Financial analysis of cogeneration projects

2004 Cogeneration Week in Cambodia
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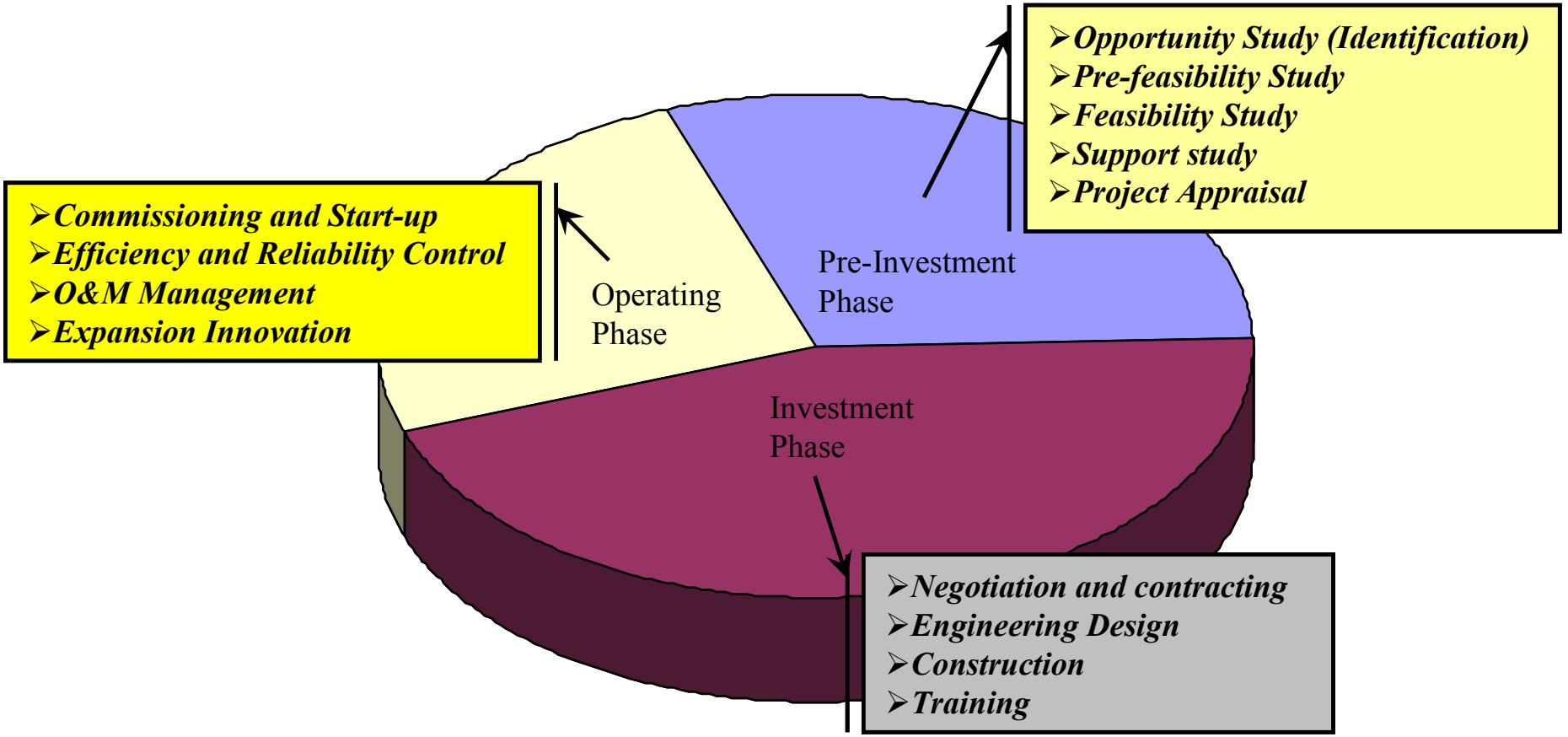
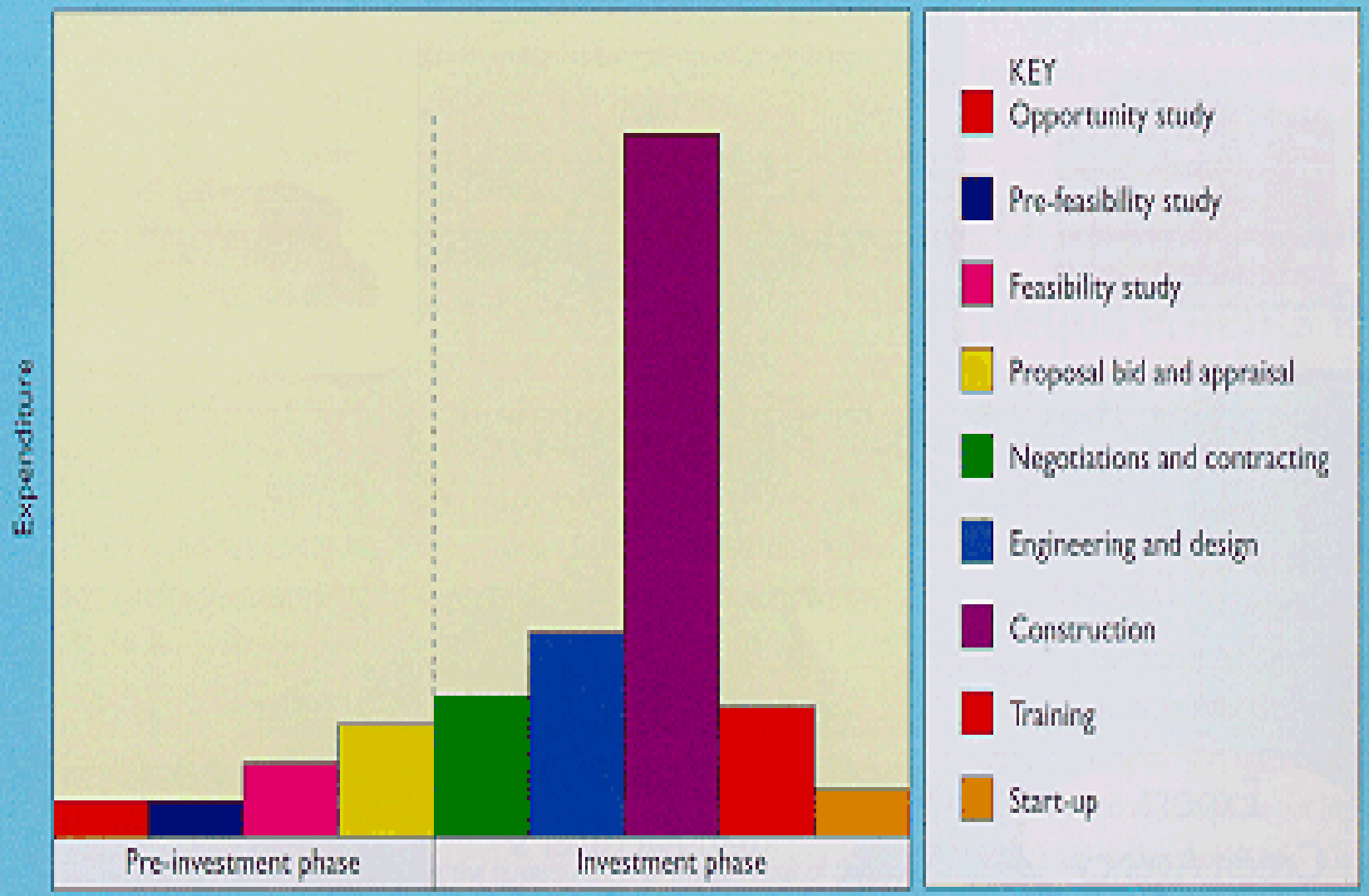
Teo Hotel, Battambang

Romel M. Carlos
COGEN 3 Financial Advisor

PROJECT DEVELOPMENT PROCESS



TYPICAL PROJECT LIFE-CYCLE EXPENDITURE

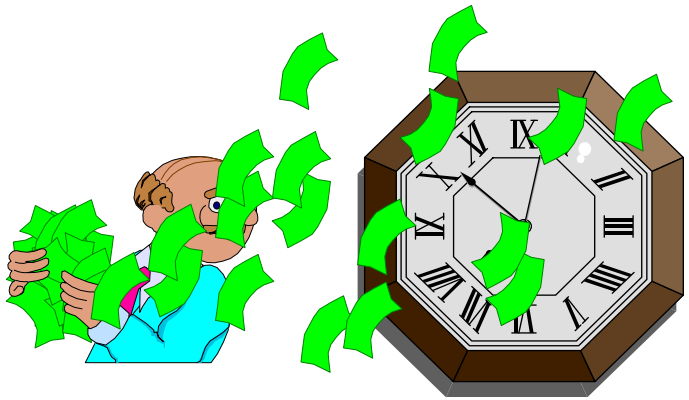


Source: ETSU, Cleaner Coal Technologies: Financing, 1999

BASIC FINANCIAL TERMS: A REVIEW

Time value of money:

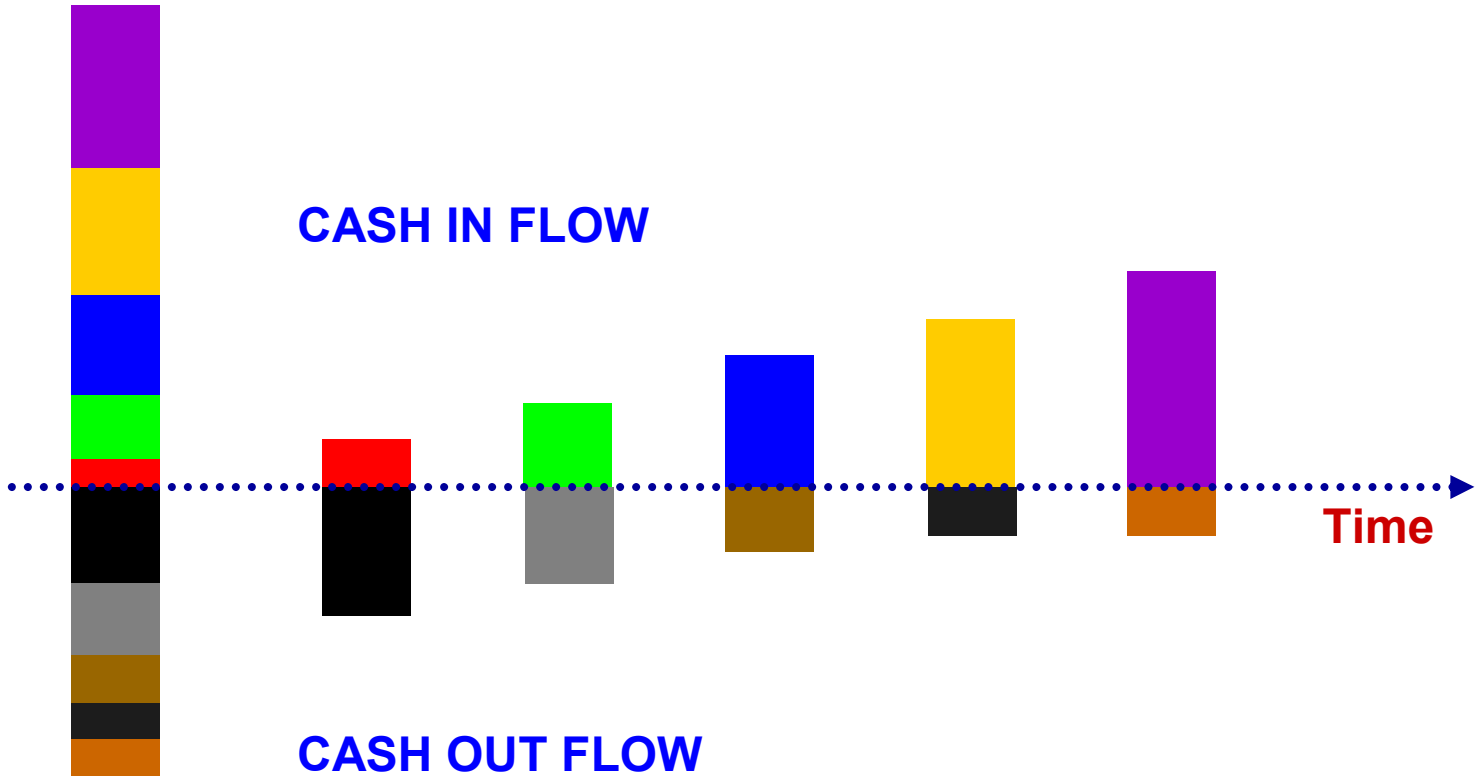
- *A dollar today is not the same as a dollar tomorrow*.



- Money can earn interest and its value may increase with time.

BASIC FINANCIAL TERMS: A REVIEW

Time value of money:



BASIC FINANCIAL TERMS: A REVIEW

Time value of money:

- Present value of the future amount at the end of year n is:

$$\textbf{Present Value (PV)} = F/(1+d)^n = F.f_d$$

Where:

d : discount rate

f_d : discount factor $(1/(1+d)^n)$

BASIC FINANCIAL TERMS: A REVIEW

Risk and money:

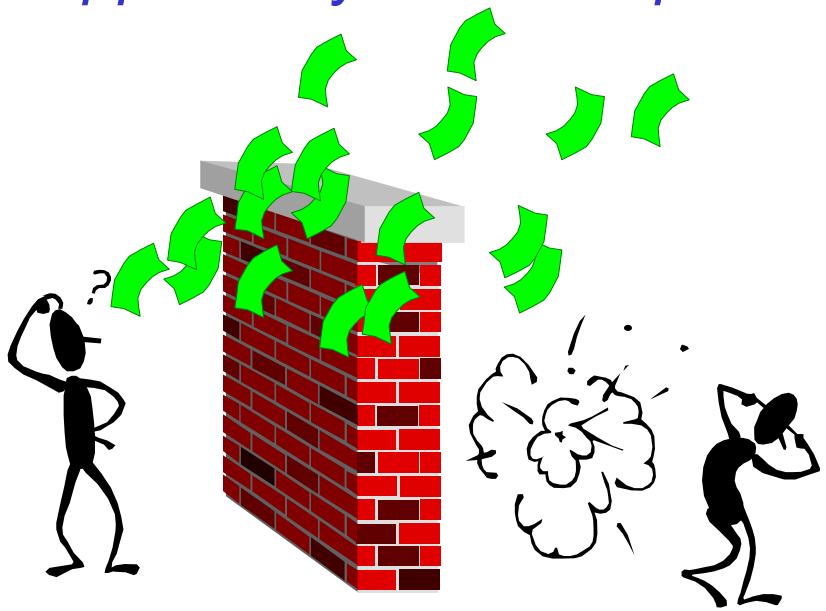
- A risk-free dollar is not the same as a risky dollar.

- High risk requires high returns, low risk implies low returns

BASIC FINANCIAL TERMS: A REVIEW

Discount rate:

- *Hurdle rate* or *opportunity cost of capital*.



- Cost of Capital = Weighted average cost of equity & cost of debt (also known as WACC or weighted cost of capital)

LIFE CYCLE RETURNS

Net Present Value:

- The difference between what the project costs and what it is worth
- Is the present value of all the after-tax cash flows connected with the project

$$NPV = CF_0 + \frac{CF_1}{(1+d)} + \frac{CF_2}{(1+d)^2} + \ldots + \frac{CF_n}{(1+d)^n}$$

Where:

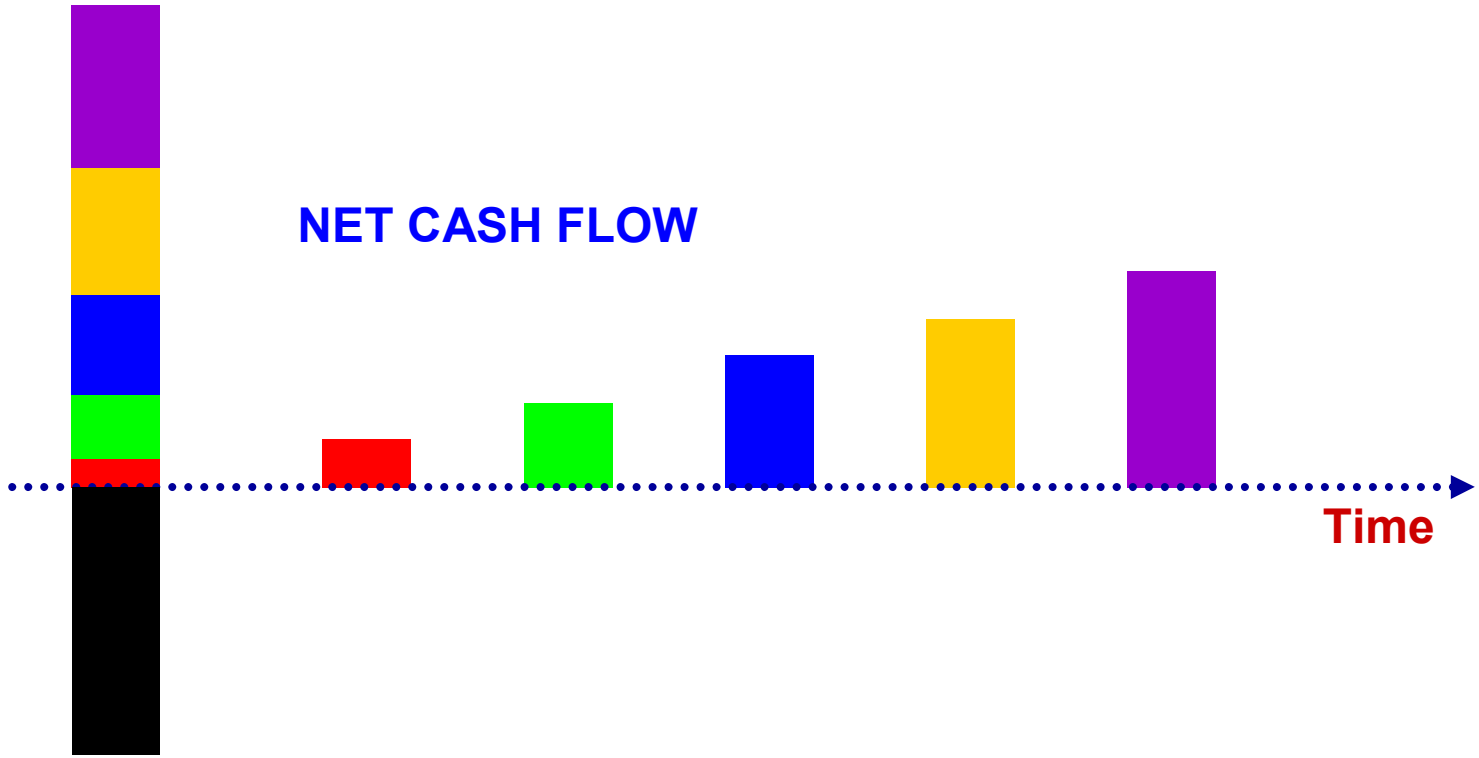
CF : after-tax cash flow at different periods

d : project's cost of capital or discount rate

- Decision rule: ***undertake capital investment project if NPV is positive.***

LIFE CYCLE RETURNS

Net present value:



LIFE CYCLE RETURNS

Internal Rate of Return:

- Expected rate of return of the project's capital investment
- The IRR for a project is the discount rate that makes the NPV zero:

$$0 = CF_0 + \frac{CF_1}{(1+IRR)} + \frac{CF_2}{(1+IRR)^2} + \ldots + \frac{CF_n}{(1+IRR)^n}$$

Where:

CF : after-tax cash flow at different periods

- Decision rule: ***undertake the capital investment project if IRR exceeds d (project's cost of capital)***

LIFE CYCLE RETURNS

Example for Calculating NPV for Different Discount Rates:

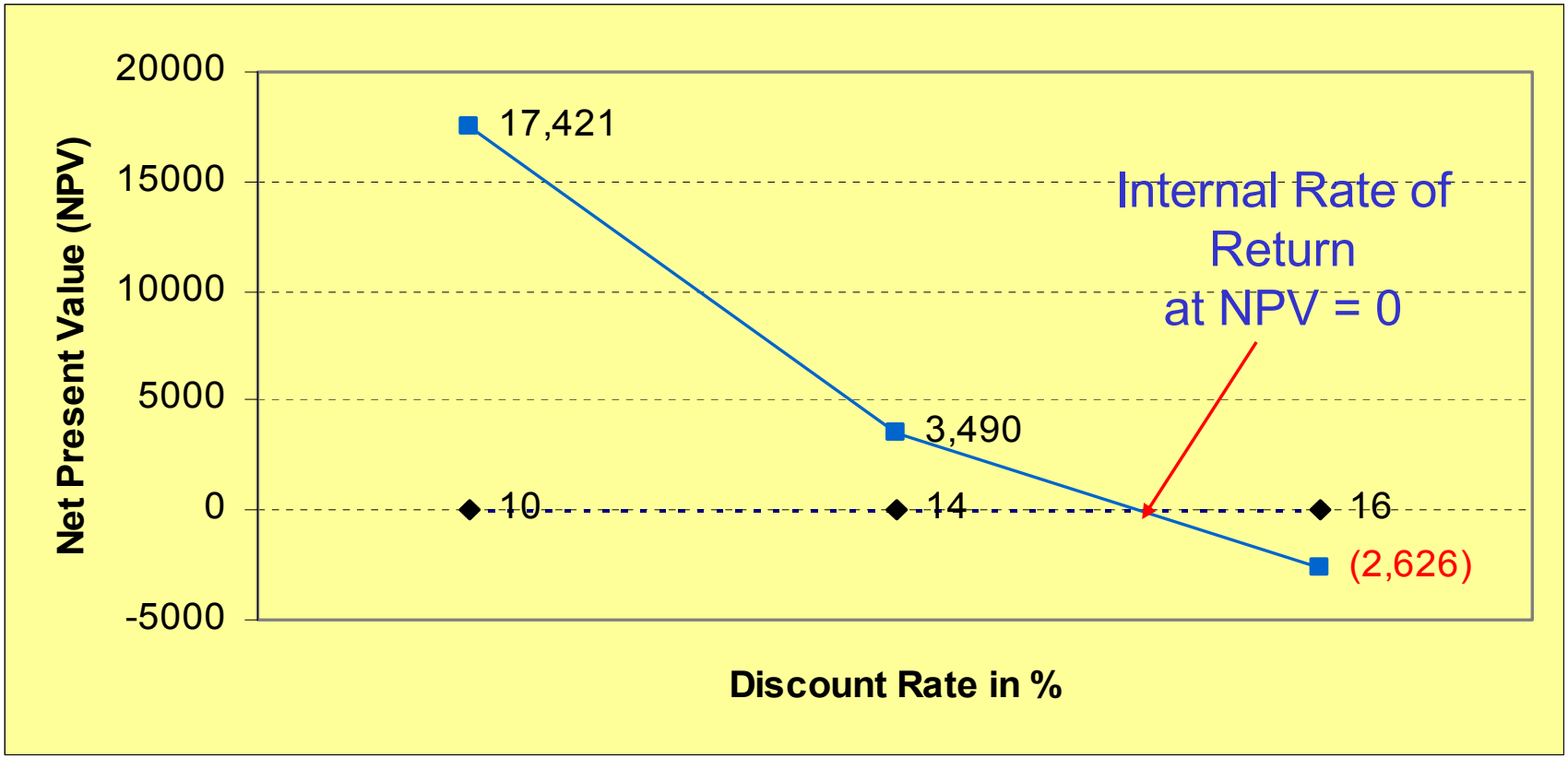
		10% Discount Rate		14% Discount Rate		16% Discount Rate	
Year	Cash Flow	Discount Factor*	Present Value	Discount Factor	Present Value	Discount Factor	Present Value
	(a)	(b)	(a*b)	(c)	(a*c)	(d)	(a*d)
0	(120,000)	1.00000	(120,000)	1.00000	(120,000)	1.00000	(120,000)
1	36,000	0.90909	32,727	0.87719	31,579	0.86207	31,034
2	34,000	0.82645	28,099	0.76947	26,162	0.74316	25,268
3	32,000	0.75131	24,042	0.67497	21,599	0.64066	20,501
4	30,000	0.68301	20,490	0.59208	17,762	0.55229	16,569
5	28,000	0.62092	17,386	0.51937	14,542	0.47611	13,331
6	26,000	0.56447	14,676	0.45559	11,845	0.41044	10,671
NPV			**17,421**		**3,490**		**(2,626)**

* Discount factor = 1/(1+Discount Rate)^year

Source: InnoTec Systemanalyse GmbH, Guide to Financing Energy Technologies in Non-OECD Countries

LIFE CYCLE RETURNS

Graphical Determination of the Internal Rate of Return:



Source: InnoTec Systemanalyse GmbH, Guide to Financing Energy Technologies in Non-OECD Countries

LIFE CYCLE RETURNS

Simple Payback Period:

- Reflects time required for project to return its investment through annual cash flow.

- Methods of calculating:

  ❶ When cash flow stream is uniform each year:

  $$\text{Payback period (in years)} = \frac{\text{Total Capital Investment}}{\text{Annual cash flow}}$$

  ❷ When cash flows are not equal from year to year

  Payback period = cumulated cash flow until it equals original investment

LIFE CYCLE RETURNS

Payback vs NPV:

	Cash Flows, Euros					
Project	C_0	C_1	C_2	C_3	Payback Period, years	NPV @ 10%
A	-2000	+2000	0	0	1	-182
B	-2000	+1000	+1000	+5000	2	+3492

LIFE CYCLE RETURNS

Payback vs NPV:

Project	Cash Flows, Euros C_0	C_1	C_2	C_3	Payback Period, years	NPV @ 10%
A	-2000	+1000	+1000	+5000	2	+3492
B	-2000	0	+2000	+5000	2	+3409
C	-2000	+1000	+1000	+100000	2	+74867

LIFE CYCLE RETURNS

IRR vs NPV:

Project	Cash Flows, Euros C_0	C_1	IRR, %	NPV @ 10%
A	-10000	+20000	100	+8182
B	-20000	+35000	75	+11818

For more information,
please visit COGEN 3 Website at:

http://www.cogen3.net

Thank You !