UNIVERSITY OF ARKANSAS
DIVISION OF AGRICULTURE

Calculating and Comparing Irrigation Pumping Costs User Guide

Introduction

Determining cost effective energy sources for irrigation pumping needs is a management practice that can reduce costs and save energy. Utilizing this spreadsheet can help the user determine the cost per acre for inputs of various fuels and pumps, allowing the user to select the cost effective pumping solution for their individual needs. Six (6) types of irrigation pumping solutions are compared in this spreadsheet: (Diesel (cells B8:B17), Electrical, Vertical Line Shaft (cells E8:E17), Electrical, Submersible Pump (cells H8:H17), Natural Gas (cells B21:B30), Liquid Petroleum (cells E21:E30), and Gasoline (cells H21:H30).

Inputs

The user must input six (6) unknowns for each energy source to be compared. Head, the pressure exerted by a fluid (based on height the water is lifted and discharge pressure), should be put in cells B8, E8, H8, B21, E21, and H21 in ft format.

Price of the energy source should be put in cells B9, E9, H9, B22, E22, and H22. The energy source price for diesel, liquid petroleum, and gasoline is in $/gallon (cells B9, E22, and H22); for both electrical pumps is $/KWH (cells E9 and H9); and for natural gas is $/ccf (cell B22).

The power output of the energy course should be put in cells B10, E10, H10, B23, E23, and H23. The power output for diesel, liquid petroleum, and gasoline is in hp-hr/gallon (cells B10, E23, and H23); for both electrical pumps is hp-hr/KWH (cells E10 and H10); and for natural gas is hp-hr/ccf (cell B23).

Pump efficiency is located in cells B11, E11, H11, B24, E24, and H24, and gear head efficiency is located in cells B12, E12, H12, B25, E25, and H25. Routine Maintenance is located in cells B15, E15, H15, B28, E28, and H28. Each of these is in percentage format.

Guidelines for acceptable and appropriate values for each of these inputs are accessible by selecting the cell. A pop-up tab will give additional information for each cell.

If the user does not know the head, he/she may input the height the water is lifted into cell J12 in feet and the discharge pressure into cell J15 in psi. The head will be calculated into cell J18.

In order to calculate pumping cost per acre, the user must input the inches of water pumped per acre into cell J26.

Intermediate Values

Energy costs and operated costs are calculated and put in the following cells: Diesel (cells B13, B14 and B16, B17), Electrical, Vertical Line Shaft (cells E13, E14 and E16, E17), Electrical, Submersible Pump (cells H13, H14 and H16, H17), Natural Gas (cells B26, B27 and B29, B30), Liquid Petroleum (cells E26, E27 and E29, E30), and Gasoline (cells H26, H27 and H29, H30). The values in cells B,E, and H 13 and B, E, and H 26 are energy costs in $/ac-in; and the values in cells B,E, and H 14 and B, E, and H 27 are energy costs in

$/ac-ft. The values in cells B,E, and H 16 and B, E, and H 29 are operating costs in $/ac-in; and the values in cells B,E, and H 17 and B, E, and H 30 are operating costs in $/ac-ft.

Final Table of Cost per Acre

Calculations for the cost per acre (for a user-given number of inches pumped per acre) are found in cells J28:L35. Column J is the type of energy source (J30:J35), column K gives the energy cost for the energy source (K30:K35), and column L gives the operating cost for the energy source (L30:35).

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