ORIE 4820: Spreadsheet-Based Modeling and Data Analysis
Project Cash Flows
Spring 2013

During this lab exercise, you will augment last week's Liquair-Pro cash flow analysis tool to include tank costs and the impact of taxes. As in last week's lab exercise, we will consider ONLY the case of a ***new customer*** desiring a ***five-year contract*** using the ***LA-1 tank option***. You will need to expand the functionality to assess the LA-3 and LA-6 tank options, different contract lengths, and the other factors mentioned in last week's lab.

Topics/Tools we will cover:

- ***Developing incremental income and cash flow statements*** associated with owning a tank for use in operations
- ***Using the PMT function to annualize cash flows*** over the relevant time horizon

Background:

Recall that in last week's lab exercise, you populated the table in the Customer Analysis area of the *New Customer Pricing* worksheet to capture the operating costs and revenues associated with the LA-1 tank option. This week, you will work on updating this table to take into account the *impact of taxes* on the operating costs and revenues, as well as factor in the *tank costs* over a 5-year horizon.

The *Tank Cash Flows* worksheet contains informational tables and an area for developing ***annual income and cash flow statements associated with owning an LA-1 tank over the tank's useful life***. The tables at the top of the *Tank Cash Flows* worksheet showing tank attributes and other cost factors are for display only – these cells are linked to the changeable parameter values on the *New Customer Pricing* worksheet. The table listing the 5-Year MACRS Depreciation Schedule gives the asset write-off percentages that Liquair-Pro can claim for tax purposes in each year relative to the year in which a tank is acquired or refurbished (e.g., the original acquisition in Year 0 will be written off in years 1-6, the refurbishment completed in Year 5 will be written off in Years 6-11, etc).

Section 1: Developing the "Tank Only" Income and Cash Flow Statements

Once completed, the *Tank Cash Flows* worksheet will estimate the annual cost of *providing a tank* for use at a customer's site.

Recall that all tanks have a 20-year useful life, and for tax purposes, all tanks fall into the 5-year MACRS asset class. Therefore, the acquisition cost of a tank purchased at the end of Year 0 will be depreciated in Years 1-6 (because of the half-year convention). Moreover, all three refurbishments are *capital improvements* and are treated the same as a new 5-year MACRS asset. Note that the refurbishment completed at the end of Year 15 will be depreciated in Years 16-21. Hence, the income and cash flow statements carry out to Year 21. We assume (for purposes of cost analysis) that the tanks are disposed of at the end of their useful lives at no gain or loss.

Instead of filling in the Income and Cash Flow Statements from top to bottom, it will make more sense if we begin by observing the structure of the Investing Activities section of the Cash Flow Statement (i.e., purchasing and refurbishing the tank). Then we will move on to the Income Statement (to record depreciation of the assets), and finally we will complete the Operating Activities section of the Cash Flow Statement (to re-capture the non-cash depreciation expenses):

(1) The Investing Activities section is already completed for you. Note that:

(a) The Year 0 entry of row 46 (Tank Purchase) contains the Acquisition Cost of LA-1 (C6) as an outflow (i.e., the negative of the entry).

(b) Row 47 (Refurbishments) contains the appropriate refurbishment cost entries in Years 5, 10, and 15 (the negatives of cells C7, C8, and C9, respectively).

(c) The next row of the Investing Activities section (Tank Inventory Investment) is left blank. This line item, which captures the cost of *maintaining an inventory* of product in the tank, is customer specific and is already accounted for in the Customer Analysis area of the *New Customer Pricing* worksheet.

(2) Complete the Income Statement as follows:

(a) Rows 23, and 25-28 should be left blank. These ***customer-specific*** items are already accounted for in the Customer Analysis area of the *New Customer Pricing* worksheet.

(b) For each Year j = 1, …, 6, the entry in row 29 (Depreciation-Initial Purchase) should contain the acquisition depreciation expense:

Appropriate MACRS % for 5-year class x Acquisition Cost of LA-1 (C6).

(c) For each Year j = 6, …, 11, the entry in row 30 (Depreciation-First Refurbishment) should contain the first refurbishment depreciation expense:

Appropriate MACRS % for 5-year class x First Refurbishment Cost of LA-1 (C7).

(d) For each Year j = 11, …, 16, the entry in row 31 (Depreciation-Second Refurbishment) should contain the second refurbishment depreciation expense:

Appropriate MACRS % for 5-year class x Second Refurbishment Cost of LA-1 (C8).

(e) For each Year j = 16, …, 21, the entry in row 32 (Depreciation-Third Refurbishment) should contain the third refurbishment depreciation expense:

Appropriate MACRS % for 5-year class x Third Refurbishment Cost of LA-1 (C9).

(f) Rows 33-35, respectively, should contain the Taxable Income, Income Taxes, and Net Income associated with tank ownership. When complete, these rows should display:

Year:	0	1	2	3	4	5	6	7	8
Taxable Income		($3,000)	($4,800)	($2,880)	($1,728)	($1,728)	($1,264)	($640)	($384)
Income Taxes		($1,020)	($1,632)	($979)	($588)	($588)	($430)	($218)	($131)
Net Income (Loss)		($1,980)	($3,168)	($1,901)	($1,140)	($1,140)	($834)	($422)	($253)

Note that the Income Taxes in row 34 are negative because the depreciation expenses give rise to ***tax shields*** (i.e., they reduce the company's tax liability).

(3) Complete the Operating Activities section as follows:

(a) Row 39 should contain the Net Income figures from row 35.

(b) Each of the rows 40-43 should contain the corresponding depreciation values from rows 29-32. Here, we will *add back* the non-cash depreciation expenses that were deducted in the net income calculation to reflect the actual *cash flows*.

(c) The Net Cash Flows (Tank Only) in row 53 have already been completed for you. Verify that for the default input parameters, this row displays:

Year:	0	1	2	3	4	5	6	7	8
Net Cash Flow (Tank Only)	($15,000)	$1,020	$1,632	$979	$588	($1,412)	$430	$218	$131

Section 2: Discounting Cash Flows and Computing Annual Equivalent Worth

Thus far, we have computed the after-tax cash flows associated with an LA-1 tank over its useful life of 20 years (21 years for tax purposes). For purposes of quoting a price to a customer, however, it does not make sense to factor in the cost of the tank over its *entire* useful life when the customer's contract length is far shorter than that. ***So, how do we fairly allocate "five years' worth" of the cost of providing a tank to a customer?***

One possibility would be to evaluate the cash flows of the *specific tank* that will be installed at the customer site for the next five years. However, ***at the time a price quote is being made to a new customer, it is not known which specific tank will be used for that customer (or even whether it will be a new or a refurbished tank).*** Moreover, the customer has no control over which specific tank unit will be installed. For purposes of pricing parity, the price quoted to a customer should not depend on the *age* of the specific tank unit that Liquair-Pro chooses to install (although it can depend upon the tank *size*, since the size is chosen by Liquair-Pro to minimize customer cost anyway).

Another option would be to pick a specific 5-year period to evaluate (e.g., Years 1-5) and simply ignore the cash flows in the other years. This is not a sound evaluation policy either, because the tank cash flows differ greatly over the course of a tank's useful life, and an inevitable under- or over-charging would result.

In this type of circumstance, a correct method of analysis finds the ***Annual Equivalent Worth*** of a tank over its 20-year useful life (i.e., the equivalent annuity value over a 20-year horizon) and then *uses this annuity cash flow to represent tank costs in each year of the relevant horizon*:

(1) In cell C55, compute the NPW of the Tank Only Cash Flows at the after-tax MARR. *Remember that Excel's* **npv** *function assumes that the series of cash flows begins at Year 1, NOT Year 0.*

(2) In cell C56, ***convert the NPW to its 20-year annuity equivalent*** using the **pmt** function.

Section 3: Completing the After-Tax Cash Flow Analysis

The Customer Analysis area of the *New Customer Pricing* worksheet captures all costs associated with providing a product to a Liquair-Pro customer EXCEPT those costs associated

with providing a tank for use at the customer's site. The table currently shows the Before-Tax analysis for operating costs (and revenues) that you completed last week.

(1) ***Update the rows of the table, taking into account the impact of taxes on various line items as appropriate.*** (Hint: The Income Statement on the *Tank Cash Flows* worksheet should indicate to you which line items are affected by taxes.)

(2) Use the AEW you computed on the *Tank Cash Flows* worksheet to represent after-tax tank cash flows in row 35.

(3) ***Run the Goal Seek macro*** to compute the breakeven price-per-KGallons based on the ***after-tax cash flows***. As a check, for the default input parameters (Average Weekly Demand = 2,500 gallons, Demand Growth = 5%, Distance = 20 miles, and all Deliveries Quantities = 1,000), the breakeven price-per-KGallons is **$594.132**. (Compare this with last week's $575.225.)