Overview

- Equity/Debt
- Discount Rate
- Weighted Average Cost of Capital (WACC)
- Inflation
- Break-even point and FLH
- Net Present Value (NPV)
- Internal Rate of Return (IRR)
- Levelized cost of Energy (LCOE)

Equity/Debt

- When starting a business, project or power plant you need capital for investment. There are different ways of raising capital:
  - Equity: Selling shares of the company to investors.
    - Shareholders gain ownership and management rights.
    - Company gives up part of future earnings and stock growth
  - Debt: Borrowing money (leveraged raising capital).
    - Bank loans and bond issues
    - The money has to be repaid with interest
    - If company goes bankrupt you have to pay back your debt.

Discount Rate

- The interest rate used in discounted cash flow analysis to determine the present value of future cash flows.
- The discount rate takes into account the time value of money (the idea that money available now is worth more than the same amount of money available in the future because it could be earning interest) and the risk or uncertainty of the anticipated future cash flows (which might be less than expected).
- The definition of discount rate is also the interest at which you would be willing to invest a certain amount of money assuming a certain amount of risk.
- Strictly, different amounts of money will have different values of discount rate:
  - Online bet for a football match: 20 USD at 40%
  - Company bond issue: 3000 USD at 15%
  - Bank Deposit: 50,000 USD at 5%

Discount rate example

- Imagine you win a National Lottery price of 2 Million dollars.
- The National Lottery agency gives you two options:
  - Receive the price amount now in one single payment.
  - Receive the money in 3 payments, the first one now and the following on the next two years with a yearly interest rate of 5%.
- What do you do?

Case 1	Year	0	1	2
	Cash flow	2,000,000	0	0
NPV 1	$2,000,000			
Case 2	Year	0	1	2
	Cashflow	666666.7	700000	735000
Nat. Lot IR	5%			
NPV 2	$1,736,789.38			
DR	10%			

Weighted Average Cost of Capital (WACC)

- WACC is a simple way to calculate the DR:
  - Current cost of raising money
  - It does not account for the value of money
  - Represents a minimum DR
- WACC = Req(Eq%) + Rbonds(Bond%)
  - Return on equity is an estimate of future growth and earnings
  - Return on debt is the interest rate paid to lenders (bond owners)
  - Equity-to-debt ratio is the % of each out of the total capital raised
- Example:
  - Capital raised for a project through Equity and Debt
  - 50 M of debt at Rdebt=8%, 100 M of equity at Req=20%
  - WACC=20%*(100/150)+8%*(50/150)=16%

Inflation

- Inflation is a rise in the general level of prices of goods and services in an economy over a period of time.
- Normally it is measured in an annual basis and through the Consumer Price Index (CPI) which measures the rate of inflation in an annual basis (annual percentage change).
- Inflation makes reference to the loss in the value of money overtime and therefore the loss of purchasing power.

Concepts you need to know

- Break-even point: In finance when we use this term we refer to the point in which the investment made equals the earnings made out of it (For future cashflows DR is needed).

- Full Load Hours: We take FLH of a technology as full power operation hours throughout the year, considering the rest of the time as if the technology was not producing. (Example FLH in UAE for solar PV=1700 FLH, out of the 8760 hours in a year).

Net Present Value (NPV)

- The cash that you receive today is more valuable than the cash you receive in the future
- You want to know and measure the value of your future cash in terms of the present value of cash → NPV

NPV = discounted value of cash generated in future

$$NPV = \sum_{t=1}^{T} \frac{C_t}{(1+r)^t} - C_0$$

Discounted value of cash Initial Investment

Net Present Value (NPV)

Time Period	Cash	Discount Rate	NPV of Cash
0	$100 000	7%	- 100 000
1	$20 000	7%	18691
2	$36 000	7%	31444
3	$42 000	7%	34285
4	$29 000	7%	22123
5	$22 000	7%	15686
6	$16 000	7%	10662
		NPV	**32891**

$$\text{NPV} = \sum_{t=1}^{T} \frac{C_t}{(1+r)^t} - C_0$$

Internal Rate of Return (IRR)

Definition:

The discount rate at which NPV of an investment becomes zero

In other words IRR shows the discount rate at which the project breaks-even

- High IRR indicates promising return
- Usually used to assess or compare different projects

IRR

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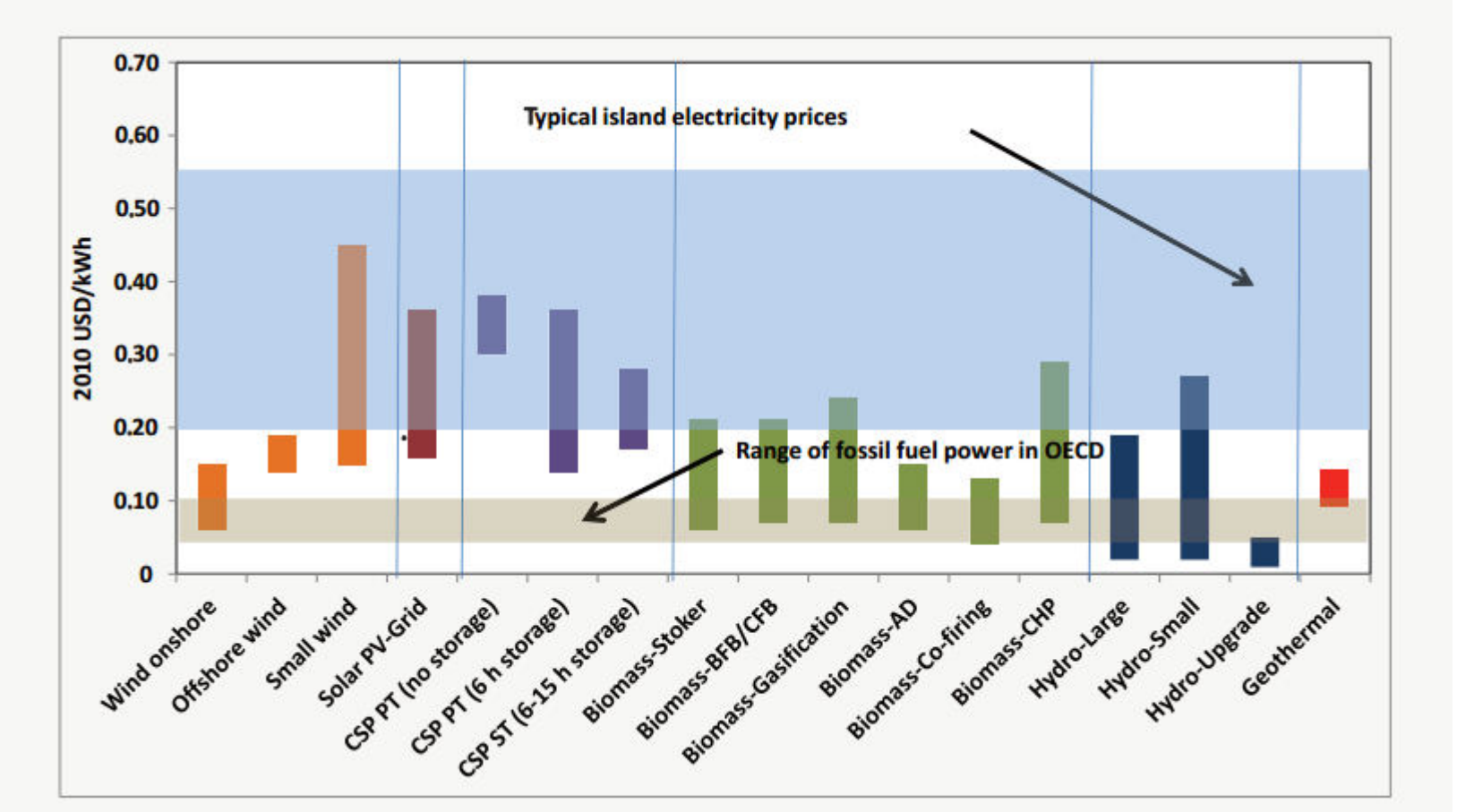
$$\text{NPV} = \sum_{t=1}^{T} \frac{C_t}{(1+r)^t} - C_0 = 0, \; r?$$

Levelized Cost of Electricity (LCOE)

- One of the most important indicators for assessing energy investment.
- LCOE is the cost of the electricity produced for the considered project
- Shows the selling price of electricity output at which the total investments break-even.

$$LCOE = \frac{\sum_{t=1}^{N} \frac{Investment_t + O\&M_t}{(1+r)^t}}{\sum_{t=1}^{N} \frac{Generation_t}{(1+r)^t}} [\$/\text{MWh}]$$

LCOE



LCOE of Renewable Generation Technologies

(Source: International Renewable Energy Agency- IRENA)

LCOE Calculation Example

To calculate the LCOE we need to know the following:

- Annual costs or cash outflows
  - Initial investment, O&M, land use and others
- Discount rate
- Annual electricity production for plant lifetime

LCOE Calculation Example

- Construction of a 1MW solar power plant.
- Initial investment: $1 000 000
- What is the price per kWh at which all costs will be recovered for the power plant lifetime?

LCOE Simple Example

Years	0	1	2	3	…	T
Cash Outflows ($)	-1000000	-20000	-20000	-20000	…	-20000
Electricity produced (MWh)	0	1700	1700	1700	…	1700
Discount Rate	7.5%					
LCOE ($/kWh)	0.16					