems (ETS)
- **Certified Emissions Reductions (CER)**, linked to Clean Development Mechanisms (CDM), derived from Projects financed by developed countries to reduce emissions in developing countries. These credits certified by UN can be traded.
- **Emissions Reduction Units (ERU)** related to joint projects aiming at reducing emissions. These credits can be traded.



Emissions Trading System (ETS): How does'it work?

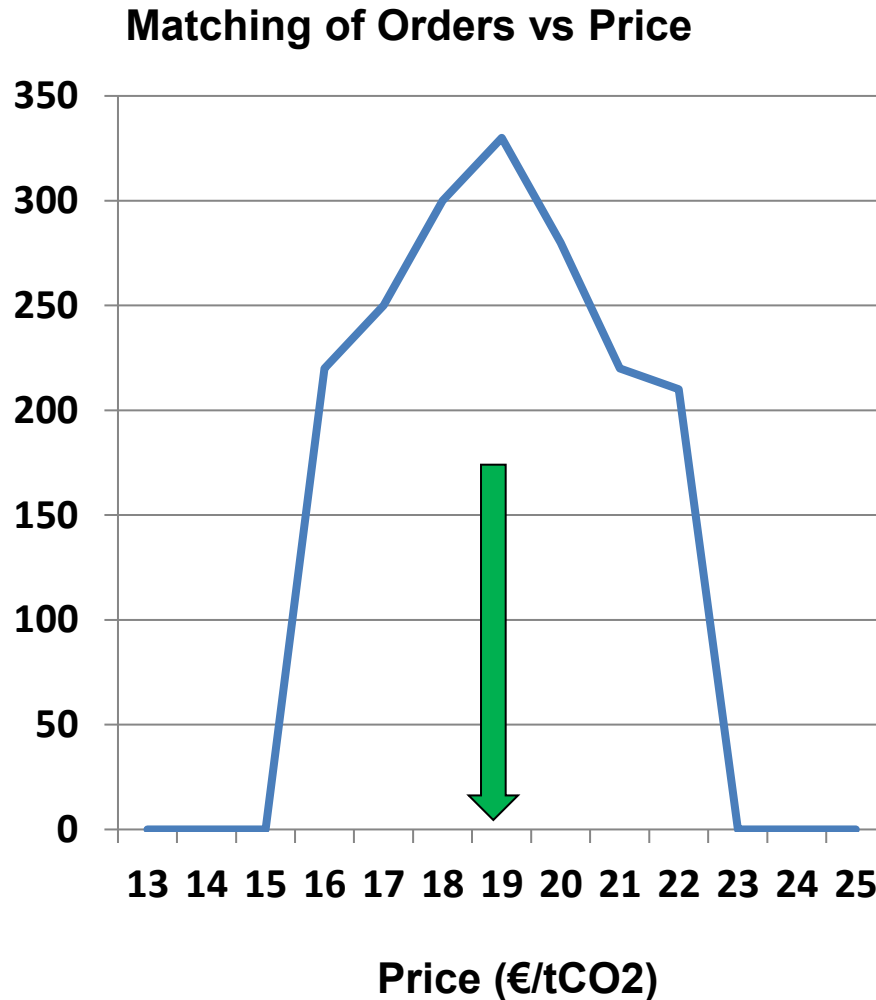
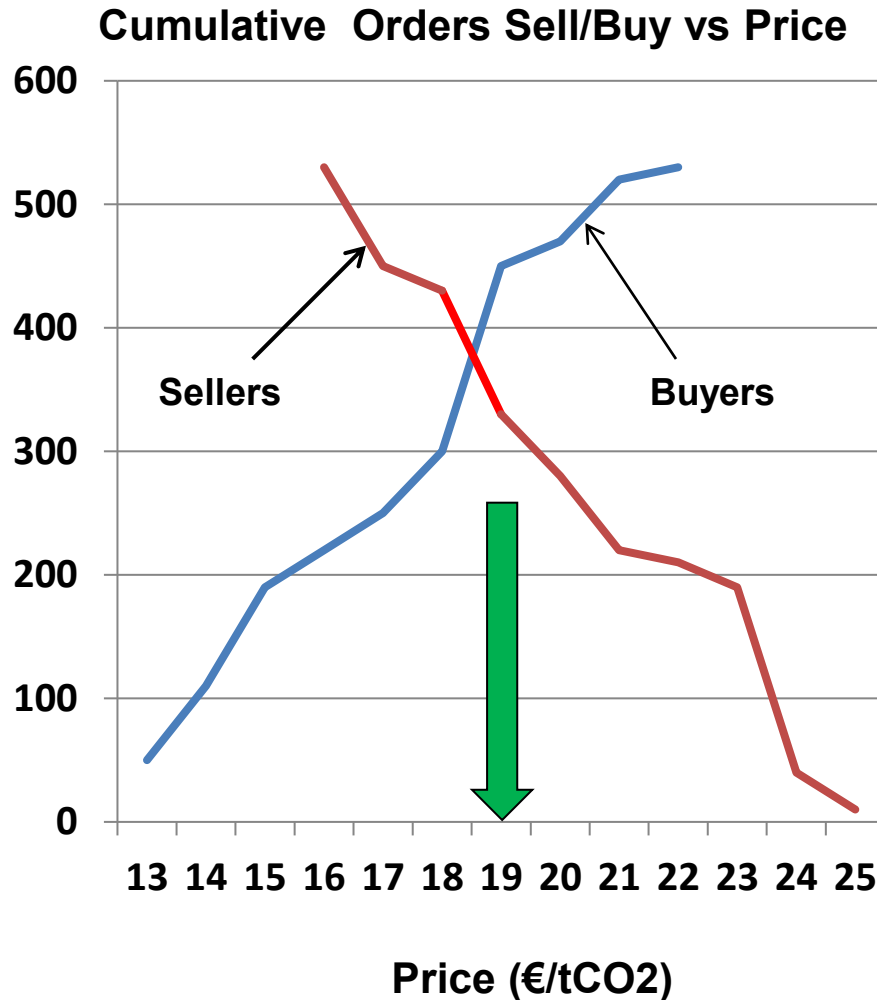
The Fixing Mecanism – One Example: **EU Period 2018 – 2022 (1)**

	Sellers of Surplus				Buyers of Deficits		
	Quantity	Price	Cumul.		Quantity	Price	Cumul.
	kt CO2	€/t CO2	kt CO2		kt CO2	€/t CO2	kt CO2
Company A	80	16	530	Company K	50	13	50
Company B	20	17	450	Company L	60	14	110
Company C	100	18	430	Company M	80	15	190
Company D	50	19	330	Company N	30	16	220
Company E	60	20	280	Company O	30	17	250
Company F	10	21	220	Company P	50	18	300
Company G	20	22	210	Company Q	150	19	450
Company H	150	23	190	Company R	20	20	470
Company I	30	24	40	Company S	50	21	520
Company J	10	25	10	Company T	10	22	530
Total	530		530		530		530



Emissions Trading System (ETS): How does it work?

The Fixing Mechanism – One Example: EU Period 2018 - 2022 (2)



Carbon Tax (CT): How does'it work?

- **Carbon Taxes are directly applicable to level of GHG emissions, expressed as a value per tonne of CO₂.**
- **In order to be efficient and accepted on the long term, the CarbonTax must be introduced and implemented incrementally to allow eligible users to adapt to rising energy prices.**
- **Carbon Tax doesn't guarantee the resulting overall level of CO₂ emissions.**
- **However, putting a price/penalty on each tonne of CO₂ emitted should motivate industrial companies to increase their energy efficiency and invest more in cleaner technologies..**



ETS vs CT

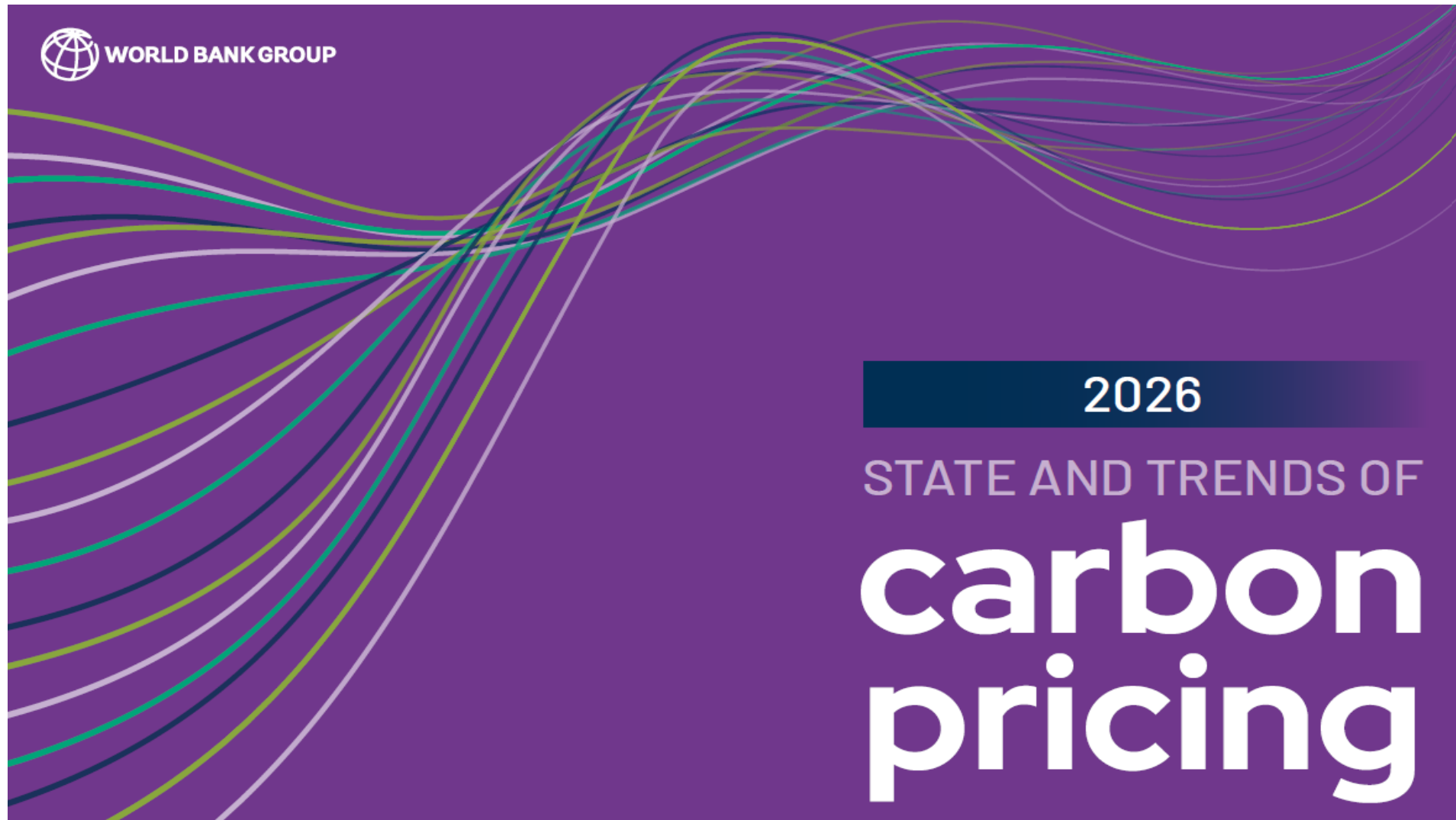
- **The two policy options have different targets and different impacts**
- **For different reasons, they tend to apply to different sectors. ETS usually target large energy - intensives activities and sectors. CT are applicable to more diffuse source of CO₂ emissions such as road transport, air transport, etc.**
- **But, actually, both systems could apply to all emitting sectors.**



Carbon Pricing in 2026



Carbon Pricing in 2026



State & Trends of Carbon Pricing – World Bank 2026

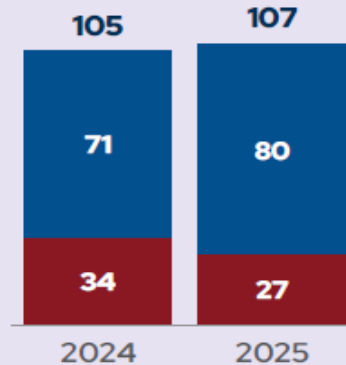
State and Trends of Carbon Pricing 2026

Carbon pricing

Average carbon prices have nearly doubled from 2016 to 2026
2026 US\$ t/CO₂e



ETS and carbon tax revenues continue to exceed US\$ 100 billion
2025 US\$



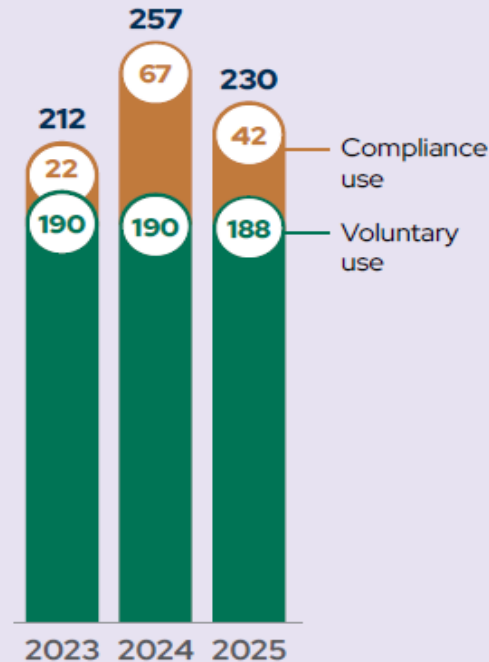
If policies under development are fully implemented by 2030, nearly

1/3

of global GHG emissions could be covered by an ETS or carbon tax

Carbon credit markets

Credit retirements around 10% lower than 2024 levels
Million tCO₂e



From 2024 to 2025 carbon credit issuances increased

8%

The first project received provisional issuance from

PACM

CORSIA-approved projects received a

US\$ 1.50-6/tCO₂e

price premium over similar credits that are not yet CORSIA-approved

Source: State and Trends of Carbon Pricing – World Bank May 2026

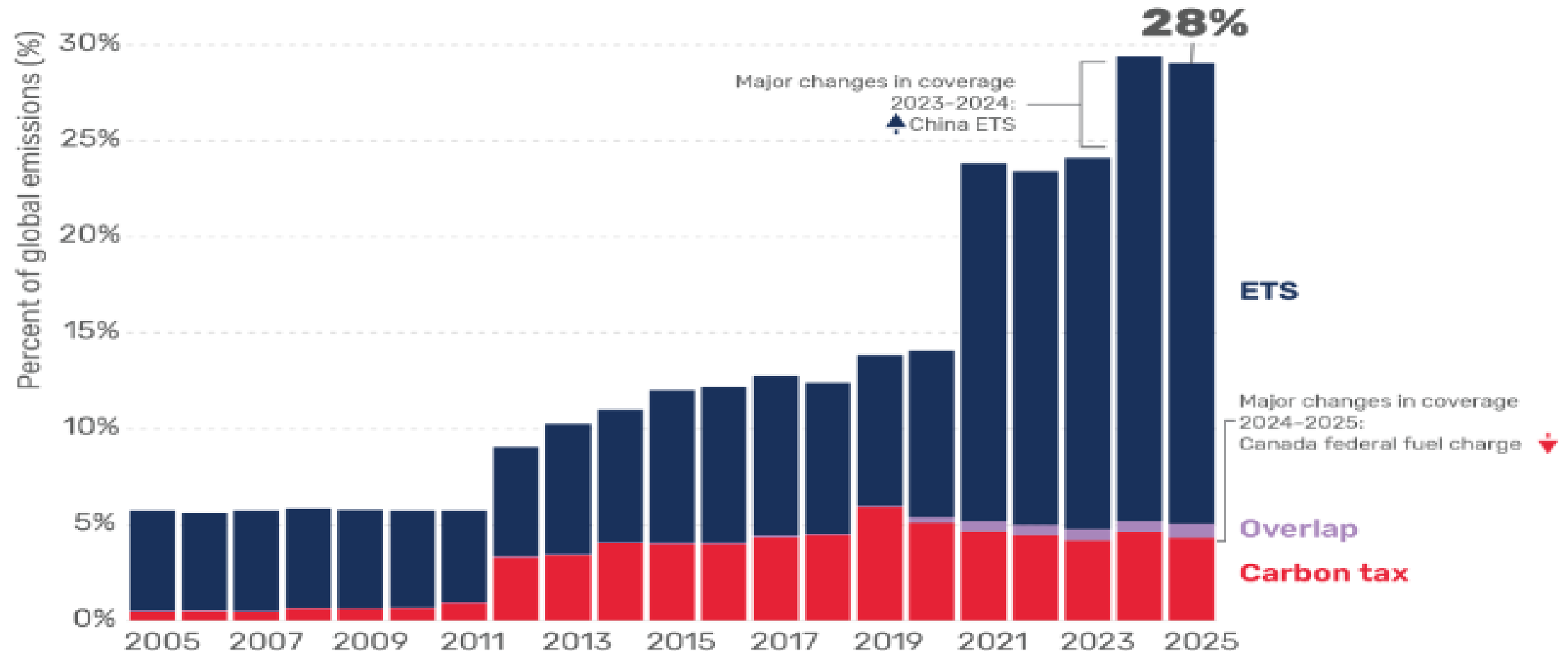
PACM: Paris Agreement Credit Mechanism –

CORSIA: Carbon Offsetting & Reduction Scheme for International Aviation

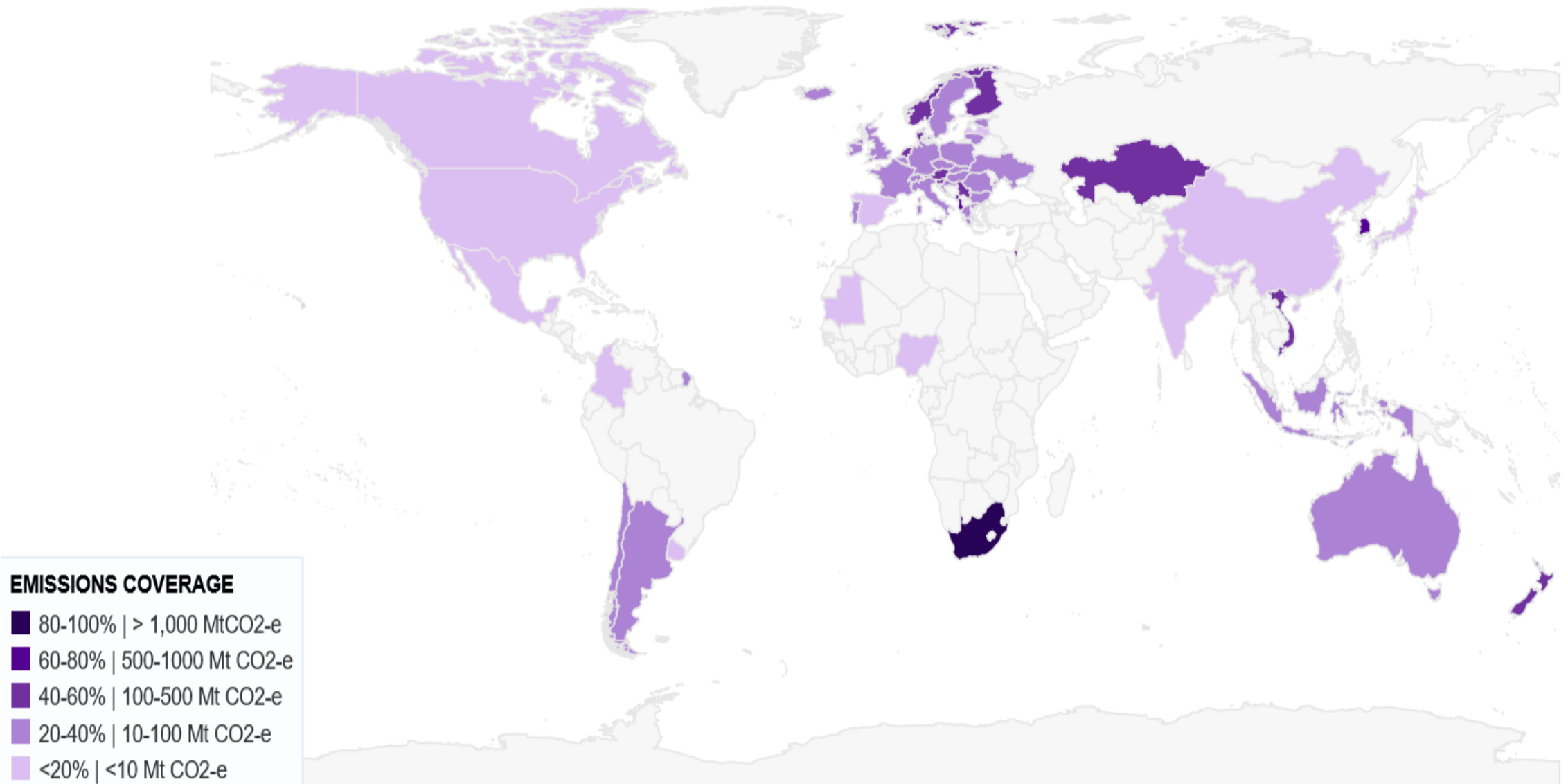


Global Emissions Coverage

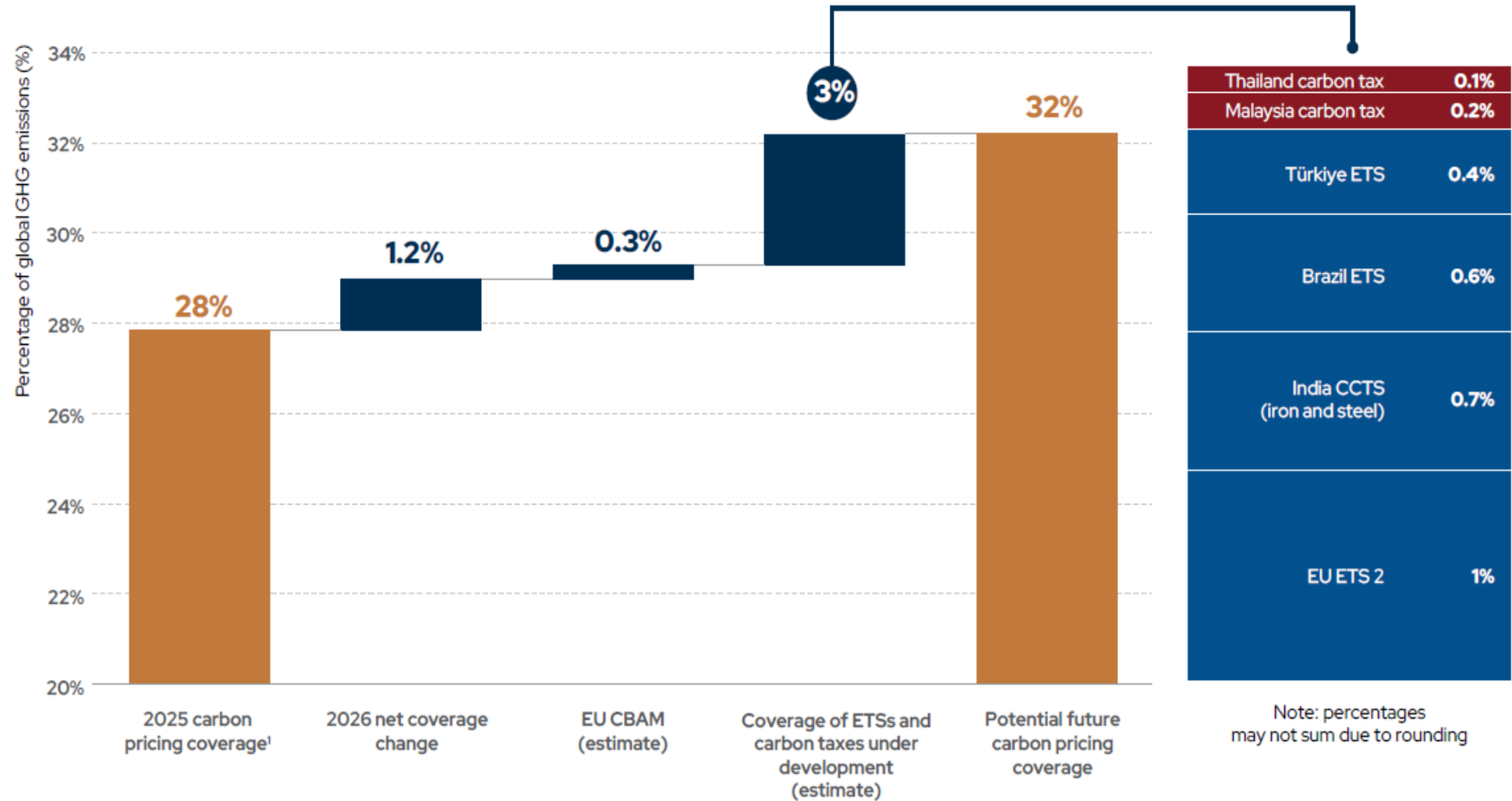
Share of global greenhouse gas emissions covered by an ETS or carbon tax, 2005–2025



Global Emissions Coverage



Global Emissions Coverage

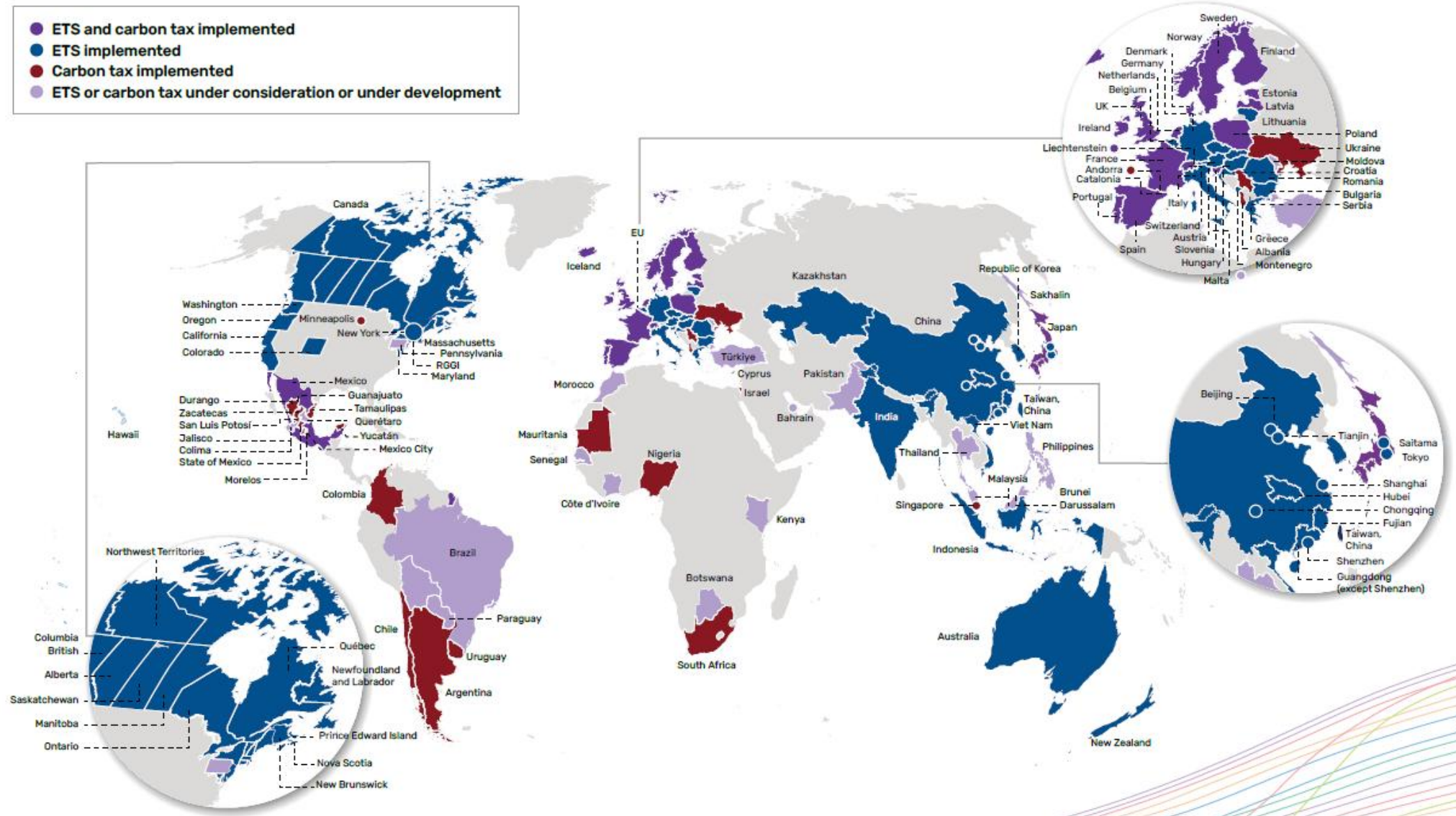


¹ Viet Nam's 0.5% ETS is implemented in 2026 but also applies to 2025 emissions

Note: Analysis does not account for potential overlaps between emissions covered by ETSs and carbon taxes and that are also subject to EU CBAM

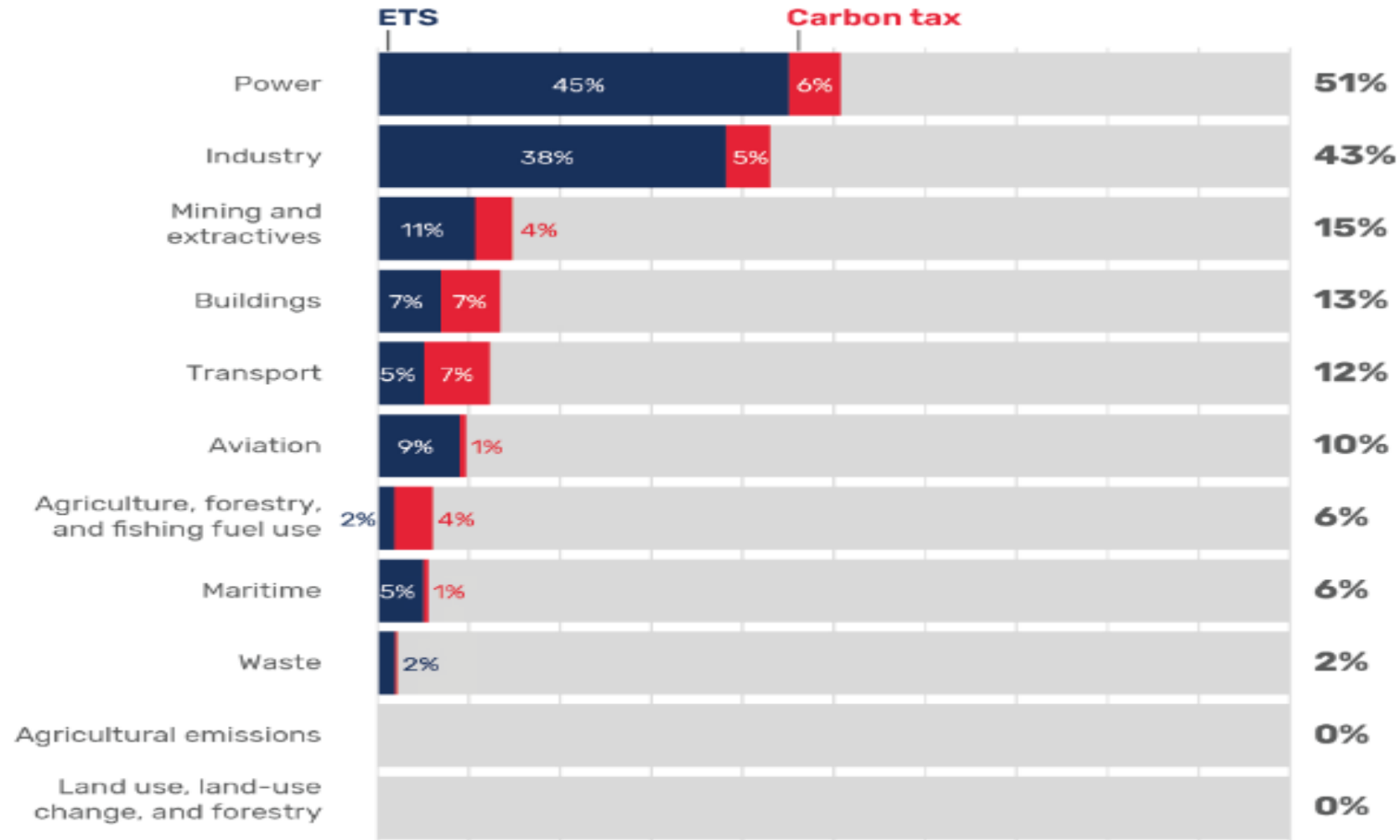


Global map of ETS & Carbon Taxes systems 2026



Economic sectors covered by a Carbon Pricing system

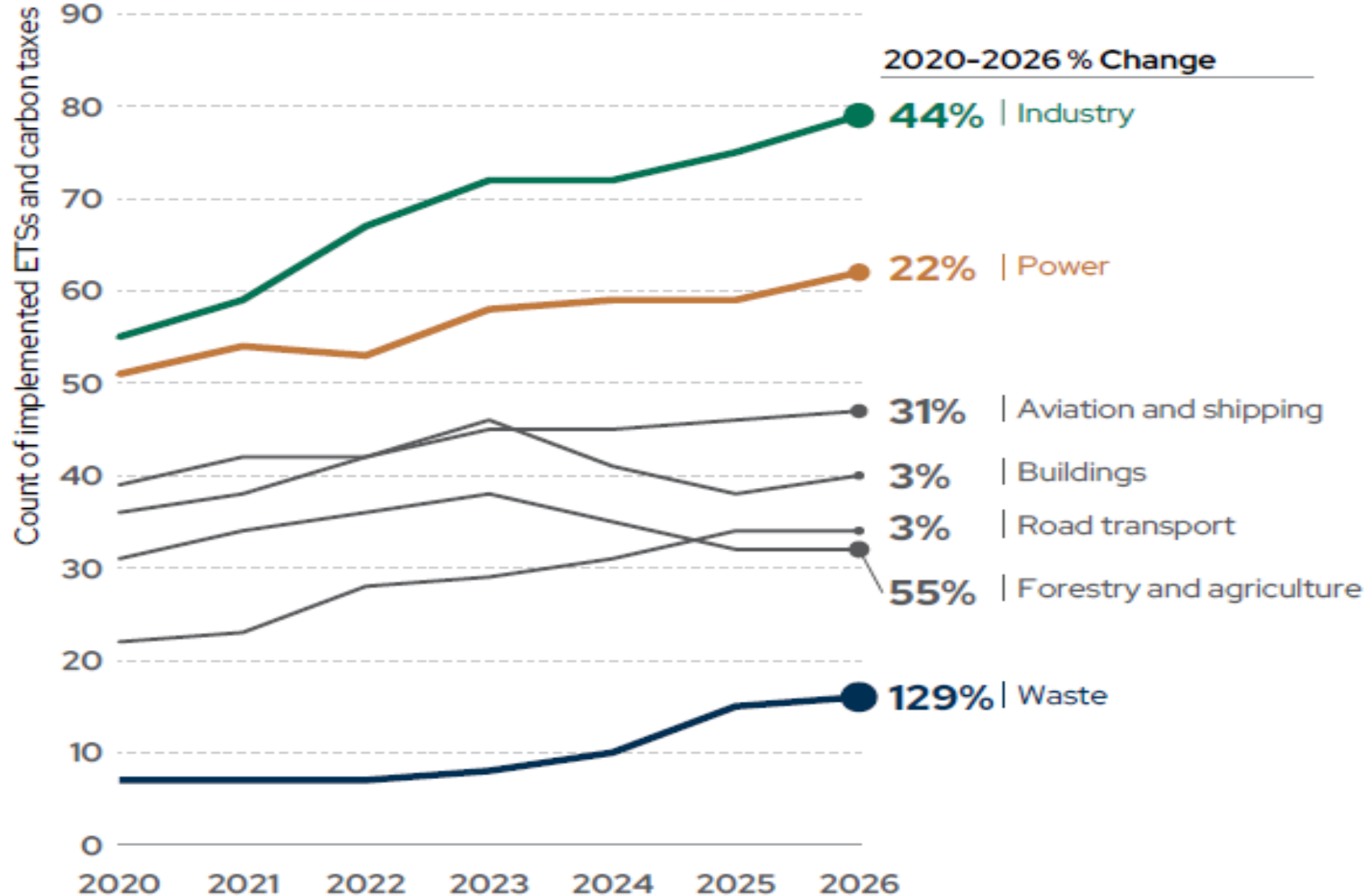
Share of economic sectors' global GHG emissions covered by an ETS or carbon tax



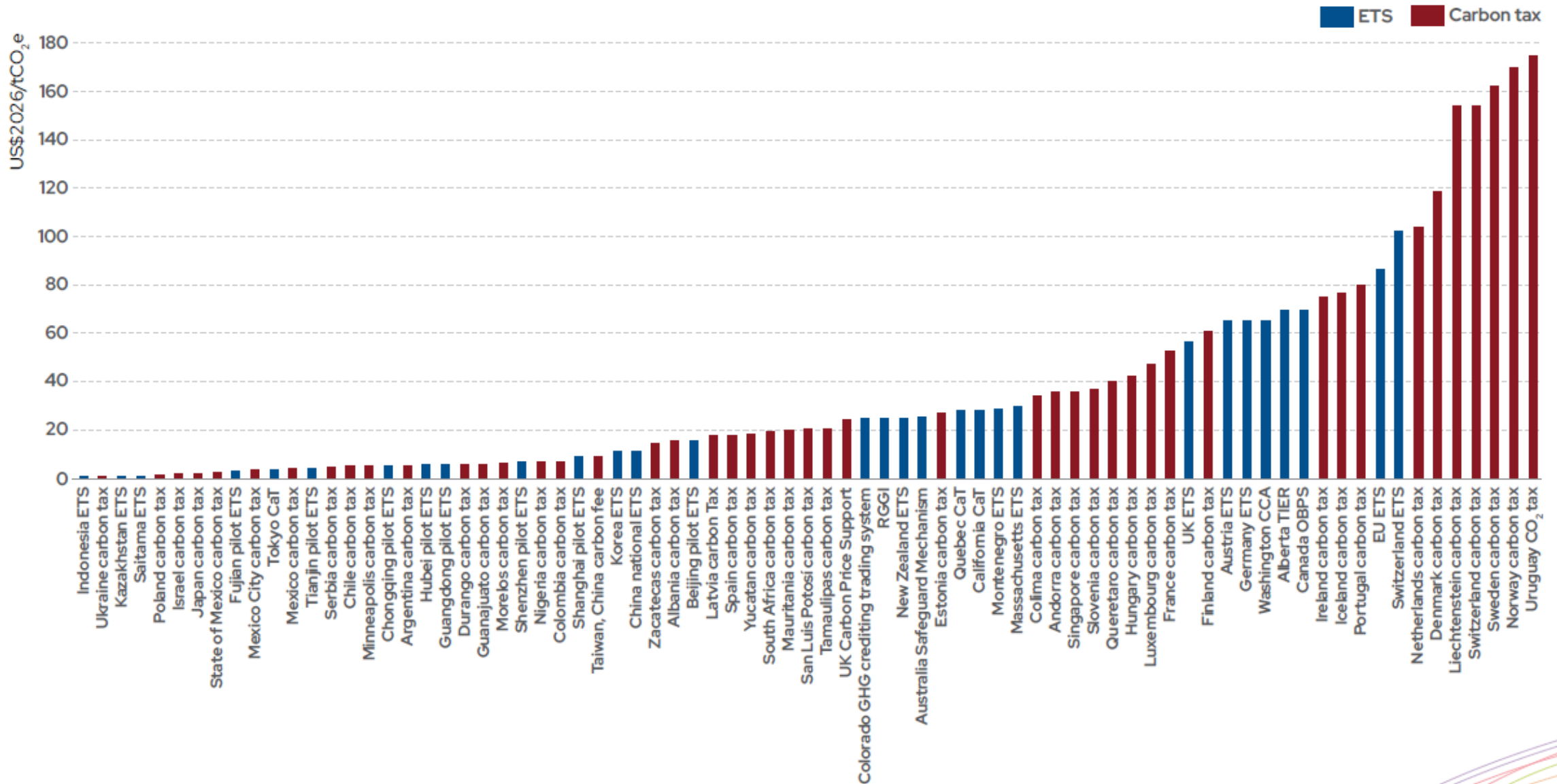
Note: Based on World Bank analysis. Values are not additive due to rounding. Aviation and maritime carbon tax coverage are both less than 1%, waste ETS coverage is 1 %, and carbon tax coverage is < 1%.



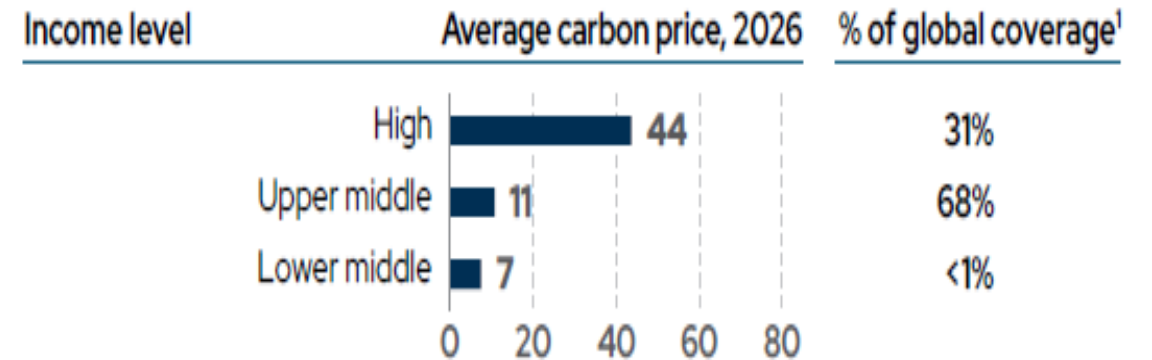
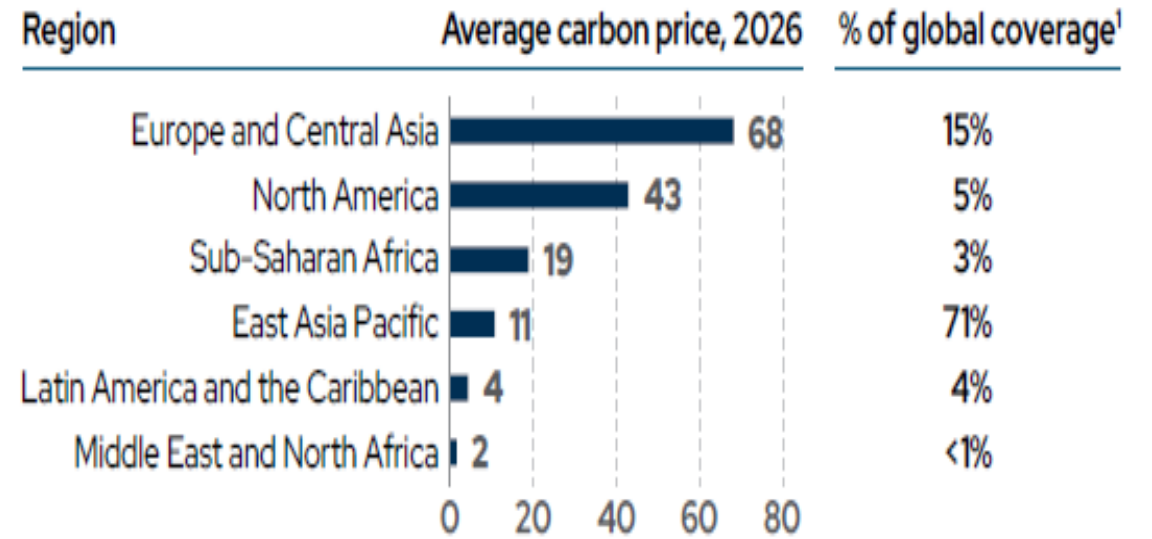
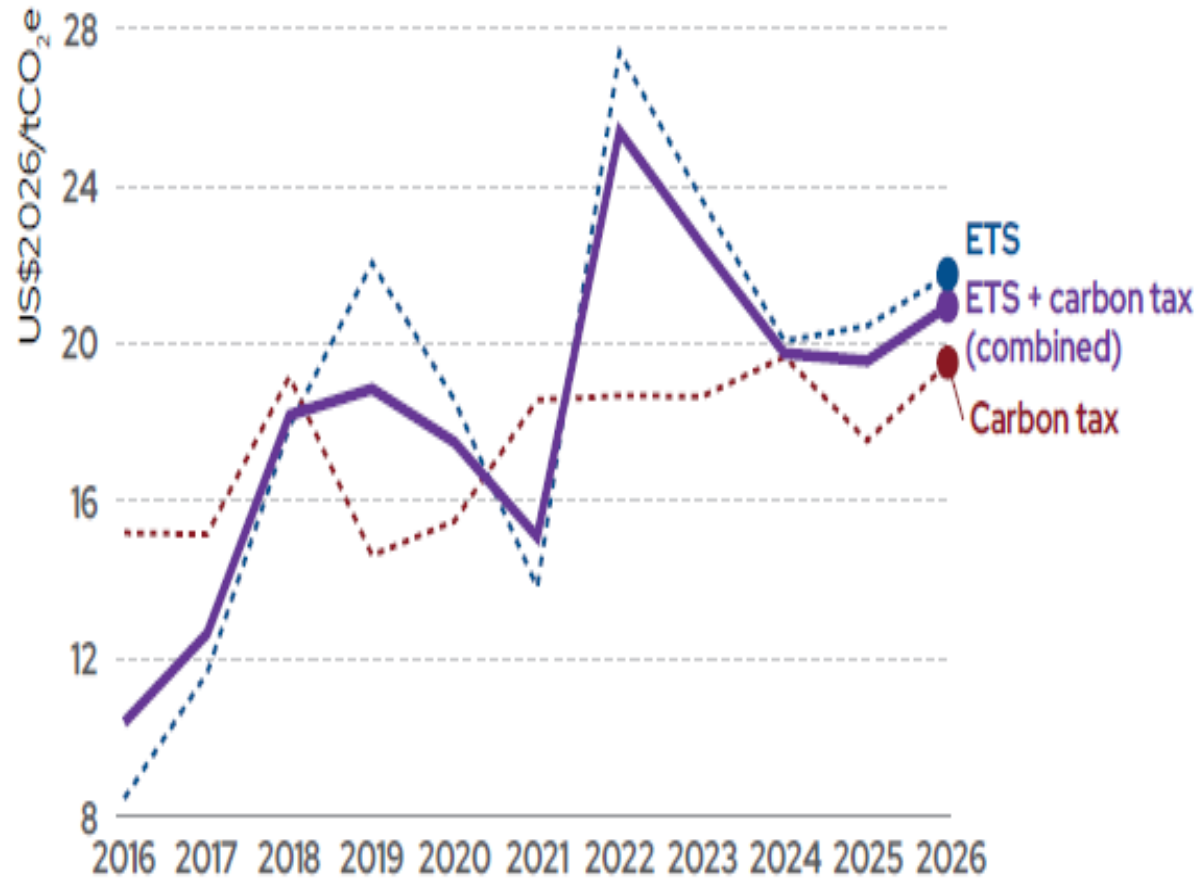
Economic sectors covered by a Carbon Pricing system



Carbon Price from ETS & CT system 1st April 2026



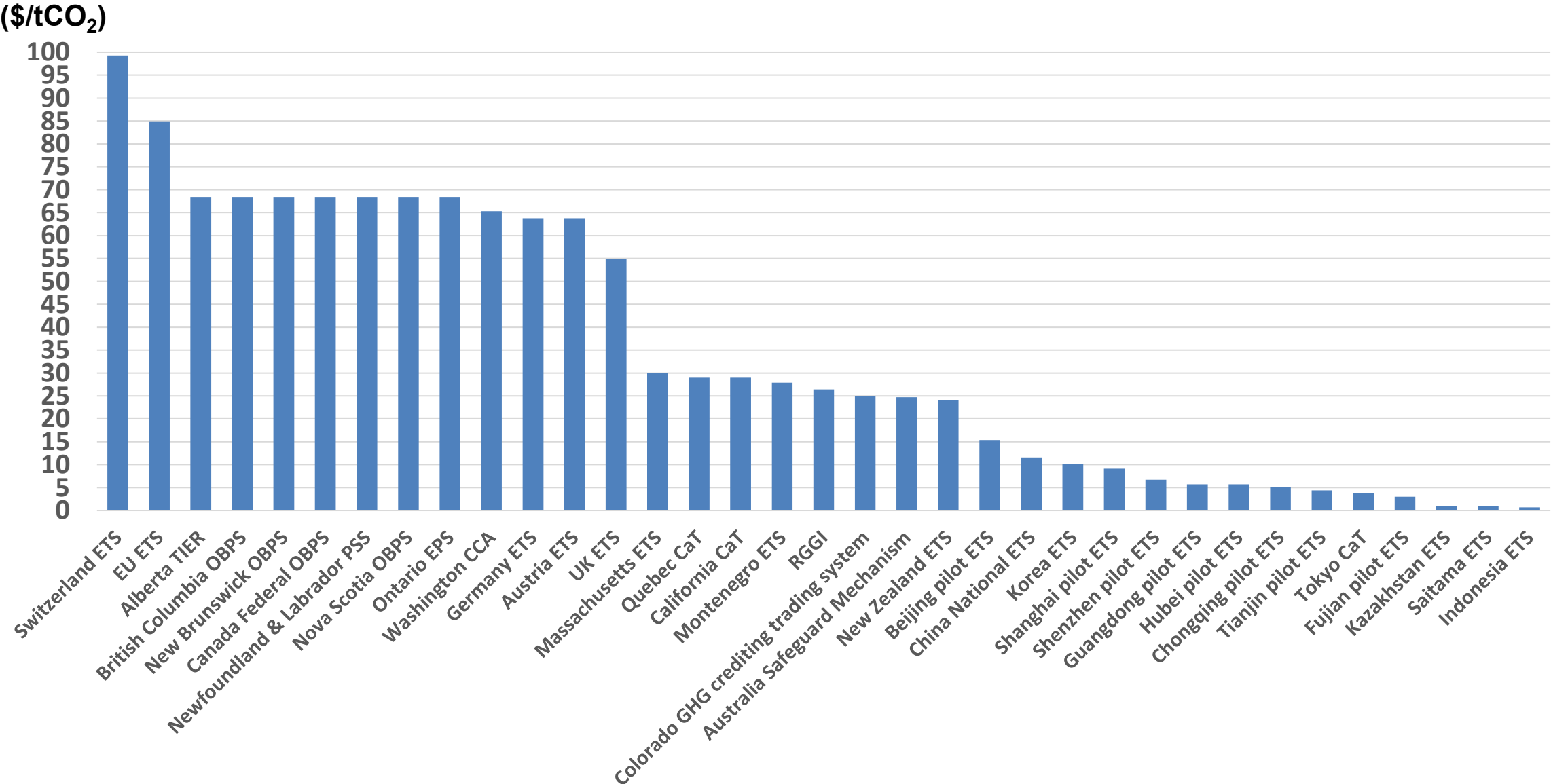
Average Carbon Price from ETS & CT system 2016 - 2026



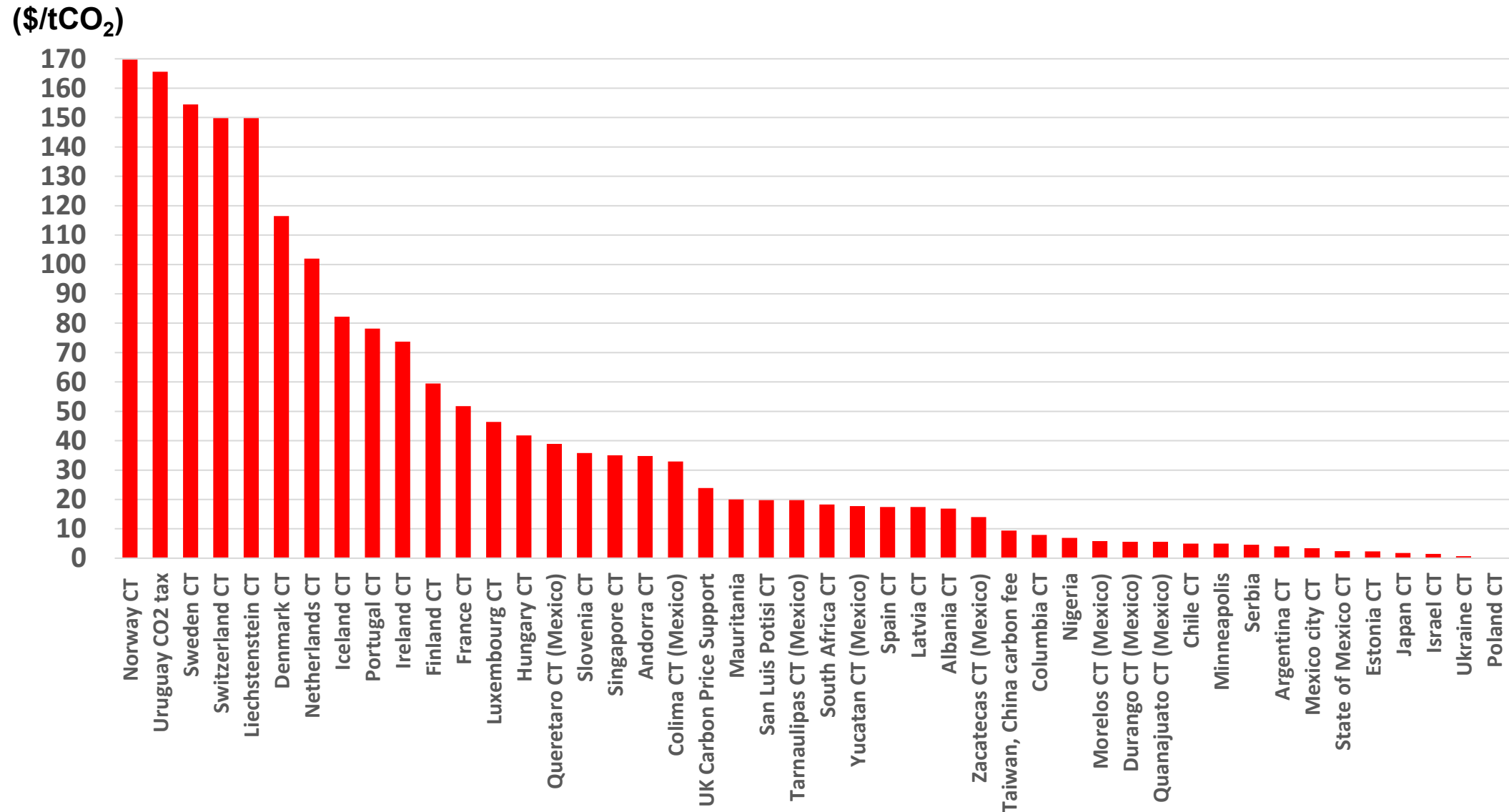
¹ Calculated as percentage of global GHG emissions covered by an ETS or carbon tax. Values exclude newly implemented ETSs in India, Japan and Viet Nam where carbon prices are not available at time of publication. Prices are as of April 1, 2026



Carbon Price for existing ETS – 2026

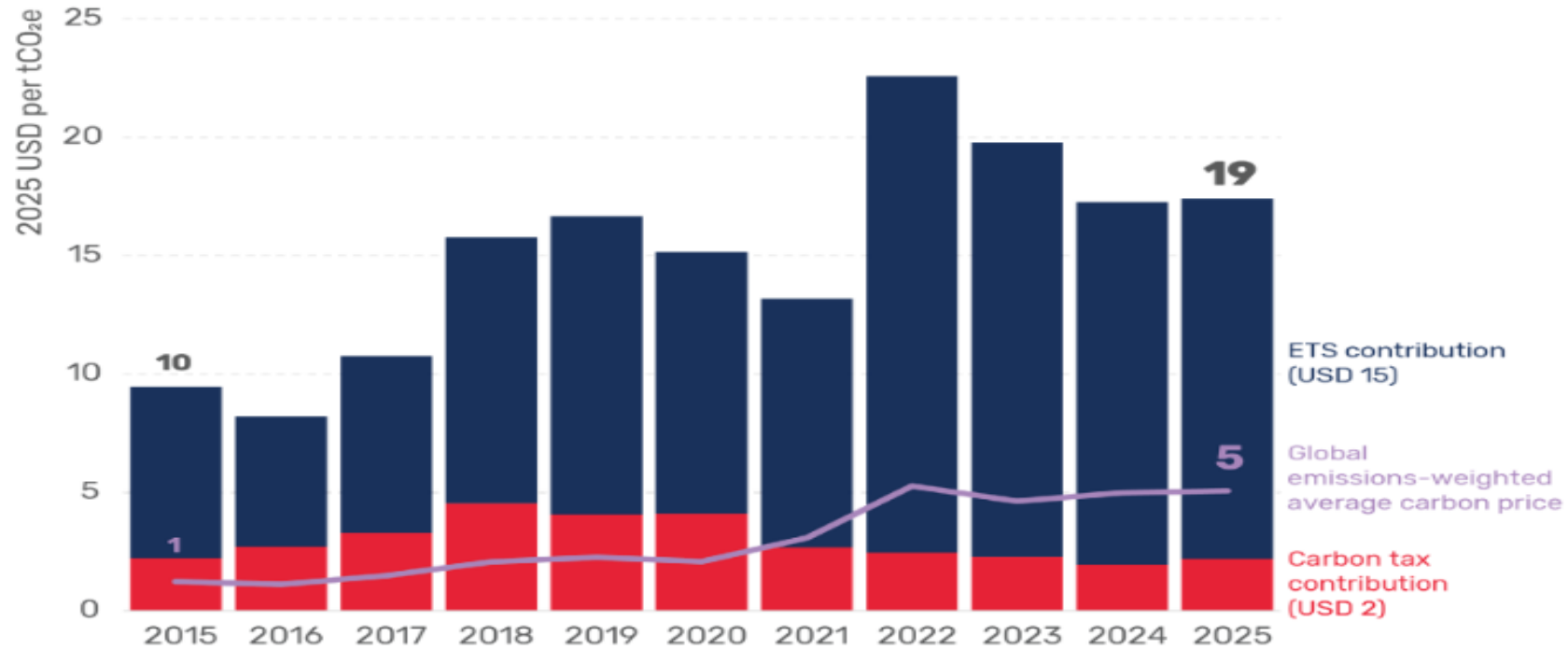


Carbon Price for existing CT Systems - 2026



Evolution of Emissions-weighted Carbon Price vs Global Emissions

Emissions-weighted average carbon prices for covered emissions and global emissions, 2015–2025

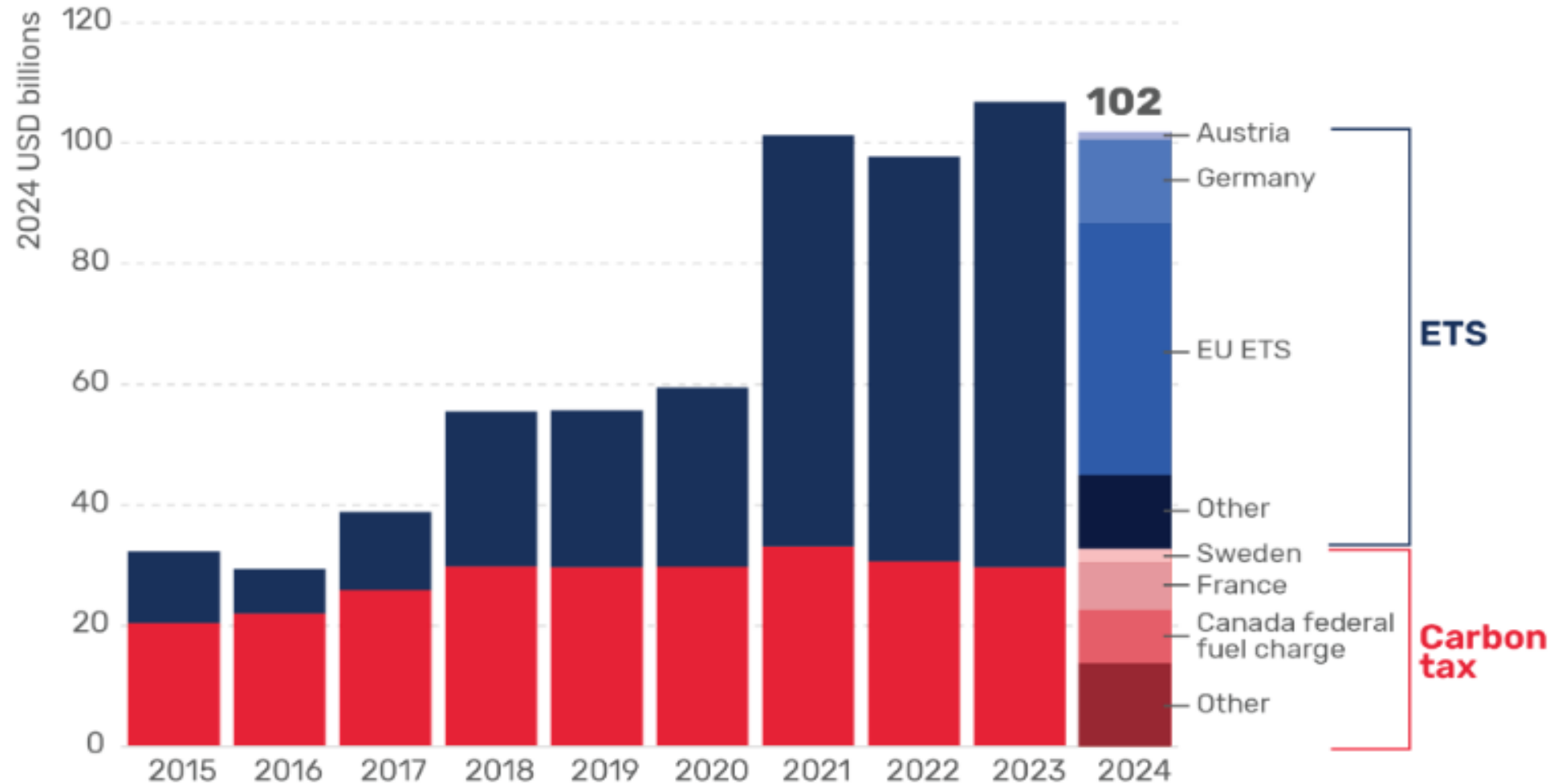


Note: The purple line shows the global emissions-weighted average carbon price. This price accounts for all global emissions, including those without a carbon price. Jurisdictions without a carbon price are included in the calculation of the global emissions-weighted average carbon price, but treated as having a carbon price of zero. The global emissions-weighted average carbon price metric provides an indication of global progress of carbon pricing, taking both price and coverage into account. The blue/red bars show average carbon price for implemented instruments. The global emissions-weighted average carbon price provides an estimate of the weighted average carbon price across countries with an implemented ETS or carbon tax. That is, each implemented carbon price is weighted by its contribution to global covered emissions, with covered emissions defined as the total emissions in each jurisdiction that are subject to that jurisdiction's carbon pricing instrument. As a result, the global emissions-weighted average carbon price only accounts for prices in those jurisdictions that have implemented a carbon price—it does not include those jurisdictions without a carbon price. The average carbon price for implemented instruments therefore provides a global snapshot of how carbon prices have changed over time in jurisdictions that have implemented a carbon price.

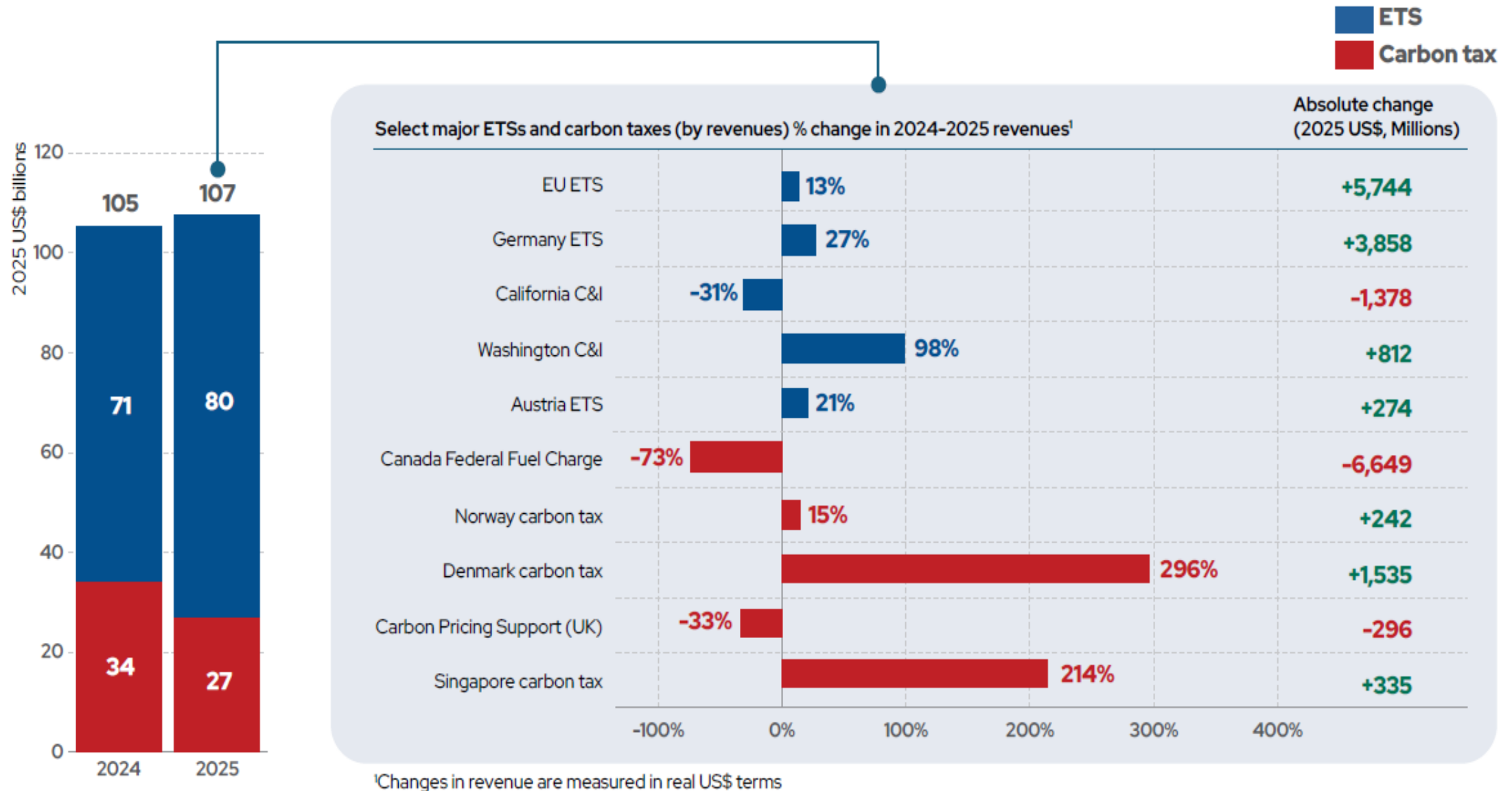


Total Revenues from ETS & CT systems

Total revenues from ETSs and carbon taxes, 2015–2024



Total Revenues from ETS & CT systems 2024 - 2025



Carbon Crediting Mechanism

Carbon Crediting Mechanism	Under a Carbon Crediting Mechanism, tradable credits (representing 1 tCO₂e) are generated through voluntary emissions reduction activities. Carbon credits are issued to activities that reduce emissions, according to protocols that aim to ensure each credit represents a genuine emission reduction. Credits can then be sold to buyers, generating revenue. Carbon credits can represent emissions reductions achieved through either avoidance (preventing GHG emissions from entering the atmosphere—like capturing methane from landfills before it is released), or removal (taking GHGs from the atmosphere, for example through sequestering carbon through afforestation). While carbon crediting mechanisms create a source of supply, they rely on a separate source of demand for credits in order to deliver a financial incentive to reduce emissions. Demand for credits can come from compliance instruments (ETEs or carbon taxes that allow the use of offsets), countries meeting Nationally Determined Contribution targets under the UNFCCC, voluntary offsetting (sometimes linked to internal carbon pricing), or results-based climate finance.
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Carbon Credit Markets

Sources of demand and supply in global carbon credit markets

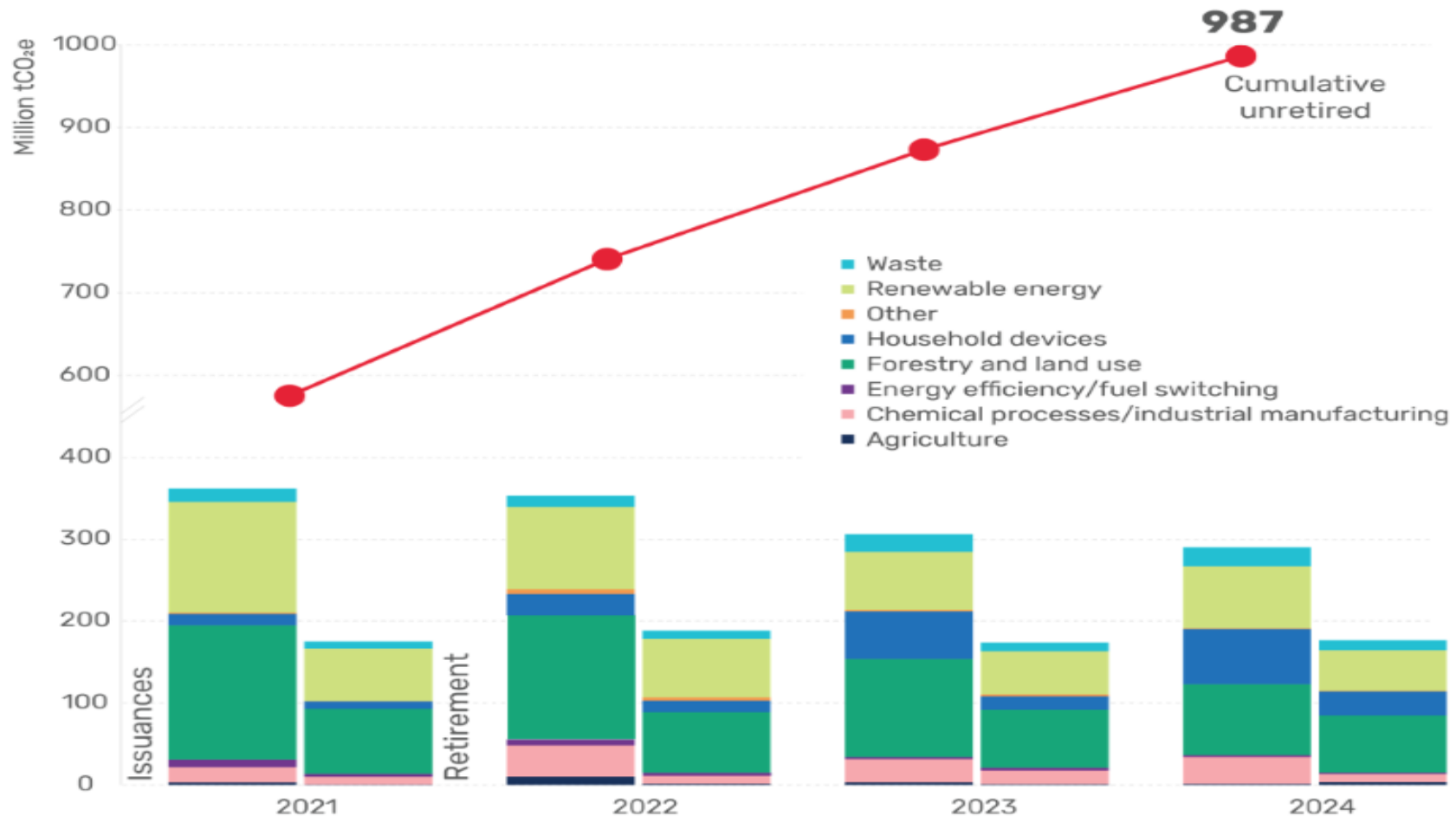


Note: While there is crossover between categories, not all sources of carbon credits are fully fungible across demand segments. For example, international compliance and nationally determined contribution achievement require authorized credits that include a corresponding adjustment.



Carbon Credit Markets

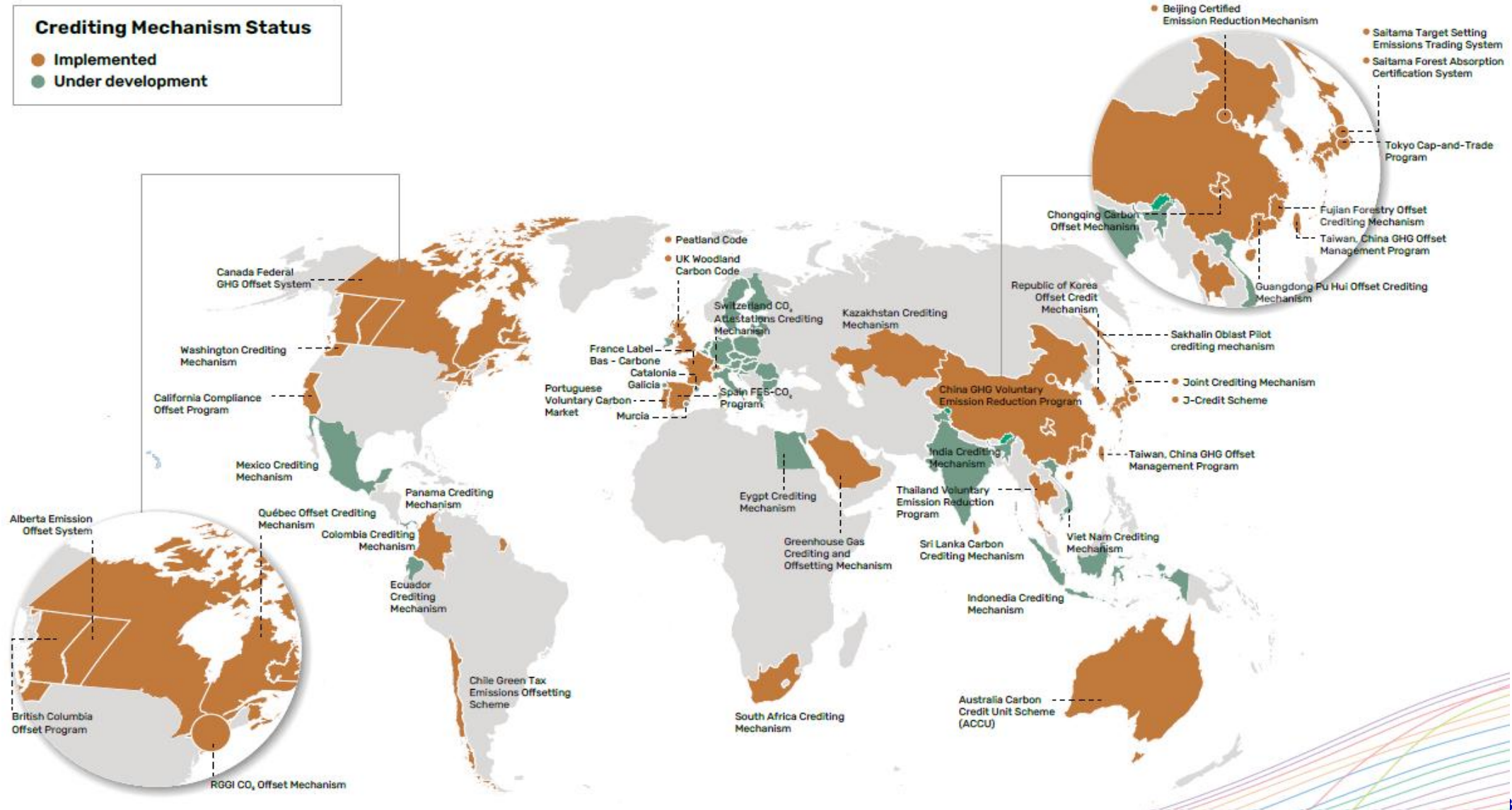
Carbon credit issuances and retirements from independent crediting mechanisms and volume of unretired credits, 2021–2024



Note: Based on data from Climate Focus's Voluntary Carbon Market Dashboard, using project categorizations based on those published by Ecosystem Marketplace. The volume of issuances and retirements by project category covers the following crediting mechanisms: American Carbon Registry, Architecture for Reducing Emissions from Deforestation and Forest Degradation Transactions, BioCarbon, Cercarbono, Climate Action Reserve, Climate Forward, Gold Standard, Plan Vivo, and Verra's VCS. All issuance and retirement data here refers to original issuances, which only include the first time a credit was issued for a specific emission reduction/removal activity to avoid double counting. Original issuances do not rely on previous issuances from other crediting mechanisms.

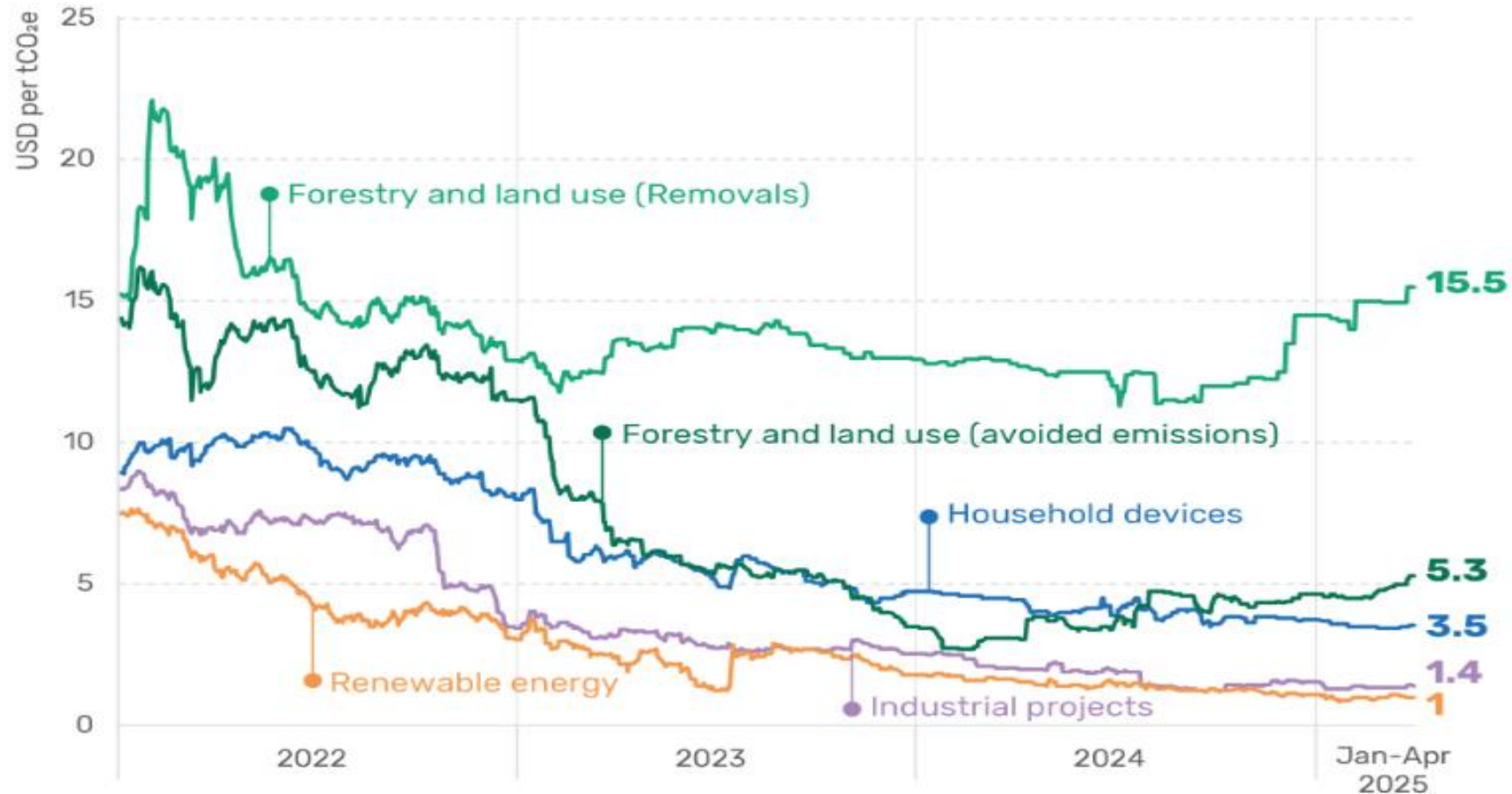


Map of government crediting mechanisms 1st April 2026



Exchange-traded Carbon Credit Prices 2022 - 2025

Exchange-traded carbon credit prices by project types, January 1, 2022 to April 1, 2025

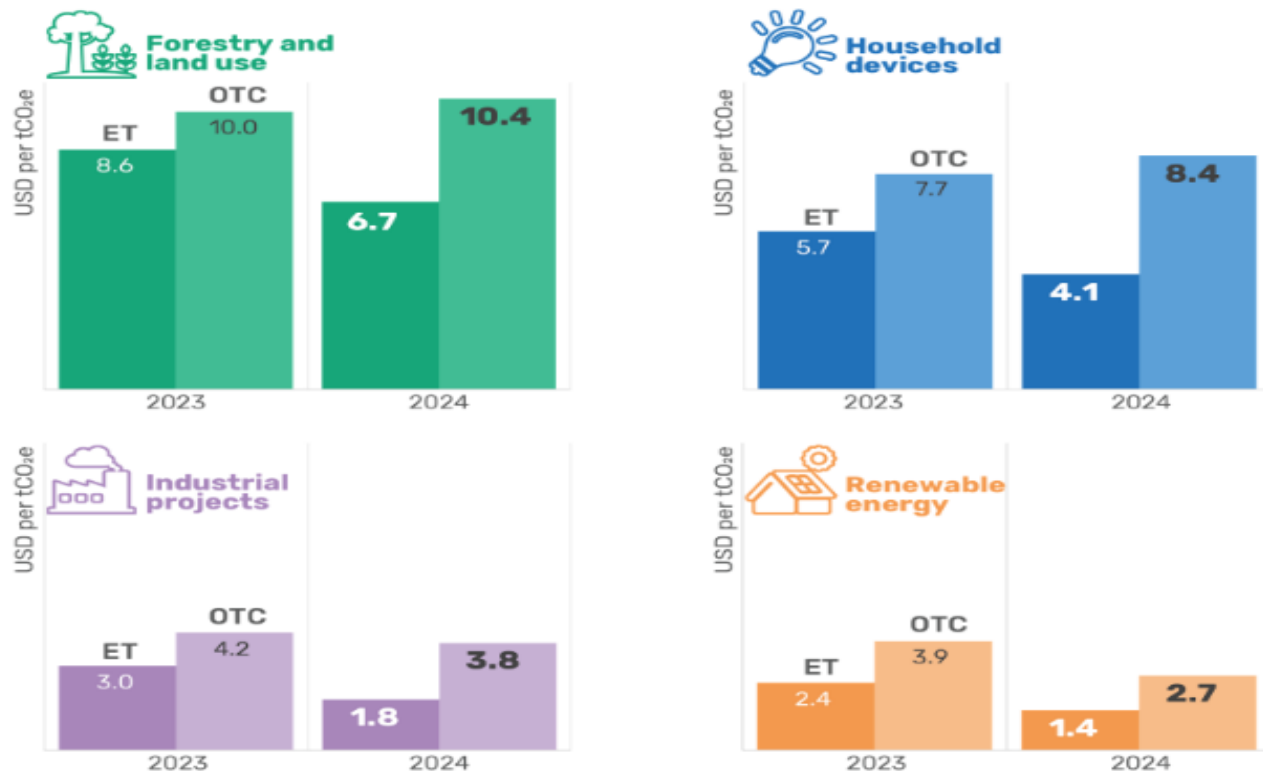


Note: Prices are based on monthly and yearly averages of the price assessments from Platts, S&P Global Commodity Insights (2025), provided by S&P Global.



Exchange-traded Carbon Credit Prices vs Over-The-Counter transactions 2023-2024

Comparison of average annual carbon credit prices from exchange-traded and over-the-counter transactions by project category, 2023–2024



Note: This figure illustrates the exchange-traded and OTC prices of carbon credits. Prices are based on monthly and yearly averages of the price assessments provided by Platts, S&P Global Commodity Insights, 2025. The Platts assessment reflects bids, offers, and trades for credits as reported in the Platts Market on Close assessment process, in the brokered market, or on trading and exchange platforms. For each of its price assessments Platts has identified a reference base to represent fungible credits across each market segment, considering certification, vintage, volume, and the Sustainable Development Goals. For the nature-based projects, a weighted average of Platts nature-based avoidance price and Platts nature-based removals price is used, rather than a singular price assessment. Adjustments are made for credits that vary from this base, normalizing values based on factors like technology, certification standards, geography, and additional benefits to align them with the market value of the reference base. OTC prices were provided by Ecosystem Marketplace and updated as of February 26, 2025. OTC prices represent volume-weighted yearly averages of carbon credit trades in the voluntary carbon markets. Discrepancies may exist in project categorizations between the exchange-traded and OTC data due to different source methodologies. See Annex C, Definitions, for a detailed note on the carbon credit categorizations used in this figure. Details on Platts' assessments can be found in the Platts' Specification Guide.



Carbon Pricing used by Companies **in the past**

Carbon Pricing then has been revised upwards

Microsoft Google Walt Disney Devon Energy	ConocoPhillips Cairn Energy BP Shell Total	Encana	Azko Nobel ExxonMobil
0 – 20 \$/t	20 – 40 \$/t	40 – 60 \$/t	60 – 80 \$/t



Carbon Pricing within TotalEnergies - 2023

Regional carbon prices

- EU27 + NO + UK:

From 2023 onwards the carbon price shall be the higher of (1) 100 \$_{mod}/t and (2) the local carbon tax implemented in the country. ETS quota purchases and free quotas can be applied in the following cases, and under the following conditions:

- Quotas shall be considered in the current and the first year of the LTP (2023 and 2024), in line with PdC and Budget forecast
- Quotas can be considered in years 2025+ under the condition (1) they are officially notified by Authorities, and (2) the resulting carbon price is higher than 100 \$_{mod}/t.

- Other countries w/ carbon price regulation:

Current price for 2023, 100 \$_{mod}/t from 2024 onwards

- Countries w/o carbon price regulation:

0 \$_{mod}/t in 2023 and 2024, 100 \$_{mod}/t from 2025 onwards

If no different local regulations apply, carbon prices shall be applied from production start-up onwards.



Carbon Pricing within TotalEnergies - 2025

Even though CO₂ pricing does not currently apply in all the countries where the Company operates, TotalEnergies includes as base case in its investment criteria a minimum CO₂ price of **100 \$/t (or the prevailing price in a given country if higher) and beyond 2030, the CO₂ price is increased by 2% per year.**

Source: TotalEnergies Sustainability & Climate 2025 Progress Report



Carbon Pricing Scenarios by IEA WEO 2025 (\$/tCO₂)

USD (2024, MER) per tonne of CO ₂	2035	2040	2050
Current Policies Scenario			
Canada	70	70	70
China	14	14	14
European Union	87	87	87
Japan	2	2	2
Korea	13	13	13
Stated Policies Scenario			
Canada	126	126	126
China	22	26	34
European Union	89	92	174
Japan	39	61	105
Korea	52	62	75
Net Zero Emissions by 2050 Scenario			
Advanced economies with net zero emissions pledges	180	205	250
Selected emerging markets and developing economies*	125	160	200
Other emerging market and developing economies	25-50	35-85	55-180

*Includes Brazil, China, India, Indonesia and South Africa.

Notes: USD = United States dollar; MER = market exchange rate. Values are rounded.

Source: IEA WEO 2025



Levelized cost of Oil & Gas production (1)

- $p = \text{Price of hydrocarbons}$
- $Q = \text{Production}$
- $n = \text{Life time of the Project}$
- $\text{Capex} = \text{Capital Expenditures}$
- $\text{Opex} = \text{Operating Expenses}$
- $i = \text{Discount Rate}$
- $GM = \text{Gross Discounted Margin}$
- $lc = \text{Discounted Levelized Cost per Unit of Production}$



Levelized cost of Oil & Gas production (2) = Discounted Costs/Discounted Production

$$\text{Gross Margin}(GM) = \sum_{k=0}^n (p_k Q_k - \text{Capex}_k - \text{Opex}_k) / (1 + i)^k$$

Suppose p_k constant = p :

$$GM = p \sum_{k=0}^n Q_k / (1 + i)^k - \sum_{k=0}^n (\text{Capex}_k + \text{Opex}_k) / (1 + i)^k$$

$$GM = p \sum_{k=0}^n Q_k / (1 + i)^k - lc \sum_{k=0}^n Q_k / (1 + i)^k$$

$$lc = \sum_{k=0}^n (\text{Capex}_k + \text{Opex}_k) / (1 + i)^k / \sum_{k=0}^n Q_k / (1 + i)^k$$



LCOE



The competitiveness of Energy Sources Levelized Cost Of Electricity (LCOE)



Levelized Cost of Electricity production (LCOE) = Discounted Costs/Discounted Production

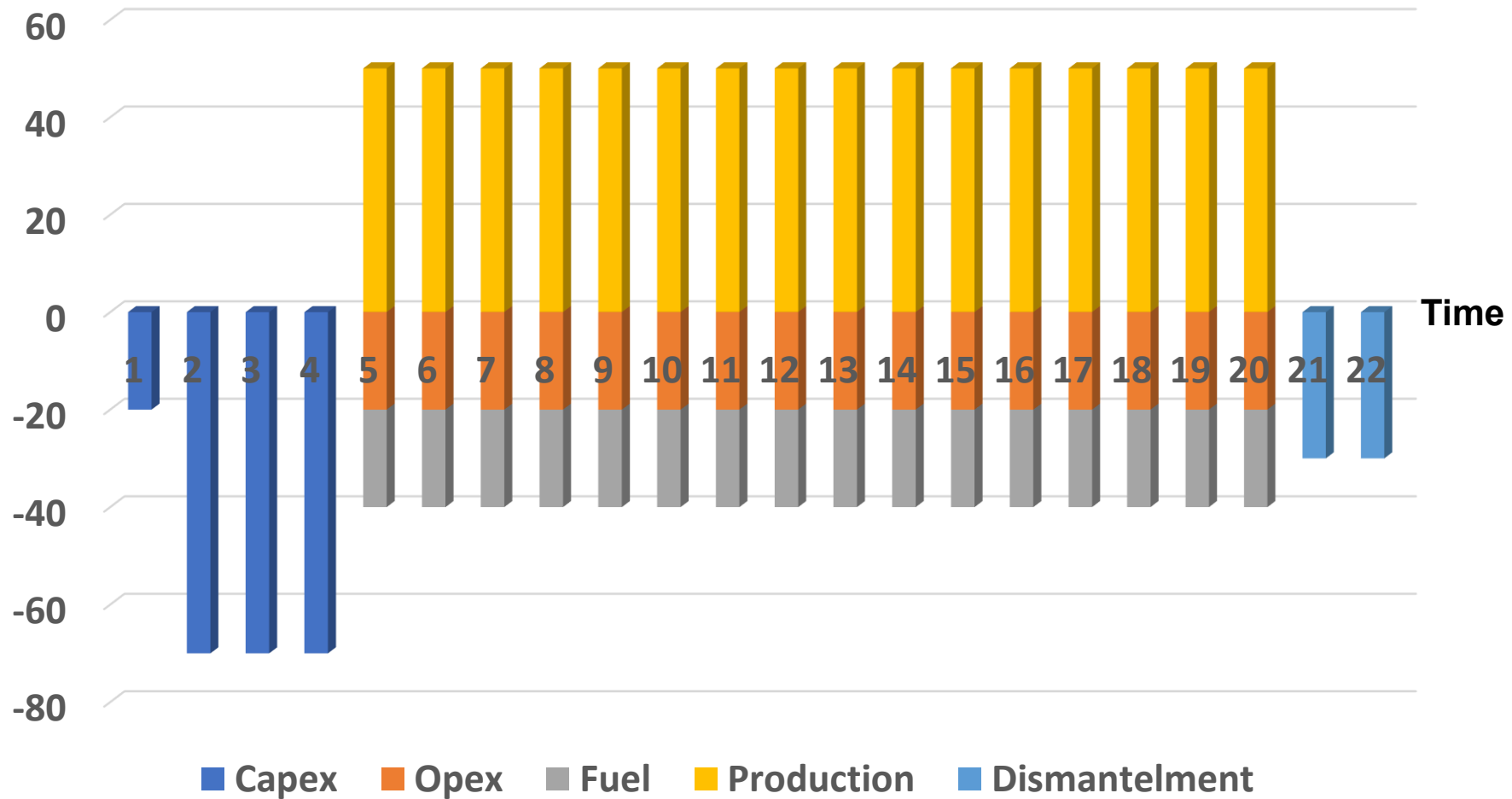
$$LCOE = \sum_{k=0}^{k=n} \frac{C_k + O_k + F_k}{(1+i)^k} / \sum_{k=0}^{k=n} \frac{Q_k}{(1+i)^k}$$

- *Q : Production of Electricity*
- *C : Capital Expenditures*
- *O : Operating Expenses*
- *F : Fuel Expenses*
- *n : Economic Plant Life*
- *i : Discount Rate*
- *Due to discounting, decommissioning costs have a negligible effect (included in Capex)*
- *For Renewables, Intermittency Costs are not included*

Nota: In the following, raw data from IEA, US DOE, UK DBEIS, IRENA, Lazard, Fraunhofer ISE, WNA,.....



A typical schedule for an Industrial Project for Electricity Generation (illustration)



Example: the case of a Offshore Wind Farm

Location: OECD Region (Saint-Nazaire/France) – 2022

Nominal Capacity	MW	480
Capacity each turbine	MW	6
Nb of turbines		80
Duration life	Years	25
Load factor	%	40
Electricity Generation	MWh/year	1681920
Total Electricity Generation	MWh	42048000
Capex	€/kW	3800
Total Capex	M€	1824
Constant Annuity @ 0%	M€	77
Constant Annuity @ 5%	M€	131
Constant Annuity @ 8%	M€	172
Opex	€/kW/year	80
Opex per year	M€	38
Total Opex	M€	960
Fuel cost	M€	0
Decommissioning	M€	91,2
Total cost	M€	2875
LCOE (not discounted)	€/MWh	68
LCOE @ 5%	€/MWh	101
LCOE @ 8%	€/MWh	125



Example: the case of a Offshore Wind Farm

Location: OECD Region (Saint-Nazaire/France) – 2022

Constant annuity calculation :

$$I_0 = A/(1+i) + A/(1+i)^2 + A/(1+i)^3 + \dots + A/(1+i)^n$$

$$I_0 = [A/(1+i)] * [1 + 1/(1+i) + 1/(1+i)^2 + \dots + 1/(1+i)^{n-1}]$$

$$I_0 = A * [(1+i)^n - 1] / i(1+i)^n \text{ Thus :}$$

$$A = I_0 * i(1+i)^n / [(1+i)^n - 1] \text{ Thus, for}$$

$$i = \epsilon\%, A = 0,040 = 4\% \text{ per year (To avoid division by 0, and 25 years of operation)}$$

$$i = 5\%, A = 0,071 = 7,1\% \text{ per year}$$

$$i = 8\%, A = 0,094 = 9,4\% \text{ per year}$$

Including Capex of 1824 M€ and taking into account dismantlement costs of 91 M€ occurring after 25 years of operation, we get :

$$\text{Constant annuity @0\%} = 77 \text{ M€}$$

$$\text{Constant annuity @5\%} = 131 \text{ M€}$$

$$\text{Constant annuity @8\%} = 172 \text{ M€}$$



Levelized Cost of Electricity production

Application to various Technologies



From top to down, from left to right:

- Nuclear Power plant, France, Cruas in Ardèche - PWR - 4x900 MW
- Nuclear EPR, France, Flamanville - 1650 MW
- Gas fired CCGT power plant, Bouchain, Northern France – 580 MW
- Heavy Fuel power plant, Liberia - 10 MW
- Coal supercritical power plant, Turkey - 2x600 MW
- Coal IGCC, Japan, Nakoso - 250 MW
- Coal IGCC with CCS, US, Kemper County Mississippi - 580 MW, CO2 for EOR



Levelized Cost of Electricity production

Application to various Technologies



From top to down, from left to right:

- Onshore Wind Farm, Germany
- Offshore Wind Farm, France, Saint-Brieuc, Brittany, 500 MW
- Solar PV Utility Scale, UK, West Raynham, Norfolk, 50 MWp
- Solar PV Rooftop
- Solar CSP, US
- Hydro Large, Norway, Alta Dam
- Biomass Power Plant, Japan, Omuta, 50 MW
- Geothermal, Iceland, Svartsengi, 75MW_e + 150 MW_{th}



LCOE is very dependant upon changes of the environment (Inflation, prices of fuels, cost of new nuclear, production costs of solar energy, access to mineral materials in particular)

For wind energy and solar energy, cost of intermittency has to be added.

LCOE is also very dependant upon the selected **Discount Rate**

The following graphs have been established taking into account the most recent data of the various components of the LCOE (Capex, Opex, Cost of Fuels) deriving from external pertinent sources. For reason of simplicity, they are illustrating the mean values for LCOE of all technologies generating Electricity. They refer to European/OECD sites, knowing that there exist large disparities according to the various sites and locations in the World



Levelized Cost of Electricity production - LCOE Assumptions (2023/2024 Environment)

- Crude oil price : 75 \$/b (Brent price 2024)
- Gas price : 14 \$/Mbtu (German Import price 2024)
- Coal price : 140 \$/t (NW Europe price 2024)
- Uranium price : 80 \$/lbU₃O₈ (Spot price 2024)
- Exchange rate : 1€ = 1,07 \$
- **Discount rate : 5%**
- Standard power ranges
- **Reference : European/OECD sites**
- Mean values, ranges differ depending upon technologies
- For Renewables, costs of intermittency are not included and have to be added.

Nota: A large range of LCOE can be observed depending upon the publications and the location of the projects
Data below from IEA, NREL, EIA, Lazard, Fraunhofer, DBEIS UK.....

131



Levelized cost of Electricity production

Assumptions: 2023/2024 Environment

		Nuclear Gener. 2	Nuclear EPR	Gas CCGT	Gas CCGT&CCS	Heavy Fuel	Coal Sup. crit.	Coal IGCC	Coal IGCC&CCS	Wind Onshore	Wind Offshore	Solar PV Utility	Solar PV Rooftop	Solar CSP	Hydro Large	Biomass	Geother.
Power reference	Mwe	1000	1650	600	600	600	700	700	700	120	250	100	0	150	1000	50	50
Construction lead	Years	7,0	8,0	3,0	3,0	3,0	5,0	5,0	5,0	1,5	2,5	2,0	0,3	2,0	6,0	3,0	3,0
Duration life	Years	60	60	30	30	30	40	40	40	25	25	25	25	25	80	25	80
Availability	%	90%	90%	80%	80%	80%	80%	80%	80%	33%	45%	17%	17%	45%	35%	80%	85%
Thermal Energy Efficiency	%	33%	37%	60%	60%	42%	40%	40%	40%								
Capex	€/kW	6000	10000	1000	2700	1200	4000	5000	7000	1500	3400	1000	2000	7000	2300	4400	5000
Opex (incl. Maintenance)	€/MWh	21	35	8	14	6	13	29	36	11	20	12	20	20	16	25	18

CCGT: Combined-Cycle Gas Turbine

IGCC: Integrated Gasification Combined-Cycle

CCS: Carbon Capture & Storage

Note: Gas CCGT & CCS and Coal IGCC & CCS includes 10€/MWh for CO2 transport & storage



Cost price of Electricity produced by the various types of Power Plants @ 5% excluding CO₂ price (**2023/2024** Environm., European/OECD sites, **Mean values**)

(€/MWh)

160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0

Nuclear Gen. 2
Nuclear New EPR
Gas CCGT
Gas CCGT with CCS
Heavy fuel
Coal Super Critical
Coal IGCC
Coal IGCC with CCS
Wind onshore
Wind Offshore
Solar PV Utility
Solar PV Rooftop
Solar CSP
Hydro Large
Biomasse
Geothermal

Variability of LCOE, according to sites, estimates 2023
Solar CSP : 100-250 €/MWh
Large Hydro : 40-120 €/MWh
Geothermal : 40-150 €/MWh
Biomasse : 50-240 €/MWh
Marine : > 350 €/MWh

Fuel Costs
Opex
Capex



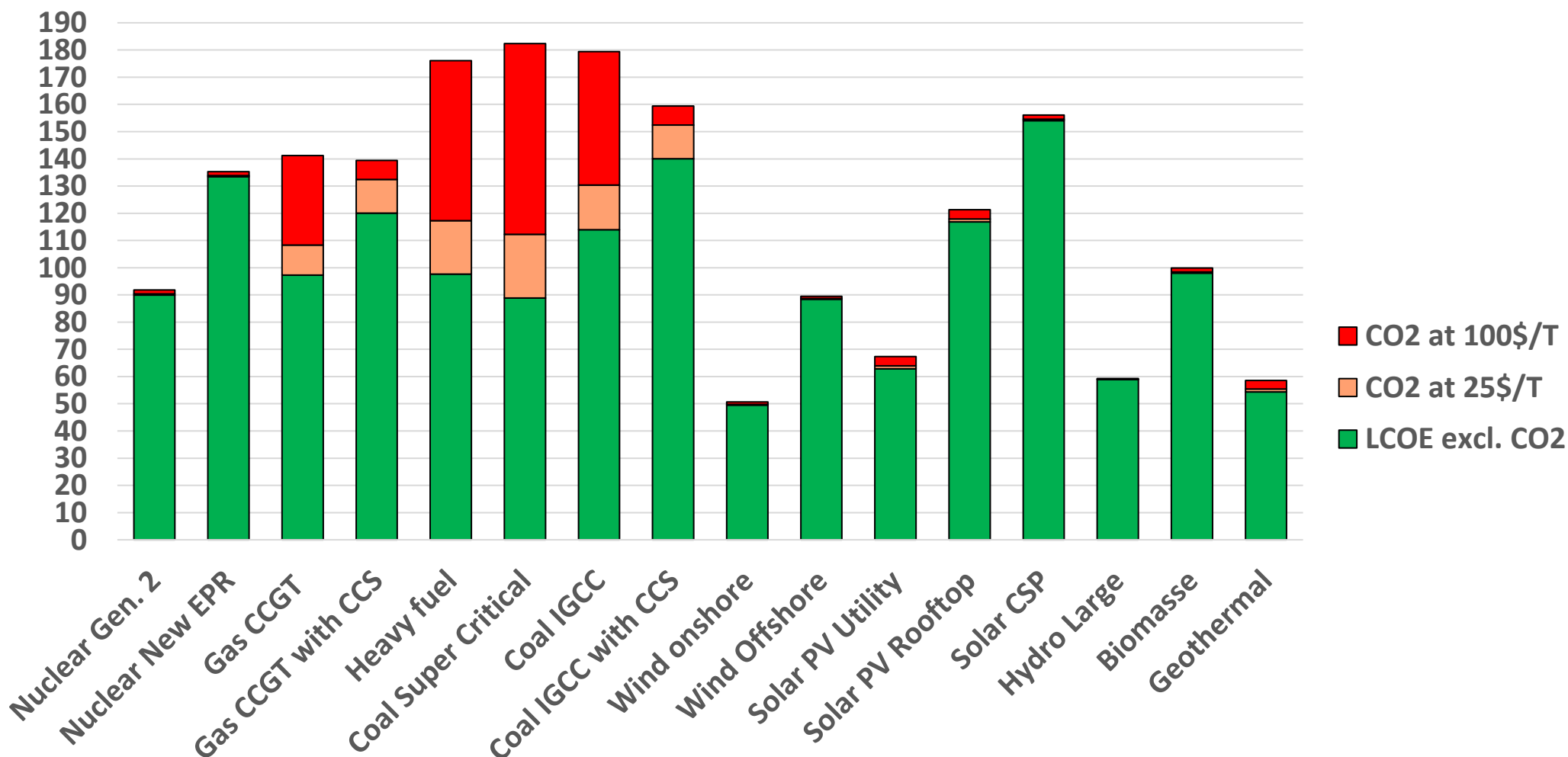
Other sources of energy, according to sites:

- ◆ Solar CSP : 100-250 €/MWh
- ◆ Large Hydro : 40-120 €/MWh
- ◆ Geothermal : 40-150 €/MWh
- ◆ Biomass : 60-240 €/MWh
- ◆ Marine : > 350 €/MWh



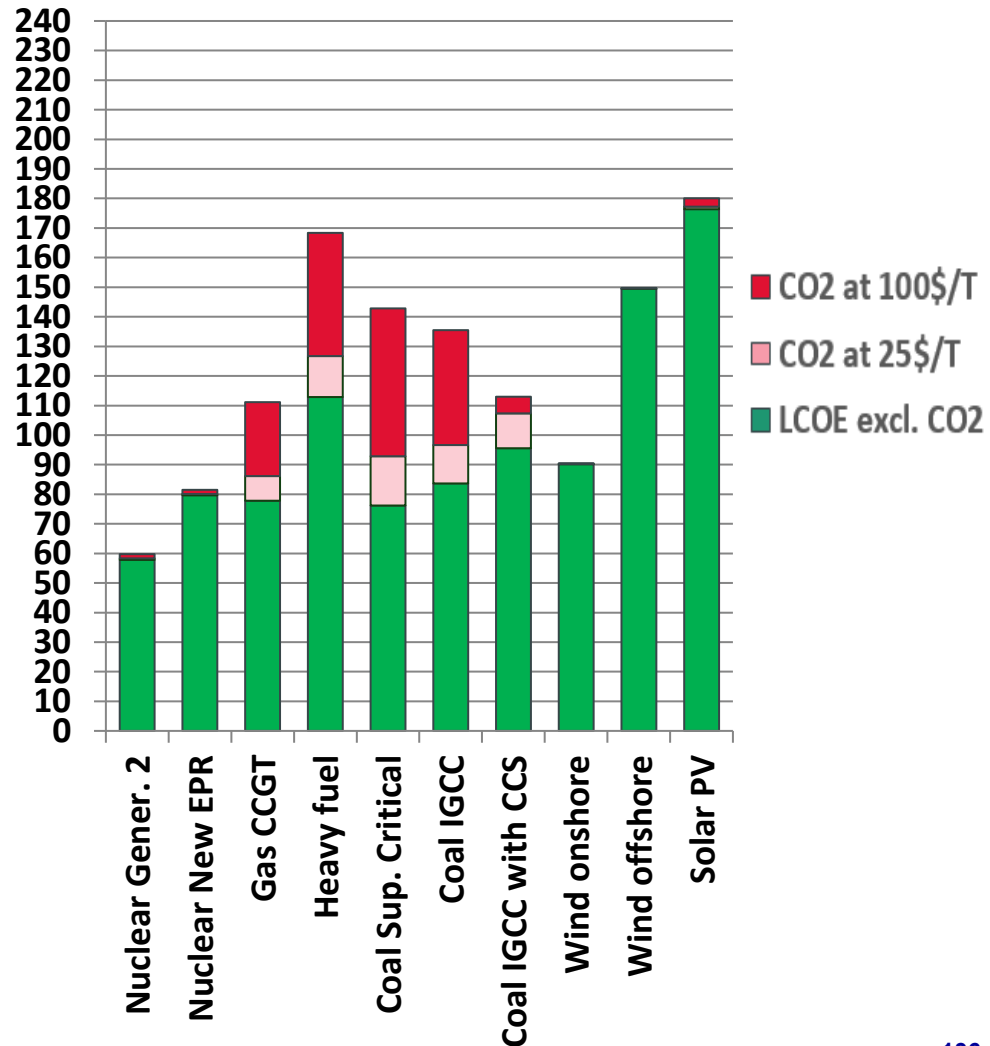
Cost price of Electricity produced by the various types of Power Plants @ 5% including CO₂ price (2023/2024 Environm., European/OECD sites, **Mean values**)

(€/MWh)

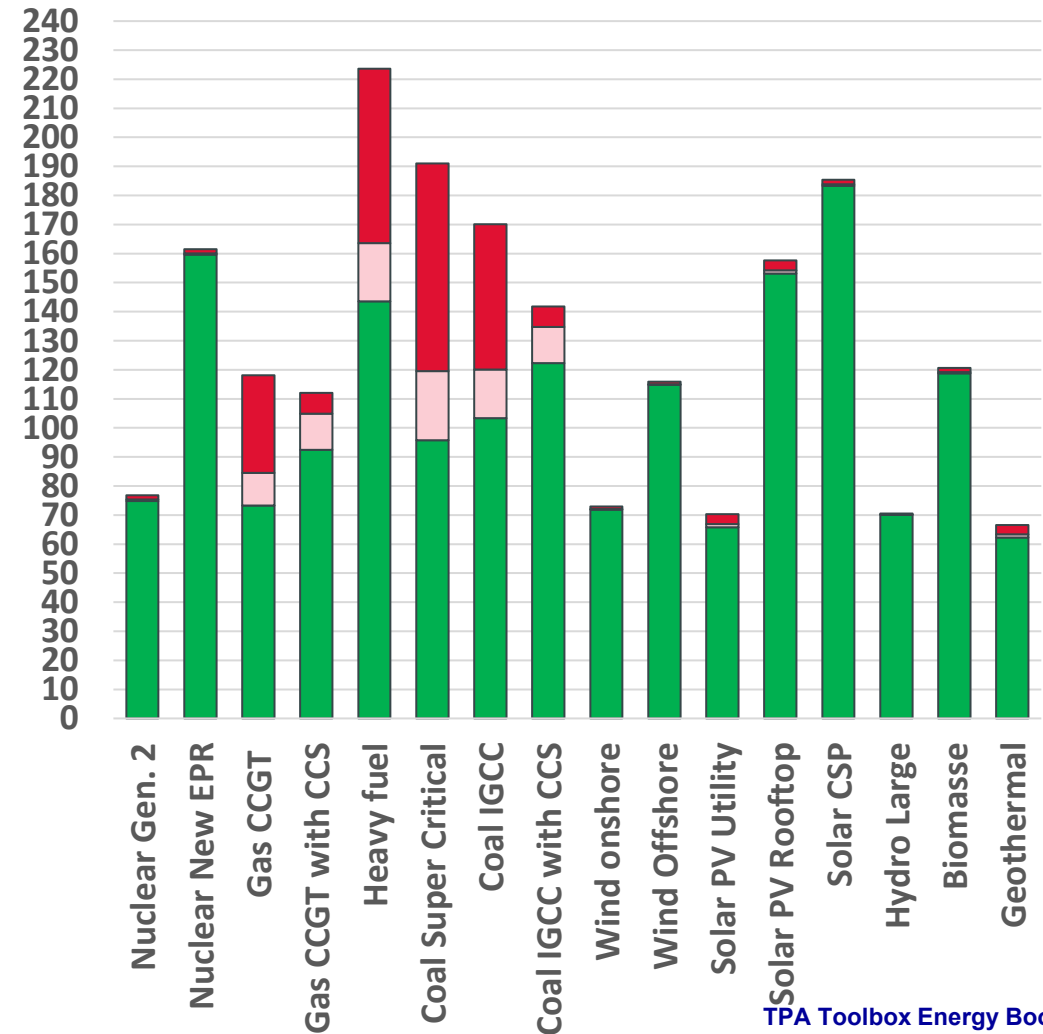


Reminder - LCOE Variations (Including CO₂ Prices) (€/MWh)

2012/2014 Environment @ 8%

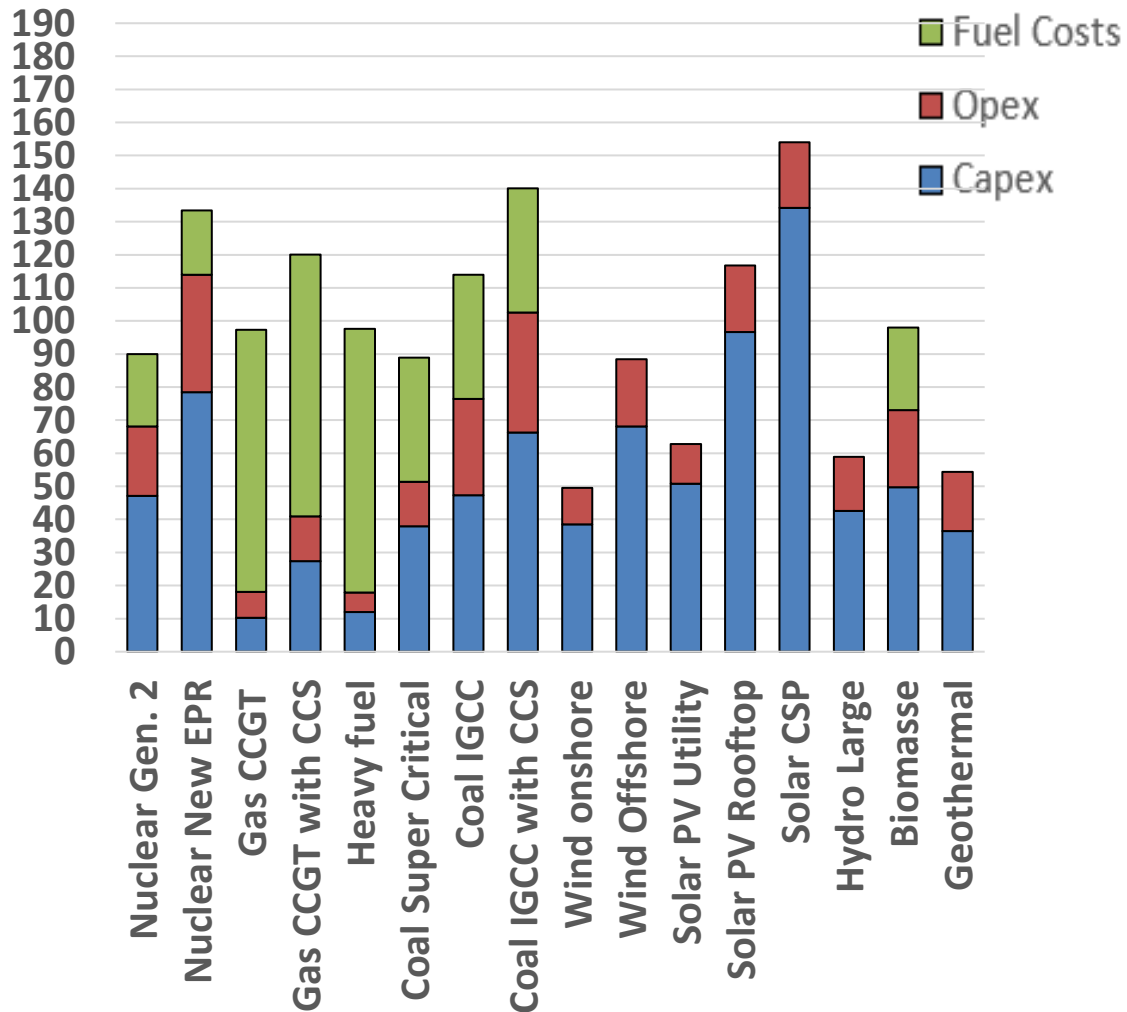


2021/2022 Environment @ 8%

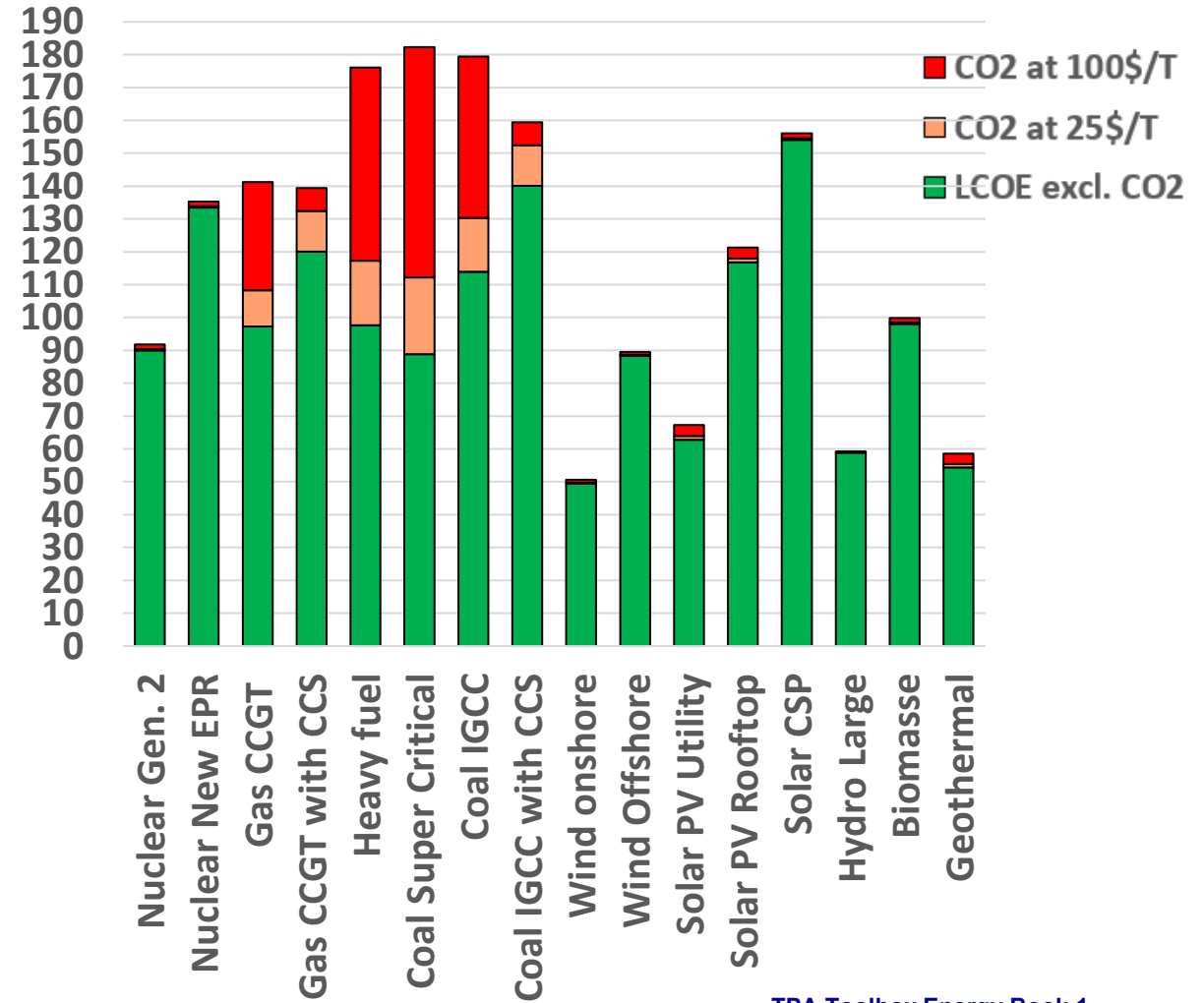


LCOE 2023/2024 Environment @ 5% (excluding & including CO₂ Penalty) (€/MWh)

Excluding CO2 penalty



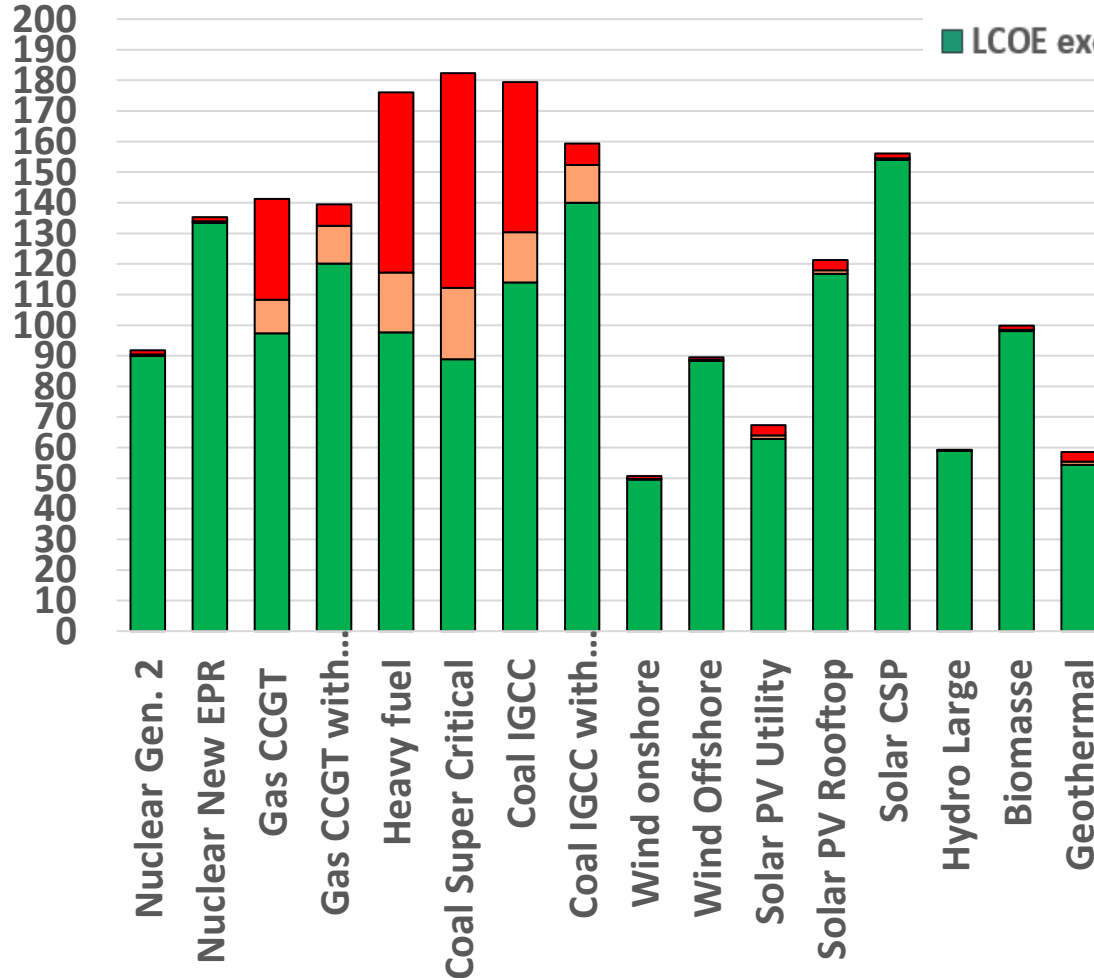
Including CO2 penalty



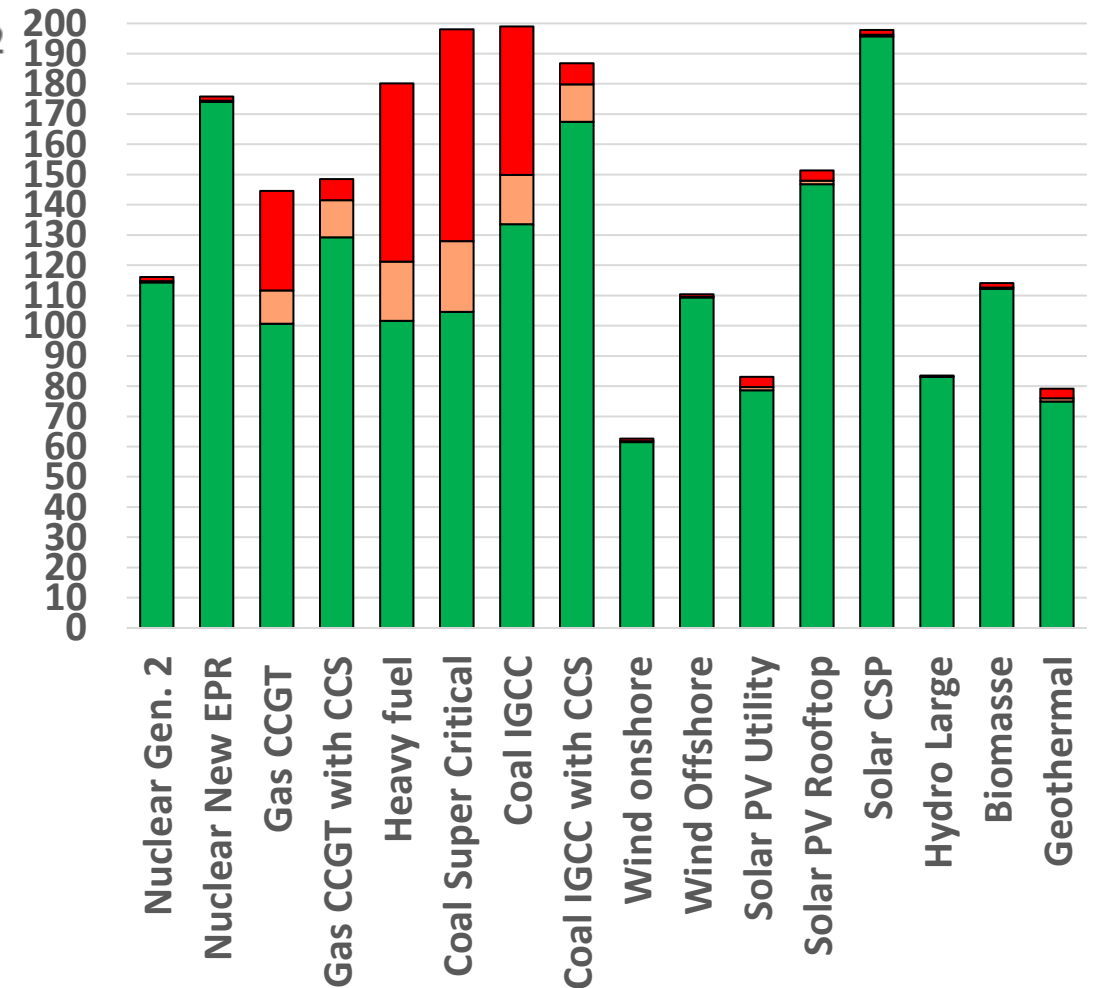
LCOE including CO₂ Prices 2023/2024 Environment Impact of the Discount Rate (€/MWh)

Discount Rate : 5%

■ CO₂ at 100\$/T
■ CO₂ at 25\$/T
■ LCOE excl. CO₂



Discount Rate 8 %



Source: Ch.Guéritte



Technological costs in specific regions by IEA WEO 2025 - STEPS

Economic assumptions are important when defining LCOE

	Capital costs (USD/kW)			Capacity factor (%)			Fuel, CO ₂ , O&M (USD/MWh)			LCOE (USD/MWh)			VALCOE (USD/MWh)		
	2024	2035	2050	2024	2035	2050	2024	2035	2050	2024	2035	2050	2024	2035	2050
United States															
Nuclear	5 000	4 700	4 500	90	90	90	30	30	30	110	110	105	110	110	105
Coal	2 100	2 100	2 100	40	30	20	30	25	25	100	120	190	100	110	180
Gas CCGT	1 000	1 100	1 100	65	55	35	30	35	40	50	60	80	50	55	70
Geothermal*	15 000	9 000	6 600	75	75	80	50	25	20	330	195	135	330	195	135
Solar PV	1 060	660	530	20	23	23	10	10	10	55	35	25	65	50	50
Wind onshore	1 570	1 510	1 460	42	44	44	10	10	10	40	40	35	45	45	40
Wind offshore	4 060	2 860	2 340	41	46	49	35	30	25	125	85	65	130	90	70
Electricity generation costs										65	65	70			
European Union															
Nuclear	6 600	5 000	4 500	75	75	80	35	35	35	165	135	120	160	120	105
Coal	2 000	2 000	2 000	20	n.a.	n.a.	120	n.a.	n.a.	280	n.a.	n.a.	235	n.a.	n.a.
Gas CCGT	1 000	1 000	1 000	15	10	10	110	110	135	200	230	290	145	150	150
Geothermal*	21 630	18 130	16 730	75	75	80	55	45	45	455	380	330	450	365	325
Solar PV	760	470	390	14	14	14	10	10	10	50	35	30	60	65	70
Wind onshore	1 620	1 540	1 510	29	30	30	15	15	15	60	55	55	70	75	75
Wind offshore	3 460	2 300	1 980	50	54	55	15	10	10	75	50	40	75	65	60
Electricity generation costs										125	100	85			

	Capital costs (USD/kW)			Capacity factor (%)			Fuel, CO ₂ , O&M (USD/MWh)			LCOE (USD/MWh)			VALCOE (USD/MWh)		
	2024	2035	2050	2024	2035	2050	2024	2035	2050	2024	2035	2050	2024	2035	2050
China															
Nuclear	2 800	2 700	2 500	75	70	70	25	25	25	70	75	70	70	75	70
Coal	800	800	800	50	25	20	40	35	35	65	80	90	60	70	70
Gas CCGT	560	560	560	25	15	15	70	65	70	100	115	125	90	90	95
Geothermal*	16 050	11 050	9 050	75	75	80	55	30	25	320	215	165	320	215	165
Solar PV	590	350	280	12	12	12	10	10	10	45	30	25	65	65	70
Wind onshore	860	800	790	23	24	24	10	10	10	40	35	35	45	45	55
Wind offshore	1 520	1 020	880	30	32	32	15	10	10	60	40	35	65	50	55
Electricity generation costs										75	75	80			
India															
Nuclear	2 800	2 800	2 800	80	85	90	30	30	30	75	70	70	75	70	70
Coal	1 200	1 200	1 200	70	70	65	40	45	50	60	65	70	60	65	65
Gas CCGT	700	700	700	30	35	45	60	70	75	90	95	95	85	90	85
Geothermal*	19 500	15 000	13 200	75	75	80	75	55	45	400	305	250	400	305	250
Solar PV	530	310	250	20	21	22	5	5	5	30	20	15	35	30	45
Wind onshore	1 110	1 040	1 010	27	29	30	15	10	10	55	45	45	60	50	55
Wind offshore	2 620	1 760	1 460	34	38	39	25	15	15	110	70	55	110	75	65
Electricity generation costs										75	65	50			

Source: IEA WEO 2025 – Cost of CO₂ is included in Opex

*Next-generation geothermal.

Sources: IEA analysis; IRENA (2025).



Technological costs in specific regions by IEA WEO 2025 - NZE

Economic assumptions are important when defining LCOE

	Capital costs (USD/kW)			Capacity factor (%)			Fuel, CO ₂ , O&M (USD/MWh)			LCOE (USD/MWh)		
	2024	2035	2050	2024	2035	2050	2024	2035	2050	2024	2035	2050
United States												
Nuclear	5 000	4 700	4 500	90	85	85	30	30	30	110	115	115
Coal	2 100	2 100	2 100	25	n.a.	n.a.	95	n.a.	n.a.	210	n.a.	n.a.
Gas CCGT	1 000	1 100	1 100	40	10	n.a.	55	90	n.a.	85	265	n.a.
Geothermal*	15 000	6 600	3 560	75	75	80	50	20	10	330	140	70
Solar PV	1 060	590	480	20	23	23	10	10	10	55	30	25
Wind onshore	1 570	1 450	1 400	42	44	44	10	10	10	40	35	35
Wind offshore	4 060	2 380	1 980	41	46	49	35	20	15	125	70	55
Electricity generation costs										65	80	70
European Union												
Nuclear	6 600	5 000	4 500	75	70	65	35	35	35	165	140	135
Coal	2 000	2 000	2 000	15	n.a.	n.a.	150	n.a.	n.a.	330	n.a.	n.a.
Gas CCGT	1 000	1 000	1 000	15	n.a.	n.a.	115	n.a.	n.a.	215	n.a.	n.a.
Geothermal*	21 630	16 030	14 000	75	75	80	55	40	35	455	335	280
Solar PV	760	440	370	14	14	14	10	10	10	50	35	30
Wind onshore	1 620	1 510	1 460	29	30	30	15	15	15	60	55	50
Wind offshore	3 460	2 180	1 800	50	54	55	15	10	10	75	45	35
Electricity generation costs										125	95	80
China												
Nuclear	2 800	2 700	2 500	80	75	75	25	25	25	70	70	70
Coal	800	800	800	40	n.a.	n.a.	80	n.a.	n.a.	105	n.a.	n.a.
Gas CCGT	560	560	560	40	30	n.a.	85	100	n.a.	100	120	n.a.
Geothermal*	16 050	8 050	5 150	75	75	80	55	25	15	320	160	95
Solar PV	590	320	260	12	12	12	10	10	5	45	30	25
Wind onshore	860	780	750	23	24	24	10	10	10	40	35	35
Wind offshore	1 520	900	760	30	32	32	15	10	10	60	35	30
Electricity generation costs										75	80	75
India												
Nuclear	2 800	2 800	2 800	80	85	85	30	30	30	75	70	70
Coal	1 200	1 200	1 200	60	25	n.a.	35	135	n.a.	60	195	n.a.
Gas CCGT	700	700	700	30	30	n.a.	50	80	n.a.	80	110	n.a.
Geothermal*	19 500	12 300	9 690	75	75	80	75	45	35	400	250	185
Solar PV	530	290	220	20	21	22	5	5	5	30	15	15
Wind onshore	1 110	1 020	970	26	29	29	15	10	10	55	45	45
Wind offshore	2 620	1 600	1 280	34	38	39	25	15	10	110	65	50
Electricity generation costs										75	75	40

*Next-generation geothermal.

Sources: IEA analysis; IRENA (2025).



PART 3

Projects Economic Evaluation and Investment Decision

3 Projects costs estimates: estimation and decision process



TABLE OF CONTENTS

1. Introduction: what do we mean by « projects »
2. Capital investment decision: theory and practice
3. Projects costs estimates: estimation and decision process
4. Projects cost monitoring: how to organize it and why
5. Project financing: impacts on project monitoring



Oil & Gas projects organisation

- ◆ Oil & gas projects are generally organized through joint-ventures (JV)
- ◆ A joint-venture is a consortium/association composed of several companies (2, 3, 4, more.....)
- ◆ One Operator, among the members of the JV, is responsible for the management and the good execution of the project.
- ◆ In some cases, a joint operating company (JOC) can be established. In such a case, the JOC organisation is composed of several managers and technicians belonging to the companies members of the JV, each having specific responsibilities.
- ◆ For the execution of the project, the Operator calls for the assistance of contractors, suppliers, service companies specialized in specific activities (For example: geophysics, drilling, construction, pipe laying, catering, etc,...). These contractors are selected following call for tenders. The Operator is responsible, on behalf of the JV, of the relationship with the contractors.
- ◆ The Operator is responsible for all phases of the project, from the beginning to the end, from the initial budget estimate to the decommissioning of the facilities.



Project cost management - main roles

- ◆ TO PREPARE THE BUDGET & TAKE CARE OF THE UPDATE & FOLLOW-UP
- ◆ TO PREPARE AND UPDATE PROJECT CONTROL PROCEDURES
- ◆ TO CONTROL AND FOLLOW-UP COMMITMENTS:
- ◆ TO ESTIMATE FINAL COST & ANALYZING DEVIATION
- ◆ TO PREPARE AND UPDATE A CONSOLIDATED REPORTING
- ◆ TO INTERFACE WITH ACCOUNTING DEPARTMENT
- ◆ TO PREPARE FINAL REPORT & STATISTICS
- ◆ TO DELIVER CONTRACTUAL OBLIGATIONS TOWARDS THE STAKEHOLDERS
(Shareholder, Partners, Government,....)



Project Costs Monitoring



From the Preliminary Estimate to the Initial Project Budget

- ◆ VARIOUS COST ESTIMATING STEPS DURING THE PRE-PROJECT PHASES
- ◆ USING THE WORK BREAKDOWN STRUCTURE (WBS)
- ◆ DETAILED ANALYSIS OF THE KEY ELEMENTS
- ◆ VARIOUS PROVISIONS TO BE INCLUDED
- ◆ KEY RATIO APPROACH
- ◆ COST ELEMENTS EXCLUDED FROM THE COST ESTIMATE
- ◆ A COST ESTIMATE STEP BY STEP/ PIPELINE-PLATFORM-PLANT
- ◆ DIFFERENCE BETWEEN OPERATOR & CONTRACTOR COST
- ◆ FROM COST ESTIMATING TO PROJECT BUDGET

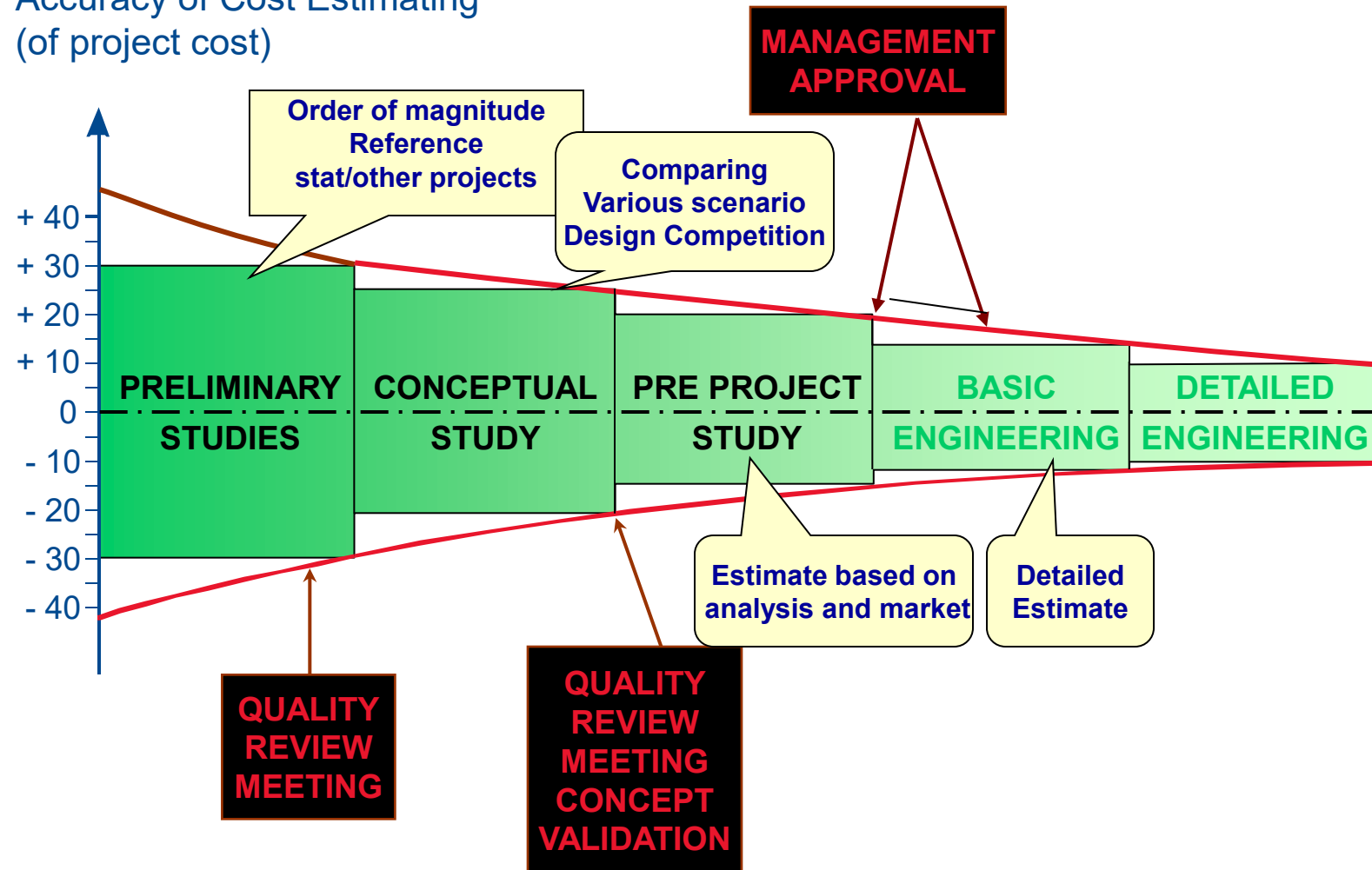


Cost Estimation



Cost estimating during study phase

Accuracy of Cost Estimating
(of project cost)



Cost estimating (1)

THREE MAIN METHODS TO PERFORM A COST ESTIMATING

- ◆ **First method - “the Rule of Thumb”:** \$/bbl or \$/Mcfd, or by analogy with an other project (ratio between capacity with exponent 0.6)
 - i.e. a project to produce 150 Mcfd (equivalent to 25 000 b/d) could cost 500 M\$, what about a 250 Mcfd project with similar conditions:
 $500 \times (250/150)^{\text{exp. } 0,6} = 680 \text{ M\$}$
- ◆ **Second method - “Semi-Analytic Estimate”** - is based on a preliminary analysis of the Project: each area or work package of the Project is estimated independently. Then the common and overhead costs are added. The work may last for few days. Can be performed in parallel with the Conceptual study.
- ◆ **Finally - the “Detailed Cost Estimate”**, the only way to obtain the agreement from the Company Management. This Detailed Cost Estimate has to be in line with the Basic Engineering.



Cost estimating (2)

PERFORMING A DETAILED COST ESTIMATE

Two main aspects have to be scrutinized

- ◆ **Market Analysis:** potential bidders, experience, possible evolution?
- ◆ **Conceptual impact:** how the Project conceptual choices may impact the cost of the Project, how to estimate new technologies?



Cost estimating (3)

COST ESTIMATING KEY RATIO

- ◆ Hundreds of ratio/factor can be built by a Company to improve or cross-check the cost estimate of development projects.
- ◆ For equipment:
 - \$/kg for vessels, but to be corrected by a steel factor, and pressure factor
 - \$/kW for compressors, turbines, electric motors, + pressure factor
 - \$/kW for pumps + material factor + pressure factor + pump type
 - \$/m³ for storage tanks, + material factor
 - \$/m² for exchangers, air coolers + material factor and type of exchanger
 - \$/tonne of steam for boilers + pressure factor
- ◆ For structure
 - Tonnes /cum, but the ratio is different for a rack, a module, an offshore structure....
 - \$/tonne
 - Mhrs/ tonne for fabrication and for construction



Cost estimating (4)

- ◆ **To achieve an estimation with an accuracy in the range +/- 10%, the following conditions are required:**
 - **Material Take-off achieved for the main bulk quantities,**
 - **Evaluation of the main equipment from a detailed data base and/or proposals and/or**
 - **Tenders received for the main contracts**



Cost estimating (5)

CONTRACTOR PRICE & OWNER/OPERATOR COST

- ◆ One common mistake is to believe that a Contractor has a better knowledge of the market than the Client/Operator.
- ◆ Receiving commercial proposal from 2 or 3 or more Tenderers is certainly useful, but a critical reading is necessary.
- ◆ In any case, the Owner/Operator must add to the Contractor cost all specific cost not included in the EPSC/EPSCC contract (EPSCC: Engineering/Procurement/Supply/Construction/Commissioning):
 - Land and right of ways
 - Permits
 - Insurance
 - Supervision, Management,
 - Fuel, consumable for start-up
 - Initial cost
 - Spare Parts....and the Commissioning for EPSC....



Cost estimating (6)

FROM COST ESTIMATING TO LOP (LIFE OF PROJECT) BUDGET

- ◆ **LOP BUDGET:** the Project Budget covering all expenses to be incorporated in the Development Cost up to the start of the Production
- ◆ **FINAL COST ESTIMATE = or $\leftrightarrow$ LOP BUDGET - several scenarios:**
 - The Contingencies/Provisions are not approved by the Partners
 - Some cost could be not chargeable to all Partners
 - Some investment could be optional
 - Some cost are not included in the cost estimate (Taxes- Affiliate costs...)
 - Some cost are kept confidential and managed by the top management
 - Budget and cost estimate are based on different currency or using different exchange rates.



Cost estimating (7)

FROM COST ESTIMATING TO LOP BUDGET

- ◆ Once the Project Cost Estimate is approved by the Management and the Partners, it becomes the LOP Initial Budget.
- ◆ The Budget can be organized and distributed in a slightly different way to take into account the follow-up of the cost by Cost Centers and Contracts.



PART 4

Projects Economic Evaluation and Investment Decision

4

Projects cost monitoring: how to organize it and why



TABLE OF CONTENTS

1. Introduction: what do we mean by « projects »
2. Capital investment decision: theory and practice
3. Projects costs estimates: estimation and decision process
4. Projects cost monitoring: why? for who? how?
5. Project financing: impacts on project monitoring



Project cost monitoring

◆ PROJECT COST MONITORING

- WHY?
- FOR WHO?
- HOW ? INITIAL STEPS
- REASONS FOR DEVIATION

◆ COMPANY METHODOLOGY and MAIN CONCEPTS

- BUDGET
- AFE (Authorization for Expenditures)
- COMMITMENTS
- EXPENSES & INVOICING
- FORECAST COST & PROVISIONS MANAGEMENT
- ACCOUNTING AND ANALYTIC ANALYSIS

◆ COST MANAGEMENT TOOLS



Project cost monitoring - why ? (1)

- ◆ To coordinate the efforts of the Project team to keep the expenses and the commitments within the envelope agreed by the Management and the Partners.
- ◆ To ensure that the expected economic criteria of the Project will be met.
- ◆ To propose wording and clauses to be incorporated in the contracts wording (Joint Operating Agreement, Accounting Agreement,)
- ◆ To keep the same methodology across the Project and sub-Projects and to verify the good circulation of the information.



Project cost monitoring - why ? (2)

- ◆ Project duration may increase the difficulty of the control (currency fluctuation-inflation...)
- ◆ Investments are facing more and more complexities and amounts are often moving towards very high figures
- ◆ Several parties are involved

REPORTING OBLIGATIONS

- ◆ Legal reporting (financial periodic reporting)
- ◆ Fiscal reporting (depreciation..)
- ◆ Operational reporting (cash call with Company and Partners)
- ◆ Reporting to Management
- ◆ Reporting to Partners



Project cost monitoring - for who ?

- ◆ For the Owner and/or Operator - Cash Call - Impact on the overall Company Financing Plan
- ◆ For the Partners' information in accordance with Management Agreement or Joint Operating Agreement
- ◆ For the top Management of the Project but also all Managers of the Project to be aware of the situation
- ◆ For the Lenders and Banks (see “project financing” chapter)
- ◆To coordinate the figures to be passed to the main office Management - updating of the economic criteria
- ◆To inform the Finance Division when and as needed
- ◆To inform the Insurance division of any significant changes (update of the CAR policy)
- ◆To provide back-up and updating of the home office data base



Project cost monitoring – how ?

- ◆ Starting from the Final Cost Estimate, well structured and broken down in accordance with the WBS (Work Breakdown Structure) and the Contractual Strategy
- ◆ Preparing the entry of data for the follow-up through the selected tool
- ◆ Following the commitments with a strict discipline
- ◆By reviewing on a permanent basis the estimate to complete and final forecast
- ◆By managing the various provisions
- ◆By implementing the adequate procedures inside the Project team, with the Owner/Operator, the Contractors
- ◆ The above supported by the right team and the adequate integrated Software (centralised or not)

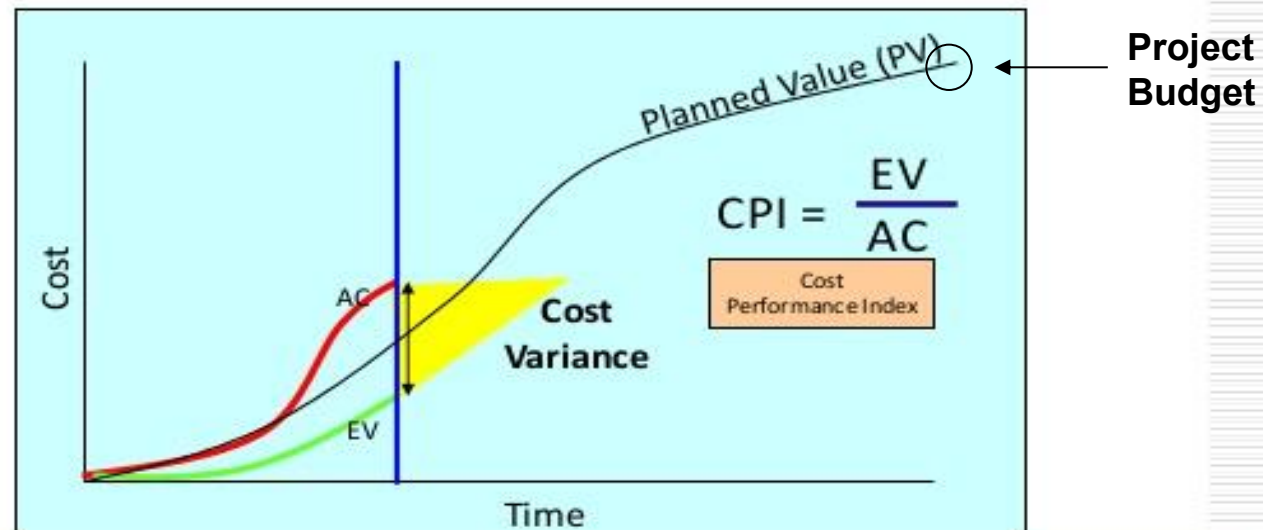


Managing the Deviations.....

Earned Value Monitoring

PV = Planned Value. Corresponds to the Project Budget, timewise.
 EV = Earned Value. Corresponds to the Cost of the **realized Work Programme** (in %) **with reference to the Project Budget**.
 AC = Actual Cost incurred

CPI	Cost Performance Index	P3ec Calculated	Period
-----	------------------------	-----------------	--------



Project cost monitoring - Reasons for deviations deviation causes (1)

CAUSES DUE TO THE OWNER/CLIENT

- ◆ Project definition ambiguous and/or incomplete
- ◆ Change during the Project execution
- ◆ Initial estimate too low for “political” reason
- ◆ Contractor selection not in accordance with the project procedure

CAUSES DUE TO THE COST ESTIMATE

- ◆ Insufficient provisions
- ◆ Wrong reference used
- ◆ Missing cost
- ◆ Bad assumption on the market

CAUSES DUE TO THE PROJECT MANAGEMENT

- ◆ Contractual strategy ambiguity
- ◆ Permanent conflicts with contractors
- ◆ Bad selection of the contractors



Project cost monitoring – Reasons for deviations deviation causes (2)

CAUSES DUE TO THE CONTRACTOR

- ◆ Initial Price too low (on purpose)
- ◆ Initial Price too low (by mistake)
- ◆ Bad Management - Poor organisation - Poor coordination
- ◆ Delay - Bankruptcy

CAUSES DUE TO THE SITE

- ◆ Unforeseen difficulties
- ◆ Blow-out or surface gas

CAUSES DUE TO GENERAL ECONOMY OR LOCAL ENVIRONMENT

- ◆ Inflation coming back
- ◆ Major change on the market (merger,...)
- ◆ Exchange rates
- ◆ Atmospheric catastrophe
- ◆ Political trouble



Project cost monitoring methodology

COMPANY METHODOLOGY & MAIN CONCEPTS:

- ◆ BUDGET
- ◆ AFE (Authorization for Expenditures)
- ◆ COMMITMENTS
- ◆ EXPENSES & INVOICING
- ◆ INVOICING & PAYMENTS – APPROVAL PROCESS
- ◆ COST FORECASTS & PROVISIONS MANAGEMENT
- ◆ ACCOUNTING & ANALYTIC ANALYSIS



Project cost monitoring methodology - preparation

- ◆ To prepare the Budget breakdown/ AFE procedures/ Follow-up of commitments
- ◆ To fix exchange rates, environmental conditions...
- ◆ To define tools and software for cost follow-up (SAP,....)



Project cost monitoring methodology - expenses & invoicing (1)

- ◆ **THE INVOICING PAYMENT PROCEDURE IN DEVELOPMENT CONTRACT DEPENDS ON THE TYPE OF REMUNERATION OF THE CONTRACT.**
- ◆ **THE PROCEDURE CAN BE**
 - **ON “PROGRESS BASIS”, WHERE THE CONTRACTOR IS USUALLY PAID EVERY MONTH ON THE BASIS OF THE PROGRESS OF THE WORK WHICH HAS BEEN ASSESSED AS ACHIEVED DURING THE MONTH.**
 - **ON “MILESTONE BASIS”, WHERE THE CONTRACTOR IS COMPENSATED THROUGH A LIMITED NUMBER OF PAYMENTS, EACH BEING CONDITIONAL TO THE SATISFACTION OF PREDEFINED CRITERIA IN RELATION WITH THE PERFORMANCE OF THE WORK.**
 - **ON “TIME BASIS” WHERE THE CONTRACTOR IS PAID ON THE BASIS OF THE MANHOURS PERFORMED BY HIS PERSONNEL AND EQUIPMENT DURING THE MONTH APPLIED TO THE RESPECTIVE CONTRACTUAL RATES.**
 - **ON “BILL OF QUANTITIES BASIS” WHERE THE CONTRACTOR IS PAID ON THE BASIS OF THE QUANTITIES OF MATERIALS INSTALLED DURING THE MONTH APPLIED TO THE RELEVANT RATES.**
 - **ON A “LUMP SUM” BASIS**



Project cost monitoring methodology - expenses & invoicing (2)

EXAMPLE: INVOICING ON “PROGRESS BASIS”

- ◆ ON “PROGRESS BASIS”, THE CONTRACTOR IS USUALLY PAID EVERY MONTH ON THE BASIS OF THE PROGRESS OF THE WORK WHICH HAS BEEN ASSESSED AS ACHIEVED DURING THE MONTH.
- ◆ THE PROGRESS MEASUREMENT PROCEDURE WILL BE SUFFICIENTLY DEFINED IN THE CONTRACT EXHIBIT AND FINALISED AT OR JUST AFTER CONTRACT SIGNATURE.
- ◆ THIS MAKES NECESSARY THAT THE PROGRESS CONTROL PROCEDURE BE PREPARED AND ACCEPTED BEFORE ANY INVOICING CAN BE ISSUED BY THE CONTRACTOR.
- ◆ A COMMON “WORK BREAKDOWN STRUCTURE” CAN BE USED BY ALL TENDERERS ALLOWING
 - A QUICK COMPARISON OF THE PRICE BREAKDOWN PER PACKAGE MADE BY EACH TENDERER,
 - THE QUICK IDENTIFICATION OF THE WORK PACKAGES PRESENTING A SIGNIFICANT PRICE DISTORTION



Project cost monitoring methodology - invoicing & payments – approval process

The Cost Monitoring and payment of invoices consist of:

- ◆ Log receipt of invoices into Cost Control System for tracking checking payment terms quantities and supporting documentation arithmetic checking
- ◆ obtaining “technical” visa i.e. invoiced work has been completed to specification
- ◆ gaining “authorisation for payment” signature
- ◆ transmitting approved invoice to Finance/Accounting for payment
- ◆ Maintaining complete set of invoices and supporting documentation.



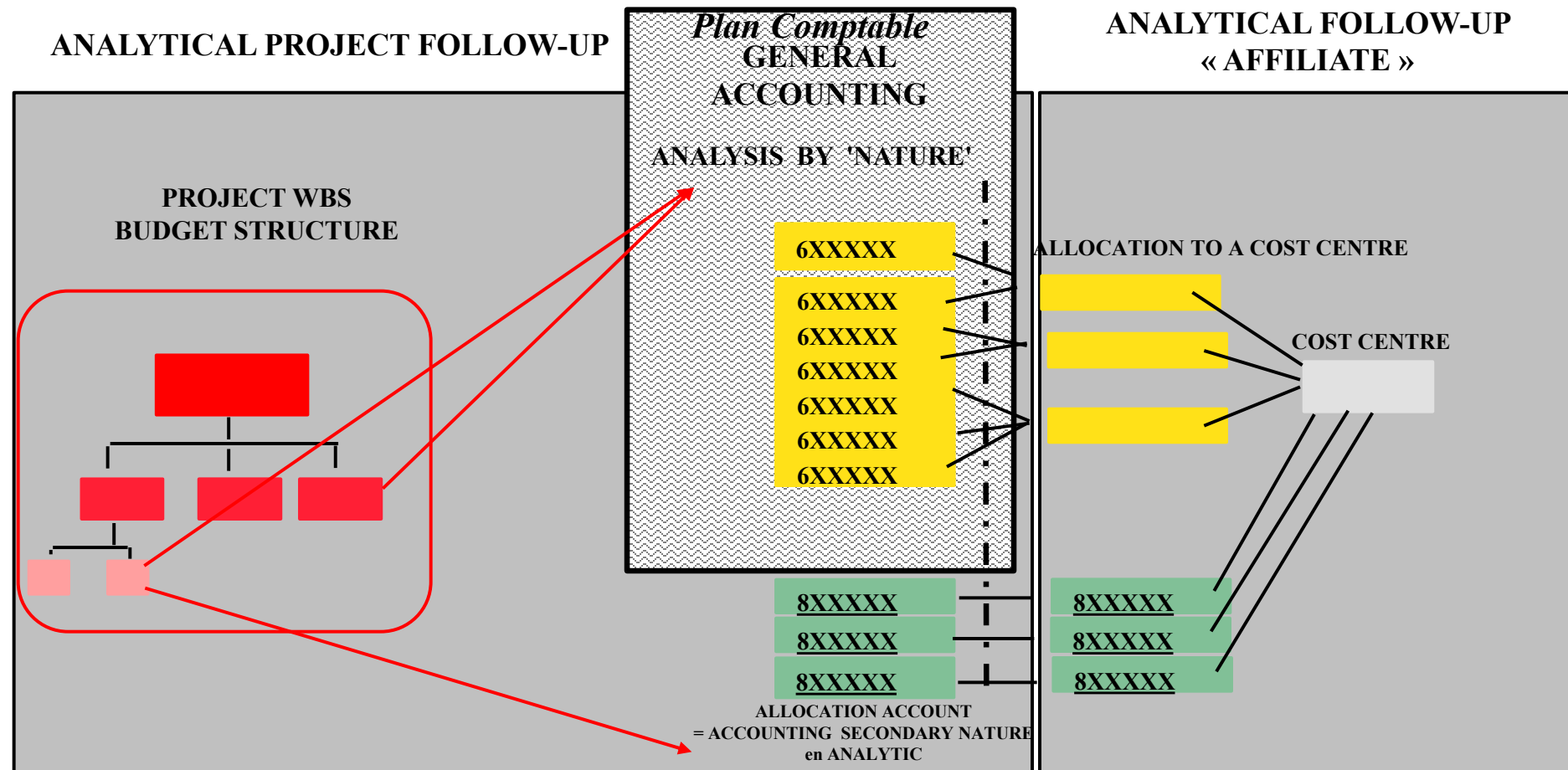
Project cost monitoring methodology - cost forecasts & provisions

Cost Forecast is updated on a regular basis (monthly).

- ◆ **Cost Forecast may anticipate on some not yet finalized commitments but Confidentiality must be addressed very cautiously**
- ◆ **Cost Forecast require a good knowledge of the technical matters**
- ◆ **Cost Forecast may introduce some budget transfer**
- ◆ **Provisions can only be used with the agreement of the Management and in line with the Operating and Accounting Agreements**
- ◆ **It is advisable not to use the Provisions during the early stage of the Project**



Project cost monitoring methodology - accounting & analytical analysis



PART 5

Projects Economic Evaluation and Investment Decision

5 Project financing: impacts on project monitoring



TABLE OF CONTENTS

1. Introduction: what do we mean by « projects »
2. Capital investment decision: theory and practice
3. Projects costs estimates: estimation and decision process
4. Projects cost monitoring: how to organize it and why
5. Project financing: impacts on project monitoring



Project financing (1)

- ◆ **Upstream Projects are seldom specifically financed but a specific Package could be financed: airport, harbour, storage (floating, or fixed..)**
- ◆ **Once completed it is also possible to envisage a partial financing.**
- ◆ **Treatment Units could be also financed under certain conditions**
- ◆ **If Project Finance is considered they are several impact on the Project organisation and follow-up:**
 - **The guarantees required by the Lenders will be introduced in the Contract wording**
 - **The Lenders may jump in the Project in case of Owner Default**
 - **The day to day life of the Project will be different....**



Project financing (2)

PROJECT FINANCING WILL HAVE A SERIOUS IMPACT ON THE PROJECT DEVELOPMENT

- ◆ As a condition precedent the financing may impact the overall schedule
- ◆ By introducing some additional costs, the overall budget will be affected
- ◆ The selection of the main contractors is also subject to the lenders agreement
- ◆ The day to day life of the project is affected: payments, approvals.....



Project financing (3)

- ◆ The follow-up of the Project will have to be organised with a full transparency towards the Lenders: reporting, communication, interface with Lenders advisors, commercial negotiation
- ◆ Lenders maybe looking to limit the role of the Operator (vis a vis the EPSC/EPSCC Contractor) by introducing additional approvals or pre-agreement clauses.
- ◆ The terms of payment will be changed most probably changed from progress payment to milestones: agreement to pay will be subject to a strict control.
- ◆ Any major default by the Contractor may provoke a “draw stop” by the Lenders.



Project financing: example of a Power Plant - Payment Milestones (1)

Month after C.D.	MILESTONES	Contract Value %
0	Date on which Notice to Proceed is issued	10%
4	Placement of order for civil sub contract	7.5%
5	Substantial completion of backfilling	7.5%
9	Site construction works started	10%
11,5	Completion of piling for Main Equipments foundation	10%
13	Start erection of Circulating Water System	5%
14	Start erection of Water Treatment System	5%
16	F.O.B. of Generator Transformer	5%
18	Delivery of approved key drawings and specifications	5%



Project financing: example of a Power Plant - Payment Milestones (2)

Month after C.D.	MILESTONES	Contract Value %
18	Gas Turbine on foundation	7.5%
18	Steam Turbine on foundation	2.5%
19	Generator on foundation	2.5%
20,5	Gas Turbine Pre commissioning started	5%
22,5	Heat Recovery Steam Generator Pressure Test	2.5%
23,5	Steam Turbine Pre commissioning started	5%
26	Performance Acceptance Test successful	10%
	TOTAL	100%





Annex

**Economic Calculations
Analytical Developments
or
How to reconcile Economic Calculations
Criteria
with Sources and Applications of Funds
Table?**



Discount Rate

Discount Rate = Weighted Average Cost of Capital (WACC)

The Weighted Average Cost of Capital combined the Cost of Capital for the Equity Shareholders and the Cost of Financial Interest for the Lenders.

The Investment programme assumes a fixed ratio between the Equity and the Debt (For instance, 25% Equity, 75% Debt) which normally corresponds to the Debt Ratio of the Company.

The Project Economics are treated as a marginal additional contribution to the Company's activity.



Different methodologies

The use of a Discount Rate, before tax or after tax?

Two different methods could be used:

- 1) BTWACC: Before Tax Weighted Average Cost of Capital**
- 2) ATWACC: After Tax Weighted Average Cost of Capital**

In the following, the BTWACC method is developed (Shadow interests method): the Discount Rate can be compared directly to an Interest Rate or a standard Cost of Opportunity (before taxes)



Definitions

- ◆ CF_n = Cash-Flow Year n
- ◆ REV_n = Revenues Year n (Sales # Production x Price)
- ◆ $OPEX_n$ = Operating Costs Year n
- ◆ $FINPR_n$ = Financial Products Year n
- ◆ $FINCH_n$ = Financial Charges Year n
- ◆ TAX_n = Taxes on Income Year n
- ◆ DEP_n = Depreciation, Depletion & Amortization Year n
- ◆ INC_n = Net Income Year n
- ◆ DIV_n = Dividends Year n
- ◆ $REARN_n$ = Retained Earnings/Net Income not distributed Year n



Definitions

- ◆ CAP_n = Resources from Shareholders/Sharehold. Equity Year n
- ◆ $LOAN_n$ = Loan drawn Year n
- ◆ $REIMB_n$ = Reimbursement of loan Year n
- ◆ $CAPEX_n$ = Investment Year n
- ◆ $SOURC_n$ = Sources of Funds Year n
- ◆ $APPL_n$ = Applications of Funds Year n
- ◆ $TREAS_n$ = Treasury Increase Year n
- ◆ $CASH_n$ = Cash availabilty end Year n
- ◆ $DEBT_n$ = Debt end Year n
- ◆ N = Duration life of the Project
- ◆ $i1$ = Interest rate at which Cash available is placed
- ◆ $i2$ = Interest rate of the loan (Cost of the Debt)



Balance between Sources and Applications of Funds

Cash-Flow & Cash-Flow from Operations

$$- CF_n = REV_n + FINPR_n - OPEX_n - FINCH_n - TAX_n$$

$$- CF_{0n} = REV_n - OPEX_n - TAX_n$$

Net Income

$$- INC_n = CF_n - DEP_n$$

Sources of Funds:

$$- SOURC_n = CF_n + CAP_n + LOAN_n$$

Applications of Funds:

$$- APPL_n = CAPEX_n + DIV_n + REIMB_n$$

The difference between Sources and Applications of Funds generates the Treasury increase (Positive or negative):

$$- CF_n + CAP_n + LOAN_n = CAPEX_n + DIV_n + REIMB_n + TREAS_n$$



The Cost of Financing

The yearly evolution of Cash availability and Debt can be written:

$$- CASH_n = CASH_{n-1} + TREAS_n$$

$$- DEBT_n = DEBT_{n-1} + LOAN_n - REIMB_n$$

Furthermore,

$$- FINPR_n = i1 * CASH_{n-1}$$

$$- FINCH_n = i2 * DEBT_{n-1}$$

Combined with

$$- CF_n + CAP_n + LOAN_n = CAPEX_n + DIV_n + REIMB_n + TREAS_n, \text{ and}$$

$$- CF_n = REV_n + FINPR_n - OPEX_n - FINCH_n - TAX_n$$

We have:

$$- REV_n - OPEX_n - TAX_n - CAPEX_n = (DIV_n - CAP_n) + (REIMB_n + FINCH_n - LOAN_n) + (TREAS_n - FINPR_n)$$

$$- REV_n - OPEX_n - TAX_n - CAPEX_n = (DIV_n - CAP_n) + (CASH_n - (1+i1)*CASH_{n-1}) - (DEBT_n - (1+i2)*DEBT_{n-1})$$



Sources and Applications of Funds

Balance between Sources and Applications of Funds gives:

$$CF0n = REVn - OPEXn - TAXn = CAPEXn + (DIVn - CAPn) + (REIMBn + FINCHn - LOANn) + (TREASn - FINPRn)$$

We can see that the Project Operating Cash-Flow serves at:

- 1) Paying-back the Investment**
- 2) Remunerating the Shareholders by a Dividends distribution**
- 3) Reimbursing and remunerating the Banks at the interest rate**
- 4) Increasing the available Cash for the Project/Company**



Discounting the Net Cash-Flow

The Discounted Net Cash-Flow (DCNF) or Net Present Value (NPV) of the Project/Company is:

$$NPV = \sum_{n=0}^N (REV_n - OPEX_n - TAX_n - CAPEX_n) / (1 + i)^n$$



Discounting the Net Cash-Flow

$$\begin{aligned} NPV(i) = & \sum_{n=0}^N (DIV_n - CAP_n)/(1+i)^n \\ & + \sum_{n=0}^N (REIMB_n + FINCH_n - LOAN_n)/(1+i)^n \\ & + \sum_{n=0}^N (TREAS_n - FINPR_n)/(1+i)^n \end{aligned}$$

The first term relates to the remuneration of shareholders

The second term relates to the remuneration of the lenders

The third term relates to the remuneration of the cash available

The Discount Rate must take into account the various types of remuneration and incorporate the level of risk which must be fairly remunerated (Opportunity Cost)



Discounting the Net Cash-Flow

The Discount Rate is a Before Tax Discount Rate.

It can be compared directly to a Before Tax Interest Rate.

The economic calculations must be carried out by taking into account the tax effects of financial products and financial charges (Shadow interests method)

In some particular cases in certain specific countries, the taxation regime on financial charges and financial products are not similar, which gets the analysis more complex.



Calculation of the Discounted Net Cash-Flow

The Discounted Net Cash-Flow (DNCF) or Net Present Value (NPV) of the Project/Company is:

$$NPV(i) = \sum_{n=0}^N (REV_n - OPEX_n - TAX_n - CAPEX_n)/(1 + i)^n$$

Or,

$$\begin{aligned} NPV(i) = & \sum_{n=0}^N (DIV_n - CAP_n)/(1 + i)^n \\ & + \sum_{n=0}^N (CASH_n - (1 + i1) * CASH_{n-1})/(1 + i)^n \\ & - \sum_{n=0}^N (DEBT_n - (1 + i2) * DEBT_{n-1})/(1 + i)^n \end{aligned}$$



Calculation of the Discounted Net Cash-Flow

This can be also written:

$$\begin{aligned} NPV(i) = & \sum_{n=0}^N (DIV_n - CAP_n)/(1+i)^n + (CASH_N - DEBT_N)/(1+i)^N \\ & + \frac{(i-i1)}{i1} * \sum_{n=0}^N FINPR_n/(1+i)^n - \frac{(i-i2)}{i2} * \sum_{n=0}^N FINCH_n/(1+i)^n \end{aligned}$$



Calculation of the Discounted Net Cash-Flow

Let's assume $i_1=i_2=i_0$, we have:

$$NPV(i) = \sum_{n=0}^N (DIV_n - CAP_n)/(1+i)^n + (CASH_N - DEBT_N)/(1+i)^N \\ + \frac{(i - i_0)}{i_0} * \sum_{n=0}^N (FINPR_n - FINCH_n)/(1+i)^n$$

If $i=i_0$,

$$NPV(i_0) = \sum_{n=0}^N \frac{DIV_n - CAP_n}{(1+i_0)^n} + (CASH_N - DEBT_N)/(1+i_0)^N$$



Four specific cases

Case 1: $i = 0$

$$NPV(0) = \sum_{n=0}^N (DIV_n - CAP_n) + (CASH_N - DEBT_N) + \sum_{n=0}^N (FINPR_n - FINCH_n)$$

Case 2: $i = i0$, Interest Rate

$$NPV(i0) = \sum_{n=0}^N \frac{DIV_n - CAP_n}{(1 + i0)^n} + (CASH_N - DEBT_N)/(1 + i0)^N$$

Case 3: $i = c$, Cost of Shareholders Equity

$$NPV(c) = \frac{CASH_N - DEBT_N}{(1 + c)^N} + \frac{(c - i0)}{i0} * \sum_{n=0}^N (FINPR_n - FINCH_n)/(1 + c)^n$$

Case 4: $i = \infty$

$$NPV(\infty) = -CAPEX_0$$



Equity Discount Rate vs Interest Rate

In the previous formulas, one factor is related to the Equity funding and two others to Debt and Cash costs.

The Equity funding affords a higher cost of capital than the loan programme with is affected by a no-risk interest rate.

So, $c > i_0$

When discounted at the cost of opportunity without risk, the overall return of Equity funding is therefore represented by the sum of Dividends received plus the final Cash available at the end of the project.



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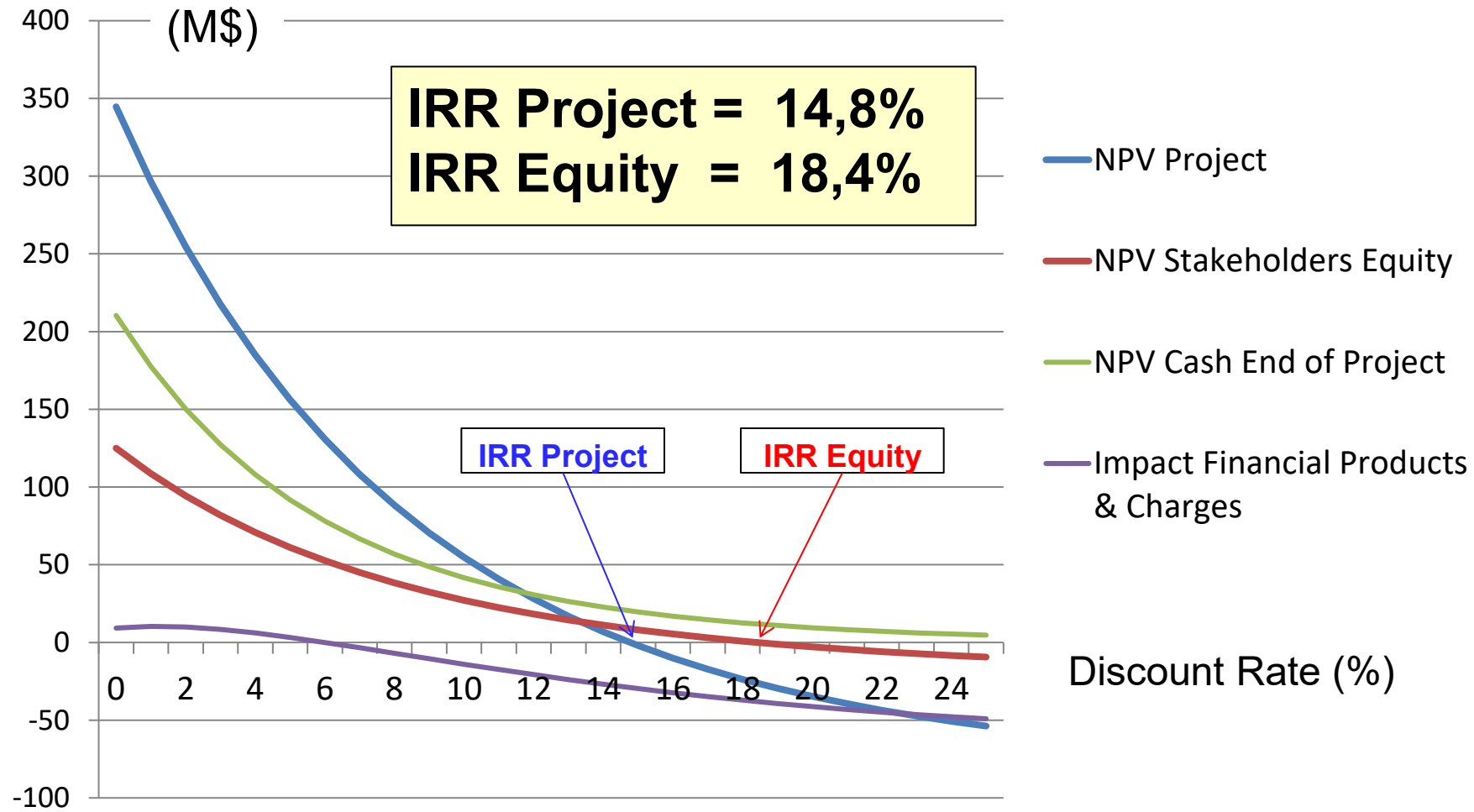
Net Cash-Flow Schedule/Example

Years	Capex	CFO	Tax impact	CFO with	NCF	Equity	Loan	Debt	Reimb.	Financ.	Sources of	Dividends	Applicat.	Cash	Financ.	Cash	Cash	Fin.Prod.-	Discount.	*[i-i0]/i0	Discount	NPV	Cumulat.	Discount	NPV	NPV Equ.+
			Fin.elem.	Shad.inter.	Shad.int.			End Year	Loan	Charg.	Funds		of Funds	Increase	Prod.	End Year	Discount.	Fin.charg.	Prod-Charg.		Factor	Project	NPV	Factor	Equity	Cash End
1	20,0	0,0	0,0	0,0	-20,0	5,0	15,0	15,0	0,0	0,0	20,0	0,0	20,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	1,000	-20,0	-20,0	1,000	-5,0	-5,0
2	50,0	0,0	0,5	0,5	-49,6	12,5	37,5	52,5	0,0	0,9	49,6	0,0	50,0	-0,4	0,0	-0,4	-0,4	-0,9	-0,8	-0,5	0,909	-45,0	-65,0	0,909	-11,4	-11,4
3	70,0	0,0	1,6	1,6	-68,4	17,5	52,5	105,0	0,0	3,2	68,4	0,0	70,0	-1,6	0,0	-2,0	-1,7	-3,2	-2,6	-1,8	0,826	-56,5	-121,6	0,826	-14,5	-14,5
4	60,0	0,0	3,2	3,2	-56,8	15,0	45,0	150,0	0,0	6,3	56,8	0,0	60,0	-3,2	-0,1	-5,2	-3,9	-6,4	-4,8	-3,2	0,751	-42,7	-164,3	0,751	-11,3	-11,3
5	0,0	30,0	4,7	34,7	34,7	0,0	0,0	142,5	7,5	9,0	25,3	12,5	20,0	5,3	-0,3	0,1	0,1	-9,3	-6,4	-4,2	0,683	23,7	-140,6	0,683	8,5	8,5
6	0,0	40,0	4,3	44,3	44,3	0,0	0,0	127,5	15,0	8,6	35,7	12,5	27,5	8,2	0,0	8,3	5,2	-8,5	-5,3	-3,5	0,621	27,5	-113,1	0,621	7,8	7,8
7	0,0	40,0	3,6	43,6	43,6	0,0	0,0	112,5	15,0	7,7	36,4	12,5	27,5	8,9	0,5	17,2	9,7	-7,2	-4,0	-2,7	0,564	24,6	-88,5	0,564	7,1	7,1
8	0,0	40,0	2,9	42,9	42,9	0,0	0,0	97,5	15,0	6,8	37,1	12,5	27,5	9,6	1,0	26,9	13,8	-5,7	-2,9	-2,0	0,513	22,0	-66,5	0,513	6,4	6,4
9	0,0	40,0	2,1	42,1	42,1	0,0	0,0	82,5	15,0	5,9	37,9	12,5	27,5	10,4	1,6	37,3	17,4	-4,2	-2,0	-1,3	0,467	19,6	-46,9	0,467	5,8	5,8
10	0,0	40,0	1,4	41,4	41,4	0,0	0,0	67,5	15,0	5,0	38,6	12,5	27,5	11,1	2,2	48,4	20,5	-2,7	-1,2	-0,8	0,424	17,5	-29,3	0,424	5,3	5,3
11	0,0	40,0	0,6	40,6	40,6	0,0	0,0	52,5	15,0	4,1	39,4	12,5	27,5	11,9	2,9	60,3	23,3	-1,1	-0,4	-0,3	0,386	15,6	-13,7	0,386	4,8	4,8
12	0,0	40,0	-0,2	39,8	39,8	0,0	0,0	37,5	15,0	3,2	40,2	12,5	27,5	12,7	3,6	73,1	25,6	0,5	0,2	0,1	0,350	13,9	0,3	0,350	4,4	4,4
13	0,0	40,0	-1,1	38,9	38,9	0,0	0,0	22,5	15,0	2,3	41,1	12,5	27,5	13,6	4,4	86,6	27,6	2,1	0,7	0,5	0,319	12,4	12,7	0,319	4,0	4,0
14	0,0	40,0	-1,9	38,1	38,1	0,0	0,0	7,5	15,0	1,4	41,9	12,5	27,5	14,4	5,2	101,1	29,3	3,8	1,1	0,7	0,290	11,0	23,7	0,290	3,6	3,6
15	0,0	40,0	-2,8	37,2	37,2	0,0	0,0	0,0	7,5	0,5	42,8	12,5	20,0	22,8	6,1	123,9	32,6	5,6	1,5	1,0	0,263	9,8	33,5	0,263	3,3	3,3
16	0,0	40,0	-3,7	36,3	36,3	0,0	0,0	0,0	0,0	0,0	43,7	12,5	12,5	31,2	7,4	155,1	37,1	7,4	1,8	1,2	0,239	8,7	42,2	0,239	3,0	3,0
17	0,0	40,0	-4,7	35,3	35,3	0,0	0,0	0,0	0,0	0,0	44,7	12,5	12,5	32,2	9,3	187,2	40,7	9,3	2,0	1,4	0,218	7,7	49,9	0,218	2,7	2,7
18	0,0	30,0	-5,6	24,4	24,4	0,0	0,0	0,0	0,0	0,0	35,6	12,5	12,5	23,1	11,2	210,4	41,6	11,2	2,2	1,5	0,198	4,8	54,7	0,198	2,5	44,1
Total	200,0	540,0	4,6	544,6	344,6	50,0	150,0	0,0	150,0	64,4	735,4	175,0	525,0	210,4	55,1	210,4	41,6	-9,3	-21,0	-14,0		54,7	54,7		27,1	68,7

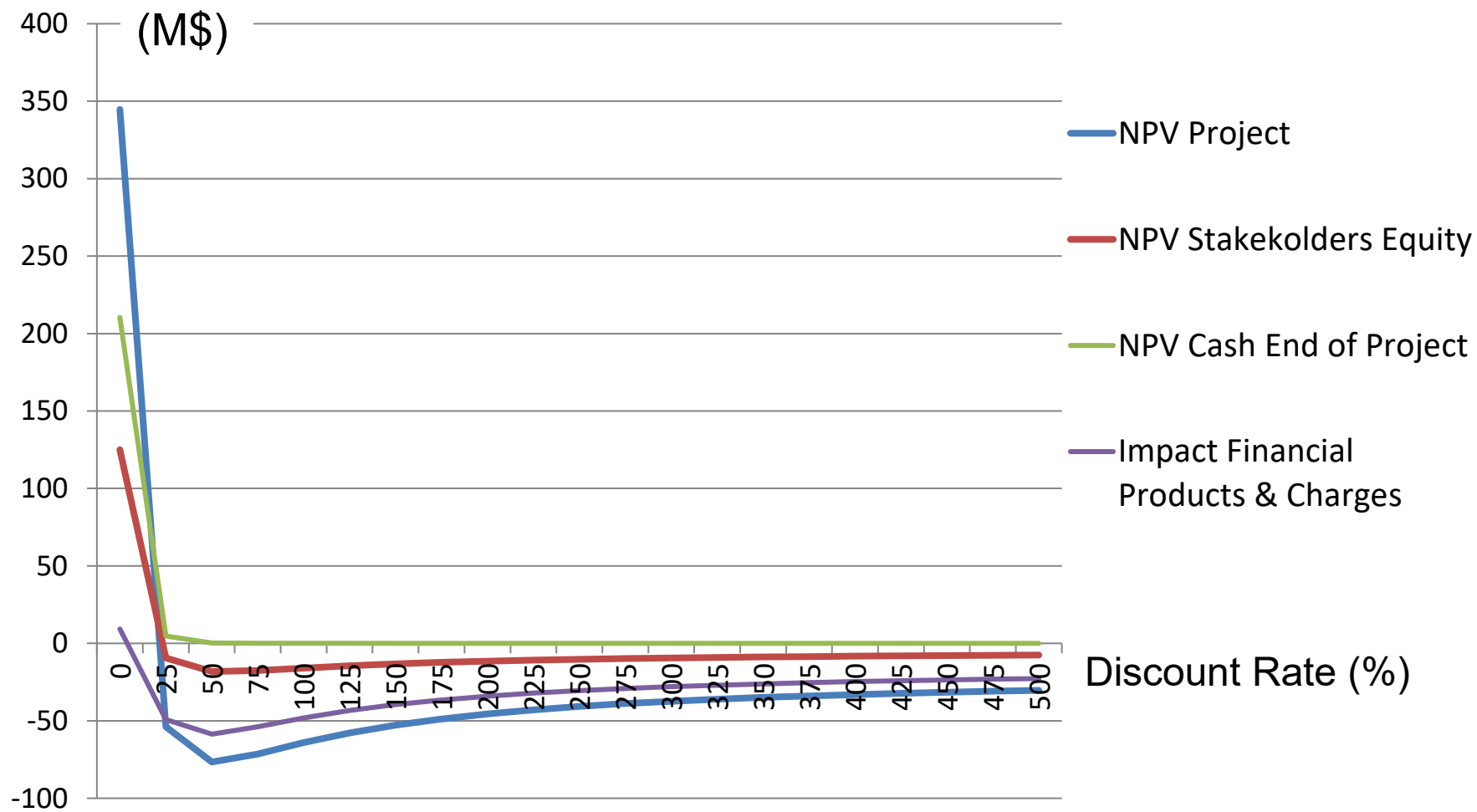


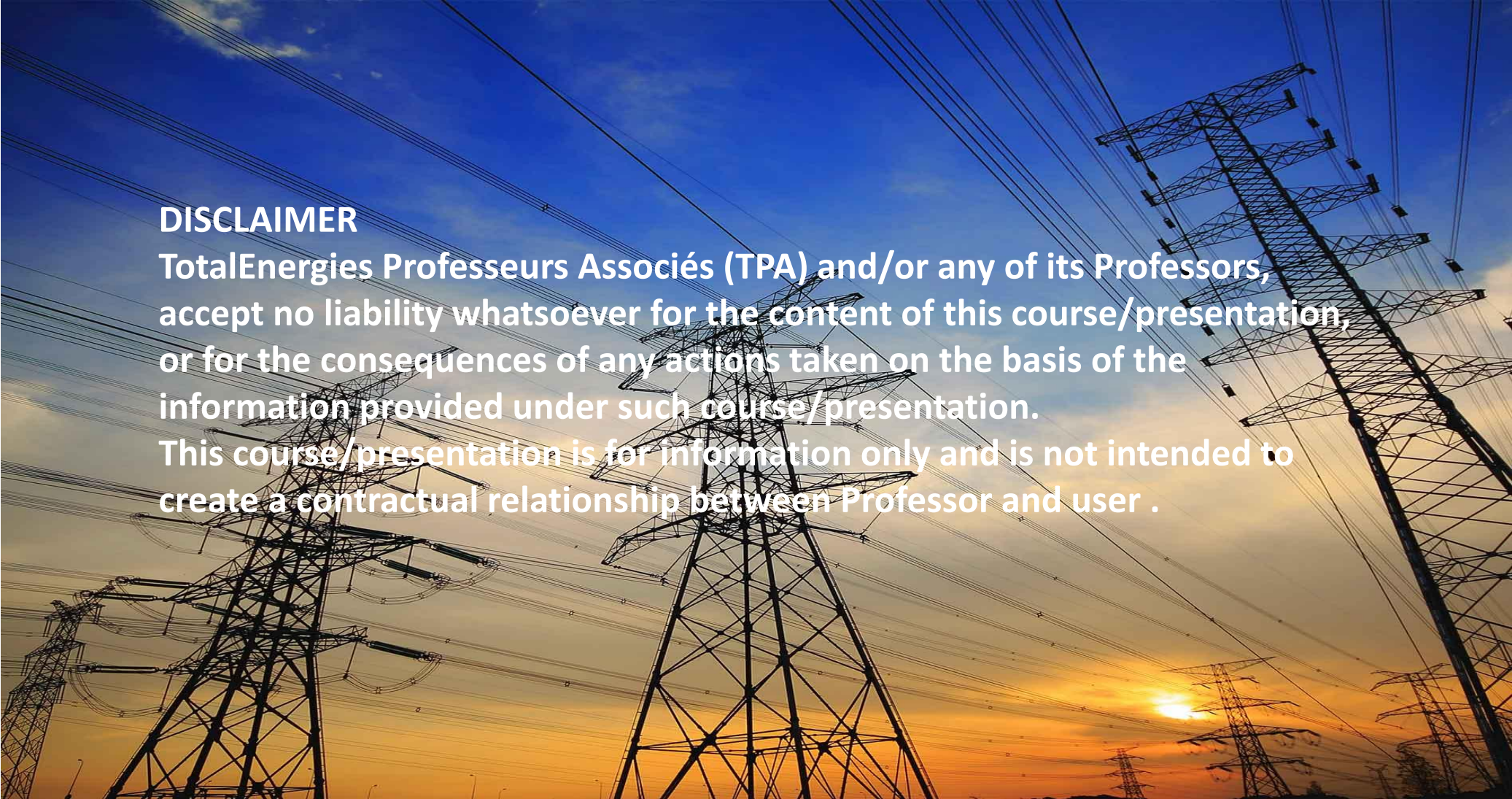
NPV's vs Discount Rate

The Leverage Effect on Equity Return



NPV's vs Discount Rate





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