

# FuelCost *A tool to evaluate irrigation pumping costs*



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**Gary A. Clark, Danny H. Rogers, and Steven Briggeman**  
*Biological and Agricultural Engineering*  
*K-State Research and Extension*



**Start listening to the FuelCost Audio Manual #1 - OPTIONAL**  
*(audio available on MIL Tool Kit CD and website)*

FuelCost can help determine whether your pumping plant is using more fuel than necessary for your pumping conditions. FuelCost also can compare the cost of alternative fuel sources on either an energy basis or an annualized capital operating cost basis.

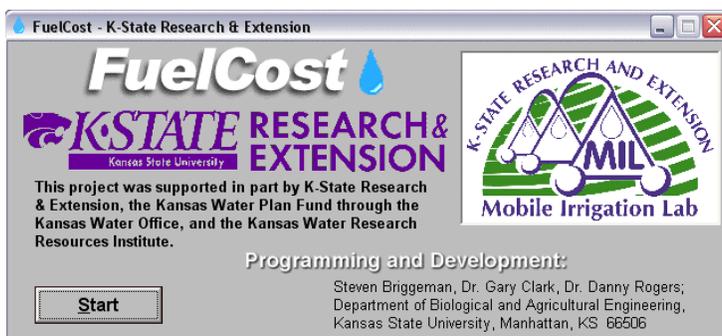


Figure 1 – The splash screen of FuelCost

## **Getting Started**

Start *FuelCost* by double clicking its icon, either on your desktop or from the Start→ Programs→ MIL Tool Kit menu. The first screen you will see is shown in Figure 1. Click on the **Start** button to begin the program.

## **The Main Input Screen**

Before any calculations can be made, the program needs some general information about your field and irrigation system. This information can be entered on the screen shown in Figure 2.

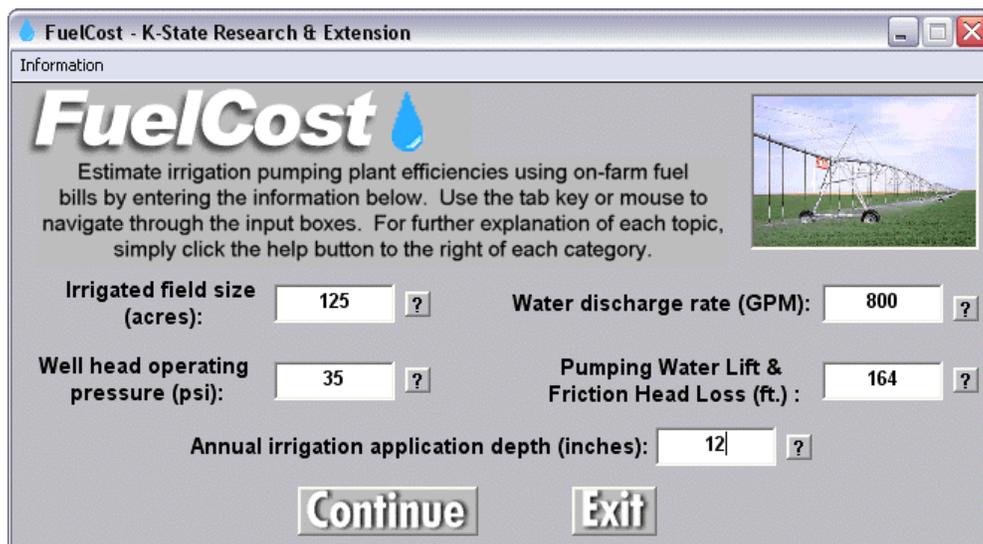


Figure 2 – General information must be entered on this screen before the program can perform the evaluations.

The five general inputs that need to be entered are irrigated field size (acres), water discharge rate (gpm), well head operating pressure (psi), pumping water lift and friction head loss (feet), and annual irrigation application depth (inches). Do not worry; if any of these entries sound confusing, there are help screens available by clicking on the question mark button just to the right of each input.

As an example, Figure 2 has values entered in the appropriate input boxes. The irrigated field size is 125 acres, water discharge rate is 800 gallons per minute, well head operating pressure is 35 psi, pumping water lift and friction head loss is 164 feet, and the annual irrigation application depth is 12 inches. As mentioned before, help is available for each input by clicking the question mark button just to the right of each input.

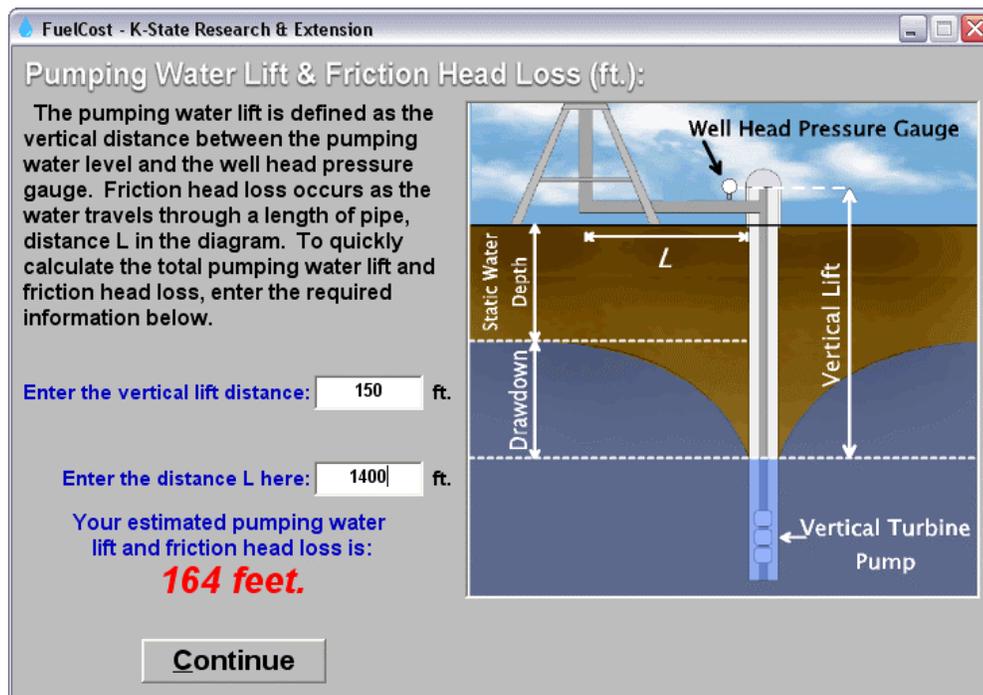


Figure 3 – The help screen for *Pumping Water Lift & Friction Head Loss*

As an example, Figure 3 shows the help screen for *Pumping Water Lift & Friction Head Loss*. To help you determine the value, you can enter the vertical lift distance and the horizontal length of pipe from the pump to the center irrigation system. To further clarify what is needed, the required distances are displayed in the graphic on the right side of the help screen. After entering the two inputs, the estimated pumping water lift and friction head loss is displayed in red numbers at the bottom of the screen. By clicking the **C**ontinue button, the value is automatically entered into the input box back on the main screen.

Once all of the input values are entered, click the **C**ontinue button to advance to the evaluation choice screen. The program is now ready to begin a variety of evaluations. Remember, the accuracy of FuelCost is only as good as your input estimates.



*Start listening to the FuelCost Audio Manual #2- OPTIONAL  
(audio available on MIL Tool Kit CD and website)*

## **Evaluate Current Pumping Costs**

The main use of FuelCost is to evaluate your current pumping costs. With information on your fuel type, fuel price, and total seasonal fuel cost, FuelCost will evaluate the efficiency of your system compared to an efficient system. To run this evaluation, click on the **Evaluate Current Pumping Costs** button, as seen in Figure 4.

To complete the evaluation, FuelCost needs to know your current fuel type, fuel price, and annual fuel costs. These values are entered into the screen shown in Figure 5. If you do not know your annual fuel costs, take a guess. For example, try \$4,120. This would be typical for a 125 acre field with a 12 inch seasonal depth.

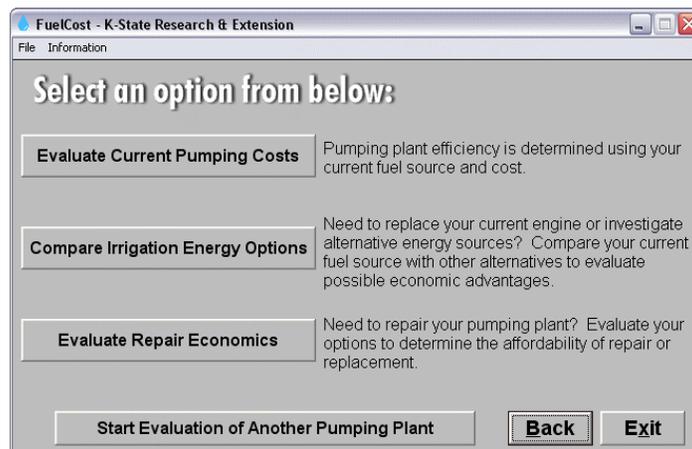


Figure 4 – This screen allows you to choose from several possible evaluations.

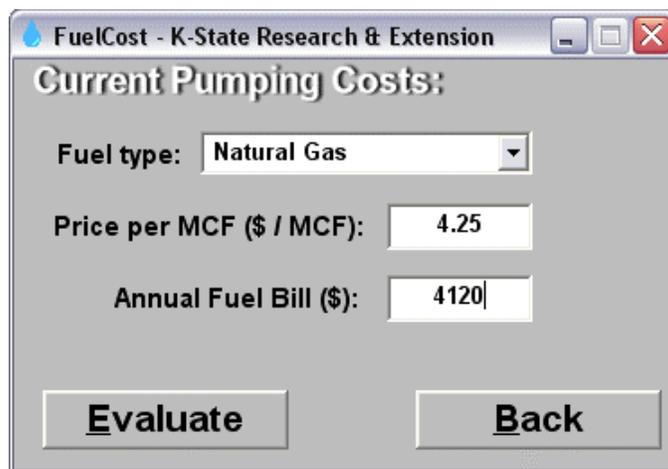


Figure 5 – Evaluate your current pumping costs by entering your fuel type, fuel price, and annual fuel bill.

After entering your fuel information, click the **Evaluate** button to complete the evaluation. The *Pumping Cost Evaluation Results* screen, shown in Figure 6, will then be displayed on your screen. The evaluation consists of the calculated brake horsepower requirement to pump the water, the projected seasonal pumping hours, projected hourly fuel use, a comparison of your actual fuel cost and the projected seasonal fuel cost, and a brief analysis of the evaluation. In our example, our seasonal fuel cost of \$4,120 is much larger than the projected seasonal fuel cost of \$2,875. In the analysis, it is stated that our pumping plant is operating at 70% of the Nebraska Performance Criteria. The Nebraska Performance Criteria is a standardized guideline for the performance of a properly designed and maintained pumping plant.

**FuelCost - K-State Research & Extension**

**Pumping Cost Evaluation Results:**

**Brake Horsepower (BHP) = 66 hp**  
\*Based upon a 75% pump efficiency

**Projected Seasonal Pumping Hours = 844 hours/year**

**Projected Hourly Fuel Use = 0.80 MCF/hr.**  
\*According to the Nebraska Performance Criteria for Pumping Plants (75% pump efficiency)

**Your Seasonal Fuel Cost = \$4,120 / year**      **\$343 / inch of water applied to field** or **\$2.75 / acre-inch**

**Projected Seasonal Fuel Cost = \$2,875 / year**      **\$240 / inch of water applied to field** or **\$1.92 / acre-inch**

**Excess Fuel Cost = \$1,245 / year**      **\$104 / inch of water applied to field** or **\$0.83 / acre-inch**

**\*This analysis estimates that the fuel use for your system is 0.35 MCF/hr. more than an efficient system. This pumping plant is operating at 70% of the Nebraska Performance Criteria.**

**\*Based on the information provided, the seasonal excess fuel cost is estimated to be \$1,245 per year.**

Print Report    **Continue Evaluations**    **Back**    **Exit**

Figure 6 – The Pumping Cost Evaluation Results window.

## **Printing a Report**

Once an evaluation is complete, you can print an evaluation summary for your records. To print a report of your evaluation, simply click the **Print Report** button at the bottom of your evaluation screen. Once you do this, you should see the screen in Figure 7.

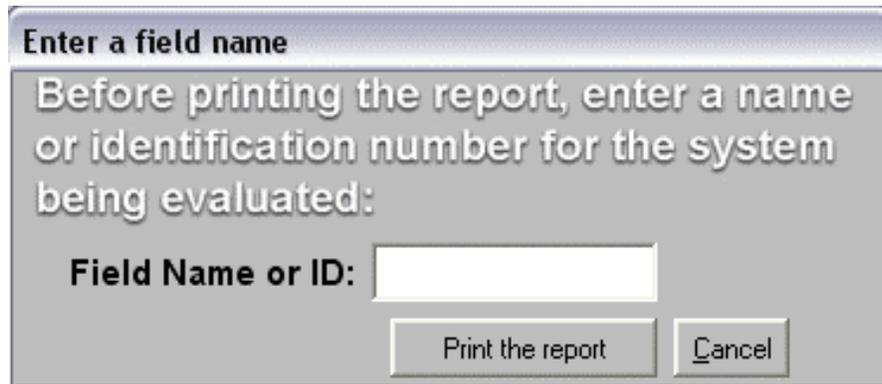
A screenshot of a software dialog box with a light gray background and a darker gray title bar. The title bar contains the text "Enter a field name". The main area of the dialog box contains the text "Before printing the report, enter a name or identification number for the system being evaluated:" in a large, bold, sans-serif font. Below this text is a label "Field Name or ID:" followed by a white rectangular text input field. At the bottom right of the dialog box are two buttons: "Print the report" and "Cancel".

Figure 7 – Before printing an evaluation report, enter a field name or ID.

The field name or ID that you enter on this screen will be used on your printed report for this system. A completed field evaluation report is shown in Figure 8.

## **Summary**

FuelCost is a tool to help provide general information regarding the performance of an irrigation pumping plant. Seek additional help from a well driller or other service provider if FuelCost indicates performance inefficiency to make certain the estimates used were valid.

# Pumping Cost Evaluation

**System Evaluated:** Demo Field  
**Date evaluated:** 8/16/2002  
**Irrigated Acreage:** 125 acres  
**Discharge Rate:** 800 GPM

**Water Lift:** 164 ft.  
**Application Depth:** 12 in.  
**Operating Pressure:** 35 psi  
**Fuel Type:** Natural Gas  
**Fuel Price:** \$4.25 /MCF



**Brake Horsepower (BHP) = 66 hp**

*\*Based upon a 75% pump efficiency*

**Projected Seasonal Pumping Hours = 844 hours/year**

**Projected Hourly Fuel Use = 0.80 MCF/hr.**

*\*According to the Nebraska Performance Criteria for Pumping Plants (75% pump efficiency)*

<b>Your Seasonal Fuel Cost =</b>	<b>\$4,120 / year</b>	<b>\$343 / inch of water or \$2.75 / acre-inch applied to field</b>
<b>Projected Seasonal Fuel Cost =</b>	<b>\$2,875 / year</b>	<b>\$240 / inch of water or \$1.92 / acre-inch applied to field</b>
<b>Excess Fuel Cost =</b>	<b>\$1,245 / year</b>	<b>\$104 / inch of water or \$0.83 / acre-inch applied to field</b>
<b>Excess Fuel Use =</b>	<b>0.35 MCF/hr.</b>	

This pumping plant is operating at 70% of the Nebraska Performance Criteria. Performance evaluations indicate that, on average, irrigation pumping plants in Kansas use about 40% more fuel than necessary if a properly sized, adjusted, and maintained pumping plant were used. Obviously, some are much worse and others are much better. Causes of excessive fuel use include:

1. Poor pump selection
2. Pumps out of adjustment
3. Worn-out pumps
4. Improperly sized engines or motors
5. Engines in need of maintenance and/or repair
6. Improperly matched gear heads

Irrigation pumping energy requirements can be estimated using the Nebraska Performance Criteria. The Nebraska criteria is a guideline for the performance of a properly designed and maintained pumping plant. Some pumping plants will exceed this criteria, but most will not.

**Danny H. Rogers, P.E., Ph.D.**  
 Extension Irrigation Engineer  
 Department of Biological & Agricultural Engineering  
 237 Seaton Hall  
 Manhattan, KS 66506  
 Phone: 785-532-5813  
 Fax: 785-532-6944  
 E-mail: drogers@bae.ksu.edu

**Mahbub Alam, Ph.D.**  
 Extension Irrigation Specialist  
 Southwest Research Extension Center  
 4500 E. Mary Street  
 Garden City, KS 67846  
 Phone: 620-275-9164  
 Fax: 620-276-6028  
 E-mail: malam@oznet.ksu.edu



**Mobile Irrigation Lab**

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Figure 8 – An example of the Pumping Cost Evaluation printout