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

During this lab session, you will begin to build a cash flow analysis tool that will enable a Liquair-Pro salesperson to: (1) quantify costs and revenues for a ***new customer*** desiring a ***five-year contract*** using the ***LA-1 tank option***, and (2) quote a break-even price-per-1,000-gallons for the customer. Today we will focus ONLY on operating costs. In next week's lab, we will incorporate capital costs (i.e., tank costs) as well as taxes.

Over the next few weeks, you will be responsible for expanding the functionality of the tool to assess the LA-3 and LA-6 tank options, as well as different contract lengths. You will also need to incorporate solutions for the issues outlined in Section 2.

The template file for this exercise is ***Liquair-Pro-New-Customer.xlsm***. Download a copy of the file from the course Blackboard site and *save it on your computer*. ***This is the file you will be using for the next several weeks, so be sure to save a copy of your work at the conclusion of each lab session.*** Partially completed workbooks will not be provided each week.

Topics/Tools we will cover:

- ***Using the NPV function to discount cash flows*** over a specified time horizon
- ***Using Goal Seek*** to find a breakeven price for a tank option

Background:

There are three worksheets in the workbook: *New Customer Pricing*, *Tank Cash Flows*, and *New Customer Risk Analysis*. There are numerous names ranges in the workbook, as well as several skeleton VBA macros. Today's lab will focus solely on the *New Customer Pricing* worksheet.

The *New Customer Pricing* worksheet contains an input area for New Customer Information, two parameter tables (Tank Attributes and Other Parameters), and a Customer Analysis area for evaluating the operating costs associated with the LA-1 tank option.

Recall that for any Liquair-Pro customer, the two principal cost categories to be evaluated are the incremental cost of *producing* the product for the customer and the incremental cost of *distributing* the product to the customer. The cost of distribution includes three inter-related components:

- the cost of *providing a tank* for use at the customer's site,
- the cost of *maintaining an inventory* of product in the tank, and
- the cost of *transporting the product* from Liquair-Pro's production facility to the tank at the customer site.

Today we will consider the last two of these components. Evaluating the cost of *providing a tank* requires a more involved analysis that we will address next week.

Section 1: Completing the Customer Analysis Area

The first three rows of the Customer Analysis area have been completed for you already. Note that the first two rows project the Annual Demand and Average Weekly Demand, respectively, for the five-year horizon based on the input parameters in cells F5, F6, and F16. The entries in the Delivery Quantity row currently show *default* inventory replenishment decisions for the customer over the five-year horizon (i.e., how many gallons are delivered with each replenishment). ***One of the key tasks for your final homework assignment will be to determine the cost-minimizing Delivery Quantity values.***

For now, given the default Delivery Quantity values, complete the rows of the table as follows:

(1) In row 27, compute the (average) number of deliveries per year by dividing the Annual Demand by the Delivery Quantity.

(2) In row 28, compute the Average Tank Inventory Level (think about it -- this is a very simple function of the Delivery Quantity).

(3) In row 29, compute the Transportation Cost per Delivery =

sqrt(Delivery Quantity / Truck Capacity) x Full Truckload Cost Per Delivery where

Full Truckload Cost Per Delivery = Full Truckload Cost Per Mile x Roundtrip Distance

(4) In row 31, compute the Annual Transportation Cost.

(5) In row 32, compute the Annual Inventory Financing Cost =

Average Tank Inventory x Production Cost per Gallon x after-tax MARR

(6) In row 33, compute the Annual Inventory Cooling Cost =

Average Tank Inventory x Cooling Cost per Gallon-Year

(7) In row 34, compute the Annual Production Cost.

(8) In row 38, take the negative sum of rows 31-36. (You will fill in rows 35 and 36 later.)

(9) In row 39, compute the Annual Revenues according to the Price-Per-KGallons in cell F20.

(10) In cell F41, compute the <u>*total*</u> NPW of the revenues and operating costs over the 5-year contract period using the **npv** function. Use the after-tax MARR as the discount rate.

<u>Note:</u> The after-tax MARR should only be used with *after-tax cash flows*. Next week you will update this area to take taxes into account. Also, the **npv** function assumes that the series of designated cash flows begins at Year 1, NOT Year 0. If there are cash flows in Year 0 to consider, they should be included separately and added to the **npv** function:

Year 0 cash flows + **npv**(*rate, Year 1, Year 2, …*)

(11) The ***breakeven price-per-Kgallons*** for Years 1-5 is the price that will yield NPW = 0 in cell F41. We can easily find this price using the "Goal Seek" tool. From the ribbon, select Data->Data Tools->What-If Analysis->Goal Seek … and set the form fields as follows:

- Set cell = F41 (the NPW)
- To value = 0
- By changing cell = F20 (Price-Per-KGallons)

Click OK. As a check, for the default input parameters (Average Weekly Demand = 2,500 gallons, Demand Growth = 5%, Distance = 20 miles, Contract Length = 5 years, and all Deliveries Quantities = 1,000), the breakeven Price-Per-KGallons is **$575.225**.

(12) ***Record a macro called Find_Breakeven_Price*** that runs Goal Seek to compute the breakeven Price-Per-KGallons and ***edit the macro to remove all hard-coded cell addresses***.

(13) Attach a button form to the macro.

Section 2: Additional Considerations

Discuss with your team how you will:

(A) ***Find the optimal delivery quantity values for each of the five years. (Hint: What costs are affected by the delivery quantity decision in each year?)***

(B) ***Ensure that only feasible delivery quantity values are considered. (Note that for the default parameter values, the Delivery Quantity of 1,000 is NOT feasible in Year 5.)***

(C) ***Indicate to the user if and in what years the tank option is not feasible for the customer.***

(D) ***Determine the N-year breakeven price-per-1,000-gallons for a new customer, where the contract length N can be an integer between 1 and 5. (We only computed the 5-year breakeven price here, which did not incorporate an early removal cost.)***