Complete financial analysis

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In this last exercise we are going to do a complete financial evaluation for your investment in a new HPP following two methodologies, one with a **fixed cost price** and another with a **variable cost price**.

Fixed cost

Setup

The investment is analysed with the respect to the investment plan for each financial item. We are going to analyse only for seven years. That correspond to the design and construction duration (5 years of construction).

Quotas for the financial items :

- Total : 67 m€
    - construction works 52,24% : 35 m€;
    - equipment 35,83% : 24 m€;
        - mechanical 8,96% : 6 m€;
        - electrical 19,4% : 13 m€;
        - hydro-mechanical 7,46% : 5 m€;
    - start-up investment 11,94% : 8 m€.

We translate those input data as the following table,

INPUT DATA

| ITEM	Proportion [%]	Proportion [EUR]	Time dynamics over the years [%]						
			1	2	3	4	5	6	7
Construction works	52.24	35,000,000.00	0	0	13	30	21	30	6
Equipment	35.82	24,000,000.00	0	0	2.71	4.83	21	49.67	21.79
Mechanical	8.96	6,000,000.00	0	0	0	15	35	40	10
Electrical	19.40	13,000,000.00	0	0	5	2	8	54	31
Hydromechanical	7.46	5,000,000.00	0	0	0	0	38	50	12
Start-up investment	11.94	8,000,000.00	12	11	19	17	15	14	12
Total	100.00	67,000,000.00	1.43	1.31	10.03	19.43	20.28	35.14	12.37

Calculation sheet

To calculate our investment cost we divide the estimated proportion cost following the time dynamics over the seven years such as:

$$Investment(y) = \frac{Dynamic(y).\,Proportion}{100}$$

ITEM	Proportion [%]	Proportion [EUR]	Time dynamics over the years [€]						
			1	2	3	4	5	6	7
Construction works	52.24	35,000,000.00	0	0	4,550,000	10,500,000	7,350,000	10,500,000	2,100,000
Equipment	35.82	24,000,000.00	0	0	650,400	1,159,200	5,040,000	11,920,800	5,229,600
Mechanical	8.96	6,000,000.00	0	0	0	900,000	2,100,000	2,400,000	600,000
Electrical	19.40	13,000,000.00	0	0	650,000	260,000	1,040,000	7,020,000	4,030,000
Hydromechanical	7.46	5,000,000.00	0	0	0	0	1,900,000	2,500,000	600,000
Start-up investment	11.94	8,000,000.00	960,000	880,000	1,520,000	1,360,000	1,200,000	1,120,000	960,000
Total	100.00	67,000,000.00	960,000	880,000	6,720,400	13,019,200	13,590,000	23,540,800	8,289,600

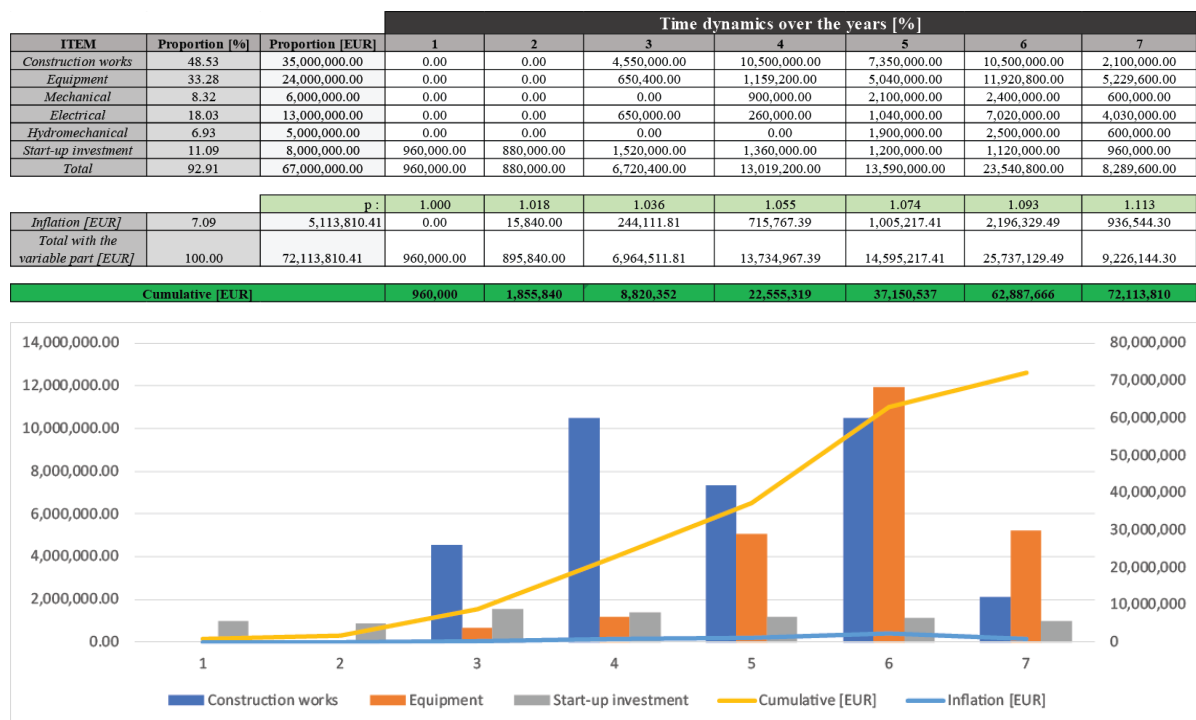| Cumulative [EUR]			960,000.00	1,840,000	8,560,400	21,579,600	35,169,600	58,710,400	67,000,000
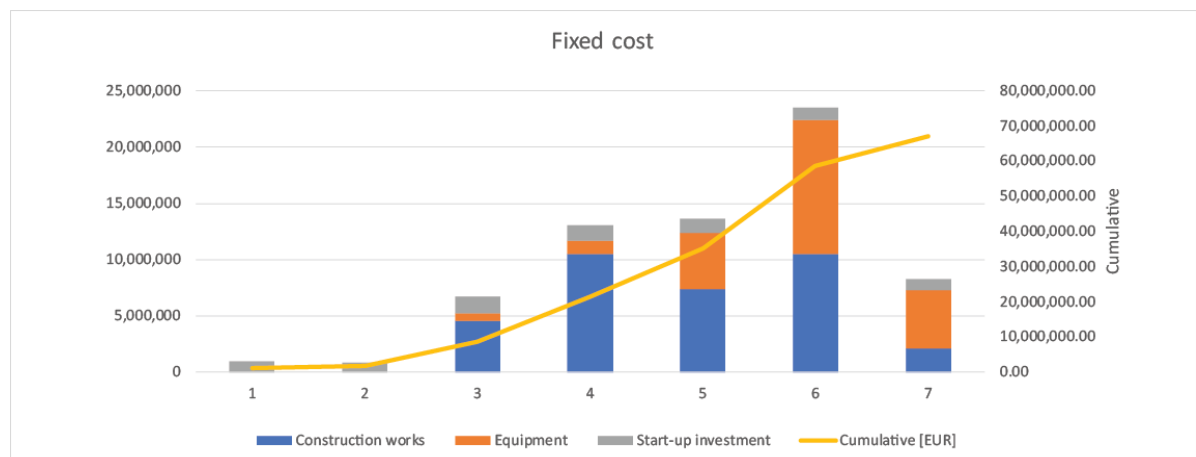
Variable cost

Integration of the inflation

In this method we consider some intermediate price increase following an inflation rate of $r = 1,8$ %/year.

To add the inflation to our calculus we use the parameter p as that we multiply by the intermediate *Total*.

$$p = (1 + \frac{r}{100})^{n-1}$$

Calculation sheet

ITEM	Proportion [%]	Proportion [EUR]	Time dynamics over the years [%]						
			1	2	3	4	5	6	7
Construction works	48.53	35,000,000.00	0.00	0.00	4,550,000.00	10,500,000.00	7,350,000.00	10,500,000.00	2,100,000.00
Equipment	33.28	24,000,000.00	0.00	0.00	650,400.00	1,159,200.00	5,040,000.00	11,920,800.00	5,229,600.00
Mechanical	8.32	6,000,000.00	0.00	0.00	0.00	900,000.00	2,100,000.00	2,400,000.00	600,000.00
Electrical	18.03	13,000,000.00	0.00	0.00	650,000.00	260,000.00	1,040,000.00	7,020,000.00	4,030,000.00
Hydromechanical	6.93	5,000,000.00	0.00	0.00	0.00	0.00	1,900,000.00	2,500,000.00	600,000.00
Start-up investment	11.09	8,000,000.00	960,000.00	880,000.00	1,520,000.00	1,360,000.00	1,200,000.00	1,120,000.00	960,000.00
Total	92.91	67,000,000.00	960,000.00	880,000.00	6,720,400.00	13,019,200.00	13,590,000.00	23,540,800.00	8,289,600.00
		p :	1.000	1.018	1.036	1.055	1.074	1.093	1.113
Inflation [EUR]	7.09	5,113,810.41	0.00	15,840.00	244,111.81	715,767.39	1,005,217.41	2,196,329.49	936,544.30
Total with the variable part [EUR]	100.00	72,113,810.41	960,000.00	895,840.00	6,964,511.81	13,734,967.39	14,595,217.41	25,737,129.49	9,226,144.30
Cumulative [EUR]			960,000	1,855,840	8,820,352	22,555,319	37,150,537	62,887,666	72,113,810

Financial construction of the project based on variable cost

We consider that the concession for hydropower production is granted for 50 years. As before preparation works and construction will last for 7 years.
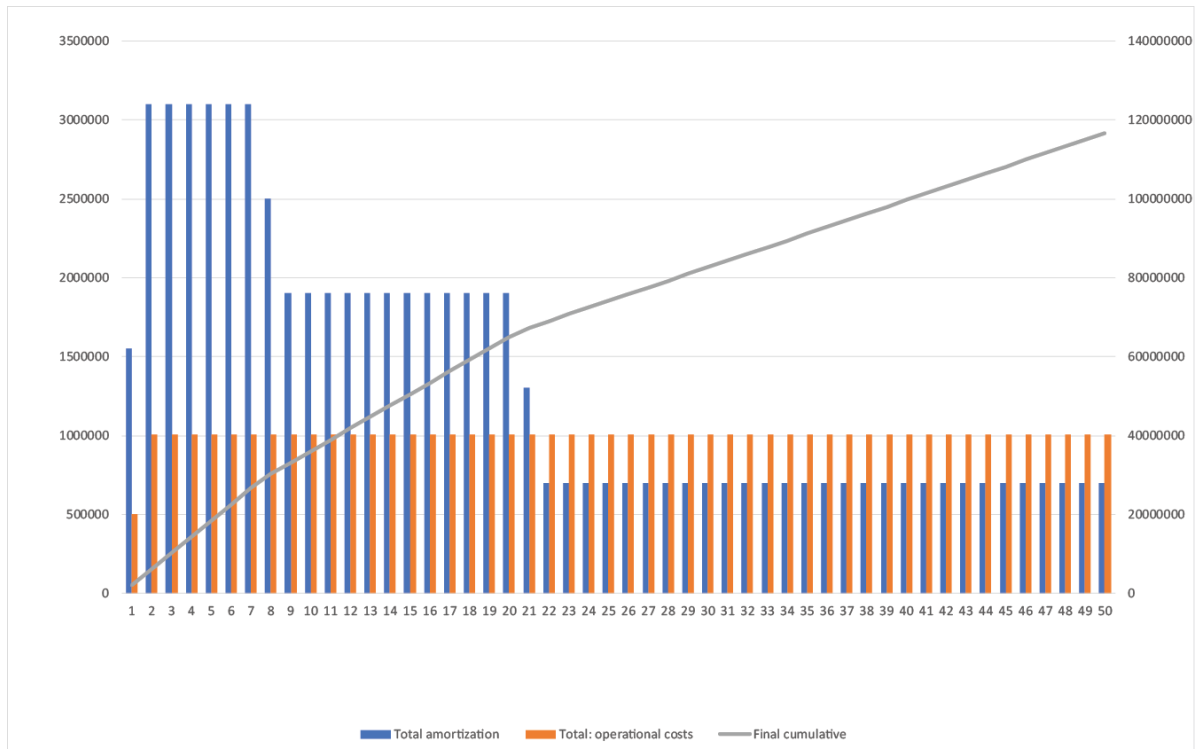
Static indicators

We can estimate :

- the average yearly production,
- the rated power of the powerhouse: 45 MW,
- the investment cost,
- the production consist of :
  - anormalization cost :
    - construction works : 2% over 30 years,
    - equipment : 5% over 20 years,
    - start-up : 15% over 7 years,

- annual operation cost (the operation is only for half of the year):
  - maintenance : 0,5%
  - insurance : 0,2 %
  - workload : 1%

	Production costs											
	Amortization					Operational costs						
	Construction costs (2%)	Equipment (5%)	Start-up investment(15%)	Total amortization	Cumulative	Maintenance (investment) (0,5%)	Insurance (0,2%)	Workload cost and other (1%)	Total: operational costs	Total: production costs	Internal cost	Final cumulative
Time [years]	[EUR]	[EUR]	[EUR]	[EUR]	[EUR]	[EUR]	[EUR]	[EUR]	[EUR]	[EUR]	[EUR/kWh]	[EUR]
1	350000	600000	600000	1550000	1550000	147500	59000	295000	501500	2051500	0.07	2051500
2	700000	1200000	1200000	3100000	4650000	295000	118000	590000	1003000	4103000	0.07	6154500
3	700000	1200000	1200000	3100000	7750000	295000	118000	590000	1003000	4103000	0.07	10257500
4	700000	1200000	1200000	3100000	10850000	295000	118000	590000	1003000	4103000	0.07	14360500
5	700000	1200000	1200000	3100000	13950000	295000	118000	590000	1003000	4103000	0.07	18463500
6	700000	1200000	1200000	3100000	17050000	295000	118000	590000	1003000	4103000	0.07	22566500
7	700000	1200000	1200000	3100000	20150000	295000	118000	590000	1003000	4103000	0.07	26669500
8	700000	1200000	600000	2500000	22650000	295000	118000	590000	1003000	3503000	0.06	30172500
9	700000	1200000		1900000	24550000	295000	118000	590000	1003000	2903000	0.05	33075500
10	700000	1200000		1900000	26450000	295000	118000	590000	1003000	2903000	0.05	35978500
11	700000	1200000		1900000	28350000	295000	118000	590000	1003000	2903000	0.05	38881500
12	700000	1200000		1900000	30250000	295000	118000	590000	1003000	2903000	0.05	41784500
13	700000	1200000		1900000	32150000	295000	118000	590000	1003000	2903000	0.05	44687500
14	700000	1200000		1900000	34050000	295000	118000	590000	1003000	2903000	0.05	47590500
15	700000	1200000		1900000	35950000	295000	118000	590000	1003000	2903000	0.05	50493500
16	700000	1200000		1900000	37850000	295000	118000	590000	1003000	2903000	0.05	53396500
17	700000	1200000		1900000	39750000	295000	118000	590000	1003000	2903000	0.05	56299500
18	700000	1200000		1900000	41650000	295000	118000	590000	1003000	2903000	0.05	59202500
19	700000	1200000		1900000	43550000	295000	118000	590000	1003000	2903000	0.05	62105500
20	700000	1200000		1900000	45450000	295000	118000	590000	1003000	2903000	0.05	65008500
21	700000	600000		1300000	46750000	295000	118000	590000	1003000	2303000	0.04	67311500
22	700000			700000	47450000	295000	118000	590000	1003000	1703000	0.03	69014500
23	700000			700000	48150000	295000	118000	590000	1003000	1703000	0.03	70717500
24	700000			700000	48850000	295000	118000	590000	1003000	1703000	0.03	72420500
25	700000			700000	49550000	295000	118000	590000	1003000	1703000	0.03	74123500
26	700000			700000	50250000	295000	118000	590000	1003000	1703000	0.03	75826500
27	700000			700000	50950000	295000	118000	590000	1003000	1703000	0.03	77529500
28	700000			700000	51650000	295000	118000	590000	1003000	1703000	0.03	79232500
29	700000			700000	52350000	295000	118000	590000	1003000	1703000	0.03	80935500
30	700000			700000	53050000	295000	118000	590000	1003000	1703000	0.03	82638500
31	700000			700000	53750000	295000	118000	590000	1003000	1703000	0.03	84341500
32	700000			700000	54450000	295000	118000	590000	1003000	1703000	0.03	86044500
33	700000			700000	55150000	295000	118000	590000	1003000	1703000	0.03	87747500
34	700000			700000	55850000	295000	118000	590000	1003000	1703000	0.03	89450500
35	700000			700000	56550000	295000	118000	590000	1003000	1703000	0.03	91153500
36	700000			700000	57250000	295000	118000	590000	1003000	1703000	0.03	92856500
37	700000			700000	57950000	295000	118000	590000	1003000	1703000	0.03	94559500
38	700000			700000	58650000	295000	118000	590000	1003000	1703000	0.03	96262500
39	700000			700000	59350000	295000	118000	590000	1003000	1703000	0.03	97965500
40	700000			700000	60050000	295000	118000	590000	1003000	1703000	0.03	99668500
41	700000			700000	60750000	295000	118000	590000	1003000	1703000	0.03	101371500
42	700000			700000	61450000	295000	118000	590000	1003000	1703000	0.03	103074500
43	700000			700000	62150000	295000	118000	590000	1003000	1703000	0.03	104777500
44	700000			700000	62850000	295000	118000	590000	1003000	1703000	0.03	106480500
45	700000			700000	63550000	295000	118000	590000	1003000	1703000	0.03	108183500
46	700000			700000	64250000	295000	118000	590000	1003000	1703000	0.03	109886500
47	700000			700000	64950000	295000	118000	590000	1003000	1703000	0.03	111589500
48	700000			700000	65650000	295000	118000	590000	1003000	1703000	0.03	113292500
49	700000			700000	66350000	295000	118000	590000	1003000	1703000	0.03	114995500
50	700000			700000	67050000	295000	118000	590000	1003000	1703000	0.03	116698500

Legend: Total amortization — Total: operational costs — Final cumulative

Dynamic indicators

- we consider the price of energy sold on the market
- the discount rate
- we estimated financial construction plan, then the NPV (Net present value)
- we estimated the internal rate of return

For a good economic plan:

- $NPV > 0$
- $IRR > DiscountRate$ or at least $IRR > 0$