12

# Lecture 19
# Tax Incentive Example: Solar Power
# After-Tax Cash Flows

## On with the Wind

## On with the Wind, cont'd

- Canada is a land of natural resources, and, as anyone who has ventured into the Crowsnest Pass knows, it is a land of wind.
- It was there, on Cowley Ridge, that Canada's first commercial wind plant was built in 1993.
- After subsequent phases in 1994 and additions in 2001, the Cowley plant had 57 Kenetech turbines, with a total rated capacity of 21.4 MW, and 15 Nordex N60 turbines, each rated at 1.3 MW.

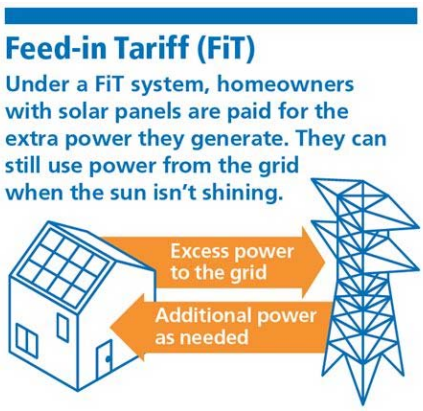
## On with the Wind, cont'd

- The plant was decommissioned in 2016.
- The transition to greater use of wind power will require significant investments in infrastructure.
- It was not technology, but rather cost factors, that previously kept wind energy from becoming an attractive investment.
- As recently as the late 1980s, wind-generated power cost roughly twice as much to produce as energy from conventional sources.

## On with the Wind, cont'd

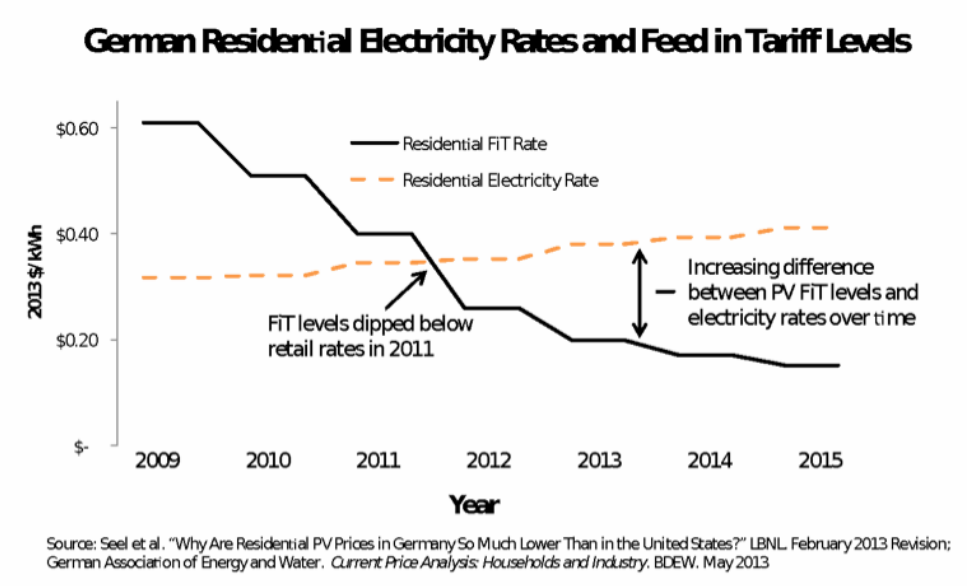
- In the past few decades, however, the price of wind energy has decreased dramatically.
- Not surprisingly, investment in wind power has also increased substantially.
- In part, this happened due to advances in wind turbine technology. But changes in tax policy can also alter investors' behaviour.
- This is also true of solar power: let's continue the story.

## Solar Feed-in Tariff Example




- Germany initiated this in 2000, as part of commitment to address climate change by switching to renewable fuel sources
- Expand solar energy deployment through the solar feed-in tariff (FiT) program. FiTs subsidize generation from renewable energy technologies, making them affordable

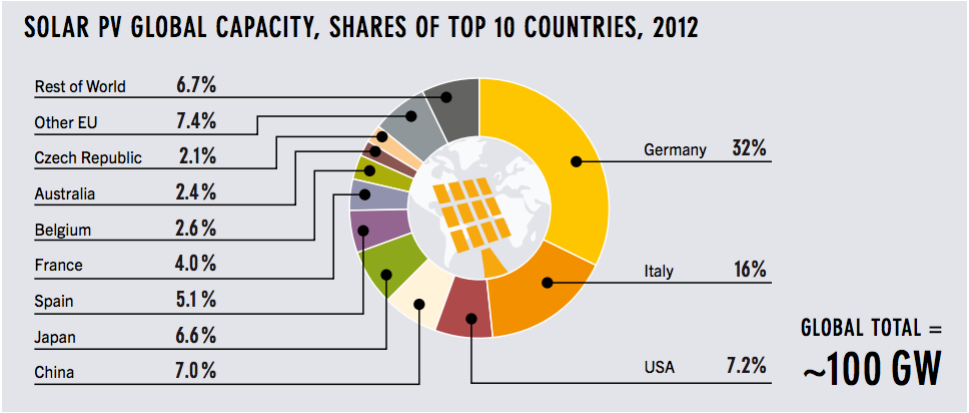
# FiT continued




Source: Seel et al. "Why Are Residential PV Prices in Germany So Much Lower Than in the United States?" LBNL. February 2013 Revision; German Association of Energy and Water. *Current Price Analysis: Households and Industry*. BDEW. May 2013

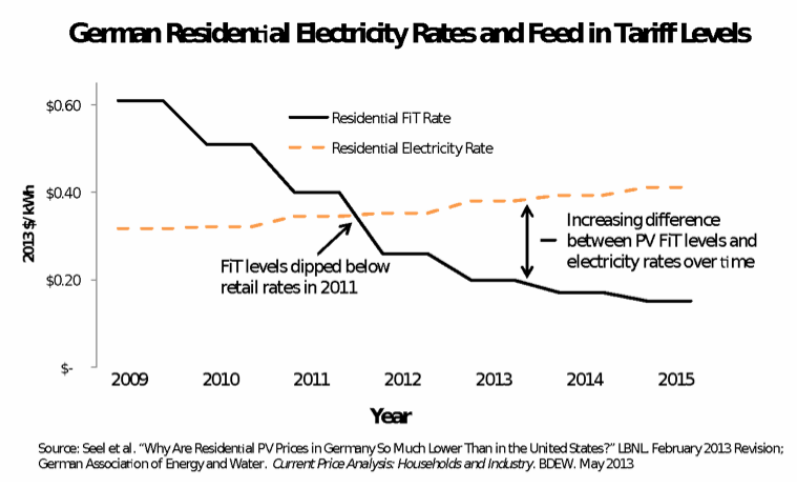
# FiT continued

- Consequences:



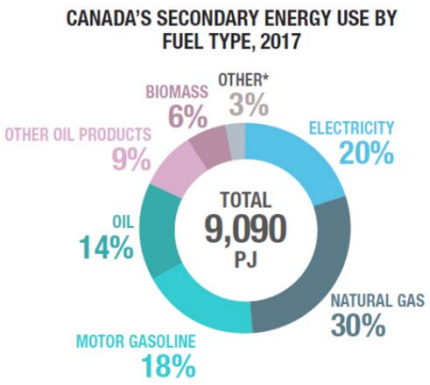
# FiT continued

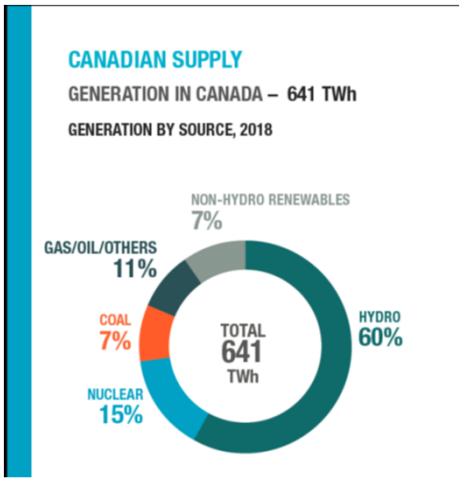
Consequences:



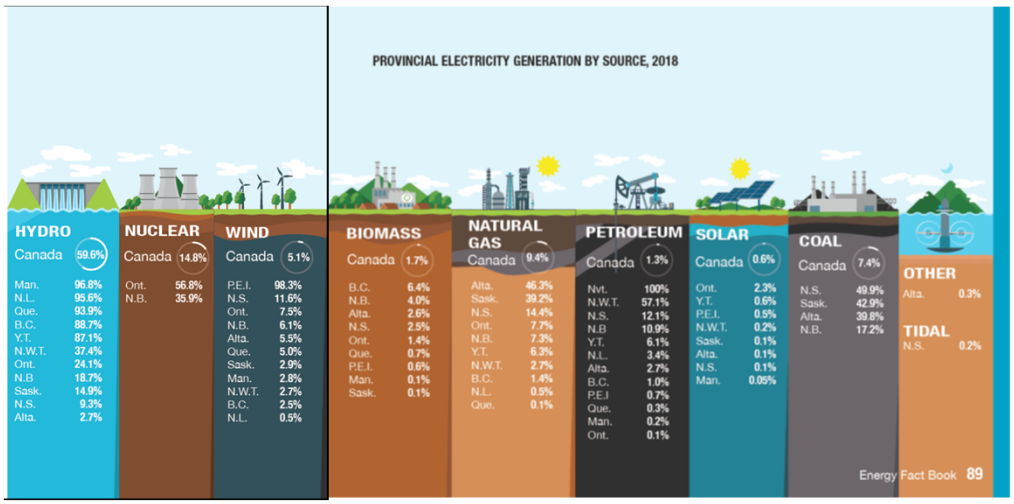

Source: Seel et al. "Why Are Residential PV Prices in Germany So Much Lower Than in the United States?" LBNL. February 2013 Revision; German Association of Energy and Water. *Current Price Analysis: Households and Industry*. BDEW. May 2013

# Renewable Energy in Canada



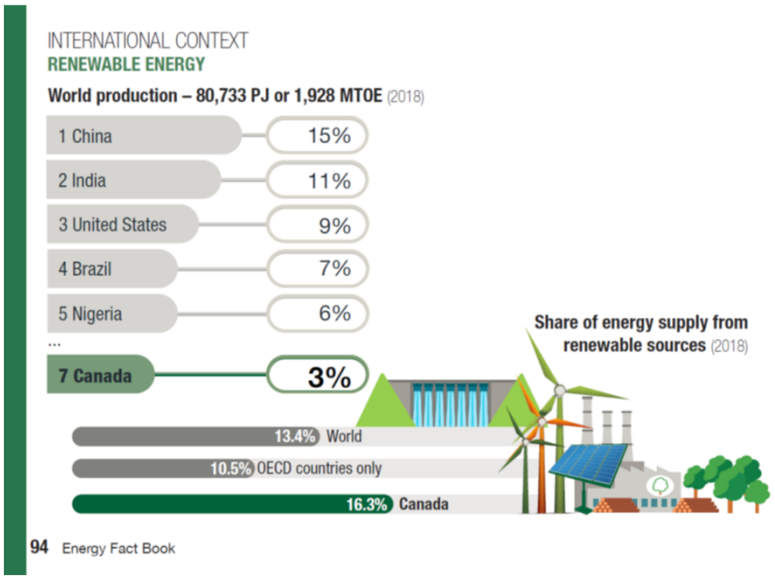



# Renewable Energy in Canada




# Renewable Energy in Canada

- Where is renewable energy most established?



## Learning Objectives

- Calculate *taxes due*, or *taxes owed*, for both individuals and corporations
- Understand the incremental nature of the individual and corporate tax rates used for calculating taxes on income
- Calculate a combined income tax rate for provincial and federal income taxes and select an appropriate tax rate for engineering economic analyses

## Learning Objectives, cont'd

- Use an *after-tax table* to find the after-tax cash flows for a prospective investment project
- Calculate measures of merit—such as present worth, annual worth, payback period, internal rate of return, and benefit-cost ratio—from developed after-tax cash flows
- Evaluate investment alternatives on an after-tax basis, including asset disposal

## Key Summary: Update

- Variables and parameters (puzzle pieces):
  - Different kinds of interest rates
  - Discount rates
  - Costs and cost savings or revenues, now and in the future
  - Different expected lives of the possible project/purchases
  - Salvage value
  - **Depreciation, taxes, and tax savings**
  - How these escalate
- Analysis methods (ways to put the pieces together):
  - Present worth analysis (Net Present Value)
  - Equivalent uniform annual cost analysis
  - Rate of return analysis
  - Benefit-cost ratio analysis
  - Payback period
  - Cost-effectiveness analysis

## A Partner in the Business

- To understand income taxes, consider the government as a partner in every business activity.
- The government shares in the profits from every successful venture.
- The government shares in the losses of unprofitable ventures too.

## Calculation of Taxable Income

- From a firm's perspective, tax is simply one more expense (disbursement).
  - Operating cost, labour etc., AND taxes
- Calculating taxes use taxable income:
  - Gross income – Deductions = Taxable Income
- Taxes owed are determined by applying tax rates, which are determined by legislation, to taxable income.

## Taxable Income of Individuals

- Average Tax Rate
  - = total taxes payable/taxable income
- Marginal Tax Rate ($t$)
  - = the tax rate that applies to the next taxable dollar

# Taxable Income of Individuals, cont'd

**TABLE 12-1 Individual Federal Income Tax Structure (2016 rates)**

| Taxable Income | | Tax Rate |
|---|---|---|
| First | $45,282 | 15% |
| Amount between | $45,282 and $90,563 | 20.5% |
| Amount between | $90,563 and $140,388 | 26% |
| Amount between | $140,388 and $ 200,000 | 29% |
| Amount above | $200,000 | 33% |

These are marginal tax rates.

# Taxable Income of Individuals, cont'd

**Table 12-2 Basic Personal Exemption (2016)**

| | |
|---|---|
| Federal | $11,474 |
| Manitoba | 9,134 |
| Ontario | 10,011 |

## Taxable Income of Individuals, cont'd

| Individual Federal Income Tax Structure (2016 rates) | | | |
|---|---|---|---|
| Income bracket | Extra (marginal) income | Marginal Tax rate | Tax owed |
| Zero to $11,474 | $ 11,474 | 0% | $ - |

- First step:
- Calculated tax on lowest part of income:

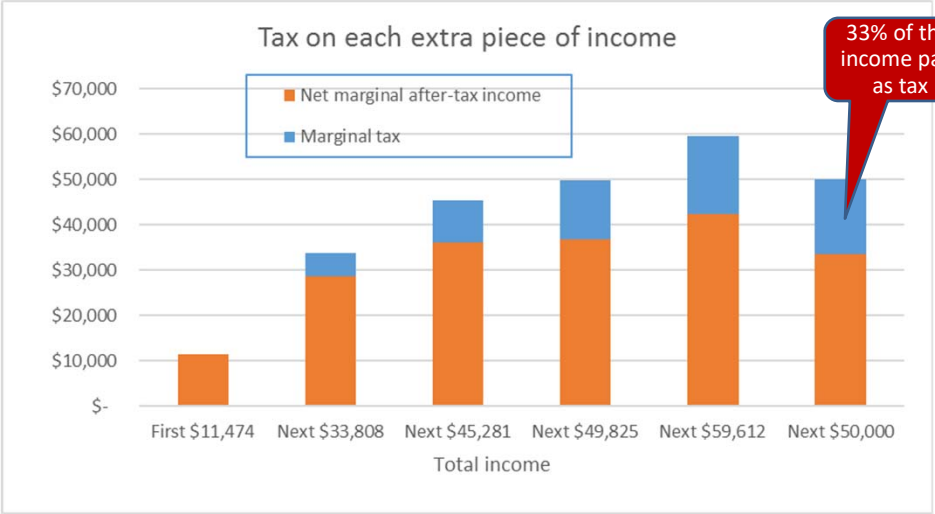
- For provincial taxes:

## Combining the info from both tables:

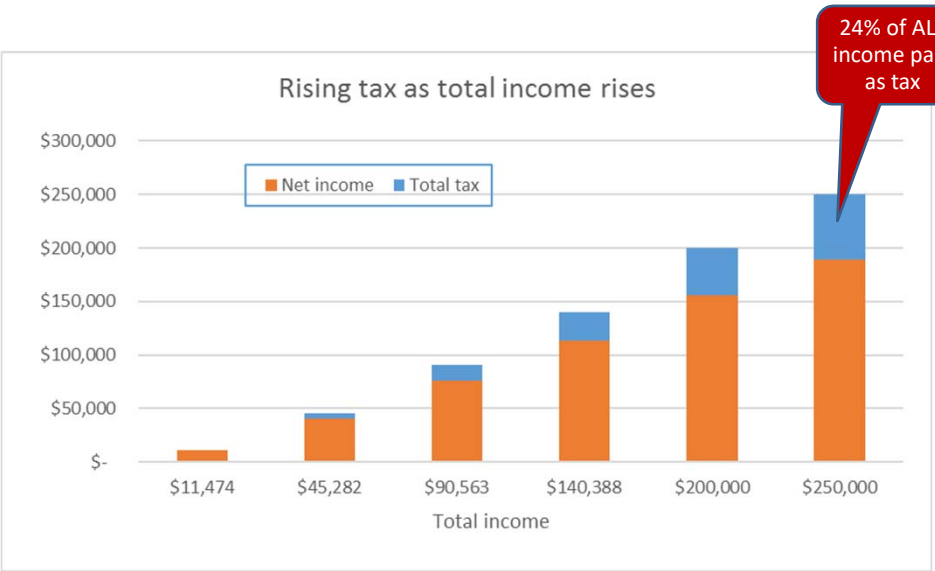
| Individual Federal Income Tax Structure (2016 rates) | | | |
|---|---|---|---|
| Income bracket | Extra (marginal) income | Marginal Tax rate | Tax owed |
| Zero to $11,474 | $ 11,474 | 0% | $ - |
| $11,474 to $45,282 | $ 33,808 | 15% | $ 5,071 |
| $45,283 to $90,563 | $ 45,281 | 20.5% | $ 9,283 |
| $90,564 to $140,388 | $ 49,825 | 26% | $ 12,955 |
| $140,389 to $200,000 | $ 59,612 | 29% | $ 17,287 |
| Above $200,000 | $ 50,000 | 33% | $ 16,500 |

# Taxable Income of Individuals, cont'd

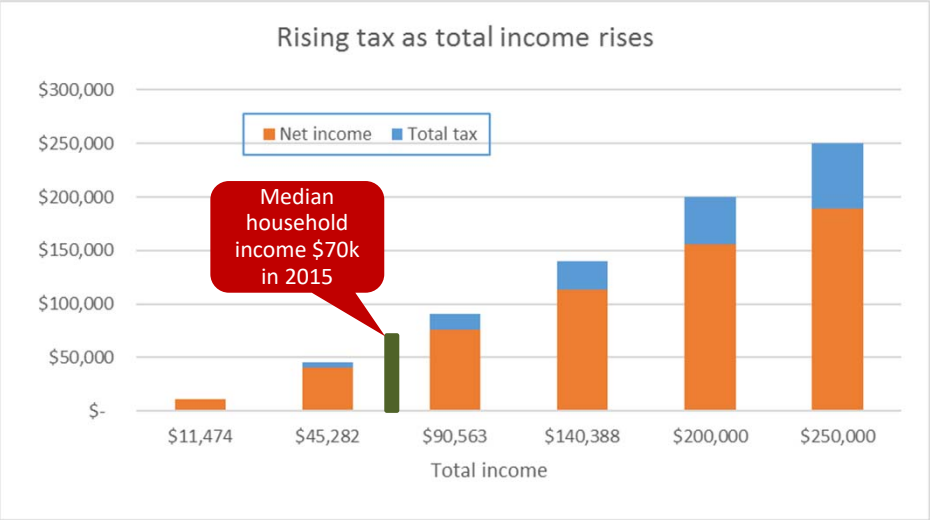
- Example: assume total income of $250,000




# Taxable Income of Individuals, cont'd



# Taxable Income of Individuals, cont'd




# Taxable Income of Individuals, cont'd

Basic Personal Exemption vs Credit:

| Individual Federal Income Tax Structure (2016 rates) | | | |
|---|---|---|---|
| Income bracket | Extra (marginal) income | Marginal Tax rate | Tax owed |
| Zero to $11,474 | $ 11,474 | 0% | $ - |

- Credit: reduction in actual tax amount.

# Corporate Income Taxes

- Contrast with personal income taxes

  Unlike personal taxes, corporate taxes are usually not progressive: the percentage owed doesn't increase as income increases

  There are a number of deduction for small business but these are not in the scope of this course

- Definitions and clarifications:

  There are a number of deduction for small business but these are not in the scope of this course

# Corporate Income Taxes, cont'd

**Table 12-3 2015 Marginal Tax Rate on Active Business Income over $500,000**

| Province or Territory | Provincial Rate | Federal Rate | Combined Rate |
|---|---|---|---|
| British Columbia | 11.0% | 15% | 26.0% |
| Alberta | 10/12% | 15% | 25/27% |
| Saskatchewan | 12.0% | 15% | 27.0% |
| Manitoba | 12.0% | 15% | 27.0% |
| Ontario | 11.5% | 15% | 26.5% |
| Quebec | 11.9% | 15% | 26.9% |
| New Brunswick | 12.0% | 15% | 27.0% |
| Nova Scotia | 16.0% | 15% | 31.0% |
| Prince Edward Island | 16.0% | 15% | 31.0% |
| Newfoundland and Labrador | 14.0% | 15% | 29.0% |
| Yukon | 15.0% | 15% | 30.0% |
| Northwest Territories | 11.5% | 15% | 26.5% |
| Nunavut | 12.0% | 15% | 27.0% |

- BC's rate has since increased to 12%, but a separate rate of 2% has been set for small businesses.

# Corporate Income Taxes, cont'd

INCOME STATEMENT
For ABC Corporation
For the year ending 7 January 2017

| | |
|---|---|
| Operating revenue | OR |
| Operating costs | − OC |
| **Before-tax cash flow** | BTCF |
| CCA | − CCA |
| Debt interest | − I |
| **Taxable income** | OR − OC − CCA − I |
| Less income tax (at rate $t$) | $-t$(OR − OC − CCA − I) |
| **Net profit** | (OR − OC − CCA − I) (1 − $t$) |

**FIGURE 12-1** Simplified income statement formula.

# Taxable Income: Problem 1

Assume that the combined tax for a business is 34% and the business has a gross income of $300,000, the operating expenses are $120,000, and the assets of the business are worth $800,000. Using straight line depreciation over a 25-year life, what are the taxes owed?

## Taxable Income: Problem 1, cont'd

**Solution**

Step 1: Calculate Depreciation

Straight-line depreciation of the asset is 800,000/25 = $32,000

Step 2: Calculate Taxable Income

Taxable Income = GI – Expenses – Depreciation

Taxable Income = 300,000 – 120,000 – 32,000 = 148,000

Step 3: Calculate Taxes

Taxes = 148,000 (0.34) = $50,320

## Potential break point

# Uses of Operating Revenues

Operating revenue (OR) = Operating cost (OC) + Before-tax cash flow (BTCF)

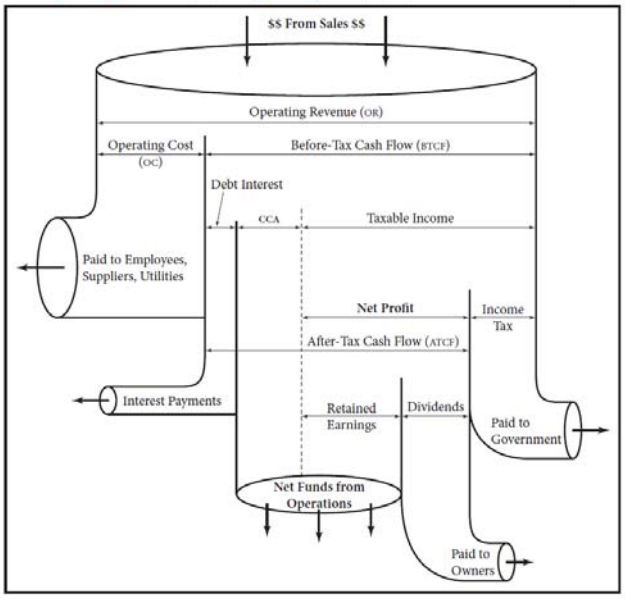



**FIGURE 12-2** The operations cash flow pipeline.

# Uses of Operating Revenues: Accounting

Operating revenue (OR) = Operating cost (OC) + Before-tax cash flow (BTCF)

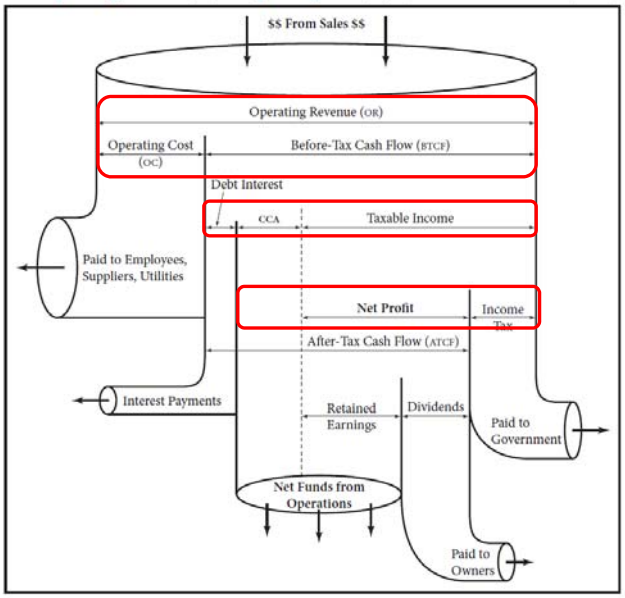



**FIGURE 12-2** The operations cash flow pipeline.

# Accounting and Engineering Economy, cont'd

- Before-tax cash flow (BTCF) = Operating revenue (OR) – Operating costs (OC)
  - BTCF is a.k.a. EBIT: Earnings Before Interest and Taxes
- Taxable income = BTCF – CCA – Debt Interest (I)
- Net profit = taxable income - income tax

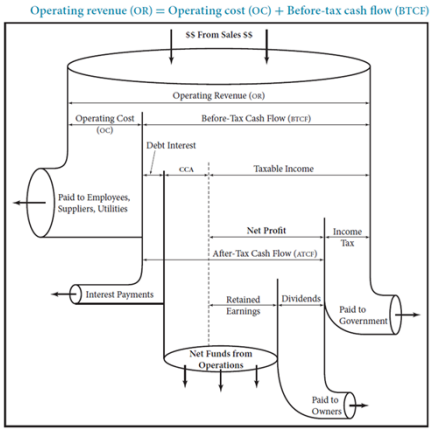



FIGURE 12-2 The operations cash flow pipeline.

# Accounting and Engineering Economy, cont'd

- After-tax cash flow (ATCF) = BTCF – tax
- Net profit = ATCF – Debt Interest (I) –CCA
  = (BTCF – tax) – I – CCA
  = (OR – OC) – tax – I – CCA
  = (OR – OC – CCA – I) * (1–tax rate *i*)

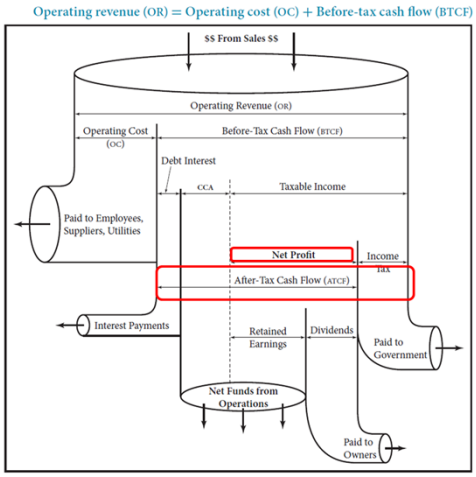



FIGURE 12-2 The operations cash flow pipeline.

# Uses of Operating Revenues: Accounting

- ATCF = Net profit + I + CCA
  = ((OR – OC – CCA – I)*(1 – *t*))+ I + CCA
  = (OR – OC)*(1-*t*) + I * *t* + CCA * *t*

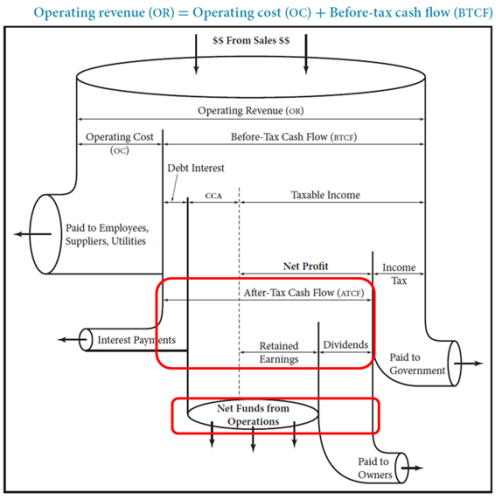



FIGURE 12-2 The operations cash flow pipeline.

# Uses of Operating Revenues: Accounting

- ATCF = Net profit + I + CCA
  = ((OR – OC – CCA – I)*(1 – *t*))+ I + CCA
  = (OR – OC)*(1-*t*) + I * *t* + CCA * *t*

- If we include dividends paid to shareholders:
  - Net cash from operations = ATCF – I – Dividends
  - Net cash from operations = (1 – *t*)[OR – OC – I] + CCA × *t* –Dividends
  - = Net profit + CCA – Dividends

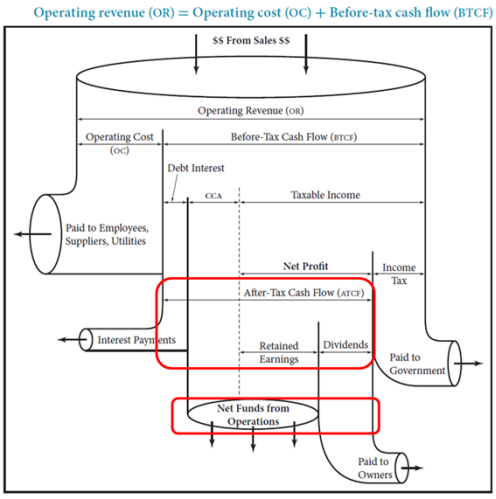



FIGURE 12-2 The operations cash flow pipeline.

# Sources and Uses of Cash

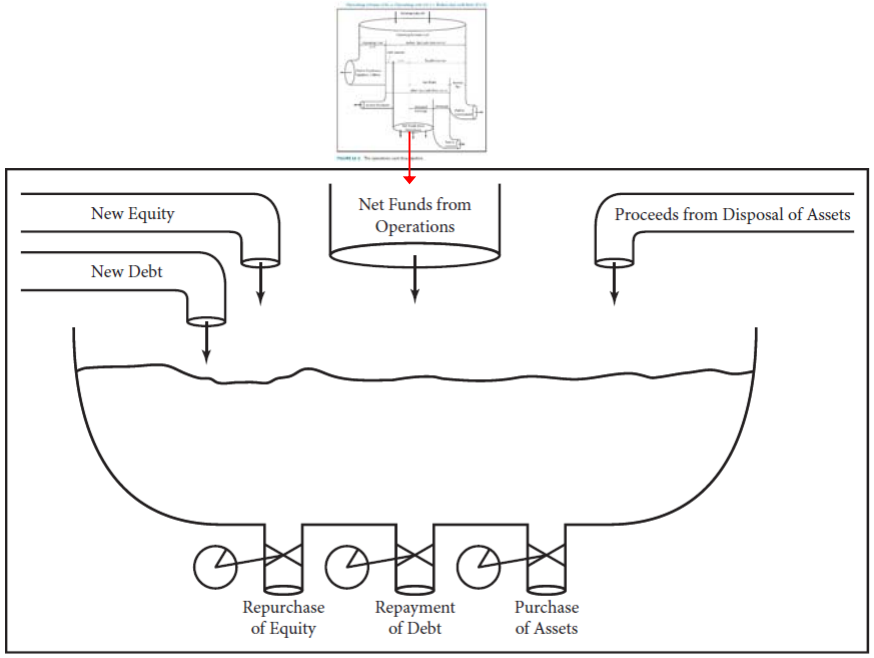



**FIGURE 12-3** Sources and uses of cash.

# Sources and Uses of Cash continued

[same information as the previous diagram just shown as an equation]

- A firm's net cash flow is:
  - Net cash flow = Net funds from operations
    + New equity
    + New debt
    + Proceeds from asset disposal
    – Repurchase of equity
    – Repayment of debt
    – Purchase of assets

Potential break point

## Continue here 23 March. Today:

Finish Chapter 12

Chapter 9 (tax-related material)

Begin Chapter 13, if time

Assignment 7 will be released tonight

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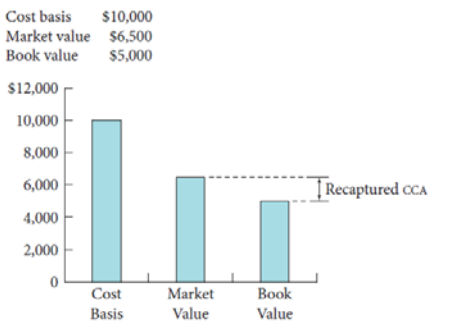
# Handling Asset Purchases and Salvage:
## Further Options for Calculating CCA

- Books-open vs books-closed assumption
  - Applies to loss on disposal or recaptured CCA
  - Neither approach can be used if a capital gain occurs

# Reminder: Depreciation and Asset Disposal

- Taxes-owed changes based on different factors with respect to disposal:
  - Recaptured CCA (recaptured depreciation):
    - Occurs when an asset is sold for more than the book value
    - Is reported as ordinary income (for which a higher tax rate applies usually)



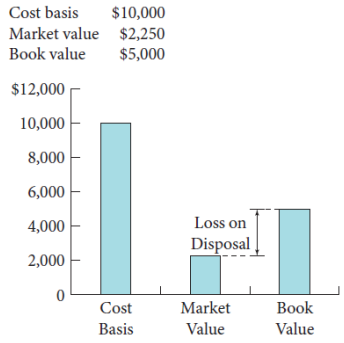

If Cost basis > Market value > Book value, there is Recaptured CCA.
Recaptured CCA = Market value minus Book value = $1,500

**FIGURE 11-7** Recaptured CCA.

# Reminder: Depreciation and Asset Disposal

- Loss on disposal
  - Occurs when the market value is less than the book value
  - Did not claim enough depreciation expense

  - Occurs when an asset is sold for less than the book value
  - Is reported as an ordinary loss



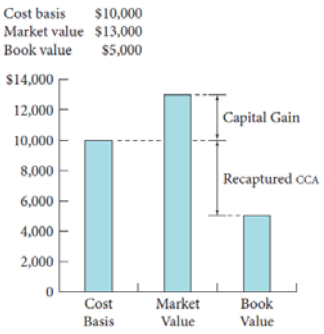

If Book value > Market value, there is a *loss on disposal*.
Loss on disposal = Book value minus Market value = $2,750

**FIGURE 11-8** Loss on disposal.

# Reminder: Depreciation and Asset Disposal

- Capital Gains
  - Occur when the asset is sold for more than its original cost
  - The excess over the original cost is a "capital gain."

  - Occurs when an asset is sold for more than the cost basis (original value)
  - Is reported as a capital gain (for which a lower tax rate applies), IF the investment has been held long enough




If Market value > Cost basis, there is a *capital gain* plus *recaptured depreciation*.
Capital gain = Market value minus Cost basis = $3,000
Recaptured depreciation = Cost basis minus Book value = $5,000

**FIGURE 11-9** Capital gain.

## Handling Asset Purchases and Salvage: Capital Gain Situation

- Situation 1: Net Salvage of Land – Capital Gain
  - Capital Gain = Realized value – Cost Basis
    - Taxes must be paid on a capital gain
    - Usually at a different rate than regular income tax
      - Canada: Half of the capital gain is taxed and half isn't. The half that is taxed is taxed at the marginal tax rate.

## Handling Asset Purchases and Salvage: Capital Gain Situation

**EXAMPLE 12-5**

Five years ago, anticipating expansion, the XYZ Company bought the lot next to its current factory for $2,300,400. Over the ensuing period it modified its production system and began to make extensive use of outsourcing. Thus, despite increasing sales, it found it used less space, not more. Consequently it sold the lot and, after paying for advertising, legal fees, and commissions, realized a sum of $3,427,958.25. If the company's marginal tax rate is 27%, what is the *net salvage value* of the land?

**SOLUTION**

$$\begin{aligned}\text{Capital gain} &= \text{Realized value} - \text{Cost basis}\\ &= \$3{,}427{,}958.25 - \$2{,}300{,}400 = \$1{,}127{,}558.25\\ \text{Capital gains tax} &= t \times 0.5 \times \text{capital gain}\\ &= 27\% \times 0.5 \times \$1{,}127{,}558.25 = \$152{,}220.36\\ \textit{Net salvage value} &= \textit{Realized value} - \textit{Capital gains tax}\\ &= \$3{,}427{,}958.25 - \$152{,}220.36 = \$3{,}275.737.89\end{aligned}$$

## Handling Asset Purchases and Salvage: Books-closed Assumption

- Situation 2: Net Salvage—Books-closed assumption
  - Can apply when the asset has lost value (which is usually, except land)
  - If over-depreciated, then funds are recaptured, and taxes apply
  - If underdepreciated, then a loss occurs, and tax credits apply
  - Net salvage value (NSV) = $S(1 - t) + B_d t$
    - Where:
      - S = salvage value
      - $t$ = marginal tax rate
      - $B_d$ = book value at disposal
    - Otherwise stated:
    - Disposal tax effect (DTE) = $t$ x ($B_d$ – S)

## Handling Asset Purchases and Salvage: Books-closed Assumption

**EXAMPLE 12-6**

As a result of the outsourcing, the XYZ Company auctioned off its production equipment (Class 43—CCA rate = 30%) for $320,000; and its fleet of trucks (Class 10—CCA rate = 30%) for $176,000. The cost basis of the equipment was $1,500,000, and the current UCC is $415,283. The cost basis of the trucks was $480,000, and the current UCC is $98,000. If the company's marginal tax rate is 31%, what is the *net salvage value* of the equipment and vehicles?

See Excel example

## Handling Asset Purchases and Salvage: Books-closed Assumption

**EXAMPLE 12-6**

As a result of the outsourcing, the XYZ Company auctioned off its production equipment (Class 43—CCA rate = 30%) for $320,000; and its fleet of trucks (Class 10—CCA rate = 30%) for $176,000. The cost basis of the equipment was $1,500,000, and the current UCC is $415,283. The cost basis of the trucks was $480,000, and the current UCC is $98,000. If the company's marginal tax rate is 31%, what is the *net salvage value* of the equipment and vehicles?

**SOLUTION**

$$\begin{aligned}\text{Equipment DTE} &= t \times (B_d - S)\\ &= 31\% \times (\$415{,}283 - \$320{,}000)\\ &= \$29{,}524\\ \text{NSV} &= S + \text{DTE}\\ &= \$320{,}000 + \$29{,}524\\ &= \$349{,}524\end{aligned}$$

With the equipment there was a *loss on disposal* (asset sold for less than UCC), which resulted in a tax credit of $38,113, so the actual *net salvage value* is greater than the selling price.

$$\begin{aligned}\text{Trucks DTE} &= t \times (B_d - S)\\ &= 31\% \times (\$98{,}000 - \$176{,}000)\\ &= -\$24{,}180\\ \text{NSV} &= S + \text{DTE}\\ &= \$176{,}000 + (-\$24{,}180)\\ &= \$151{,}820\end{aligned}$$

Since trucks sold for more than their book value, there was *recaptured* CCA and consequent tax liability. Thus the actual *net salvage value* is less than the selling price.

## Handling Asset Purchases and Salvage: Books-open Assumption

- Situation 3: Purchase and Net Salvage—Books-open assumption
  - Under this assumption, due to the way depreciation is calculated (CCA), the purchase of an asset generates an infinite series of depreciation deductions.
  - These result in positive cash flows, through tax credits
  - The opposite is true when an asset is disposed of: tax liabilities result due to the elimination of these deductions.

## Handling Asset Purchases and Salvage: Books-open Assumption - Capital Tax Factors

- The present worth of an after-tax cost of an depreciable capital **asset** is:

$$PW = \mathrm{P}\left[1 - \left(\frac{td}{i+d}\right)\left(\frac{1+{}^{i}/_{2}}{1+i}\right)\right]$$

Equation in brackets is called the 'Capital Tax Factor (CTF)'

- Present worth of after-tax cost of **salvage** of a disposable asset at the end of period *n*:

$$PW = S\left(1 - \frac{td}{i+d}\right)$$

Equation in parentheses is called the 'Capital Salvage Factor (CSF)'

where d is the CCA rate, t is the tax rate, and *i* is the discount rate.

## Handling Asset Purchases and Salvage: Summary

Example 12-8:

- Capital expenditure $246,000 for equipment (CCA Class 8, 20% depreciation rate). Expected BTCF flows over 10 years:
- Yr 1 $35,000, adding $10,000 each year for 10 total years
- Equipment sold for $20,000 in year 10.
- 35% marginal tax rate
- 12% MARR

Comparison of two options: 'books-open' method and 'books-closed'.

- <turn to Excel examples>
- How does the choice of method impact decision recommendations?

# Working Capital Requirements

- Firms usually have to pay for materials, equipment, rent, labour first, and later get revenues back. There is a lag, or gap, between when costs are incurred and revenues received.
- Firms need money (cash, really) to cover this lag. Money for this purpose is referred to as "working capital."
- Often working capital is only necessary at the start, but depending on fluctuations can be required at other times.
- Long-term and short term impacts on business:

# Incorporating Loan Financing into Analyses

- Interest vs Repayment
  - Interest is paid on borrowed funds: this is considered an expense of doing business. Interest is deducted from income before taxes are calculated: it's another operating cost.
  - Loan repayments, however, are not treated the same way. They must be paid out of funds after taxes are paid.
  - Interest payments are incorporated into CTF and CSF calculations, but this is beyond the scope of this class.
  - Interest payments can more easily be included into a 'books-closed' analysis: See Example 12-11.

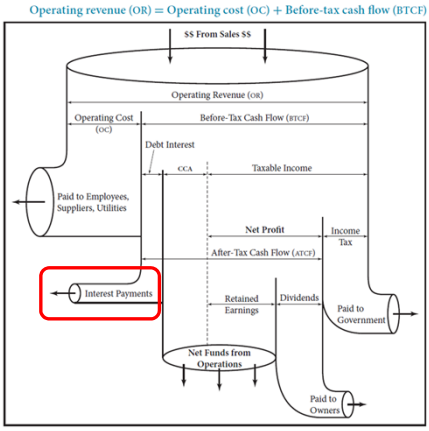



FIGURE 12-2 The operations cash flow pipeline.

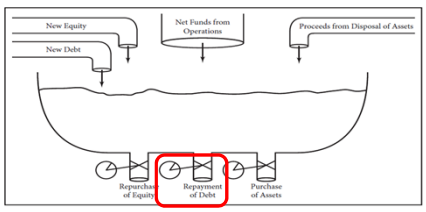



FIGURE 12-3 Sources and uses of cash.

## Incorporating Loan Financing into Analyses

- An example starting with the information in Example 12-12 builds on what we learned in earlier chapters, and adds in the implications of borrowing money and paying tax on our analysis.

Example 12-12: A company was adding a new product line that required $80,000 of Class 43 equipment (CCA rate=30%) and initial working capital of $55,000. The product would have production costs of $79,000 a year and annual revenues of $167,000. The product would be manufactured for five years and then discontinued, the working capital would be recovered, and the equipment would be sold for $5,000. To assist in financing the project, the company is borrowing $100,000 at 12% interest. The loan is to be repaid in five equal annual payments. Find the EUAW if MARR=10% and t=29%.

Example 12-12 contains a couple of errors, which we will review. <switch to Excel>

## Estimating the After-Tax Rate of Return

- The equation relating before and after-tax cost of debt capital is:
  - $i_{dt} = i_d(1 - t)$
  - Where:
    - $i_{dt}$ = after-tax cost $t$ of debt capital
    - $i_d$ = before-tax cost $t$ of debt capital
    - $t$ = marginal tax rate
- No shortcut exists to compute the after-tax rate of return, except when non-depreciable assets and financing are repaid in one lump sum at the end. Then, we can approximate:
  - After-tax ROR = (1 – Marginal tax rate) × (Before-tax ROR)