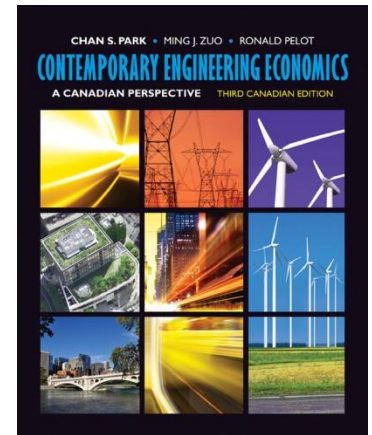


Developing Cash Flow Statements



Lecture No. 28

Chapter 10

Contemporary Engineering Economics

Third Canadian Edition

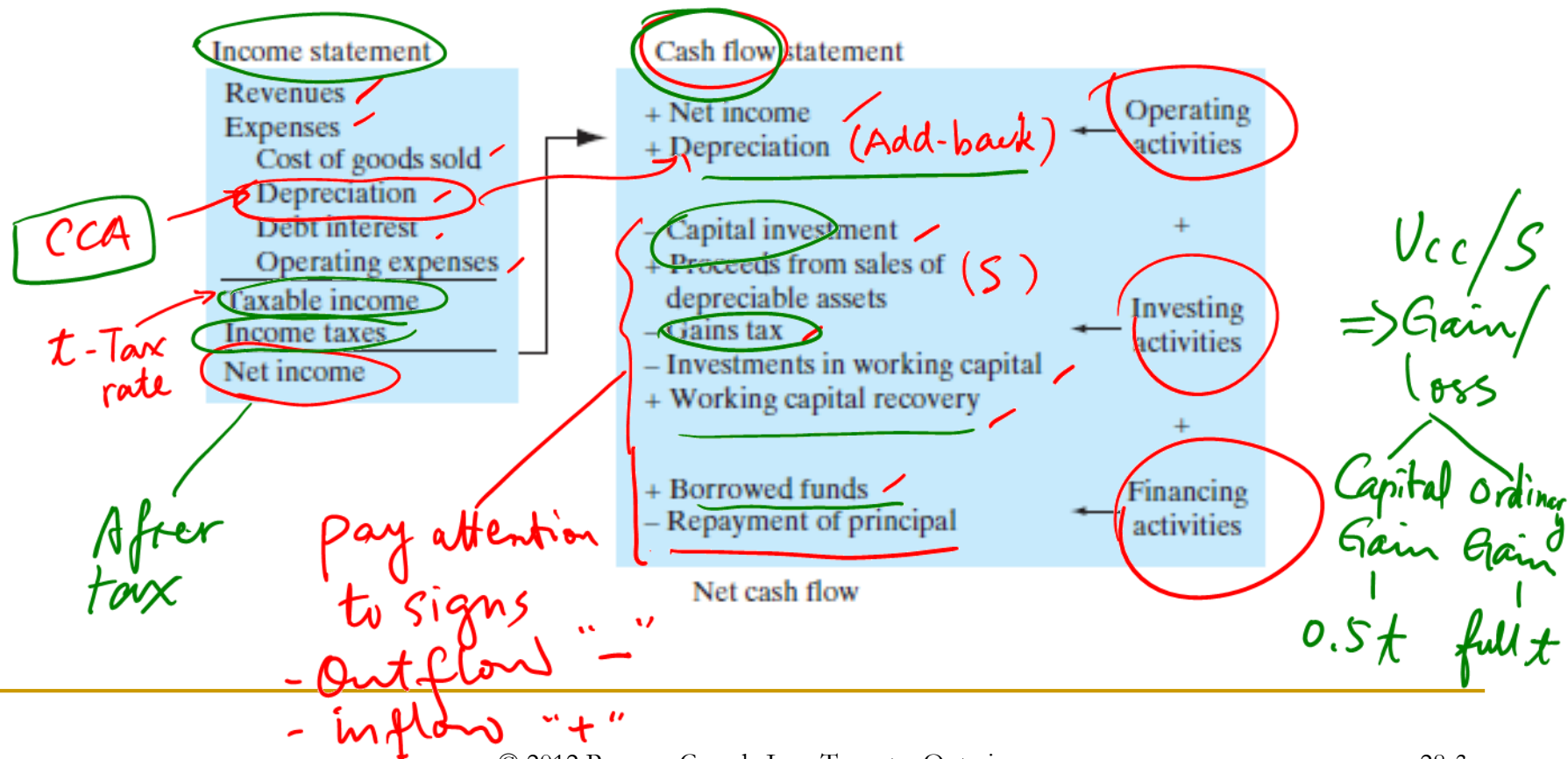
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Lecture 28 Objectives

- How do you use the income statement approach in developing project cash flows?
- How do you treat the gains and losses related to disposal of an asset in the project cash flow statement?
- How do you determine the working capital requirement and its impact on project cash flows?
- How do you incorporate the costs associated with financing a project in developing the project's cash flow statement?

Developing Cash Flow Statements

- Use net operating income as the starting point to get net operating cash flow. Add back any non-cash expense (mainly CCA).



Example 10.1: Cash Flow Statement: Operating and Investing Activities for an Expansion Project

- A computerized machining centre has been proposed for a small tool manufacturing company. If the new machine, which costs \$125,000, is installed, it will generate annual revenues of \$100,000 and will require \$20,000 in annual labour, \$12,000 in annual material expenses, and another \$8,000 in annual overhead expenses. The automation facility is classified as a Class 43 property. The company expects to phase out the facility in five years, at which time it will be sold for \$50,000. Find the year-by-year after tax cash flow for the project at a 40% effective tax rate and determine the after-tax present equivalent value of the project at the company's MARR of 15%.

CCA
rate 9
3%

(S)

$t = 40\%$

$\rightarrow PW(15\%) = ?$

Example 10.1: Cash Flow Statement: Operating and Investing Activities for an Expansion Project (continued)

- **Project Nature:** Installation of a new computer control system

- **Financial Data:**

- Investment: \$125,000 *P*
- Project life: 5 years *N*
- Salvage value: \$50,000 *S*
- Annual labour savings: \$100,000 (*Revenue*)
- Annual additional expenses:
 - Labour: \$20,000 */*
 - Material: \$12,000 */*
 - Overhead: \$8,000 */*

- CCA Class 43 (30%) */*

- Effective Income tax rate: 40% */*

- MARR: 15% */*

Use these items as input parameters

Example 10.1: Solution

Year		0	1	2	3	4	5
Income Statement							
Revenues			\$100,000	\$100,000	\$100,000	\$100,000	\$100,000
Expenses							
Labour			20,000	20,000	20,000	20,000	20,000
Material			12,000	12,000	12,000	12,000	12,000
Overhead			8,000	8,000	8,000	8,000	8,000
CCA (30%)			18,750	31,875	22,313	15,619	10,933
Taxable Income			\$41,250	\$28,125	\$37,687	\$44,381	\$49,067
Income Tax (40%)			16,500	11,250	15,075	17,752	19,627
Net Income (After tax)			\$24,750	\$16,875	\$22,612	\$26,629	\$29,440

$$CCA_1 = CCA \text{ rate} \times UCC_0 \times 50\%$$

$$= 30\% \times \$125,000 \times 50\% = 18,750$$

$$CCA_2 = 30\% \times UCC_1$$

$$= 31,875$$

$$UCC_1 = \$125,000 - \$18,750$$

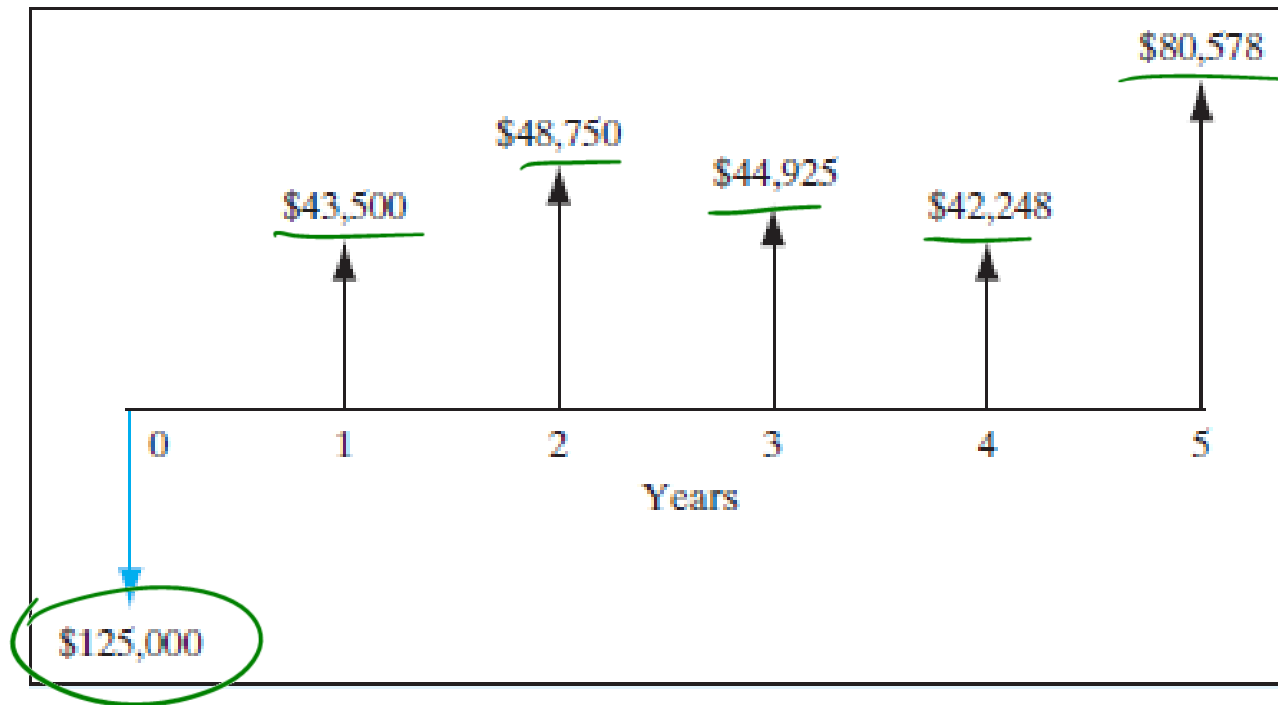
Example 10.1: Solution (continued)

Year	0	1	2	3	4	5
Income Statement						
Net Income		\$24,750	\$16,875	\$22,612	\$26,629	\$29,440
Cash Flow Statement						
Operating Activities						
Net Income		24,750	16,875	22,612	26,629	29,440
CCA		18,750	31,875	22,313	15,619	10,933
Investment Activities						
Investment	(125,000)					
Salvage						50,000
Disposal Tax						(9,796)
Net Cash Flow	(125,000)	43,500	48,750	44,925	42,248	80,577

$S = \$50,000$
 $S > U_{CCS}$
 $Gain = S - U_{CCS}$
 $= \$24,490$
 $Disposal\ effect = t \times Gain = 40\% \times \$24,490 = \$9,796$

$U_{CCS} = \$125,000 - \$18,750 - \$31,875$
 $= \$25,510$

Example 10.1: Solution (continued)



- $PW(15\%) = -\$125,000 + \$43,500(P/F, 15\%, 1) + \dots + \$80,578 (P/F, 15\%, 5) = \underline{\$43,443} > 0$

(We continue from the next slide)

When Projects Require Working Capital Investment

Recall - Balance sheet accounts

- In many cases, changing a production process will have an impact on cash balances, accounts receivable, inventory, and accounts payable.
- For example, if a company is going to the market with a new product, inventories of the product and larger inventories of raw materials will be needed. Accounts receivable from sale will increase.
- The investments in working capital are investments just as are those in depreciable assets (except that they cannot be depreciated). *No depreciation*
- Working capital requirements differ according to the nature of the investment project.

Example 10.3: Cash Flow Statement, Including Working Capital

- Update the after-tax cash flows for the automated machining centre project of Example 10.1 by including a working-capital requirement of \$23,331 in year 0 and full recovery of the working capital at the end of year 5.
- Example 10.1: A computerized machining centre has been proposed for a small tool manufacturing company. If the new machine, which costs \$125,000, is installed, it will generate annual revenues of \$100,000 and will require \$20,000 in annual labour, \$12,000 in annual material expenses, and another \$8,000 in annual overhead expenses. The automation facility is classified as a Class 43 property. The company expects to phase out the facility in five years, at which time it will be sold for \$50,000. Find the year-by-year after tax cash flow for the project at a 40% effective tax rate and determine the after-tax present equivalent value of the project at the company's MARR of 15%.

original
case

Example 10.3: Solution

Year			0	1	2	3	4	5
Income Statement								
Revenues				\$100,000	\$100,000	\$100,000	\$100,000	\$100,000
Expenses								
Labour				20,000	20,000	20,000	20,000	20,000
Material				12,000	12,000	12,000	12,000	12,000
Overhead				8,000	8,000	8,000	8,000	8,000
CCA (30%)				18,750	31,875	22,313	15,619	10,933
Taxable Income				\$41,250	\$28,125	\$37,687	\$44,381	\$49,067
Income Tax (40%)				16,500	11,250	15,075	17,752	19,627
Net Income				\$24,750	\$16,875	\$22,612	\$26,629	\$29,440

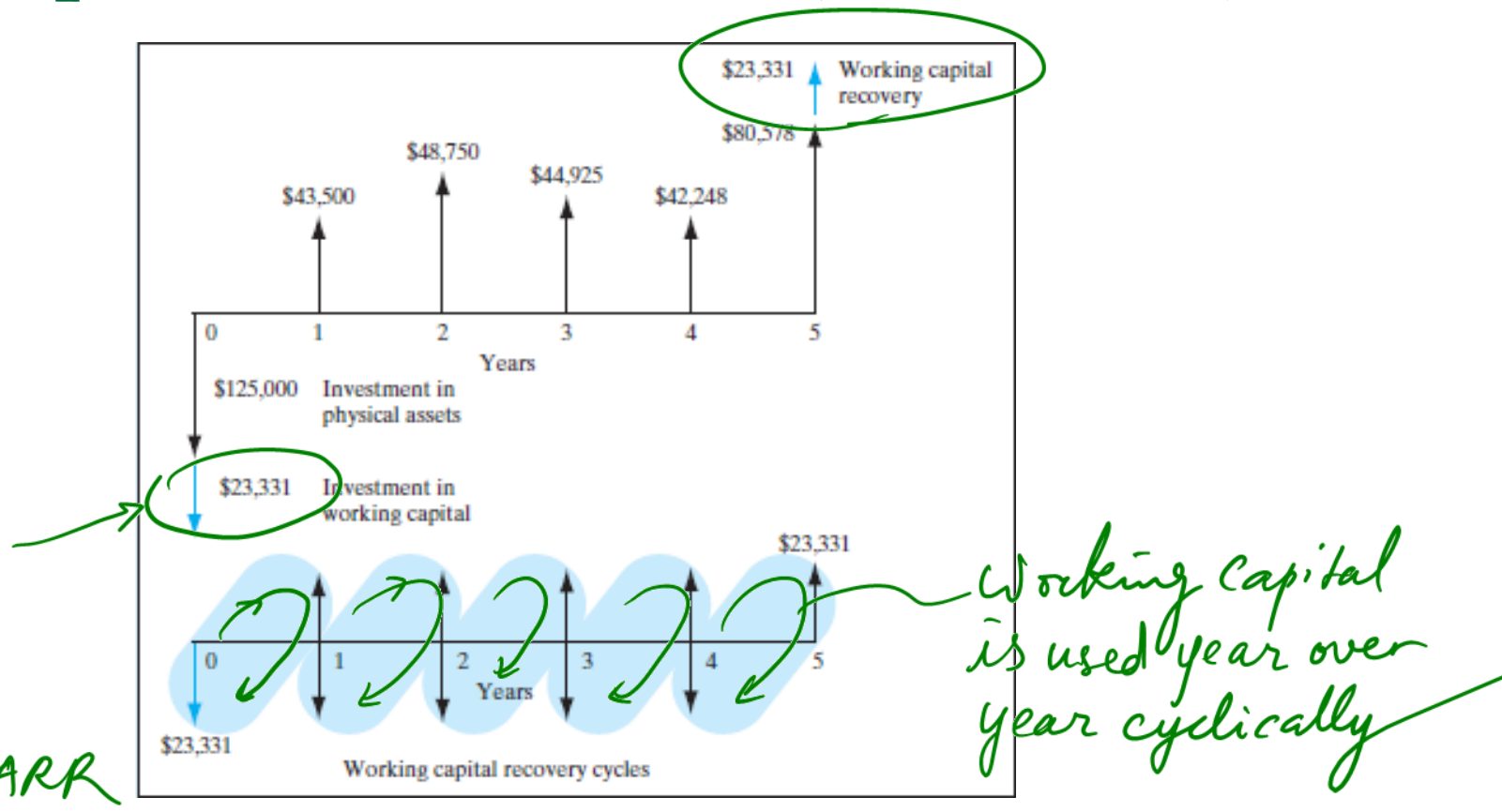
Example 10.3: Solution (continued)

Year		0	1	2	3	4	5
Income Statement							
Net Income			\$24,750	\$16,875	\$22,612	\$26,629	\$29,440
Cash Flow Statement							
Operating Activities							
Net Income			24,750	16,875	22,612	26,629	29,440
CCA			18,750	31,875	22,313	15,619	10,933
Investment Activities							
Investment		(125,000)					
Salvage							50,000
Disposal Tax							(9,796)
Working capital		(23,331)					23,331
Net Cash Flow		<u>(148,331)</u>	43,500	48,750	44,925	42,248	<u>103,908</u>

outflow

inflow

Example 10.3: Solution (continued)



■ $PW(15\%) = -\$148,331 + \$43,500(P/F, 15\%, 1) + \dots + \$103,909(P/F, 15\%, 5) = \$31,712 > 0$

When Projects Are Financed With Borrowed Funds

- Many companies use a mixture of debt and equity (company's earnings) to finance physical plant and equipment.
- The ratio of total debt to total investment (debt ratio) *for the project* represents the percentage of total initial investment provided by borrowed funds.

Example 10.4: Cash Flow Statement With Financing (Borrowing)

- We now re-examine Example 10.3 assuming that \$62,500 of the \$125,000 paid for the investment is obtained through debt financing (debt ratio = 0.5). The loan is to be repaid in equal annual installments at 10% interest over five years. The remaining \$62,500 will be provided by equity (e.g., from retained earnings).
- **Example 10.1:** A computerized machining centre has been proposed for a small tool manufacturing company. If the new machine, which costs \$125,000, is installed, it will generate annual revenues of \$100,000 and will require \$20,000 in annual labour, \$12,000 in annual material expenses, and another \$8,000 in annual overhead expenses. The automation facility is classified as a Class 43 property. The company expects to phase out the facility in five years, at which time it will be sold for \$50,000. Find the year-by-year after tax cash flow for the project at a 40% effective tax rate and determine the after-tax present equivalent value of the project at the company's MARR of 15%.
- **Example 10.3:** Based on Example 10.1. Working capital \$23,331 ✓

*updated
Case*

Example 10.4: Solution

Total principal

Amount financed: \$62,500, or 50% of total capital expenditure

Financing rate: 10% per year

Annual installment: $A = \$62,500(A/P, 10\%, 5) = \underline{\underline{\$16,487}}$

End of Year	Beginning Balance	Interest Payment	Principal Payment	Ending Balance
1	\$62,500	\$6,250	\$10,237	\$52,263
2	52,263	5,226	11,261	41,002
3	41,002	4,100	12,387	28,615
4	28,615	2,861	13,626	14,989
5	14,989	1,499	14,988	0

\$16,487

expenses

Year		0	1	2	3	4	5
Revenues			\$100,000	\$100,000	\$100,000	\$100,000	\$100,000
Expenses							
Labour			20,000	20,000	20,000	20,000	20,000
Material			12,000	12,000	12,000	12,000	12,000
Overhead			8,000	8,000	8,000	8,000	8,000
Debt Interest			6,250	5,226	4,100	2,861	1,499
CCA (30%)			18,750	31,875	22,313	15,619	10,933
Taxable Income			\$35,000	\$22,899	\$33,587	\$41,520	\$47,568
Income Tax (40%)			14,000	9,160	13,435	16,608	19,027
Net Income			\$21,000	\$13,739	\$20,152	\$24,912	\$28,541
Cash Flow Statement							
Operating Activities							
Net Income			21,000	13,739	20,152	24,912	28,541
CCA			18,750	31,875	22,313	15,619	10,933
Investment Activities							
Investment		(125,000)					
Salvage							50,000
Disposal Tax							(9,796)
Working Capital		(23,331)					23,331
Borrowed Funds		62,500					
Loan Principal Repayment			(10,237)	(11,261)	(12,387)	(13,626)	(14,988)
Net Cash Flow		(85,831)	29,513	34,353	30,078	26,905	88,021

Additional
entries related
to debt financing

inflow

Repay
principal

Example 10.4: Solution (continued)

- Is this investment justifiable at a MARR of 15%?



- $$\text{PW}(15\%) = -\$85,331 + \$29,513(P/F, 15\%, 1) + \dots + \$88,021(P/F, 15\%, 5) = \underline{\$44,729} > 0$$

When Projects Result in Negative Taxable Income

$*t \Rightarrow$ Tax credit

- In a typical year, revenues from a single project may not be large enough to offset its own expenses, thereby resulting in a negative taxable income. The **negative taxable income** can be used to **reduce the taxable incomes generated by other business operations** (tax savings).
- When comparing cost-only mutually exclusive projects (service projects), no revenues are considered resulting in a negative taxable income.

Example 10.5: Project Cash Flows for a Cost-Only Project

- Project Nature: Installing a cooling-fan at Alcoa Aluminum's McCook plant to reduce the work-in-process inventory buildup
- Financial Facts:
 - Required investment: ~~\$536,000~~ ^{563,000} ✓ *error correction*
 - Service life: 16 years
 - Salvage value: 0
 - Reduction of WIP (working-capital release): \$2,121,000 *WIP Savings in Working Capital*
 - CCA rate: 20%
 - Annual electricity cost: \$86,000 ↑
 - Income tax rate: 40%
 - MARR: 20%
- Develop the project cash flow

Example 10.5: Solution

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Income Statement																	
Revenues																	
Expenses																	
CCA		\$56,300	\$101,340	\$81,072	\$64,858	\$51,886	\$41,509	\$33,207	\$26,566	\$21,253	\$17,002	\$13,602	\$10,881	\$8,705	\$6,964	\$5,571	\$4,457
Electricity cost		86,000	86,000	86,000	86,000	86,000	86,000	86,000	86,000	86,000	86,000	86,000	86,000	86,000	86,000	86,000	86,000
Taxable income		(142300)	(187340)	(167072)	(150858)	(137886)	(127509)	(119207)	(112566)	(107253)	(103002)	(99602)	(96881)	(94705)	(92964)	(91571)	(90457)
Income taxes (40%)		(56920)	(74936)	(66829)	(60343)	(55154)	(51004)	(47683)	(45026)	(42901)	(41201)	(39841)	(38753)	(37882)	(37186)	(36628)	(36183)
Net income		(85380)	(112404)	(100243)	(90515)	(82732)	(76505)	(71524)	(67539)	(64352)	(61801)	(59761)	(58129)	(56823)	(55778)	(54943)	(54274)
Cash Flow Statement																	
Operating activities																	
Net income		(85380)	(112404)	(100243)	(90515)	(82732)	(76505)	(71524)	(67539)	(64352)	(61801)	(59761)	(58129)	(56823)	(55778)	(54943)	(54274)
CCA		56,300	101,340	81,072	64,858	51,886	41,509	33,207	26,566	21,253	17,002	13,602	10,881	8,705	6,964	5,571	4,457
Investment activities																	
Cooling fans	\$ (563,000)																
Salvage value																	0
Disposal tax effects																	7131
Working capital		(2,121,000)															(2,121,000)
Net cash flow	\$ (563,000)	\$ 2,091,920	\$ (11,064)	\$ (19,171)	\$ (25,657)	\$ (30,846)	\$ (34,996)	\$ (38,317)	\$ (40,974)	\$ (43,099)	\$ (44,799)	\$ (46,159)	\$ (47,247)	\$ (48,118)	\$ (48,814)	\$ (49,372)	\$ (2,163,686)

Note: The working capital release attributable to reduction in work-in-process inventories will be materialized at the end of year 1.

~~\$~~ 2.121M
Big saving

Work Capital
re-installed
(out flow)

Example 10.5: Solution

- Is this investment justifiable at a MARR of 20%?
- $PW(20\%) = -\$563,000 + \$2,091,920(P/F, 20\%, 1)$
- $\$11,064(P/F, 20\%, 2) + \dots$
- $\$2,163,686(P/F, 20\%, 16)$
 $= \$949,144 > 0$

Example 10.6: A Project Requiring Multiple Assets

LMC

- Langley Manufacturing Company is considering purchasing a new computer-controlled milling machine to produce a custom-ordered metal product. The following are the relevant financial data related to the project:

1. The machine costs \$90,000 with installation, site preparation, and wiring costs of \$10,000. The machine's salvage value at the end of 10 years would be \$10,000 and its CCA rate is 30%. The machine also needs special jigs and dies, which will cost \$12,000 and will last five years. The special jigs and dies are worth only \$1,000 as scrap metal and have a CCA rate of 100%.

50% rule applies

Example 10.6: A Project Requiring Multiple Assets (continued)

2. Purchase a 8,000 m² warehouse at a cost of \$160,000. For tax depreciation purposes, the warehouse cost of \$160,000 is divided into \$120,000 for the building with a CCA rate of 4% and \$40,000 for land. At the end of 10 years, the building will have a salvage value of \$80,000, but the value of the land will have appreciated to \$110,000. \uparrow — Capital Gain $\rightarrow 0.5t$

3. Revenue from increased production is expected to be \$150,000 per year. The additional annual production costs are estimated as follows: materials, \$22,000; labour, \$32,000; energy \$3,500; and other miscellaneous costs, \$2,500. } operational

4. For the analysis, a 10-year life will be used. LMC has a marginal tax rate of 40% and a MARR of 18%. No money is borrowed to finance the project. Capital gains will be taxed at 20%.

$$t = 40\%$$

$$0.5t = 20\%$$

Example 10.6: Solution

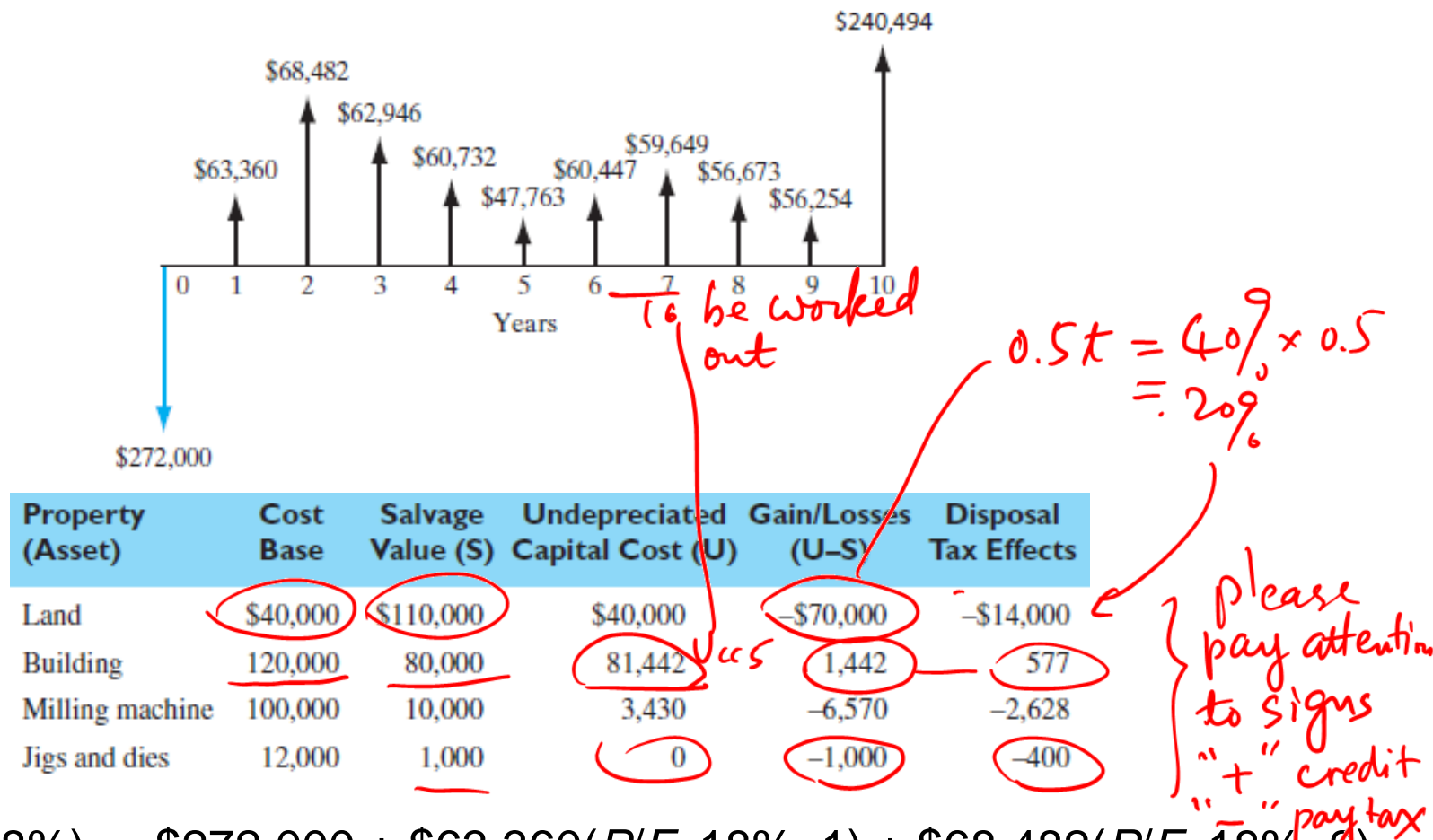
Building $UCC_0 = 120,000$ $CCA = UCC_0 \times 4\% \times 5\% = \$2,400$

$UCC_5 = (120,000 - \$2,400) = \$117,600$

Year	0	1	2	3	4	5	6	7	8	9	10
Income Statement											
Revenues		\$150,000	\$150,000	\$150,000	\$150,000	\$150,000	\$150,000	\$150,000	\$150,000	\$150,000	\$150,000
Expenses											
Materials		22,000	22,000	22,000	22,000	22,000	22,000	22,000	22,000	22,000	22,000
Labour		32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000
Energy		3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500
Others		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
CCA											
Building (4%)		2,400	4,704	4,516	4,335	4,162	3,995	3,836	3,682	3,535	3,393
Machines (30%)		15,000	25,500	17,850	12,495	8,747	6,123	4,286	3,000	2,100	1,470
Tools (100%)		6,000	6,000	-	-	-	6,000	6,000	-	-	-
Taxable income		66,600	53,796	67,634	73,170	77,092	73,882	75,879	83,318	84,365	85,137
Income taxes (40%)		26,640	21,518	27,054	29,268	30,837	29,553	30,351	33,327	33,746	34,055
Net income		\$39,960	\$32,278	\$40,580	\$43,902	\$46,255	\$44,329	\$45,527	\$49,991	\$50,619	\$51,082
Cash Flow Statement											
Operating activities											
Net income		\$39,960	\$32,278	\$40,580	\$43,902	\$46,255	\$44,329	\$45,527	\$49,991	\$50,619	\$51,082
CCA		23,400	36,204	22,366	16,830	12,908	16,118	14,121	6,682	5,635	4,863
Investment activities											
Land	\$(40,000)										110,000
Building	(120,000)										80,000
Machines	(100,000)										10,000
Tools (1st cycle)	(12,000)										
Tools (2nd cycle)											
Disposal tax effects											
Land											(14,000)
Building											577
Machines											(2,628)
Tools						(400)					(400)
Net cash flow	\$(272,000)	\$63,360	\$68,482	\$62,946	\$60,732	\$47,763	\$60,447	\$59,649	\$56,673	\$56,254	\$240,494

Note: Investment in tools (jigs and dies) will be repeated at the end of year 5 with the same initial purchase costs.

Example 10.6: Solution (continued)



- $$PW(18\%) = -\$272,000 + \$63,360(P/F, 18\%, 1) + \$68,482(P/F, 18\%, 2) + \dots + \$240,494(P/F, 18\%, 10) = \$36,218 > 0$$

Example 10.7: Considering Investment Tax Credits (ITC)

Continue from here

- Suppose in Example 10.6 that a 35% ITC was allowed on the purchase of the milling machine and the jigs and dies. How does the ITC affect the profitability of the investment?

Example 10.7: Solution

ITC (Based valid expenses)

- The ITC amount for each asset is
 - Milling machine: $0.35 \times \$100,000 = \$35,000$
 - Jigs and dies: $0.35 \times \$12,000 = \$4,200$

after tax calculated; Part of Cash Flow
- The ITC for the milling machine occurs in year 1 while the ITC for jigs and dies occurs in both year 1 and year 6.

Two cycles
- The CCAs for their respective first year of use are:

ITC applied for 2 times

 - Milling machine: $\$100,000 \times 30\% / 2 = \$15,000$
 - Jigs and dies: $\$12,000 \times 100\% / 2 = \$6,000$

*UCC₂ = UCC₁ - CCA₁ - ITC₁
machine = \$100,000 - \$15,000 - \$35,000 = \$50,000
UCC₂ die = 12,000 - 6,000 - 4,200 = 1,800*
- The UCCs at the beginning of their respective 2nd year of use are:
 - Milling machine: $\$100,000 - \$15,000 - \$35,000 = \$50,000$
 - Jigs and dies: $\$12,000 - \$6,000 - \$4,200 = \$1,800$

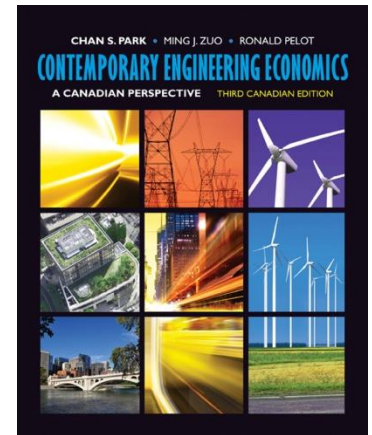
Example 10.7: Solution

Table 10.7 (Canadian 3rd Edition):											
	dB=	4%	t=	40%							
	dE=	30%	id=								
	dO=	100%	MARR=	18%							
	tCG=	20%	N=	10							
Year	0	1	2	3	4	5	6	7	8	9	10
Income Statement											
Revenues		150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000
Expenses											
Materials		22,000	22,000	22,000	22,000	22,000	22,000	22,000	22,000	22,000	22,000
Labor		32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000
Energy		3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500
O&M		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
CCA											
Building @ 4%		2,400	4,704	4,516	4,335	4,162	3,995	3,836	3,682	3,535	3,393
Machines @ 30%		15,000	15,000	10,500	7,350	5,145	3,602	2,521	1,765	1,235	865
Tools @ 100%		6,000	1,800	-	-	-	6,000	1,800	-	-	-
Taxable income		66,600	68,496	74,984	78,315	80,693	76,403	81,843	84,553	85,230	85,742
Income taxes @ 40%		26,640	27,398	29,994	31,326	32,277	30,561	32,737	33,821	34,092	34,297
Net income		39,960	41,098	44,990	46,989	48,416	45,842	49,106	50,732	51,138	51,445
Cash Flow Statement											
Operating activities											
Net income		39,960	41,098	44,990	46,989	48,416	45,842	49,106	50,732	51,138	51,445
CCA		23,400	21,504	15,016	11,685	9,307	13,597	8,157	5,447	4,770	4,258
Investment activities											
Land	(40,000)										110,000
Building	(120,000)										80,000
Machines	(100,000)										10,000
Tools (1st cycle)	(12,000)					1,000					
Tools (2nd cycle)						(12,000)					1,000
ITC											
Machines		35,000									
Tools		4,200									
Disposal tax effect											
Land											(14,000)
Building											577
Machines											(3,193)
Tools						(400)					(400)
Net cash flow	(272,000)	102,560	62,602	60,006	58,674	46,323	63,639	57,263	56,179	55,908	239,687
PE(MARR) =	\$ 61,804.14										
AE(MARR) =	\$ 13,752.33										
IRR=	23.97%										

Example 10.7: Solution (continued)

- Is this investment justifiable at a MARR of 18%?
- $PW(18\%) = -\$272,000 + \$102,560(P/F, 18\%, 1)$
 $+ \$62,602(P/F, 18\%, 2) + \dots$
 $+ \$239,687(P/F, 18\%, 10)$
 $= \underline{\$61,804} > 0$

Summary



The **income statement approach** is typically used in organizing project cash flows. This approach groups cash flows according to whether they are operating, investing, or financing functions.