Propane Irrigation

Clean, efficient energy for water pumping

Modern, engine-driven irrigation systems water crops at essential times to ensure a productive harvest. The cost of energy required to power irrigation engines is significant: in 2003, growers spent approximately $1.55 billion on energy for irrigation.* Because the price of gasoline and diesel fuel has risen substantially in recent years, growers are exploring alternative fuels and taking steps to upgrade the overall efficiency of these systems.

Today's propane-fueled engines offer growers a viable, cost-effective way to power irrigation systems. Advances in engine technology have increased the efficiency and reliability of propane irrigation engines in recent years, giving growers greater value for their irrigation dollar. Propane engines can also help growers reduce irrigation systems' maintenance costs. As an EPA-recognized clean fuel, propane does not leave significant lead, varnish, or carbon deposits on the engine, which means it reduces maintenance costs by preventing premature wear of pistons, rings, valves, and spark plugs. Compared with diesel engines, propane engines also require less oil and use lower-priced replacement air filters.

Seasonal price patterns make propane a more cost-effective choice for summer irrigation, and its extended storage capability makes it more convenient for seasonal use. Precise information about the cost of operating irrigation engines has not been readily available to growers looking to make cost-effective choices.

Project Description

To fill this need and quantify propane's advantages in irrigation applications, the Propane Education & Research Council (PERC) sponsored *Economic Analysis and Demonstration of Propane Irrigation Engines* (**Docket 12049**) and *Economic Analysis and Demonstration of Propane Irrigation Engines – Phase 2* (**Docket 12296**). In partnership with the University of Nebraska, Lincoln, PERC launched these projects to provide the testing and demonstration needed to compare the performance and cost-effectiveness of various fuels. The projects had the following objectives:

- Test common irrigation engine platforms at various performance levels.
- Record and publish updated power and fuel consumption data to allow for comparison of propane with other fuels.
- Place three engines for field demonstration and long-term collection of fuel consumption and maintenance cost data.

Irrigation system in Nebraska field test.

Compare Propane with Other Fuel Sources

To help farmers find the most economical option for fueling their irrigation systems, PERC has developed an online energy calculator called the Agriculture Cost Estimator, available at www.agweb.com/propane_calc.aspx

The online Agriculture Cost Estimator is simple to use. Follow these steps:

1. Plug in the pumping rate and total dynamic head figures for your irrigation systems.
2. Enter the amount you're currently spending on diesel or gasoline.
3. Enter the current rate for propane in your area.
4. Click "Calculate."

Instantly, you'll see the pumping cost per hour to power your irrigation systems on these fuels.

To order the Agricultural Cost Estimator in a printed format, call PERC at (866) 905-1075 and request item 001020.

* USDA, Table 20, 2003 *Farm and Ranch Irrigation Survey* (November 2003), http://www.agcensus.usda.gov/Publications/2002/FRIS/tables/fris03_20.pdf, Nov. 17, 2008.

The Benefits of Propane in Irrigation

Propane offers many benefits as a fuel source for irrigation.

- **Clean burning** — Provides the same amount of power to pump water, with lower emissions.
- **Low maintenance** — Lower potential maintenance costs than diesel.
- **Cost effective** — Propane engines can be less expensive than diesel, and fuel costs are competitive, especially in summer.
- **Storable** — Will not break down when stored for extended periods.
- **Nontoxic and insoluble in water** — Protects soil, aquifers, and surface water; no fuel containment issues.
- **Portable** — Tanks can be placed and serviced wherever power is needed.
- **Reliable** — Can irrigate at any time; not subject to interruptions in grid power.

Project Implementation

Propane irrigation engines were tested and compared with engines powered by diesel in both lab and field demonstration settings. The engines compared included the GM 8.1 liter and the Ford 6.8 liter V-10. These are two common engine platforms used in many irrigation pumps in the upper Midwest.

Engine performance was measured in these categories:

- Engine RPM.
- Power output.
- Torque.
- Fuel consumption.
- Oil and water temperature.
- Intake vacuum.

Project Status: In Progress

Results gathered from the engine tests indicate that, for a given irrigation engine, propane provides a cost-effective alternative to other fuels. Considering initial cost savings and potential fuel savings, propane irrigation may lower growers' operating and capital costs. For example:

- The fuel economies of both the GM 8.1 liter and the Ford 6.8 liter are competitive with diesel engines.
- Systems powered by both the GM 8.1 liter and the Ford 6.8 liter exceeded the Nebraska pumping plant criteria.
- Between 1.5 and 1.6 gallons of propane can deliver the same horsepower output as one gallon of diesel fuel.
- A calculated propane energy cost for water pumping for an entire season was 22 percent lower than diesel cost. Diesel cost $22.40 per hour, while propane cost $17.45 per hour.

Next Steps

PERC's Agriculture Advisory Committee plans to continue supporting these efforts through education, demonstrations, and promotion. The University of Nebraska, Lincoln will continue field-testing the GM 8.1 liter V-8 and the Ford 6.8 liter V-10 engines to:

- Measure power output from engines installed on irrigation wells.
- Monitor fuel consumption.
- Conduct pumping plant tests to separate overall performance into pump efficiency and engine output components.
- Use collected data to expand the Nebraska pumping plant standard for generations of engines found in operation.
- Illustrate benefits of updated engines and improved pumping plant efficiency.

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