

1. Problem 2.21

$$\text{ROI} = \frac{10\text{yr}}{\$40 \text{ MM}}$$

$$\boxed{\text{ROI} = 25\%}$$

$$\text{FCI} = \$40 \text{ MM} \cdot 0.85 = \$34 \text{ MM}$$

$$\text{PBP} = \frac{\$34 \text{ MM}}{10\text{yr}}$$

$$\boxed{\text{PBP} = 3.4\text{yr}}$$

2. Problem 2.22

$$\text{income} = (5 \text{ MMBTU/hr} \cdot \$4/\text{BTU} + 14 \text{ MMBTU/hr} \cdot \$7/\text{BTU}) \cdot 8000 \text{ hr/yr}$$

$$\text{income} = \$0.944 \text{ MM/yr}$$

$$\text{Depreciation} = \frac{\$4 \text{ MM}}{10\text{yr}} = \$0.4 \text{ MM/yr}$$

$$\text{After tax income} = (\$0.944 \text{ MM/yr} - \$0.4 \text{ MM/yr} - \$0.5 \text{ MM/yr}) \cdot (1 - 0.25) + \$0.4 \text{ MM/yr}$$

$$\text{After tax income} = \$0.433 \text{ MM/yr}$$

$$\text{PBP} = \frac{\$4 \text{ MM}}{\$0.433 \text{ MM/yr}}$$

$$\boxed{\text{PBP} = 9.24 \text{ yr}}$$

3. Problem 2.23

For $i = 0.15$

$$\text{Depreciation} = \frac{\$4 \text{ MM} - \$0.5 \text{ MM}}{10\text{yr}} = \$0.35 \text{ MM/yr}$$

$$\text{income} = (\$1 \text{ MM/yr} - \$0.35 \text{ MM/yr} - \$0.2 \text{ MM/yr}) \cdot (1 - 0.3) + \$0.35 \text{ MM/yr}$$

$$\text{income} = \$0.665 \text{ MM/yr}$$

$$\text{NPV} = \$0.665 \text{ MM/yr} \cdot \left(\frac{(1 + 0.15)^{10} - 1}{0.15 \cdot (1 + 0.15)^{10}} \right) + \frac{\$0.4 \text{ MM} + \$0.5 \text{ MM}}{(1 + 0.15)^{10}} - \$4.4 \text{ MM}$$

$$\boxed{\text{NPV} = -\$0.84 \text{ MM}}$$

For $i = 0.1$

Procedure is the same as above for $i = 0.1$

$$\boxed{\text{NPV} = \$0.0331 \text{ MM}}$$

The lower discount rate project has a higher NPV. It is desirable to have a higher discount rate because that will result in a higher NPV at the end of the project.

4. Problem 2.24

$$\text{NPV} = \$1 \text{ MM/yr} \cdot \left(\frac{(1+i)^{10} - 1}{i \cdot (1+i)^{10}} \right) + \frac{\$0.4 \text{ MM}}{(1+i)^{10}} - \$3.6 \text{ MM}$$

Find i where $\text{NPV} = 0$:

$$i = 0.251$$

$$\boxed{\text{ROI} = 25.1\%}$$

The ROI of this project is sufficiently high for the company to invest in.

5. Problem 2.25

Data from spreadsheet used for calculations calculations:

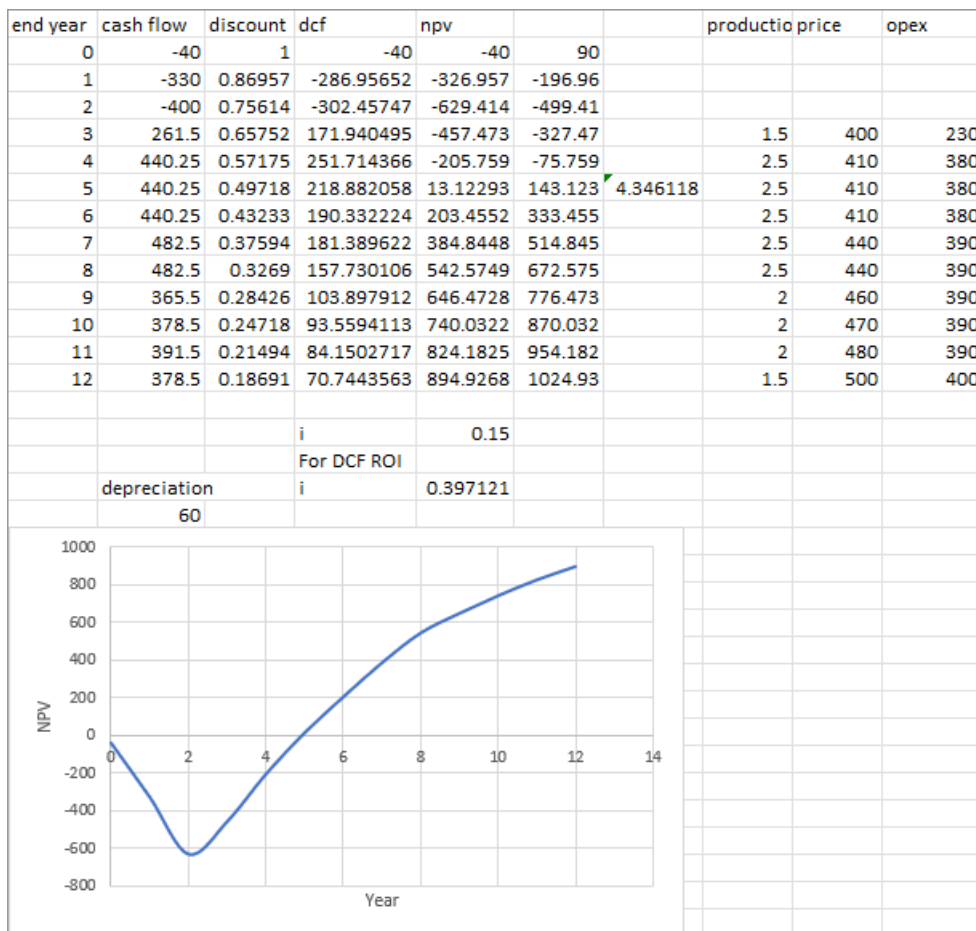
Year	Cash flow (\$MM/yr)	Discount	Discounted cash flow (\$MM/yr)	NPV
0	-40	1	-40	-40
1	-330	0.8695	-286.956	-326.956
2	-400	0.7561	-302.457	-629.413
3	261.5	0.6575	171.940	-457.473
4	440.25	0.5717	251.714	-205.759
5	440.25	0.4971	218.882	13.122
6	440.25	0.4323	190.332	203.455
7	482.5	0.3759	181.389	384.844
8	482.5	0.3269	157.730	542.574
9	365.5	0.2842	103.897	646.472
10	378.5	0.2471	93.5594	740.032
11	391.5	0.2149	84.1502	824.182
12	378.5	0.1869	70.7443	894.926

NPV: 894.926

Discounted PBP: 4.35 yr

Discounted ROI: 39.7%

Spreadsheet screenshot:



6. Problem 2.26

Base project:

$$\text{ROI} = \frac{\$1 \text{ MM/yr}}{\$5 \text{ MM}}$$
$$\text{ROI} = 20\%$$

Base project i:

$$\text{ROI} = \frac{\$1.8 \text{ MM/yr} - \$1 \text{ MM/yr}}{\$2 \text{ MM}}$$
$$\text{ROI} = 40\%$$

Base project ii:

$$\text{ROI} = \frac{\$2.2 \text{ MM/yr} - \$1.8 \text{ MM/yr}}{\$4 \text{ MM}}$$
$$\text{ROI} = 10\%$$

Total project i:

$$\text{ROI} = \frac{\$1.8 \text{ MM/yr}}{\$7 \text{ MM}}$$
$$\text{ROI} = 25.7\%$$

Total project ii:

$$\text{ROI} = \frac{\$2.2 \text{ MM/yr}}{\$11 \text{ MM}}$$
$$\text{ROI} = 20\%$$

The first alternative has an ROI of 40% which is better than the base project. This project is worth the additional investment. The second alternative has an ROI of 10% which is less than the 20% ROI of the base project, and thus this project is not worth the additional investment.

The total ROI of each project is above the minimum set out by the company. However, the second project is deceptive in that its individual ROI is insufficient. If the company wants at least 15% ROI on its investments, only the base or first project should be considered.