

Chapter 9 Project Cash Flow Analysis

9.1)

- wages paid to temporary workers: **Variable cost**
- property taxes on factory building: **Fixed cost**
- property taxes on administrative building: **Fixed cost**
- sales commission: **Variable cost**
- electricity for machinery and equipment in a plant: **Variable cost**
- heat and air-conditioning for a plant: **Fixed cost**
- salaries paid to design engineers: **Fixed cost**
- regular maintenance on machinery and equipment: **Fixed cost**
- basic raw materials used in production: **Variable cost**
- factory fire insurance: **Fixed cost**

9.2)

- a) 6
- b) 11
- c) 5 (Note: It is tempting to select “1”, but the graphs are drawn on cumulative basis)
- d) 4
- e) 2
- f) 10
- g) 3
- h) 7
- i) 9

9.3)

- a) Incremental cost

Description	In-house Option	Outsourcing Option
Soldering operation		\$4.80
Direct materials	\$7.50	\$6.00
Direct labor	\$5.00	\$4.25
Mfg. Overhead	\$4.00	\$3.40
Variable	\$3.80	\$3.23
Fixed	\$0.20	\$0.20
Unit cost	\$16.50	\$18.28

No. The outsourcing option would cost \$1.78 more for each unit. Note that the fixed cost of \$20,000 (or \$0.20 per unit based on 100,000 production volume) remains unchanged under either option.

b) Break-even price = $\$4.80 - \$1.78 = \$3.02$ per unit

9.4)

(a)

$$\text{Breakeven volume} = \frac{\$255,000}{\$3(0.1) + \$2(0.5) + \$1(0.4)} = 150,000 \text{ units}$$

(b)

Total marginal contribution: $\$3(0.1) + \$2(0.5) + \$1(0.4) = \1.70
Operating income:

$$\$3(20,000) + \$2(100,000) + \$1(80,000) - \$255,000 = \$85,000$$

(c)

$$\text{Breakeven volume} = \frac{\$255,000}{\$3(0.1) + \$2(0.4) + \$1(0.5)} = 159,375$$

Operating income:

$$\$3(20,000) + \$2(80,000) + \$1(100,000) - \$255,000 = \$65,000$$

9.5)

a) Marginal tax rates:

	Without project	With project
Taxable income	\$350,000	\$530,000
Income taxes	\$119,000	\$180,200

marginal tax rate without the project = 34%

marginal tax rate with the project = 34%

b) Average tax rates:

$$\begin{aligned} \text{without the project} &= \$119,000 / \$350,000 \\ &= 34\% \end{aligned}$$

$$\begin{aligned} \text{with the project} &= \$180,200 / \$530,000 \\ &= 34\% \end{aligned}$$

9.6)

a) Marginal tax rates with the project:

<i>n</i>	Revenue	Depreciation	Taxable income	Combined income	Marginal rate
1	\$120,000	\$21,000	\$99,000	\$399,000	34%
2	\$120,000	\$33,600	\$86,400	\$386,400	34%
3	\$120,000	\$20,160	\$99,840	\$399,840	34%
4	\$120,000	\$12,096	\$107,904	\$407,904	34%
5	\$120,000	\$12,096	\$107,904	\$407,904	34%
6	\$120,000	\$6,048	\$113,952	\$413,952	34%

b) Average tax rates

<i>n</i>	Combined income	Combined income taxes	Average tax rate
1	\$399,000	\$135,660.00	34%
2	\$386,400	\$131,376.00	34%
3	\$399,840	\$135,945.60	34%
4	\$407,904	\$138,687.36	34%
5	\$407,904	\$138,687.36	34%
6	\$413,952	\$140,743.68	34%

9.7)

Incremental tax rate calculation:

	Year 1	Year 2
Revenue	\$200,000	\$200,000
Operating Costs	\$100,000	\$100,000
Depreciation	\$10,000	\$16,000
Taxable income	\$90,000	\$84,000

	Year 1	Year 2
Taxable income without project	\$500,000	\$500,000
Income taxes (34%)	\$170,000	\$170,000
Taxable income with project	\$590,000	\$584,000
Income taxes (34%)	\$200,600	\$198,560
Incremental taxable income	\$90,000	\$84,000
Incremental income taxes	\$30,600	\$28,560
Incremental tax rate	34%	34%

Comments: Note that the marginal tax rates over the project life remain unchanged because the additional income from the new project is not large enough to push the company into a higher tax bracket.

9.8) Taxable income from the project during year 1:

$$D_1 = 0.20(\$100,000) = \$20,000$$

$$\text{Taxable income} = \$80,000 - \$20,000 = \$60,000$$

a) & b) Increment in income tax due to the project during year 1:

	Year 1
Taxable income without project	\$195,000
Income taxes	\$59,300
Taxable income with project	\$255,000
Income taxes	\$82,700
Incremental taxable income	\$60,000
Incremental income taxes	\$23,400
Incremental tax rate	39%

9.9) Incremental tax calculations:

a) Additional taxable income due to project:

	Year 1	Year 2	Year 3
Annual revenue	\$90,000	\$90,000	\$90,000
Operating cost	\$25,000	\$25,000	\$25,000
Depreciation	\$16,667	\$22,222	\$3,704
Taxable income	\$48,333	\$42,778	\$61,296

b) Additional income tax calculation:

	Year 1	Year 2	Year 3
Taxable income without project	\$400,000	\$400,000	\$400,000
Income taxes	\$136,000	\$136,000	\$136,000
Taxable income with project	\$448,333	\$442,778	\$461,296
Income taxes	\$152,433	\$150,544	\$156,841
Incremental taxable income	\$48,333	\$42,778	\$61,296
Incremental income taxes	\$16,433	\$14,544	\$20,841
Incremental tax rate	34%	34%	34%

9.10)

(a), (b), and (c)

Input		Output					
Tax Rate(%)=	40	PW(i) =	\$299,551	>0, acceptable			
MARR(%)=	12	IRR(%) =	97%				
	0	1	2	3	4	5	6
Income Statement							
Revenues (savings)		\$300,000	\$300,000	\$300,000	\$300,000	\$300,000	\$300,000
Expenses:							
Labor		\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000
Materials		50,000	50,000	50,000	50,000	50,000	50,000
Depreciation		20,000	32,000	19,200	11,520	11,520	5,760
Taxable Income		\$130,000	\$118,000	\$130,800	\$138,480	\$138,480	\$144,240
Income Taxes (40%)		52,000	47,200	52,320	55,392	55,392	57,696
Net Income		\$78,000	\$70,800	\$78,480	\$83,088	\$83,088	\$86,544
Cash Flow Statement							
Operating Activities:							
Net Income		\$ 78,000	\$ 70,800	\$ 78,480	\$ 83,088	\$ 83,088	\$ 86,544
Depreciation		\$ 20,000	\$ 32,000	\$ 19,200	\$ 11,520	\$ 11,520	\$ 5,760
Investment Activities:							
Investment	\$ (100,000)						
Salvage							0
Gains Tax							0
Net Cash Flow	(\$100,000)	\$98,000	\$102,800	\$97,680	\$94,608	\$94,608	\$92,304

9.11) Investment in industrial robot:

	0	1	2	3	4	5
Income Statement						
Revenues (savings)		\$125,000	\$125,000	\$125,000	\$125,000	\$125,000
Expenses:						
Depreciation		35,725	61,225	43,725	31,225	11,163
Taxable Income		\$89,275	\$63,775	\$81,275	\$93,775	\$113,838
Income Taxes (35%)		31,246	22,321	28,446	32,821	39,843
Net Income		\$58,029	\$41,454	\$52,829	\$60,954	\$73,994
Cash Flow Statement						
Operating Activities:						
Net Income		\$58,029	\$41,454	\$52,829	\$60,954	\$73,994
Depreciation		\$35,725	\$61,225	\$43,725	\$31,225	\$11,163
Investment Activities:						
Investment	(\$250,000)					
Salvage						\$50,000
Gains Tax						\$5,928
Net Cash Flow	(\$250,000)	\$93,754	\$102,679	\$96,554	\$92,179	\$141,085
	PW(15%)=	\$95,498				Accept the investment
	IRR=	29%	>15%(MARR)			

9.12)

$$X = \$60,000(P / A, 15\%, 10)$$

$$= \$301,128$$

9.13) Investment in a new trench excavator:

	0	1	2	3	4	5
Income Statement						
Revenues (savings)		\$50,000	\$50,000	\$50,000	\$50,000	\$50,000
Expenses:						
Required annual digging (ft)		8,000	8,000	8,000	8,000	8,000
Number of hours to operate		500	500	500	500	500
Operating cost (@\$10/hr)		\$5,000	\$5,000	\$5,000	\$5,000	\$5,000
Depreciation		\$60,000	\$96,000	\$57,600	\$34,560	\$17,280
Taxable Income		(\$15,000)	(\$51,000)	(\$12,600)	\$10,440	\$27,720
Income Taxes (35%)		(\$5,250)	(\$17,850)	(\$4,410)	\$3,654	\$9,702
Net Income		(\$9,750)	(\$33,150)	(\$8,190)	\$6,786	\$18,018
Cash Flow Statement						
Operating Activities:						
Net Income		(\$9,750)	(\$33,150)	(\$8,190)	\$6,786	\$18,018
Depreciation		\$60,000	\$96,000	\$57,600	\$34,560	\$17,280
Investment Activities:						
Investment	(\$300,000)					
Salvage						\$100,000
Gains Tax						(\$22,904)
Net Cash Flow	(\$300,000)	\$50,250	\$62,850	\$49,410	\$41,346	\$112,394
	IRR=	1.6%			BV=	\$34,560
	PV(15%)= \$	(96,773) < 0		Not Acceptable		

9.14) Tucson Solar Company:
(a)

Income Statement

Revenues (savings)	\$66,000	\$70,000	\$74,000	\$80,000	\$64,000	\$50,000
Expenses:						
Operating Expenses	29,000	28,400	32,000	38,800	31,000	25,000
Depreciation	10,800	17,280	10,368	6,221	6,221	3,110
Taxable Income	\$26,200	\$24,320	\$31,632	\$34,979	\$26,779	\$21,890
Income Taxes (35%)	9,170	8,512	11,071	12,243	9,373	7,661
Net Income	\$17,030	\$15,808	\$20,561	\$22,736	\$17,406	\$14,228

Cash Flow Statement

Operating Activities:						
Net Income	\$	17,030	\$	15,808	\$	20,561
Depreciation	\$	10,800	\$	17,280	\$	10,368
Investment Activities:						
Investment	\$	(54,000)				
Salvage					\$	8,000
Gains Tax					\$	(2,800)
Net Cash Flow	(\$54,000)	\$27,830	\$33,088	\$30,929	\$28,957	\$23,627
	NPV=	\$62,469		AE(12%)=	\$15,194	

(b)

$$\begin{aligned}
 AE(12\%) &= (\$62,469) \times (A/P/12\%, 6) \\
 &= \$15,194
 \end{aligned}$$

9.15) Investment in energy management system: $N = 9$ years

Input		Output	
Tax Rate(%) =	35	PW(i) =	\$1,998
MARR(%) =	10	IRR(%) =	11.19%

	0	1	2	3	4	5 - 8	9
Income Statement							
Energy Savings		\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
Expenses:							
Depreciation		16,665	22,225	7,405	3,705	0	0
Taxable Income		(\$6,665)	(\$12,225)	\$2,595	\$6,295	\$10,000	\$10,000
Income Taxes		(2,333)	(4,279)	908	2,203	3,500	3,500
Net Income		(\$4,332)	(\$7,946)	\$1,687	\$4,092	\$6,500	\$6,500
Cash Flow Statement							
Operating Activities:							
Net Income		\$ (4,332)	\$ (7,946)	\$ 1,687	\$ 4,092	\$ 6,500	\$ 6,500
Depreciation		\$ 16,665	\$ 22,225	\$ 7,405	\$ 3,705	\$ -	\$ -
Investment Activities:							
Investment	\$ (50,000)						
Salvage							0
Gains Tax							(0)
Net Cash Flow	(\$50,000)	\$12,333	\$14,279	\$9,092	\$7,797	\$6,500	\$6,500

9.16) Investment decision based on after-tax IRR:

Input		Output	
Tax Rate(%) =	40	PW(i) =	(\$0)
MARR(%) =	12	IRR(%) =	12.00%

	0	1	2	3	4	5
Income Statement						
Revenues (savings)		\$130,000	\$130,000	\$130,000	\$130,000	\$130,000
Expenses:						
O&M costs		\$20,000	\$20,000	\$20,000	\$20,000	\$20,000
Depreciation		116,920	155,928	51,953	25,994	0
Taxable Income		(\$6,920)	(\$45,928)	\$58,047	\$84,006	\$110,000
Income Taxes (40%)		(2,768)	(18,371)	23,219	33,602	44,000
Net Income		(\$4,152)	(\$27,557)	\$34,828	\$50,404	\$66,000
Cash Flow Statement						
Operating Activities:						
Net Income		\$ (4,152)	\$ (27,557)	\$ 34,828	\$ 50,404	\$ 66,000
Depreciation		\$ 116,920	\$ 155,928	\$ 51,953	\$ 25,994	\$ -
Investment Activities:						
Investment	\$ (350,794)					
Salvage						0
Gains Tax						0
Net Cash Flow	(\$350,794)	\$112,768	\$128,371	\$86,781	\$76,398	\$66,000

9.17) Investment in Mazda automatic screw machine:

Input		Output	
Tax Rate(%) =	40	PW(i) =	\$37,761
MARR(%) =	15	IRR(%) =	33.74%

	0	1	2	3	4	5	6
Income Statement							
Revenues (savings)		\$38,780	\$38,780	\$38,780	\$38,780	\$38,780	\$38,780
Expenses:							
Depreciation		9,817	16,825	12,016	8,581	6,135	3,064
Taxable Income		\$28,963	\$21,955	\$26,764	\$30,199	\$32,645	\$35,716
Income Taxes (40%)		11,585	8,782	10,706	12,080	13,058	14,286
Net Income		\$17,378	\$13,173	\$16,059	\$18,120	\$19,587	\$21,430
Cash Flow Statement							
Operating Activities:							
Net Income		\$ 17,378	\$ 13,173	\$ 16,059	\$ 18,120	\$ 19,587	\$ 21,430
Depreciation		\$ 9,817	\$ 16,825	\$ 12,016	\$ 8,581	\$ 6,135	\$ 3,064
Investment Activities:							
Investment	\$ (68,701)						
Salvage							\$ 3,500
Gains Tax							\$ 3,505
Net Cash Flow	(\$68,701)	\$27,195	\$29,998	\$28,074	\$26,700	\$25,722	\$31,499

Since $PW(15\%) > 0$, accept the investment.

9.18)

Income Statement

	0	1	2	3
Income Statement				
Revenue		<u>\$16,651</u>	<u>\$16,651</u>	<u>\$16,651</u>
Expenses:				
Depreciation		10,600	16,960	5,088
Taxable Income		\$6,051	(\$310)	\$11,563
Income Taxes		\$2,118	(\$108)	\$4,047
Net Income		\$3,933	(\$201)	\$7,516

Cash Flow Statement

Cash from operation				
Net Income		\$ 3,933	\$ (201)	\$ 7,516
Depreciation		\$ 10,600	\$ 16,960	\$ 5,088
Investment / Salvage	\$ (53,000)			\$ 22,000
Security Deposit	\$ 1,500			\$ (1,500)
Gains Tax				\$ (577)
Net Cash Flow (actual)	\$ (51,500)	\$ 14,533	\$16,759	\$ 32,527

PW (10%) = (\$0)

The required lease payment should be \$16,651 per year, payable at the end of each year.
 If the ACLC schedules each lease payment to be made at the beginning of each year, the required lease payment should be much lower, or precisely \$15,137 per year.

9.19) Investment decision based on after-tax IRR:

Input		Output	
Tax Rate(%) =	40	PW(i) =	\$137,306
MARR(%) =	15	IRR(%) =	48.13%

	0	1	2	3	4	5
Income Statement						
Revenues (savings)		\$200,000	\$200,000	\$200,000	\$200,000	\$200,000
Expenses:						
O&M costs		80,000	80,000	80,000	80,000	80,000
Depreciation		25,000	25,000	25,000	25,000	25,000
Taxable Income		\$95,000	\$95,000	\$95,000	\$95,000	\$95,000
Income Taxes (40%)		38,000	38,000	38,000	38,000	38,000
Net Income		\$57,000	\$57,000	\$57,000	\$57,000	\$57,000
Cash Flow Statement						
Operating Activities:						
Net Income		57,000	57,000	57,000	57,000	57,000
Depreciation		25,000	25,000	25,000	25,000	25,000
Investment Activities:						
Investment	\$ (150,000)					
Salvage						25,000
Gains Tax						0
Net Cash Flow	(\$150,000)	\$82,000	\$82,000	\$82,000	\$82,000	\$107,000

9.20) (a), (b), and (c)

(Unit:\$000)

	0	1	2	3	4	5-7	8	9	10-11	12
Income Statement										
Revenue		\$ 84,000	\$ 84,000	\$ 84,000	\$ 84,000	\$ 140,000	\$ 224,000	\$ 224,000	\$ 224,000	\$ 224,000
Expenses:										
Production costs		\$ 45,000	\$ 45,000	\$ 45,000	\$ 45,000	\$ 75,000	\$ 120,000	\$ 120,000	\$ 120,000	\$ 120,000
Depreciation :										
Building		\$ 529	\$ 1,154	\$ 1,154	\$ 1,154	\$ 1,154	\$ 1,154	\$ 1,154	\$ 1,154	\$ 1,106
Equipment		\$ 14,290	\$ 24,490	\$ 17,490	\$ 12,490	\$ 8,930	\$ 4,460			
Taxable Income		\$ 24,181	\$ 13,356	\$ 20,356	\$ 25,356	\$ 54,916	\$ 98,386	\$ 102,846	\$ 102,846	\$ 102,894
Income Taxes (40%)		\$ 9,672	\$ 5,342	\$ 8,142	\$ 10,142	\$ 21,966	\$ 39,354	\$ 41,138	\$ 41,138	\$ 41,158
Net Income		\$ 14,509	\$ 8,014	\$ 12,214	\$ 15,214	\$ 32,950	\$ 59,032	\$ 61,708	\$ 61,708	\$ 61,736
Cash Flow Statement										
Operating Activities:										
Net Income		\$ 14,509	\$ 8,014	\$ 12,214	\$ 15,214	\$ 32,950	\$ 59,032	\$ 61,708	\$ 61,708	\$ 61,736
Depreciation		\$ 14,819	\$ 25,644	\$ 18,644	\$ 13,644	\$ 10,084	\$ 5,614	\$ 1,154	\$ 1,154	\$ 1,106
Investment Activities:										
Land	\$ (5,000)									\$ 8,000
Building	\$ (45,000)									\$ 30,000
Equipment	\$ (100,000)									\$ 10,000
Gains Tax										
Land (35%)										\$ (1,050)
Building (40%)										\$ 731
Equipment (40%)										\$ (4,004)
Net Cash Flow	(\$150,000)	\$29,328	\$33,658	\$30,858	\$28,858	\$43,034	\$64,646	\$62,862	\$62,862	\$106,519

$$PW(15\%) = \$81,880$$

IRR = 24.30%

Note 1: In a strict sense, capital gains are only realized for the sale of land.

Note 2: It is assumed that the building will be disposed of at the end of December of the 12th year.

9.21) Investment in 3-D computerized car-styling system

Input		Output	
Tax Rate(%) =	40	PW(i) =	\$459,071
MARR(%) =	12	IRR(%) =	95.53%

	0	1	2	3	4	5
Income Statement						
Revenues (savings)		\$350,000	\$350,000	\$350,000	\$350,000	\$350,000
Expenses:						
O&M costs		\$80,000	\$80,000	\$80,000	\$80,000	\$80,000
Depreciation		36,000	57,600	34,560	20,736	10,368
Taxable Income		\$234,000	\$212,400	\$235,440	\$249,264	\$259,632
Income Taxes (40%)		93,600	84,960	94,176	99,706	103,853
Net Income		\$140,400	\$127,440	\$141,264	\$149,558	\$155,779
Cash Flow Statement						
Operating Activities:						
Net Income		\$ 140,400	\$ 127,440	\$ 141,264	\$ 149,558	\$ 155,779
Depreciation		\$ 36,000	\$ 57,600	\$ 34,560	\$ 20,736	\$ 10,368
Investment Activities:						
Investment	\$ (180,000)					
Salvage						\$ 5,000
Gains Tax						\$ 6,294
Net Cash Flow	(\$180,000)	\$176,400	\$185,040	\$175,824	\$170,294	\$177,442

9.22)

a) Equal repayment of the principal:

	Loan	Repayment	Loan
n	Interest	Principal	Balance
0			\$300,000
1	\$36,000	\$50,000	\$250,000
2	\$30,000	\$50,000	\$200,000
3	\$24,000	\$50,000	\$150,000
4	\$18,000	\$50,000	\$100,000
5	\$12,000	\$50,000	\$50,000
6	\$6,000	\$50,000	0

b) Equal repayment of the interest:

	Loan	Repayment	Loan
n	Interest	Principal	Balance
0			\$300,000
1	\$36,000		\$300,000
2	\$36,000		\$300,000
3	\$36,000		\$300,000
4	\$36,000		\$300,000
5	\$36,000		\$300,000
6	\$36,000	\$300,000	0

c) Equal annual installment:

$$A = \$300,000(A/P, 12\%, 6) = \$72,968$$

	Loan	Repayment	Loan
n	Interest	Principal	Balance
0			\$300,000
1	\$36,000	\$36,968	\$263,032
2	\$31,564	\$41,404	\$221,628
3	\$26,595	\$46,373	\$175,255
4	\$21,031	\$51,937	\$123,318
5	\$14,798	\$58,170	\$65,148
6	\$7,818	\$65,148	0

9.23)

Input			
Tax Rate(%) =		40	
MARR(%) =		15	
	0	1	2
Income Statement			
Revenues (savings)		\$35,000	\$35,000
Expenses:			
Operation cost		\$5,000	\$5,000
Depreciation		6,666	4,445
Debt interest		2,000	1,048
Taxable Income		\$21,334	\$24,507
Income Taxes (40%)		8,534	9,803
Net Income		\$12,800	\$14,704
Cash Flow Statement			
Operating Activities:			
Net Income		\$ 12,800	\$ 14,704
Depreciation		\$ 6,666	\$ 4,445
Investment Activities:			
Investment	\$ (20,000)		
Salvage			\$ 6,000
Gains Tax			\$ 1,156
Financing Activities:			
Borrowed funds	\$ 20,000		
Principal repayment		\$ (9,524)	\$ (10,476)
Net Cash Flow	\$ -	\$ 9,942	\$ 15,829
Output			
PW(i) =		\$20,614	

9.24)

(a), (b), and (c)

Income Statement

	0	1	2	3	4	5
Income Statement						
Revenue		\$95,000	\$95,000	\$95,000	\$95,000	\$95,000
Expenses:						
Depreciation		30,000	48,000	28,800	17,280	8,640
Interest (12%)		10,800	9,100	7,196	5,063	2,675
Taxable Income		\$54,200	\$37,900	\$59,004	\$72,657	\$83,685
Income Taxes (35%)		\$18,970	\$13,265	\$20,651	\$25,430	\$29,290
Net Income		\$35,230	\$24,635	\$38,353	\$47,227	\$54,395

Cash Flow Statement

Cash from operation:						
Net Income		\$ 35,230	\$ 24,635	\$ 38,353	\$ 47,227	\$ 54,395
Depreciation		\$ 30,000	\$ 48,000	\$ 28,800	\$ 17,280	\$ 8,640
Investment / Salvage	\$ (150,000)					\$ 10,000
Gains Tax						\$ 2,548
Loan repayment	\$ 90,000	\$ (14,167)	\$ (15,867)	\$ (17,771)	\$ (19,903)	\$ (22,292)
Net Cash Flow (actual)	(\$60,000)	\$51,063	\$56,768	\$49,382	\$44,603	\$53,291

PW (20%) = \$93,479
IRR = 82.19%

9.25) Income statement approach: (a), (b), and (c)

(a)	Input		Output							
	Tax Rate(%)=	40	PW(i) =		\$240,033					
	MARR(%) =	18	IRR(%) =		54.45%					
	0	1	2	3	4	5 - 7	8	9	10	
Income Statement										
Revenues:										
Additional revenue		\$120,000	\$120,000	\$120,000	\$120,000	\$120,000	\$120,000	\$120,000	\$120,000	
Labor & materials savings		50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	
Expenses:										
Depreciation		50,015	85,715	61,215	43,715	31,255	15,610			
Debt interest		22,500	15,000	7,500						
Taxable Income		97,485	69,285	101,285	126,285	138,745	154,390	170,000	170,000	
Income Taxes		38,994	27,714	40,514	50,514	55,498	61,756	68,000	68,000	
Net Income		\$58,491	\$41,571	\$60,771	\$75,771	\$83,247	\$92,634	\$102,000	\$102,000	
Cash Flow Statement										
Operating Activities:										
Net Income		58,491	41,571	60,771	75,771	83,247	92,634	102,000	102,000	
Depreciation		50,015	85,715	61,215	43,715	31,255	15,610	-	-	
Investment Activities:										
Investment	(350,000)									
Salvage									20,000	
Gains Tax									(8,000)	
Financing Activities:										
Borrowed funds	250,000									
Principal repayment		(83,333)	(83,333)	(83,333)						
Net Cash Flow	(\$100,000)	\$25,173	\$43,953	\$38,653	\$119,486	\$114,502	\$108,244	\$102,000	\$114,000	

9.26) (a) and (b)

Input		Output	
Tax Rate(%) =	35	PW(i) =	(\$1,318,770)
MARR(%) =	18	AE(i) =	(\$421,713.40)

	0	1	2	3	4	5
Income Statement						
Revenues (savings)						
Expenses:						
Depreciation		\$285,800	\$489,800	\$349,800	\$249,800	\$89,300
Debt interest (10%)		80,000	66,896	52,482	36,626	19,185
Taxable Income		(365,800)	(556,696)	(402,282)	(286,426)	(108,485)
Income Taxes (35%)		(128,030)	(194,844)	(140,799)	(100,249)	(37,970)
Net Income		(\$237,770)	(\$361,853)	(\$261,483)	(\$186,177)	(\$70,515)
Cash Flow Statement						
Operating Activities:						
Net Income		(237,770)	(361,853)	(261,483)	(186,177)	(70,515)
Depreciation		285,800	489,800	349,800	249,800	89,300
Investment Activities:						
Investment	(2,000,000)					
Salvage						200,000
Gains Tax						117,425
Financing Activities:						
Borrowed funds	800,000					
Principal repayment		(131,038)	(144,142)	(158,556)	(174,412)	(191,853)
Net Cash Flow	\$ (1,200,000)	\$ (83,008)	\$ (16,194)	\$ (70,239)	\$ (110,789)	\$ 144,357

(c) This is a service project. The equivalent annual cost is

$$\begin{aligned}
 AEC(18\%) &= \$1,318,770(A/P, 18\%, 5) \\
 &= \$421,713.40
 \end{aligned}$$

9.27) (a) and (b)

Input		Output	
Tax Rate(%) =	40	PW(i) =	\$75,616
MARR(%) =	14	IRR(%) =	43.24%

0	1	2	3	4	5	6	7	8
---	---	---	---	---	---	---	---	---

Income Statement

Revenues (savings)	\$60,000	\$60,000	\$60,000	\$60,000	\$60,000	\$60,000	\$60,000	\$60,000
Expenses:								
O&M cost	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000
Depreciation	15,719	26,939	19,239	13,739	9,823	9,812	9,823	4,906
Debt interest (10%)	4,000	3,650	3,265	2,842	2,377	1,865	1,301	682
Taxable Income	32,281	21,411	29,496	35,419	39,800	40,323	40,876	46,412
Income Taxes (40%)	12,912	8,564	11,798	14,168	15,920	16,129	16,350	18,565
Net Income	\$19,369	\$12,846	\$17,697	\$21,251	\$23,880	\$24,194	\$24,525	\$27,847

Cash Flow Statement

Operating Activities:									
Net Income		19,369	12,846	17,697	21,251	23,880	24,194	24,525	27,847
Depreciation		15,719	26,939	19,239	13,739	9,823	9,812	9,823	4,906
Investment Activities:									
Investment	(110,000)								
Salvage									10,000
Gains Tax									(4,000)
Financing Activities:									
Borrowed funds	40,000								
Principal repayment		(3,498)	(3,848)	(4,232)	(4,656)	(5,121)	(5,633)	(6,196)	(6,816)
Net Cash Flow	(\$70,000)	\$31,590	\$35,938	\$32,704	\$30,335	\$28,582	\$28,373	\$28,152	\$31,937

9.28) (a) with no borrowed funds:

Input		Output				
Tax Rate(%) =	35	PW(i) = \$9,403				
MARR(%) =	9					
	0	1	2	3	4	5
Income Statement						
Revenues (savings)		\$7,500	\$7,500	\$7,500	\$7,500	\$7,500
Expenses:						
Depreciation		3,000	4,800	2,880	1,728	864
Debt interest		-	-	-	-	-
Taxable Income		4,500	2,700	4,620	5,772	6,636
Income Taxes (35%)		1,575	945	1,617	2,020	2,323
Net Income		\$2,925	\$1,755	\$3,003	\$3,752	\$4,313
Cash Flow Statement						
Operating Activities:						
Net Income		2,925	1,755	3,003	3,752	4,313
Depreciation		3,000	4,800	2,880	1,728	864
Investment Activities:						
Investment	(15,000)					
Salvage						3,000
Gains Tax						(445)
Financing Activities:						
Borrowed funds	-					
Principal repayment		-	-	-	-	-
Net Cash Flow	(\$15,000)	\$5,925	\$6,555	\$5,883	\$5,480	\$7,732

(b) With borrowed funds:

Instructor Solutions Manual to accompany Fundamentals of Engineering Economics, Second Edition, by Chan S. Park.

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Input		Output	
Tax Rate(%) =	35	PW(9%) =	\$10,629
MARR(%) =	9		

	0	1	2	3	4	5
Income Statement						
Revenues (savings)		\$7,500	\$7,500	\$7,500	\$7,500	\$7,500
Expenses:						
Depreciation		3,000	4,800	2,880	1,728	864
Debt interest (9%)		1,350	1,124	879	611	318
Taxable Income		3,150	1,576	3,741	5,161	6,318
Income Taxes (35%)		1,103	552	1,309	1,806	2,211
Net Income		\$2,048	\$1,024	\$2,432	\$3,355	\$4,107
Cash Flow Statement						
Operating Activities:						
Net Income		2,048	1,024	2,432	3,355	4,107
Depreciation		3,000	4,800	2,880	1,728	864
Investment Activities:						
Investment	(15,000)					
Salvage						3,000
Gains Tax						(445)
Financing Activities:						
Borrowed funds	15,000					
Principal repayment		(2,506)	(2,732)	(2,978)	(3,246)	(3,538)
Net Cash Flow	\$0	\$2,542	\$3,092	\$2,334	\$1,837	\$3,988

(c) Which alternative to choose? The debt financing option is more attractive.

9.29) Net cash flow

Input		Output				
Tax Rate(%) =	40	PW(12%) =		\$77,275		
MARR(%) =	12					
	0	1	2	3	4	5
Income Statement						
Revenues (savings)		\$60,000	\$60,000	\$60,000	\$60,000	\$60,000
Expenses:						
Depreciation		25,000	40,000	24,000	14,400	7,200
Debt interest (10%)		12,500	10,453	8,200	5,723	2,998
Taxable Income		22,500	9,547	27,800	39,877	49,802
Income Taxes (40%)		9,000	3,819	11,120	15,951	19,921
Net Income		\$13,500	\$5,728	\$16,680	\$23,926	\$29,881
Cash Flow Statement						
Operating Activities:						
Net Income		13,500	5,728	16,680	23,926	29,881
Depreciation		25,000	40,000	24,000	14,400	7,200
Investment Activities:						
Investment	(125,000)					
Salvage						50,000
Gains Tax						(14,240)
Financing Activities:						
Borrowed funds	125,000					
Principal repayment		(20,475)	(22,522)	(24,774)	(27,252)	(29,977)
Net Cash Flow	\$0	\$18,025	\$23,206	\$15,906	\$11,074	\$42,864

9.30)

$$\begin{aligned}
 PW(18\%) &= -\$3,500 + \$6,343(P/F, 18\%, 1) + \cdots + \$9,454(P/F, 18\%, 15) \\
 &= \$22,134 > 0
 \end{aligned}$$

Accept the investment.

(unit: \$000)	0	1	2	3	4	5	6	7
Income Statement								
Revenues (savings)		\$40,000	\$40,000	\$40,000	\$40,000	\$40,000	\$40,000	\$40,000
Expenses:								
O&M		\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000
Depreciation		5,002	8,572	6,122	4,375	3,122	3,126	3,122
Debt interest (9%)		2,835	2,835	2,835	2,835	2,835	2,835	2,835
Taxable Income		2,163	(1,407)	1,043	2,790	4,043	4,039	4,043
Income Taxes (38%)		822	(535)	396	1,060	1,536	1,535	1,536
Net Income		\$1,341	(\$872)	\$647	\$1,730	\$2,507	\$2,504	\$2,507
Cash Flow Statement								
Operating Activities:								
Net Income		1,341	(872)	647	1,730	2,507	2,504	2,507
Depreciation		5,002	8,572	6,122	4,375	3,122	3,126	3,122
Investment Activities:								
Investment	(35,000)							
Financing Activities:								
Borrowed funds	31,500							
Principal repayment								
Net Cash Flow	(\$3,500)	\$6,343	\$7,700	\$6,769	\$6,105	\$5,629	\$5,630	\$5,629
	8	9	10	11	12	13	14	15
Income Statement								
Revenues (savings)	\$40,000	\$40,000	\$40,000	\$40,000	\$40,000	\$40,000	\$40,000	\$40,000
Expenses:								
O&M	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
Depreciation	1,561							
Debt interest (9%)	2,835	2,835	2,835					
Taxable Income	5,604	7,165	7,165	10,000	10,000	10,000	10,000	10,000
Income Taxes (38%)	2,130	2,723	2,723	3,800	3,800	3,800	3,800	3,800
Net Income	\$3,474	\$4,442	\$4,442	\$6,200	\$6,200	\$6,200	\$6,200	\$6,200
Cash Flow Statement								
Operating Activities:								
Net Income	3,474	4,442	4,442	6,200	6,200	6,200	6,200	6,200
Depreciation	1,561							
Investment Activities:								
Investment								
Salvage								5250
Gains Tax								(1,996)
Financing Activities:								
Borrowed funds								
Principal repayment			(31,500)					
Net Cash Flow	\$5,035	\$4,442	(\$27,058)	\$6,200	\$6,200	\$6,200	\$6,200	\$9,454

9.31)

- Option 1: Lease (a lease paid at the start of each period)

$$\begin{aligned} PW(12\%)_{\text{lease}} &= -\$144,000(1 - 0.40)(1 + (P/A, 12\%, 29)) \\ &= -\$779,484 \end{aligned}$$

- Option 2: Purchase

- Note 1: It is assumed that the property is placed in service during January.

$$D_1 \text{ \& } D_{30} = (11.5/12)(1/39)(\$650,000) = \$15,972$$

$$D_2 \text{ to } D_{29} = (12/12)(1/39)(\$650,000) = \$16,667$$

- Note 2: Property tax calculation:

$$(\$800,000)(0.05) = \$40,000$$

Input		Output	
Tax Rate(%) =	40	PW(i) =	(\$931,551)
MARR(%) =	12		

Income Statement

Revenues:

Expenses:

	0	1	2	3	4--28	29	30
Depreciation		\$ 15,972	\$ 16,667	\$ 16,667	\$ 16,667	\$ 16,667	\$ 15,972
Property tax		\$ 40,000	\$ 40,000	\$ 40,000	\$ 40,000	\$ 40,000	\$ 40,000
Taxable Income		\$ (55,972)	\$ (56,667)	\$ (56,667)	\$ (56,667)	\$ (56,667)	\$ (55,972)
Income Taxes		\$ (22,389)	\$ (22,667)	\$ (22,667)	\$ (22,667)	\$ (22,667)	\$ (22,389)
Net Income		\$ (33,583)	\$ (34,000)	\$ (34,000)	\$ (34,000)	\$ (34,000)	\$ (33,583)

Cash Flow Statement

Operating Activities:

Net Income	\$ (33,583)	\$ (34,000)	\$ (34,000)	\$ (34,000)	\$ (34,000)	\$ (33,583)
Depreciation	\$ 15,972	\$ 16,667	\$ 16,667	\$ 16,667	\$ 16,667	\$ 15,972

Investment Activities:

Investment (land)	\$ (150,000)					
Investment (structure)	\$ (650,000)					
Salvage						\$ 215,000
Gains Tax						\$ 34,556
Net Cash Flow	\$ (800,000)	\$ (17,611)	\$ (17,333)	\$ (17,333)	\$ (17,333)	\$ 231,944

$$PW(12\%)_{\text{purchase}} = -\$931,551$$

- Option 3: Remodel

- Note 1: Depreciation base: Remodeling cost = \$300,000

$$D_1 \text{ \& } D_{30} = (11.5 / 12)(1 / 39)(\$300,000) = \$7,372$$

$$D_2 \text{ to } D_{29} = (12 / 12)(1 / 39)(\$300,000) = \$7,692$$

- Note 2: Cost basis for property tax calculation:

$$\text{Land} + \text{building} + \text{remodeling cost} = \$660,000$$

Input		Output	
Tax Rate(%) =	40	PW(i) =	(\$494,425)
MARR(%) =	12		

	0	1	2	3	4---28	29	30
Income Statement							
Revenues:							
Expenses:							
Depreciation		\$ 7,372	\$ 7,692	\$ 7,692	...	\$ 7,692	\$ 7,372
Property tax		\$ 33,000	\$ 33,000	\$ 33,000	...	\$ 33,000	\$ 33,000
Lease fee (Parking lot)		\$9,000	\$9,500	\$10,000	...	\$23,000	\$23,500
Taxable Income		\$ (49,372)	\$ (50,192)	\$ (50,692)	...	\$ (63,692)	\$ (63,872)
Income tax		\$ (19,749)	\$ (20,077)	\$ (20,277)	...	\$ (25,477)	\$ (25,549)
Net Income		\$ (29,623)	\$ (30,115)	\$ (30,415)	...	\$ (38,215)	\$ (38,323)
Cash Flow Statement							
Operating Activities:							
Net Income		\$ (29,623)	\$ (30,115)	\$ (30,415)	...	\$ (38,215)	\$ (38,323)
Depreciation		\$ 7,372	\$ 7,692	\$ 7,692	...	\$ 7,692	\$ 7,372
Investment Activities:							
Investment (Remodeling)	\$ (300,000)						
Salvage							\$ 30,000
							\$ 15,949
Net Cash Flow	\$ (300,000)	\$ (22,251)	\$ (22,423)	\$ (22,723)	...	\$ (30,523)	\$ 14,997

$$PW(12\%)_{\text{remodel}} = -\$494,425$$

Option 3 is the least costly alternative.

9.32) Comparison by annual equivalent cost (all units in thousand dollars):

	Plant A	Plant B	Plant C
Book Value ($n = 20$)	\$380.61	\$423.80	\$470.56
Salvage Value	\$853.00	\$949.80	\$1,054.60
Taxable gains	\$472.39	\$526	\$584.04
Gains tax (39%)	\$184.23	\$205.14	\$227.78
Net Proceeds from sale	\$668.77	\$744.66	\$826.82

Plant A

- Capital recovery cost with return:

$$A_1 = (\$8,530 - \$668.77)(A/P, 12\%, 20) + \$668.77(0.12) = \$1,132.70$$

- After-tax O&M cost:

$$A_2 = (1 - 0.39)(\$1,964) = \$1,198.04$$

- Depreciation tax shield:

$$A_3 = 0.39(\$8,530)[0.0375(P/F, 12\%, 1) + \dots](A/P, 12\%, 20) = \$172.22$$

- Total equivalent annual cost:

$$A = \$1,132.70 + \$1,198.04 - \$172.22 = \$2,158.52$$

- Unit cost:

$$\frac{\$2,158,520}{50,000,000 \text{ kWh}} = \boxed{\$0.04317 / \text{kWh}}$$

Plant B

- Capital recovery cost with return:

$$A_1 = (\$9,498 - \$744.66)(A/P, 12\%, 20) + \$744.66(0.12) = \$1,261.25$$

- After-tax O&M cost:

$$A_2 = (1 - 0.39)(\$1,744) = \$1,063.84$$

- Depreciation tax shield:

$$A_3 = 0.39(\$9,498)[0.0375(P/F, 12\%, 1) + \dots](A/P, 12\%, 20) \\ = \$191.76$$

- Total equivalent annual cost:

$$A = \$1,261.25 + \$1,063.84 - \$191.76 = \$2,133.33$$

- Unit cost:

$$\frac{\$2,133,330}{50,000,000\text{kWh}} = \boxed{\$0.04267/\text{kWh}}$$

Plant C

- Capital recovery cost with return:

$$A_1 = (\$10,546 - \$826.82)(A/P, 12\%, 20) + \$826.82(0.12) = \$1,400.41$$

- After-tax O&M cost:

$$A_2 = (1 - 0.39)(\$1,632) = \$995.52$$

- Depreciation tax shield:

$$A_3 = 0.39(\$10,546)[0.0375(P/F, 12\%, 1) + \dots](A/P, 12\%, 20) \\ = \$212.92$$

- Total equivalent annual cost:

$$A = \$1,400.41 + \$1,995.52 - \$212.92 = \$3,183.01$$

- Unit cost:

$$\frac{\$3,183,010}{50,000,000\text{kWh}} = \boxed{\$0.06366/\text{kWh}}$$

Plant B is the most economical.

9.33)

(a) H&H's cost of leasing in present worth:

$$\begin{aligned}\text{after-tax lease expense} &= (1 - 0.40)(\$11,000) \\ &= \$6,600 \\ \text{PW}(15\%)_{\text{lease}} &= -\$6,600 - \$6,600(P/A, 15\%, 3) \\ &= \boxed{-\$21,670}\end{aligned}$$

(b) H&H's cost of owning in present worth:

- PW of after-tax maintenance expenses:

$$\begin{aligned}P_1 &= -\$1,200(1 - 0.40)(P/A, 15\%, 4) \\ &= -\$2,055\end{aligned}$$

- PW of after-tax loan repayment

$$\begin{aligned}P_2 &= -\$13,169(P/A, 15\%, 4) \\ &= -\$37,597\end{aligned}$$

- PW of tax credit (shield) on depreciation and interest:

n	D_n	I_n	Combined Tax Savings
1	\$8,000	\$4,800	$\$12,800(0.40) = \$5,120$
2	\$12,800	\$3,796	$\$16,596(0.40) = \$6,638$
3	\$7,680	\$2,671	$\$10,351(0.40) = \$4,140$
4	\$2,304	\$1,411	$\$3,715(0.40) = \$1,486$

$$\begin{aligned}P_3 &= \$5,120(P/F, 15\%, 1) + \$6,638(P/F, 15\%, 2) \\ &\quad + \$4,140(P/F, 15\%, 3) + \$1,486(P/F, 15\%, 4) \\ &= \$13,043\end{aligned}$$

- PW of net proceeds from sale:

total depreciation amount = \$30,784

book value = \$9,216

taxable gain = \$10,000 - \$9,216
= \$784

gains tax = (0.40)(\$784) = \$314

net proceeds from sale = \$10,000 - \$314
= \$9,686

$P_4 = \$9,686(P/F, 15\%, 4)$
= \$5,538

$PW(15\%)_{\text{buy}} = P_1 + P_2 + P_3 + P_4 = -\$21,071$

(c) Should the truck be leased or purchased? The borrow–buy option is a better choice.

Input		Output
Tax Rate(%) =	40	PW(15%) = (\$21,072)
MARR(%) =	15	

0	1	2	3	4
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Income Statement

Revenues (savings)

Expenses:

O&M	\$1,200	\$1,200	\$1,200	\$1,200
Depreciation	8,000	12,800	7,680	2,304
Debt interest (12%)	4,800	3,796	2,671	1,411

Taxable Income	(14,000)	(17,796)	(11,551)	(4,915)
Income Taxes (40%)	(5,600)	(7,118)	(4,620)	(1,966)

Net Income	(\$8,400)	(\$10,678)	(\$6,931)	(\$2,949)
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Cash Flow Statement

Operating Activities:

Net Income	(8,400)	(10,678)	(6,931)	(2,949)
Depreciation	8,000	12,800	7,680	2,304

Investment Activities:

Investment	(40,000)			
Salvage				10,000
Gains Tax				(314)

Financing Activities:

Borrowed funds	40,000			
Principal repayment		(8,369)	(9,374)	(10,499)

Net Cash Flow	\$0	(\$8,769)	(\$7,252)	(\$9,750)	(\$2,717)
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9.34) Note: Since the operating revenues will be the same for both options, we will only consider the cost of ownership.

(a) PW (incremental) cost of owning the equipment:

- PW of after-tax O&M

$$\begin{aligned} P_1 &= -\$50,000(1 - 0.40)(P/A, 15\%, 4) \\ &= -\$85,649 \end{aligned}$$

- PW of after-tax loan repayment:

$$\begin{aligned} P_2 &= -\$37,857(P/A, 15\%, 4) \\ &= -\$108,080 \end{aligned}$$

- PW of tax credit (shield) on depreciation and interest:

n	D_n	I_n	Combined Tax Savings
1	\$24,000	\$12,000	$\$36,000(0.40) = \$14,400$
2	\$38,400	\$9,414	$\$47,817(0.40) = \$19,126$
3	\$23,040	\$6,570	$\$29,610(0.40) = \$11,844$
4	\$6,912	\$3,441	$\$10,353(0.40) = \$4,141$

$$\begin{aligned} P_3 &= \$14,400(P/F, 15\%, 1) + \$19,126(P/F, 15\%, 2) \\ &\quad + \$11,844(P/F, 15\%, 3) + \$4,141(P/F, 15\%, 4) \\ &= \$37,139 \end{aligned}$$

- PW of net proceeds from sale:

$$\begin{aligned} \text{total depreciation amount} &= \$92,352 \\ \text{book value} &= \$27,648 \\ \text{taxable gain} &= \$20,000 - \$27,648 = (\$7,648) \\ \text{loss credit} &= (0.40)(\$7,648) = \$3,059 \\ \text{net proceeds from sale} &= \$20,000 + \$3,059 \\ &= \$23,059 \\ P_4 &= \$23,059(P/F, 15\%, 4) \\ &= \$13,184 \end{aligned}$$

$$PW(15\%)_{\text{buy}} = P_1 + P_2 + P_3 + P_4 = -\$143,406$$

Input		Output	
Tax Rate(%) =	40	PW(15%) =	(\$143,405)
MARR(%) =	15		

	0	1	2	3	4
Income Statement					
Revenues (savings)		\$0	\$0	\$0	\$0
Expenses:					
O&M		\$50,000	\$50,000	\$50,000	\$50,000
Depreciation		24,000	38,400	23,040	6,912
Debt interest (10%)		12,000	9,414	6,570	3,441
Taxable Income		(86,000)	(97,814)	(79,610)	(60,353)
Income Taxes (40%)		(34,400)	(39,126)	(31,844)	(24,141)
Net Income		(\$51,600)	(\$58,688)	(\$47,766)	(\$36,212)
Cash Flow Statement					
Operating Activities:					
Net Income		(51,600)	(58,688)	(47,766)	(36,212)
Depreciation		24,000	38,400	23,040	6,912
Investment Activities:					
Investment	(120,000)				
Salvage					20,000
Gains Tax					3,059
Financing Activities:					
Borrowed funds	120,000				
Principal repayment		(25,857)	(28,442)	(31,286)	(34,415)
Net Cash Flow	\$0	(\$53,457)	(\$48,730)	(\$56,012)	(\$40,656)

(b) PW (incremental) cost of leasing the equipment:

- PW of after-tax operating cost:

$$\begin{aligned}
 P_1 &= \$40,000(1 - 0.40)(P/A, 15\%, 4) \\
 &= \$68,519
 \end{aligned}$$

- PW of after-tax leasing

$$\begin{aligned}
 P_2 &= \$44,000(1 - 0.40) + \$44,000(1 - 0.40)(P / A, 15\%, 3) \\
 &= \$86,677 \\
 P &= P_1 + P_2 \\
 &= \boxed{\$155,196}
 \end{aligned}$$

(c) Should ICI buy or lease the equipment? The buying option is a better choice.

9.35)

(a) OMC' PW cost of leasing (payments at start of year):

$$\begin{aligned}
 \text{PW}(15\%)_{\text{leasing}} &= \$22,000(0.60)(P / A, 15\%, 3) * (1.15) \\
 &= \$34,658.98
 \end{aligned}$$

(b) OMC' PW cost of owning:

- PW of after-tax maintenance expenses:

$$\begin{aligned}
 P_1 &= \$6,000(1 - 0.40)(P / A, 15\%, 3) \\
 &= \$8,219.52
 \end{aligned}$$

- PW cost of after-tax loan repayment:

$$\begin{aligned}
 P_2 &= \$40,386(P / A, 15\%, 3) \\
 &= \$92,209.32
 \end{aligned}$$

- PW of tax credit (shield) on depreciation and interest:

n	D_n	I_n	Combined Tax Savings
1	\$13,861	\$11,640	$\$25,501(0.40) = \$10,200$
2	\$23,755	\$8,191	$\$31,946(0.40) = \$12,778$
3	\$8,483	\$4,327	$\$12,810(0.40) = \$5,124$

$$\begin{aligned}
 P_3 &= \$10,200(P / F, 15\%, 1) + \$12,778(P / F, 15\%, 2) \\
 &\quad + \$5,124(P / F, 15\%, 3) \\
 &= \$21,901
 \end{aligned}$$

- PW of net proceeds from sale:

$$\begin{aligned}
\text{total depreciation amount} &= \$46,099 \\
\text{book value} &= \$50,901 \\
\text{taxable loss} &= \$45,000 - \$50,901 = -\$5,901 \\
\text{tax credit} &= (0.40)(\$5,901) = \$2,360 \\
\text{net proceeds from sale} &= \$45,000 + \$2,360 \\
&= \$47,360 \\
P_4 &= \$47,360(P / F, 15\%, 3) \\
&= \$31,140
\end{aligned}$$

$$PW(15\%)_{\text{buy}} = P_1 + P_2 - P_3 - P_4 = \boxed{\$47,387.84}$$

Input		Output
Tax Rate(%) =	40	PW(15%) = (\$47,388)
MARR(%) =	15	

	0	1	2	3
Income Statement				
Revenues (savings)		\$0	\$0	\$0
Expenses:				
O&M		\$6,000	\$6,000	\$6,000
Depreciation		13,861	23,755	8,483
Debt interest (12%)		11,640	8,191	4,327
Taxable Income		(31,501)	(37,946)	(18,810)
Income Taxes (40%)		(12,600)	(15,178)	(7,524)
Net Income		(\$18,901)	(\$22,768)	(\$11,286)
Cash Flow Statement				
Operating Activities:				
Net Income		(18,901)	(22,768)	(11,286)
Depreciation		13,861	23,755	8,483
Investment Activities:				
Investment	(97,000)			
Salvage				45,000
Gains Tax				2,360
Financing Activities:				
Borrowed funds	97,000			
Principal repayment		(28,746)	(32,195)	(36,059)
Net Cash Flow	\$0	(\$33,786)	(\$31,208)	\$8,498

9.36) (a) and (b)

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	0	1	2
Income Statement			
Revenue		\$114,000	\$114,000
Expenses:			
O&M		\$56,490	\$59,315
Depreciation		\$11,000	\$8,800
Interest		\$5,000	\$2,619
Taxable Income		\$41,510	\$43,266
Income Taxes(40%)		\$16,604	\$17,306
Net Income		\$24,906	\$25,960
Cash Flow Statement			
Cash from operation			
Net Income		\$24,906	\$25,960
Depreciation		\$11,000	\$8,800
Investment / Salvage	(\$55,000)		\$29,768
Gains Tax			\$2,173
Loan repayment	\$50,000	(\$23,810)	(\$26,190)
Net Cash Flow (actual)	(\$5,000)	\$12,096	\$40,510
Net Cash Flow (constant)	(\$5,000)	\$11,520	\$36,743
	PW (18%) = \$	34,345	
	IRR' (%) =	309.75%	

Sample calculation:

- O & M Expense in year 1: $\$53,800(1 + 0.05) = \$56,490$
- Salvage value in year 2: $\$27,000(1 + 0.05)^2 = \$29,768$
- Note that both depreciation and interest expenses are not responsive to inflation.

9.37) (a) and (b)

(a) Project Cash Flows with Inflation

	0	1	2	3	4	5	6
Income Statement							
Revenue		\$162,750	\$170,888	\$179,432	\$188,403	\$197,824	\$207,715
Expenses:							
O&M		92,400	97,020	101,871	106,965	112,313	117,928
Depreciation		26,000	41,600	24,960	14,976	14,976	7,488
Interest		11,700	11,700				
Taxable Income		32,650	20,568	52,601	66,463	70,535	82,298
Income Taxes (40%)		13,060	8,227	21,040	26,585	28,214	32,919
Net Income		\$19,590	\$12,341	\$31,561	\$39,878	\$42,321	\$49,379
Cash Flow Statement							
Cash from operation							
Net Income		19,590	12,341	31,561	39,878	42,321	49,379
Depreciation		26,000	41,600	24,960	14,976	14,976	7,488
Cash from investing activities:							
Investment / Salvage	(130,000)						26,802
Gains Tax							(10,721)
Working Capital							
Cash from financing activities:							
Loan repayment	130,000		(130,000)				
Net Cash Flow (actual)	\$0	\$45,590	(\$76,060)	\$56,521	\$54,854	\$57,297	\$72,948

PW (18%) = \$98,771

(b) Income Statement (without inflation)

	0	1	2	3	4	5	6
Income Statement							
Revenue		\$155,000	\$155,000	\$155,000	\$155,000	\$155,000	\$155,000
Expenses:							
O&M		\$88,000	\$88,000	\$88,000	\$88,000	\$88,000	\$88,000
Depreciation		\$26,000	\$41,600	\$24,960	\$14,976	\$14,976	\$7,488
Interest		\$11,700	\$11,700				
Taxable Income		\$29,300	\$13,700	\$42,040	\$52,024	\$52,024	\$59,512
Income Taxes		\$11,720	\$5,480	\$16,816	\$20,810	\$20,810	\$23,805
Net Income		\$17,580	\$8,220	\$25,224	\$31,214	\$31,214	\$35,707
Cash Flow Statement							
Cash from operation							
Net Income		\$17,580	\$8,220	\$25,224	\$31,214	\$31,214	\$35,707
Depreciation		\$26,000	\$41,600	\$24,960	\$14,976	\$14,976	\$7,488
Investment / Salvage	(\$130,000)						\$20,000
Gains Tax							(\$8,000)
Working Capital							
Loan repayment	\$130,000		(\$130,000)				
Net Cash Flow (actual)	\$0	\$43,580	(\$80,180)	\$50,184	\$46,190	\$46,190	\$55,195

$$PW (12.38\%) = \$92,781$$

(c) Present value gain (or loss) due to inflation:

$$i' = \frac{0.18 - 0.05}{1 + 0.05} = 12.38\%$$

$$PW(12.38\%)_{\text{no inflation}} = \$92,781$$

$$PW(18\%)_{\text{with inflation}} = \$98,771$$

$$\begin{aligned} \text{present value gain} &= \$98,771 - \$92,781 \\ &= \$5,990 \end{aligned}$$

(d) Present value gain due to borrowing:

Net Financing cost			NET
<i>n</i>	Principal	Interest(A/T)	Loan flow
0	\$130,000		\$130,000
1		-\$7,020	-\$7,020
2	-\$130,000	-\$7,020	-\$137,020

Note: Interest payment (before tax) = \$130,000(0.09) = \$11,700

Interest payment (after-tax) = \$11,700(1 - 0.40) = \$7,020

$$\begin{aligned} PW(18\%)_{\text{Loan}} &= \$130,000 - \$7,020(P/F, 18\%, 1) \\ &\quad - \$137,020(P/F, 18\%, 2) \\ &= \boxed{\$25,642.79} \end{aligned}$$

9.38) (a), (b)

		0	1	2	3
Income Statement					
Revenue (Savings)	inflation 5%		\$84,000	\$88,200	\$92,610
Expenses:					
O&M					
Depreciation			\$21,435	\$36,735	\$13,118
Interest					
Taxable Income			\$62,565	\$51,465	\$79,493
Income Taxes (40%)			\$25,026	\$20,586	\$31,797
Net Income			\$37,539	\$30,879	\$47,696
Cash Flow Statement					
Cash from operation					
Net Income			\$37,539	\$30,879	\$47,696
Depreciation			\$21,435	\$36,735	\$13,118
Cash from investing activities:					
Investment / Salvage		(\$150,000)			\$80,000
Gains Tax					(\$515)
Working capital	8%	(\$10,000)	(\$800)	(\$864)	\$11,664
Cash from financing activities:					
Loan repayment					
Net Cash Flow (actual)		(\$160,000)	\$58,174	\$66,750	\$151,962
Net Cash Flow (constant)		(\$160,000)	\$54,881	\$59,407	\$127,590
PW (20%) =		\$	22,773		
PW (13.21%) =		\$	22,765	←rounding error	

Accept the project.

(c). The project is acceptable

9.39)

	0	1	2	3	4
Income Statement					
Revenue		\$33,000	\$36,300	\$39,930	\$43,923
Expenses:					
O&M		11,000	12,100	13,310	14,641
Depreciation		10,000	10,000	10,000	10,000
Taxable Income		12,000	14,200	16,620	19,282
Income Taxes		6,000	7,100	8,310	9,641
Net Income		\$6,000	\$7,100	\$8,310	\$9,641
Cash Flow Statement					
Cash from operation					
Net Income		6,000	7,100	8,310	9,641
Depreciation		10,000	10,000	10,000	10,000
Investment / Salvage	(40,000)				
Gains Tax					
Net Cash Flow (actual)	(\$40,000)	\$16,000	\$17,100	\$18,310	\$19,641
Net Cash Flow (constant)	(\$40,000)	\$14,545	\$14,132	\$13,757	\$13,415
IRR' (%) =		15.06%			

9.40)

	0	1	2	3	4	5	6	7	8
Income Statement									
Revenue		\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000
Expenses:									
O&M		\$ 8,000	\$ 8,000	\$ 8,000	\$ 8,000	\$ 8,000	\$ 8,000	\$ 8,000	\$ 8,000
Depreciation		\$ 7,145	\$ 12,245	\$ 8,745	\$ 6,245	\$ 4,465	\$ 4,460	\$ 4,465	\$ 2,230
Taxable Income		\$4,855	(\$245)	\$3,255	\$5,755	\$7,535	\$7,540	\$7,535	\$9,770
Income Taxes		\$1,699	(\$86)	\$1,139	\$2,014	\$2,637	\$2,639	\$2,637	\$3,420
Net Income		\$3,156	(\$159)	\$2,116	\$3,741	\$4,898	\$4,901	\$4,898	\$6,351
Cash Flow Statement									
Cash from operation									
Net Income		\$ 3,156	\$ (159)	\$ 2,116	\$ 3,741	\$ 4,898	\$ 4,901	\$ 4,898	\$ 6,351
Depreciation		\$ 7,145	\$ 12,245	\$ 8,745	\$ 6,245	\$ 4,465	\$ 4,460	\$ 4,465	\$ 2,230
Investment / Salvage	\$ (50,000)								\$ 5,000
Gains Tax									\$ (1,750)
Working capital	\$ (10,000)								\$ 10,000
Net Cash Flow	(\$60,000)	\$10,301	\$12,086	\$10,861	\$9,986	\$9,363	\$9,361	\$9,363	\$21,831
PW (18%)=		(\$14,523)		IRR(%) =	10.18%				

(b) Project's IRR with inflation

Income Statement (no inflation)

	0	1	2	3	4	5	6	7	8
Income Statement									
Revenue		\$21,600	\$23,328	\$25,194	\$27,210	\$29,387	\$31,737	\$34,276	\$37,019
Expenses:									
O&M		8,480	8,989	9,528	10,100	10,706	11,348	12,029	12,751
Depreciation		7,145	12,245	8,745	6,245	4,465	4,460	4,465	2,230
Taxable Income		5,975	2,094	6,921	10,865	14,216	15,929	17,782	22,038
Income Taxes		2,091	733	2,422	3,803	4,976	5,575	6,224	7,713
Net Income		\$3,884	\$1,361	\$4,499	\$7,062	\$9,240	\$10,354	\$11,559	\$14,325
Cash Flow Statement									
Cash from operation									
Net Income		3,884	1,361	4,499	7,062	9,240	10,354	11,559	14,325
Depreciation		7,145	12,245	8,745	6,245	4,465	4,460	4,465	2,230
Investment / Salvage	(50,000)								7,387
Gains Tax									(2,585)
Working capital	(10,000)	(800)	(864)	(933)	(1,008)	(1,088)	(1,175)	(1,269)	17,138
Loan repayment									
Net Cash Flow (actual dollars)	(\$60,000)	\$10,229	\$12,742	\$12,311	\$12,299	\$12,617	\$13,639	\$14,754	\$38,495
Net Cash Flow (constant dollars)	(\$60,000)	\$9,741	\$11,558	\$10,635	\$10,119	\$9,885	\$10,178	\$10,485	\$26,054

PW (12.38%)= (\$2,902.01) IRR' (%)= 11.11% < 12.38%, so it is not acceptable.

9.41) (a) Real after-tax yield on bond investment:

- Nontaxable municipal bond:

$$i'_{\text{municipal}} = \frac{0.09 - 0.03}{1 + 0.03} = 5.825\%$$

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- Taxable corporate bond:

$$i'_{\text{municipal}} = \frac{0.12(1-0.3) - 0.03}{1+0.03} = 5.245\%$$

(b) Given $i = 6\%$, and $\bar{f} = 3\%$

$$i'_{\text{savings}} = 2.91\%$$

Since $i'_{\text{municipal}} > 2.91\%$ and $i'_{\text{corporate}} > 2.91\%$, both bond investments are better than the savings account. Now to compare two mutually exclusive bond investment alternatives, we need to perform an incremental analysis.

n	After- tax Cash F low		
	Municipal	Corporate	Incremental
0	-\$10,000	-\$10,000	\$0
1	\$900	\$840	-\$60
2	\$900	\$840	-\$60
3	\$900	\$840	-\$60
4	\$900	\$840	-\$60
5	\$900	\$840	-\$60

We cannot find the rate of return on incremental investment, as returns from municipal bond dominate those from corporate bond in every year. Municipal bond is a clear choice for any value of MARR.

9.42) (a), (b), and (c)

Engine A

	0	1	2	3	4	5
Income Statement						
Revenue						
Expenses:						
O&M		\$135,000	\$145,800	\$157,464	\$170,061	\$183,666
Depreciation		12,000	12,000	12,000	12,000	12,000
Taxable Income		(147,000)	(157,800)	(169,464)	(182,061)	(195,666)
Income Taxes		(58,800)	(63,120)	(67,786)	(72,824)	(78,266)
Net Income		(\$88,200)	(\$94,680)	(\$101,678)	(\$109,237)	(\$117,400)
Cash Flow Statement						
Cash from operation						
Net Income		(88,200)	(94,680)	(101,678)	(109,237)	(117,400)
Depreciation		12,000	12,000	12,000	12,000	12,000
Investment / Salvage	(100,000)					40,000
Gains Tax						\$0
Net Cash Flow	(\$100,000)	(\$76,200)	(\$82,680)	(\$89,678)	(\$97,237)	(\$65,400)
PW (20%) =		(\$345,989)	AE (20%) =	(\$115,692)	FW (20%) =	(\$860,932)

Engine B

	0	1	2	3	4	5
Income Statement						
Revenue						
Expenses:						
O&M		\$86,400	\$93,312	\$100,777	\$108,839	\$117,546
Depreciation		24,000	24,000	24,000	24,000	24,000
Taxable Income		(110,400)	(117,312)	(124,777)	(132,839)	(141,546)
Income Taxes		(44,160)	(46,925)	(49,911)	(53,136)	(56,618)
Net Income		(\$66,240)	(\$70,387)	(\$74,866)	(\$79,703)	(\$84,928)
Cash Flow Statement						
Cash from operation						
Net Income		(66,240)	(70,387)	(74,866)	(79,703)	(84,928)
Depreciation		24,000	24,000	24,000	24,000	24,000
Investment / Salvage	(200,000)					80,000
Gains Tax						0
Net Cash Flow	(\$200,000)	(\$42,240)	(\$46,387)	(\$50,866)	(\$55,703)	\$19,072
PW (20%)=		(\$316,048)	AE (20%)=	(\$105,680)	FW (20%)=	(\$786,429)

Select B.

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9.43) (a) & (b) Actual and constant dollar analysis:

	0	1	2
Income Statement			
Revenue		\$126,000	\$132,300
Expenses:			
O&M		62,400	64,896
Depreciation		12,000	9,600
Taxable Income		51,600	57,804
Income Taxes		15,480	17,341
Net Income		36,120	40,463
Cash Flow Statement			
Cash from operation			
Net Income		36,120	40,463
Depreciation		12,000	9,600
Investment / Salvage	(60,000)		40,000
Working capital	(5,000)	(200)	5,200
Gains Tax			(480)
Net Cash Flow (actual)	(\$65,000)	\$47,920	\$94,783
Net Cash Flow (constant)	(\$65,000)	\$44,370	\$81,261
IRR' (%)	=	51.04%	

(c) Given $\bar{f} = 8\%$, $i = 15\%$

$$i' = \frac{0.15 - 0.08}{1 + 0.08} = 6.48\% \text{ (Inflation-free MARR)}$$

Since $IRR' > 6.48\%$, the project is a profitable one.

9.44)

(a) & (b) Project cash flows in actual and constant dollars:

	0	1	2	3	4	5	6
Income Statement							
Revenue		\$84,800	\$89,888	\$95,281	\$100,998	\$107,058	\$113,482
Expenses:							
O&M							
Depreciation		\$20,000	\$32,000	\$19,200	\$11,520	\$11,520	\$5,760
Interest							
Taxable Income		\$64,800	\$57,888	\$76,081	\$89,478	\$95,538	\$107,722
Income Taxes		\$25,920	\$23,155	\$30,432	\$35,791	\$38,215	\$43,089
Net Income		\$38,880	\$34,733	\$45,649	\$53,687	\$57,323	\$64,633
Cash Flow Statement							
Cash from operation							
Net Income		\$38,880	\$34,733	\$45,649	\$53,687	\$57,323	\$64,633
Depreciation		\$20,000	\$32,000	\$19,200	\$11,520	\$11,520	\$5,760
Investment / Salvage	(\$100,000)						\$42,556
Gains Tax							(\$17,022)
Working capital							
Loan repayment							
Net Cash Flow (actual \$)	(\$100,000)	\$58,880	\$66,733	\$64,849	\$65,207	\$68,843	\$95,927
Net Cash Flow (constant \$)	(\$100,000)	\$55,547	\$59,392	\$54,448	\$51,650	\$51,443	\$67,625
	PW (18%) =	\$136,553					
	IRR' (%) =	51.53%					

(c) The effects of project financing under inflation:

(c) Income Statement

	0	1	2	3	4	5	6
Income Statement							
Revenue		\$84,800	\$89,888	\$95,281	\$100,998	\$107,058	\$113,482
Expenses:							
O&M							
Depreciation		\$20,000	\$32,000	\$19,200	\$11,520	\$11,520	\$5,760
Interest		\$12,000	\$10,521	\$8,865	\$7,010	\$4,933	\$2,606
Taxable Income		\$52,800	\$47,367	\$67,216	\$82,468	\$90,605	\$105,116
Income Taxes		\$21,120	\$18,947	\$26,886	\$32,987	\$36,242	\$42,046
Net Income		\$31,680	\$28,420	\$40,330	\$49,481	\$54,363	\$63,070
Cash Flow Statement							
Cash from operation							
Net Income		\$31,680	\$28,420	\$40,330	\$49,481	\$54,363	\$63,070
Depreciation		\$20,000	\$32,000	\$19,200	\$11,520	\$11,520	\$5,760
Investment / Salvage	(\$100,000)						\$42,556
Gains Tax							(\$17,022)
Working capital							
Loan repayment	\$100,000	(\$12,323)	(\$13,801)	(\$15,457)	(\$17,312)	(\$19,390)	(\$21,717)
Net Cash Flow (actual \$)	\$0	\$39,357	\$46,619	\$44,072	\$43,688	\$46,493	\$72,646
Net Cash Flow (constant \$)	\$0	\$37,130	\$41,491	\$37,004	\$34,605	\$34,743	\$51,213
PW (18%) =		\$163,425					

(d) The present value loss due to inflation:

(d) Income Statement (no inflation)

	0	1	2	3	4	5	6
Income Statement							
Revenue		\$80,000	\$80,000	\$80,000	\$80,000	\$80,000	\$80,000
Expenses:							
O&M							
Depreciation		\$20,000	\$32,000	\$19,200	\$11,520	\$11,520	\$5,760
Interest							
Taxable Income		\$60,000	\$48,000	\$60,800	\$68,480	\$68,480	\$74,240
Income Taxes		\$24,000	\$19,200	\$24,320	\$27,392	\$27,392	\$29,696
Net Income		\$36,000	\$28,800	\$36,480	\$41,088	\$41,088	\$44,544
Cash Flow Statement							
Cash from operation							
Net Income		\$36,000	\$28,800	\$36,480	\$41,088	\$41,088	\$44,544
Depreciation		\$20,000	\$32,000	\$19,200	\$11,520	\$11,520	\$5,760
Investment / Salvage	(\$100,000)						\$30,000
Gains Tax							(\$12,000)
Working capital							
Loan repayment							
Net Cash Flow (actual \$)	(\$100,000)	\$56,000	\$60,800	\$55,680	\$52,608	\$52,608	\$68,304

PW (11.32%) = \$140,656

Present value loss = \$136,553 - \$140,656 = (\$4,103)

Present value loss = \$136,553 - \$140,656 = (\$4,103)

(e) Required additional before-tax annual revenue in actual dollars (equal amount) to make-up the inflation loss.

$$\frac{\$4,103(A/P, 18\%, 6)}{1 - 0.40} = \$1,955$$

9.45)

(a) & (b) The project cash flows and IRR with no inflation:

Income Statement	0	1	2	3	4	5	6	7	8	9	10
Revenue		\$80,000	\$80,000	\$80,000	\$80,000	\$80,000	\$80,000	\$80,000	\$80,000	\$80,000	\$80,000
Expenses:											
O&M		\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000
Labor		\$15,000	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000
Material		\$9,000	\$9,000	\$9,000	\$9,000	\$9,000	\$9,000	\$9,000	\$9,000	\$9,000	\$9,000
Energy		\$4,500	\$4,500	\$4,500	\$4,500	\$4,500	\$4,500	\$4,500	\$4,500	\$4,500	\$4,500
Depreciation :											
Building											
Milling machine		\$15,719	\$26,939	\$19,239	\$13,739	\$9,823	\$9,812	\$9,823	\$4,906	\$0	\$0
Jigs & dies		\$3,333	\$4,445	\$1,481	\$741	\$0	\$3,333	\$4,445	\$1,481	\$741	\$0
Taxable Income		\$29,448	\$17,116	\$27,780	\$34,020	\$38,677	\$35,355	\$34,232	\$42,113	\$47,759	\$48,500
Income Taxes		\$10,307	\$5,991	\$9,723	\$11,907	\$13,537	\$12,374	\$11,981	\$14,740	\$16,716	\$16,975
Net Income		\$19,141	\$11,125	\$18,057	\$22,113	\$25,140	\$22,981	\$22,251	\$27,373	\$31,043	\$31,525
Cash Flow Statement											
Cash from operation											
Net Income		\$19,141	\$11,125	\$18,057	\$22,113	\$25,140	\$22,981	\$22,251	\$27,373	\$31,043	\$31,525
Depreciation											
Building											
Milling machine		\$15,719	\$26,939	\$19,239	\$13,739	\$9,823	\$9,812	\$9,823	\$4,906	\$0	\$0
Jigs & dies		\$3,333	\$4,445	\$1,481	\$741	\$0	\$3,333	\$4,445	\$1,481	\$741	\$0
Investment / Salvage											
Building											
Milling machine	(\$110,000)										\$10,000
Jigs & dies	(\$10,000)					\$300					
(Replacement)						(\$10,000)					\$300
Gains Taxes:											
Building											
Milling machine											(\$3,500)
Jigs & dies											(\$105)
Net Cash Flow	(\$120,000)	\$38,193	\$42,509	\$38,777	\$36,593	\$25,158	\$36,126	\$36,519	\$33,760	\$31,784	\$38,220
PW (11.32%) =	\$90,992										
IRR (%) =					28.40%						

Instructor Solutions Manual to accompany Fundamentals of Engineering Economics, Second Edition, by Chan S. Park.

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(c) & (d)

(c) and (d) Income Statement (with inflation)

	0	1	2	3	4	5	6	7	8	9	10
Revenue		\$85,600	\$91,592	\$98,003	\$104,864	\$112,204	\$120,058	\$128,463	\$137,455	\$147,077	\$157,372
Expenses:											
O&M		\$3,090	\$3,183	\$3,278	\$3,377	\$3,478	\$3,582	\$3,690	\$3,800	\$3,914	\$4,032
Labor		\$15,750	\$16,538	\$17,364	\$18,233	\$19,144	\$20,101	\$21,107	\$22,162	\$23,270	\$24,433
Material		\$9,360	\$9,734	\$10,124	\$10,529	\$10,950	\$11,388	\$11,843	\$12,317	\$12,810	\$13,322
Energy		\$4,635	\$4,774	\$4,917	\$5,065	\$5,217	\$5,373	\$5,534	\$5,700	\$5,871	\$6,048
Depreciation :											
Building											
Milling machine		\$15,719	\$26,939	\$19,239	\$13,739	\$9,823	\$9,812	\$9,823	\$4,906	\$0	\$0
Jigs & dies		\$3,333	\$4,445	\$1,481	\$741	\$0	\$3,333	\$4,445	\$1,481	\$741	\$0
Taxable Income		\$33,713	\$25,979	\$41,599	\$53,181	\$63,592	\$66,468	\$72,021	\$87,088	\$100,470	\$109,537
Income Taxes		\$11,800	\$9,093	\$14,560	\$18,613	\$22,257	\$23,264	\$25,207	\$30,481	\$35,165	\$38,338
Net Income		\$21,913	\$16,887	\$27,040	\$34,568	\$41,335	\$43,204	\$46,814	\$56,607	\$65,306	\$71,199
Cash Flow Statement											
Cash from operation											
Net Income		\$21,913	\$16,887	\$27,040	\$34,568	\$41,335	\$43,204	\$46,814	\$56,607	\$65,306	\$71,199
Depreciation											
Building											
Milling machine		\$15,719	\$26,939	\$19,239	\$13,739	\$9,823	\$9,812	\$9,823	\$4,906	\$0	\$0
Jigs & dies		\$3,333	\$4,445	\$1,481	\$741	\$0	\$3,333	\$4,445	\$1,481	\$741	\$0
Investment / Salvage											
Building											
Milling machine	(\$110,000)										\$10,000
Jigs & dies	(\$10,000)					\$300					
(Replacement)						(\$10,000)					\$300
Gains Taxes:											
Building											
Milling machine											(\$3,500)
Jigs & dies						(\$105)					(\$105)
Net Cash Flow (actual)	(\$120,000)	\$40,965	\$48,271	\$47,760	\$49,048	\$41,353	\$56,349	\$61,082	\$62,994	\$66,047	\$77,894
Net Cash Flow (constant)	(\$120,000)	\$38,647	\$42,960	\$40,100	\$38,850	\$30,899	\$39,724	\$40,620	\$39,523	\$39,093	\$43,496
PW (11.32%) =		\$108,411		IRR' (%) =		30.53%					

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(e). The economic gain in present worth due to inflation = \$108,411 - \$90,992 = \$17,419.

9.46)

After-tax cost of debt:

a) $(0.12)(1 - 0.25) = 0.09$ or (9%)

b) $(0.14)(1 - 0.34) = 0.0924$ or (9.24%)

c) $(0.15)(1 - 0.40) = 0.09$ or (9%)

9.47)

$$0.07 + 1.7(0.14 - 0.07) = 18.9\%$$

9.48)

$$i_e = 0.25$$

$$i_d = (0.12)(1 - 0.40) = 0.072$$

$$\begin{aligned} k &= (0.072)(0.40) + (0.25)(0.60) \\ &= 0.1788 \end{aligned}$$

9.49)

$$i_e = r_f + \beta(r_M - r_f)$$

$$i_{e_AT\&T} = 0.0435 + 1.2(0.115 - 0.0435) = 0.1293$$

$$i_{e_MS} = 0.0435 + 1.0(0.115 - 0.0435) = 0.115$$

$$i_{e_Walmart} = 0.0435 + 0.75(0.115 - 0.0435) = 0.09713$$

9.50)

$$0.2 = 0.05 + \beta(0.15 - 0.05)$$

$$\beta = 1.5$$

9.51)

(a) The net after-tax cash flows for each financing option:

- Option 1: Equity Financing (Retained earnings)

Input		Output					
Tax Rate(%) =	39	PW(i) = \$161,321					
MARR(%) =	18	IRR(%) = 42.46%					
	0	1	2	3	4	5	6
Income Statement							
Revenues (savings)		\$174,000	\$174,000	\$174,000	\$174,000	\$174,000	\$174,000
Expenses:							
O&M costs		\$22,000	\$22,000	\$22,000	\$22,000	\$22,000	\$22,000
Depreciation		\$28,580	\$48,980	\$34,980	\$24,980	\$17,860	\$8,930
Debt interest							
Taxable Income		\$123,420	\$103,020	\$117,020	\$127,020	\$134,140	\$143,070
Income Taxes		\$48,134	\$40,178	\$45,638	\$49,538	\$52,315	\$55,797
Net Income		\$75,286	\$62,842	\$71,382	\$77,482	\$81,825	\$87,273
Cash Flow Statement							
Operating Activities:							
Net Income		\$75,286	\$62,842	\$71,382	\$77,482	\$81,825	\$87,273
Depreciation		\$28,580	\$48,980	\$34,980	\$24,980	\$17,860	\$8,930
Investment Activities:							
Investment	(\$200,000)						
Salvage							\$30,000
Gains Tax							\$2,219
Working capital	(\$25,000)						\$25,000
Financing Activities:							
Borrowed funds							
Principal repayment							
Net Cash Flow	(\$225,000)	\$103,866	\$111,822	\$106,362	\$102,462	\$99,685	\$153,422

- Option 2: Debt Financing at 12%

	MARR(%) = 18		IRR(%) = 263.36%				
	0	1	2	3	4	5	6
Income Statement							
Revenues (savings)		\$174,000	\$174,000	\$174,000	\$174,000	\$174,000	\$174,000
Expenses:							
O&M costs		\$22,000	\$22,000	\$22,000	\$22,000	\$22,000	\$22,000
Depreciation		28,580	48,980	34,980	24,980	17,860	8,930
Debt interest		24,000	21,043	17,730	14,020	9,866	5,212
Taxable Income		\$99,420	\$81,977	\$99,290	\$113,000	\$124,274	\$137,858
Income Taxes (39%)		38,774	31,971	38,723	44,070	48,467	53,765
Net Income		\$60,646	\$50,006	\$60,567	\$68,930	\$75,807	\$84,093
Cash Flow Statement							
Operating Activities:							
Net Income		\$ 60,646	\$ 50,006	\$ 60,567	\$ 68,930	\$ 75,807	\$ 84,093
Depreciation		\$ 28,580	\$ 48,980	\$ 34,980	\$ 24,980	\$ 17,860	\$ 8,930
Investment Activities:							
Investment	\$ (200,000)						
Salvage							\$ 30,000
Gains Tax							\$ 2,219
Working capital	\$ (25,000)						\$ 25,000
Financing Activities:							
Borrowed funds	200,000						
Principal repayment		(24,645)	(27,603)	(30,915)	(34,625)	(38,780)	(43,433)
Net Cash Flow	\$ (25,000)	\$ 64,581	\$ 71,383	\$ 64,632	\$ 59,285	\$ 54,887	\$ 106,809
PW(18%)=	\$ 214,469						

- Option 3: Lease Financing

Input		Output	
Tax Rate(%) =	39	PW(i) =	\$170,092
MARR(%) =	18	IRR(%) =	101.06%

	0	1	2	3	4	5	6
Income Statement							
Revenues (savings)		\$174,000	\$174,000	\$174,000	\$174,000	\$174,000	\$174,000
Expenses:							
Lease Payment	\$55,000	\$55,000	\$55,000	\$55,000	\$55,000	\$55,000	
O&M costs		22,000	22,000	22,000	22,000	22,000	22,000
Debt interest							
Taxable Income	(\$55,000)	\$97,000	\$97,000	\$97,000	\$97,000	\$97,000	\$152,000
Income Taxes (39%)	(\$21,450)	37,830	37,830	37,830	37,830	37,830	59,280
Net Income	(\$33,550)	\$59,170	\$59,170	\$59,170	\$59,170	\$59,170	\$92,720
Cash Flow Statement							
Operating Activities:							
Net Income	\$ (33,550)	\$ 59,170	\$ 59,170	\$ 59,170	\$ 59,170	\$ 59,170	\$ 92,720
Depreciation							
Investment Activities:							
Investment							
Salvage							
Gains Tax							
Working capital	\$ (25,000)						\$ 25,000
Financing Activities:							
Borrowed funds							
Principal repayment							
Net Cash Flow	\$ (58,550)	\$ 59,170	\$ 59,170	\$ 59,170	\$ 59,170	\$ 59,170	\$ 117,720

(b) Vermont's PW cost of owning the equipment by borrowing:

- PW of total after-tax revenue:

$$\begin{aligned}P_1 &= \$174,000(1 - 0.39)(P / A, 18\%, 6) \\ &= \$371,236\end{aligned}$$

- PW cost of working capital drain:

$$\begin{aligned}P_2 &= \$25,000 - \$25,000(P / F, 18\%, 6) \\ &= \$15,739\end{aligned}$$

- PW cost of operating expense:

$$\begin{aligned}P_3 &= \$22,000(1 - 0.39)(P / A, 18\%, 6) \\ &= \$46,938\end{aligned}$$

- PW cost of owning by borrowing:

$$\begin{aligned}\text{Net cost} &= -\$214,469 + P_1 - P_2 - P_3 \\ &= \$94,090\end{aligned}$$

(c) Vermont's PW cost of leasing the equipment:

- PW cost of after-tax leasing

$$\begin{aligned}P &= \$55,000(1 - 0.39) + \$55,000(1 - 0.39)(P / A, 18\%, 5) \\ &= \$138,467\end{aligned}$$

(d) Buy the tipping machine.

9.52) (a),(b),(c) & (d): Assumption: The building will be placed in service in January.

	-2	-1	0	1	2	3	4	5	6	7	8
Revenues:											
Sales unit				200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000
Unit price				\$400	\$420	\$441	\$463	\$486	\$511	\$536	\$563
Sales volume				\$80,000,000	\$84,000,000	\$88,200,000	\$92,610,000	\$97,240,500	\$102,102,525	\$107,207,651	\$112,568,034
Expenses:											
Fixed costs				\$8,500,000	\$8,925,000	\$9,371,250	\$9,839,813	\$10,331,803	\$10,848,393	\$11,390,813	\$11,960,354
Variable costs				\$52,000,000	\$54,600,000	\$57,330,000	\$60,196,500	\$63,206,325	\$66,366,641	\$69,684,973	\$73,169,222
Depreciation :											
Building				\$258,017	\$269,231	\$269,231	\$269,231	\$269,231	\$269,231	\$269,231	\$269,231
Equipment				\$2,715,100	\$4,653,100	\$3,323,100	\$2,373,100	\$1,696,700	\$1,694,800	\$1,696,700	\$847,400
Amortization				\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000
Taxable Income				\$15,526,884	\$14,552,670	\$16,906,420	\$18,931,357	\$20,736,441	\$21,923,460	\$23,165,934	\$25,321,828
Income Taxes (38%)				\$5,900,216	\$5,530,014	\$6,424,439	\$7,193,916	\$7,879,848	\$8,330,915	\$8,803,055	\$9,622,295
Net Income				\$9,626,668	\$9,022,655	\$10,481,980	\$11,737,441	\$12,856,594	\$13,592,545	\$14,362,879	\$15,699,533
Cash Flow Statement											
Operating Activities:											
Net Income				\$9,626,668	\$9,022,655	\$10,481,980	\$11,737,441	\$12,856,594	\$13,592,545	\$14,362,879	\$15,699,533
Depreciation				\$2,973,117	\$4,922,331	\$3,592,331	\$2,642,331	\$1,965,931	\$1,964,031	\$1,965,931	\$1,116,631
Amortization				\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000
Investment activities											
Opportunity cost*	(\$3,040,000)										
Land	(\$2,500,000)										\$4,500,000
Building		(\$3,500,000)	(\$7,000,000)								\$3,000,000
Equipment			(\$19,000,000)								\$3,500,000
Gains Taxes											
Land											(\$760,000)
Building											\$2,035,801
Equipment											(\$1,330,000)
Working capital			(\$9,600,000)	(\$480,000)	(\$504,000)	(\$529,200)	(\$555,660)	(\$583,443)	(\$612,615)	(\$643,246)	\$13,508,164
Net Cash Flow (actual)	(\$5,540,000)	(\$3,500,000)	(\$35,600,000)	\$13,119,784	\$14,440,986	\$14,545,111	\$14,824,112	\$15,239,081	\$15,943,961	\$16,685,564	\$42,270,128
Net Cash Flow (constant)	(\$5,540,000)	(\$3,333,333)	(\$32,290,249)	\$11,333,363	\$11,880,635	\$11,396,475	\$11,061,980	\$10,830,130	\$10,791,500	\$10,755,663	\$25,950,192
PW (15%,n = -2)		\$21,153,974	PW (15%,n = 0) PW(F/P, 15%,2)			\$27,976,130.45		IRR' =		21.47%	
			AE(15%)= PW(A/P, 15%,8)=			\$6,234,483.18					
			Unit profit per production=			\$31.17					

Note: If the firm decides not to invest in the project, the firm could write off the R&D expenditure. The amount of write-off will be $(0.38)(\$8,000,000) = \$3,040,000$. If the firm decides to undertake this project, then an opportunity cost of \$3,040,000 will be incurred.

(e)

	-2	-1	0	1	2	3	4	5	6	7	8
Revenues:											
Sales unit				132,016	132,016	132,016	132,016	132,016	132,016	132,016	132,016
Unit price				\$400	\$420	\$441	\$463	\$486	\$511	\$536	\$563
Sales volume				\$52,806,477	\$55,446,801	\$58,219,141	\$61,130,098	\$64,186,603	\$67,395,933	\$70,765,729	\$74,304,016
Expenses:											
Fixed costs				\$8,500,000	\$8,925,000	\$9,371,250	\$9,839,813	\$10,331,803	\$10,848,393	\$11,390,813	\$11,960,354
Variable costs				\$34,324,210	\$36,040,420	\$37,842,441	\$39,734,564	\$41,721,292	\$43,807,356	\$45,997,724	\$48,297,610
Depreciation :											
Building				\$269,231	\$269,231	\$269,231	\$269,231	\$269,231	\$269,231	\$269,231	\$269,231
Equipment				\$2,715,100	\$4,653,100	\$3,323,100	\$2,373,100	\$1,696,700	\$1,694,800	\$1,696,700	\$847,400
Amortization				\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000
Taxable Income				\$5,997,936	\$4,559,050	\$6,413,119	\$7,913,391	\$9,167,577	\$9,776,153	\$10,411,262	\$11,929,421
Income Taxes				\$2,279,216	\$1,732,439	\$2,436,985	\$3,007,089	\$3,483,679	\$3,714,938	\$3,956,280	\$4,533,180
Net Income				\$3,718,721	\$2,826,611	\$3,976,134	\$4,906,303	\$5,683,898	\$6,061,215	\$6,454,982	\$7,396,241
Cash Flow Statement											
Operating Activities:											
Net Income				\$3,718,721	\$2,826,611	\$3,976,134	\$4,906,303	\$5,683,898	\$6,061,215	\$6,454,982	\$7,396,241
Depreciation				\$2,984,331	\$4,922,331	\$3,592,331	\$2,642,331	\$1,965,931	\$1,964,031	\$1,965,931	\$1,116,631
Amortization				\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000
Investment activities											
Opportunity cost*	(\$3,040,000)										
Land	(\$2,500,000)										\$4,500,000
Building		(\$3,500,000)	(\$7,000,000)								\$3,000,000
Equipment			(\$19,000,000)								\$3,500,000
Gains Taxes											
Land											(\$760,000)
Building											\$2,031,539
Equipment											(\$1,330,000)
Working capital			(\$6,336,777)	(\$316,839)	(\$332,681)	(\$349,315)	(\$366,781)	(\$385,120)	(\$404,376)	(\$424,594)	\$8,916,482
Net Cash Flow (actual)	(\$5,540,000)	(\$3,500,000)	(\$32,336,777)	\$7,386,212	\$8,416,261	\$8,219,149	\$8,181,852	\$8,264,709	\$8,620,870	\$8,996,318	\$29,370,893
Net Cash Flow (constant)	(\$5,540,000)	(\$3,333,333)	(\$29,330,410)	\$6,380,488	\$6,924,078	\$6,439,919	\$6,105,424	\$5,873,574	\$5,834,944	\$5,799,107	\$18,031,180
PW (15%,n=-2) :		\$0	PW (15%,n=0) :PW(F/P,15%,2)			\$0.00					

(f)

Income Statement	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
	-2	-1	0	1	2	3	4	5	6	7	8
Revenues:											
Sales unit				200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000
Unit price				\$400	\$388	\$376	\$365	\$354	\$343	\$333	\$323
Sales volume				\$80,000,000	\$77,600,000	\$75,272,000	\$73,013,840	\$70,823,425	\$68,698,722	\$66,637,760	\$64,638,628
Expenses:											
Fixed costs				\$8,500,000	\$8,925,000	\$9,371,250	\$9,839,813	\$10,331,803	\$10,848,393	\$11,390,813	\$11,960,354
Variable costs				\$52,000,000	\$50,440,000	\$48,926,800	\$47,458,996	\$46,035,226	\$44,654,169	\$43,314,544	\$42,015,108
Depreciation :											
Building				\$269,231	\$269,231	\$269,231	\$269,231	\$269,231	\$269,231	\$269,231	\$269,231
Equipment				\$2,715,100	\$4,653,100	\$3,323,100	\$2,373,100	\$1,696,700	\$1,694,800	\$1,696,700	\$847,400
Amortization				\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000
Taxable Income				\$15,515,670	\$12,312,670	\$12,381,620	\$12,072,701	\$11,490,465	\$10,232,129	\$8,966,473	\$8,546,536
Income Taxes				\$5,895,954	\$4,678,814	\$4,705,015	\$4,587,626	\$4,366,377	\$3,888,209	\$3,407,260	\$3,247,684
Net Income				\$9,619,715	\$7,633,855	\$7,676,604	\$7,485,075	\$7,124,088	\$6,343,920	\$5,559,213	\$5,298,852
Cash Flow Statement											
Operating Activities:											
Net Income				\$9,619,715	\$7,633,855	\$7,676,604	\$7,485,075	\$7,124,088	\$6,343,920	\$5,559,213	\$5,298,852
Depreciation				\$2,984,331	\$4,922,331	\$3,592,331	\$2,642,331	\$1,965,931	\$1,964,031	\$1,965,931	\$1,116,631
Amortization				\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000
Investment activities											
Opportunity cost*	(\$3,040,000)										
Land	(\$2,500,000)										\$4,500,000
Building		(\$3,500,000)	(\$7,000,000)								\$3,000,000
Equipment			(\$19,000,000)								\$3,500,000
Gains Taxes											
Land											(\$760,000)
Building											\$2,031,539
Equipment											(\$1,330,000)
Working capital			(\$9,600,000)	\$288,000	\$279,360	\$270,979	\$262,850	\$254,964	\$247,315	\$239,896	\$7,756,635
Net Cash Flow (actual)	(\$5,540,000)	(\$3,500,000)	(\$35,600,000)	\$13,892,046	\$13,835,546	\$12,539,914	\$11,390,255	\$10,344,983	\$9,555,266	\$8,765,040	\$26,113,657
Net Cash Flow (constant)	(\$5,540,000)	(\$3,333,333)	(\$32,290,249)	\$12,000,471	\$11,382,538	\$9,825,351	\$8,499,584	\$7,351,986	\$6,467,380	\$5,650,023	\$16,031,520
PW (15%, n=2) :	\$8,660,609	PW (15%) =	PW(F/P, 15%, 2)			\$11,453,656	IRR' =		15.48%		
		AE(15%) =	PW(A/P, 15%, 8)			\$2,552,448					

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9.53) (a) The net cash flow from the cogeneration project with bond financing:

(a) The net cash flow from the cogeneration project with bond financing:

	0	1	2	3	4	5	6	7	8	9	10	11	12
Income Statement													
Revenue													
Electricity bill		\$6,120,000	\$6,120,000	\$6,120,000	\$6,120,000	\$6,120,000	\$6,120,000	\$6,120,000	\$6,120,000	\$6,120,000	\$6,120,000	\$6,120,000	\$6,120,000
Excess power		\$480,000	\$480,000	\$480,000	\$480,000	\$480,000	\$480,000	\$480,000	\$480,000	\$480,000	\$480,000	\$480,000	\$480,000
Expenses:													
O&M		\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000
Misc.		\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000
Standby power		\$6,400	\$6,400	\$6,400	\$6,400	\$6,400	\$6,400	\$6,400	\$6,400	\$6,400	\$6,400	\$6,400	\$6,400
Fuel		\$1,280,000	\$1,280,000	\$1,280,000	\$1,280,000	\$1,280,000	\$1,280,000	\$1,280,000	\$1,280,000	\$1,280,000	\$1,280,000	\$1,280,000	\$1,280,000
Other													
Overhaul				\$1,500,000			\$1,500,000			\$1,500,000			\$1,500,000
Standby power(overhaul)				\$100,000			\$100,000			\$100,000			\$100,000
Depreciation													
Unit		\$500,000	\$950,000	\$855,000	\$770,000	\$693,000	\$623,000	\$590,000	\$590,000	\$591,000	\$590,000	\$591,000	\$295,000
Inter Equipment		\$100,000	\$160,000	\$96,000	\$57,600	\$57,600	\$28,800						
Interest (9%)		\$945,000	\$945,000	\$945,000	\$945,000	\$945,000	\$945,000	\$945,000	\$945,000	\$945,000	\$945,000	\$945,000	\$945,000
Taxable Income		\$2,268,600	\$1,758,600	\$317,600	\$2,041,000	\$2,118,000	\$616,800	\$2,278,600	\$2,278,600	\$677,600	\$2,278,600	\$2,277,600	\$973,600
Income Taxes		\$816,696	\$633,096	\$114,336	\$734,760	\$762,480	\$222,048	\$820,296	\$820,296	\$243,936	\$820,296	\$819,936	\$350,496
Net Income		\$1,451,904	\$1,125,504	\$203,264	\$1,306,240	\$1,355,520	\$394,752	\$1,458,304	\$1,458,304	\$433,664	\$1,458,304	\$1,457,664	\$623,104
Cash Flow Statement													
Cash from operation													
Net Income		\$1,451,904	\$1,125,504	\$203,264	\$1,306,240	\$1,355,520	\$394,752	\$1,458,304	\$1,458,304	\$433,664	\$1,458,304	\$1,457,664	\$623,104
Depreciation													
Unit		\$500,000	\$950,000	\$855,000	\$770,000	\$693,000	\$623,000	\$590,000	\$590,000	\$591,000	\$590,000	\$591,000	\$295,000
Inter Equipment		\$100,000	\$160,000	\$96,000	\$57,600	\$57,600	\$28,800	\$0	\$0	\$0	\$0	\$0	\$0
Investment / Salvage													
Unit	(\$10,000,000)												\$1,000,000
Inter Equipment	(\$500,000)												
Gains Tax													\$490,320
Loan repayment	\$10,500,000												(\$10,500,000)
Net Cash Flow (actual)	\$0	\$2,051,904	\$2,235,504	\$1,154,264	\$2,133,840	\$2,106,120	\$1,046,552	\$2,048,304	\$2,048,304	\$1,024,664	\$2,048,304	\$2,048,664	(\$8,091,576)
PW (27%) =		\$5,954,443											

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(b). The maximum annual lease amount that ACC is willing to pay is \$907,673.

(b) The maximum annual lease amount that ACC is willing to pay is \$907,664:

	0	1	2	3	4	5	6	7 - 11	12
Income Statement									
Revenue									
Electricity bill		\$6,120,000	\$6,120,000	\$6,120,000	\$6,120,000	\$6,120,000	\$6,120,000	\$6,120,000	\$6,120,000
Excess power		\$480,000	\$480,000	\$480,000	\$480,000	\$480,000	\$480,000	\$480,000	\$480,000
Expenses:									
O&M		\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000	\$500,000
Misc.		\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000
Standby power		\$6,400	\$6,400	\$6,400	\$6,400	\$6,400	\$6,400	\$6,400	\$6,400
Overhead		\$1,280,000	\$1,280,000	\$1,280,000	\$1,280,000	\$1,280,000	\$1,280,000	\$1,280,000	\$1,280,000
Lease		\$907,673	\$907,673	\$907,673	\$907,673	\$907,673	\$907,673	\$907,673	\$907,673
Taxable Income		\$2,905,927	\$2,905,927	\$2,905,927	\$2,905,927	\$2,905,927	\$2,905,927	\$2,905,927	\$2,905,927
Income Taxes		\$1,046,134	\$1,046,134	\$1,046,134	\$1,046,134	\$1,046,134	\$1,046,134	\$1,046,134	\$1,046,134
Net Income		\$1,859,793	\$1,859,793	\$1,859,793	\$1,859,793	\$1,859,793	\$1,859,793	\$1,859,793	\$1,859,793
Cash Flow Statement									
Cash from operation									
Net Income		\$1,859,793	\$1,859,793	\$1,859,793	\$1,859,793	\$1,859,793	\$1,859,793	\$1,859,793	\$1,859,793
Net Cash Flow (actual)	\$0	\$1,859,793	\$1,859,793	\$1,859,793	\$1,859,793	\$1,859,793	\$1,859,793	\$1,859,793	\$1,859,793
PW (27%) =		\$6,496,872							