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 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

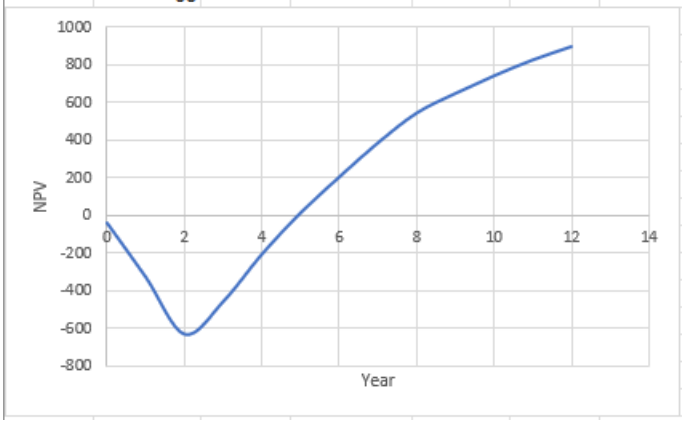
NPV: $\boxed{894.926}$

Discounted PBP: $\boxed{4.35 \text{ yr}}$

Discounted ROI: $\boxed{39.7\%}$

Spreadsheet screenshot:

end year	cash flow	discount	dcf	npv			productio	price	opex
0	-40	1	-40	-40	90				
1	-330	0.86957	-286.95652	-326.957	-196.96				
2	-400	0.75614	-302.45747	-629.414	-499.41				
3	261.5	0.65752	171.940495	-457.473	-327.47		1.5	400	230
4	440.25	0.57175	251.714366	-205.759	-75.759		2.5	410	380
5	440.25	0.49718	218.882058	13.12293	143.123	4.346118	2.5	410	380
6	440.25	0.43233	190.332224	203.4552	333.455		2.5	410	380
7	482.5	0.37594	181.389622	384.8448	514.845		2.5	440	390
8	482.5	0.3269	157.730106	542.5749	672.575		2.5	440	390
9	365.5	0.28426	103.897912	646.4728	776.473		2	460	390
10	378.5	0.24718	93.5594113	740.0322	870.032		2	470	390
11	391.5	0.21494	84.1502717	824.1825	954.182		2	480	390
12	378.5	0.18691	70.7443563	894.9268	1024.93		1.5	500	400
			i	0.15					
			For DCF ROI						
	depreciation		i	0.397121					
	60								



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 i:

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

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.