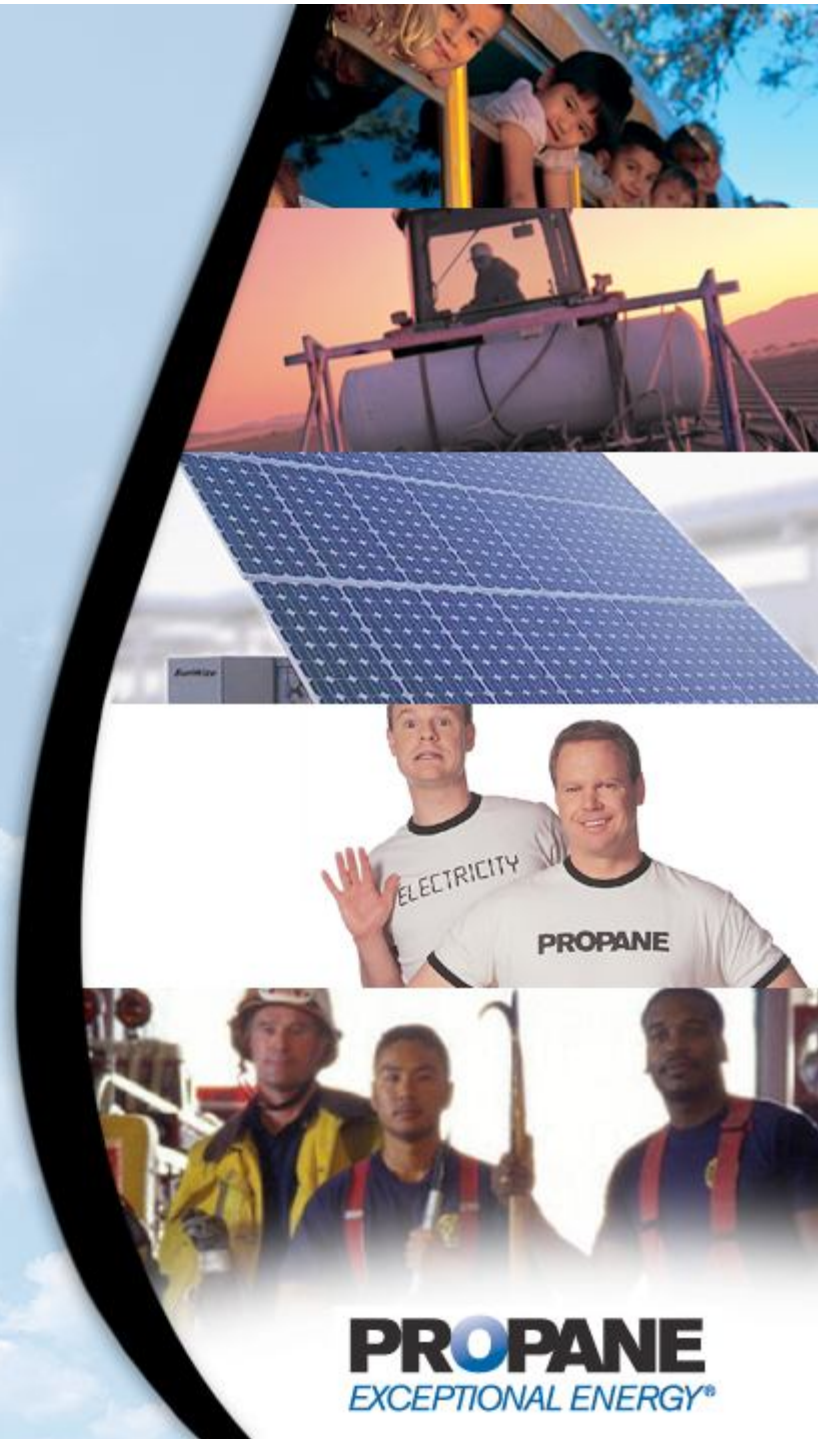


# Propane Education & Research Council (PERC)

John Emmitte  
PERC Strategic Consultant

6<sup>th</sup> Heat Treatment Workshop  
May 14, 2009



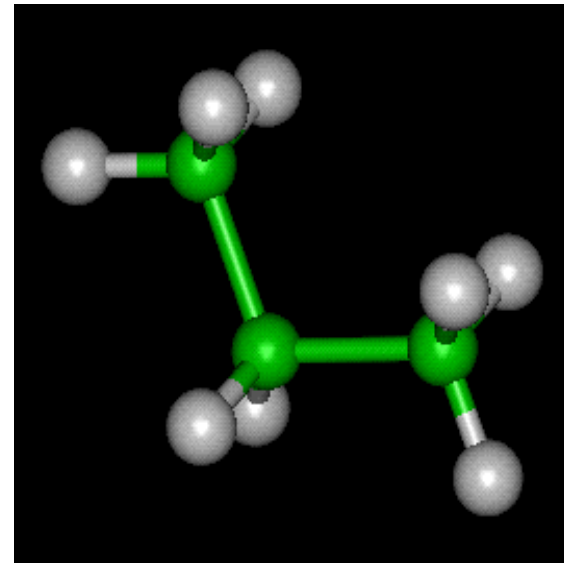
## What is Propane?

### Ask Hank Hill...



## What is Propane?

- Propane is a hydrocarbon (C<sub>3</sub>H<sub>8</sub>) sometimes referred to as liquefied petroleum gas, LP-gas or LPG
- Propane is produced from both natural gas processing and crude oil refining



## What is Propane? (continued)

- Propane is nontoxic, colorless and virtually odorless.
- As with all natural gases, an identifying odor is added so the gas can be readily detected.



# Propane Education & Research Council

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- Propane is easy to transport and can be used in areas beyond the natural gas mains.
- Because it is 270 times more compact as a liquid than as a gas, it is economical to store and transport as a liquid.



- **>14 million U.S. families use propane to fuel their furnaces, water heaters, outdoor grills, fireplaces, dryers & range tops**
- **Used on more than 660,000 farms for crop/grain drying, space and water heating, standby generators, & other farm equipment**



## Propane and the Environment

- One of the cleanest burning of all fossil fuels
- A clean fuel listed in the 1990 Clean Air Act as well as the National Energy Policy Act
- If spilled, propane vaporizes and dissipates rapidly (thus does not contaminate soil or groundwater)



## What is the Council (PERC)?

- **Propane Education and Research Act (PERA)** signed October 11, 1996 (Public Law 104-284)
- PERA authorized the creation of the Council; then propane producers and marketers in a referendum voted overwhelmingly to approve its formation



## Who is the Council?

- **PERC is governed by a 21-member board appointed by:**
  - National Propane Gas Association
  - Gas Processors Association

(Both associations appoint nine Council members and cooperate in the appointment of three public members)

## PERC Mission

- “Promote the safe, efficient use of odorized propane gas as a preferred energy resource through consumer & employee education and technology development and commercialization.”



## Funding

- PERC receives funding by an assessment, or “check-off”, on each gallon of odorized propane gas.
- The assessment collects ½ of one penny per gallon and is projected to collect \$46 million in 2009 to fund programs and projects.



# Examples of Check-Off Programs

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## Agriculture Commitment

- No less than 5% of assessment collections shall be used for programs and projects intended to benefit the U.S. agriculture industry. The Council shall coordinate these activities with the U.S. agriculture industry



# Why Propane?

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**Due to a unique combination of benefits, propane is well suited for use in a variety of applications in the home and on the farm:**

- **Clean-burning**
- **Portable**
- **Suitable for long term storage**
- **Non-toxic, won't contaminate soil or water**
- **Produced domestically, primarily from natural gas**

# Areas of Focus

- Production (Crops/Livestock)
- Processing/Harvesting
- Power Applications
- Nutrient/Waste Management
- Infrastructure Improvements
- Education & Safety
- Traditional & Non Traditional
- Energy Efficiency

## Propane Agriculture Roadmap Supplement Summary



### PROPANE Agricultural Technologies

Almost 80 percent of farms in the U. S. use propane, largely due to its inherent environmental and economic benefits. The propane industry, through the Propane Education & Research Council (PERC), devotes at least five percent of its total budget toward programs and projects that benefit the U.S. agriculture industry.

The Agriculture Advisory Committee oversees PERC's efforts and actively seeks innovative solutions to help farmers increase productivity and decrease operating costs.

Published in 2002, the Propane Agriculture Roadmap outlined the propane industry's strategic approach for building long-term demand for propane in the agricultural sector. To that end, the industry has instituted agriculture programs to offer exceptional value and gain recognition from the agriculture industry as a preferred energy source.

To continue and enhance these efforts, PERC led the development of the 2006 Agriculture Roadmap Supplement. Based on lessons learned and prior accomplishments, the supplement serves as a resource for the propane industry as they strive to address agricultural challenges while growing the market for propane.

### VISION OF PROPANE IN AGRICULTURE

By 2010, the agriculture industry will recognize propane as a preferred energy source offering exceptional value through product benefits such as cost-effectiveness, efficiency and productivity, reliability, portability, and environmental friendliness.

To achieve this vision, the propane industry has identified eight priority areas that, if pursued, could strengthen propane's position as the fuel of choice for farms. These priorities fall into the following two categories:

1. Application-Specific Activities develop technologies, equipment, and practices to meet particular farming needs through the use of propane.
2. Enabling Activities lay the ground work to encourage rapid progress in the adoption and development of new and existing propane-use applications.

### ROADMAP SUPPLEMENT PRIORITY ACTIVITIES

Developed by a diverse group of propane and agricultural leaders, the activities with the brightest future for the agriculture industry are described briefly below:

#### Top Application-Specific Activities

- Thermal Agriculture: Develop soil sanitation technologies
- Crop/Food Conditioning: Develop structure fumigation technologies
- Power: Find partners for engine development and certification
- Nutrient Management: Develop incineration technologies; Convert agriculture waste to value-added products



#### Top Enabling Activities

- Technology R&D: Enhance propane refueling mechanisms
- Communications: Improve R&D communications with technology partnerships
- Data Collection and Benchmarking: Identify emissions credit trading mechanisms; Analyze research and communicate and archive results
- Strategic Partnerships: Encourage incentives for technology replacement



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[www.agpropane.com](http://www.agpropane.com)

November 2006

# Sample Projects

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# Steam Weed Control - Conservation Innovation Grant



Lincoln, CA - USDA/NRCS  
Steam weeder and propane irrigation system  
Continued USDA interest





Technology Fact Sheet

## Propane Industry and California High School Partner in Conservation Project

Teaching students and farmers about environmentally friendly alternatives to weed control and power generation is important. So the Propane Education & Research Council (PERC), in conjunction with the U.S. Department of Agriculture Natural Resources Conservation Service, partnered with Western Placer Unified School District (LHS) in Lincoln, CA, to provide equipment and support to the LHS farm, a 280-acre facility in Northern California (**Docket 11732**).

A Batchen Stinger, a propane-powered steam weed-control machine, was provided to the school. Students have worked with the Stinger since spring 2008, gaining valuable experience with this emerging technology that benefits growers, the community, and the environment. The students have been keeping records of their trials, logging drive speeds, weather conditions, weed maturities, and weed kill rates to track the impact and effectiveness of the machine.

PERC also placed a new clean-burning propane engine with an intelligent remote moisture management system for the operation. Testing on the system began in spring 2007. Students will record run-time data on the irrigation pump engine's hours operated, gallons pumped, and fuel consumed. They will also be able to calculate emissions reductions of the propane-fueled irrigation engine in comparison to diesel and gasoline.

In addition, area farmers have been using the Stinger. A diverse mix of local growers are interested in learning how the Stinger can be used in their fruit and vegetable operations. A growing number of traditional farmers are also interested in the technology because the Stinger represents a cost-effective way to reduce some of the chemical volume used on their farms.

**Project Equipment & Benefits**

**Batchen Stinger**  
The Batchen Stinger, an innovative, thermal weed control machine, uses a generator to convert combusting propane fuel and water into, high-velocity, 800-degree (F) steam.

- Reduced risk of run-off from chemical herbicides
- Reduced risk of chemical exposure for students and workers
- Immediate re-entry into fields prevents harvest delays
- Compliant with USDA national organic program

**Irrigation Pump System**  
A 3.0L, CARB-certified, propane engine and a customized, mobile, low-lift centrifugal pump, allows LHS students to irrigate from any point in the canal.

- Reduced generation of CO<sub>2</sub>
- Reduced generation of particulate matter

**Moisture Management System**  
The radio-based moisture sensor solution from IRRometer (www.rrometer.com) transmits data to a classroom receiver where the students can collect and evaluate data.

- Precise control of water
- New learning opportunities

**Storage Building**  
To properly house the Batchen Stinger and mobile engine/pump system, PERC made arrangements with a local supplier to install a 20' by 20' storage shed.

- Security
- Protection of equipment



Batchen Stinger Steam Weed Control Machine

For more information on this and other research products, go to [www.usepropane.org/rd](http://www.usepropane.org/rd).



# Combined Heat and Power

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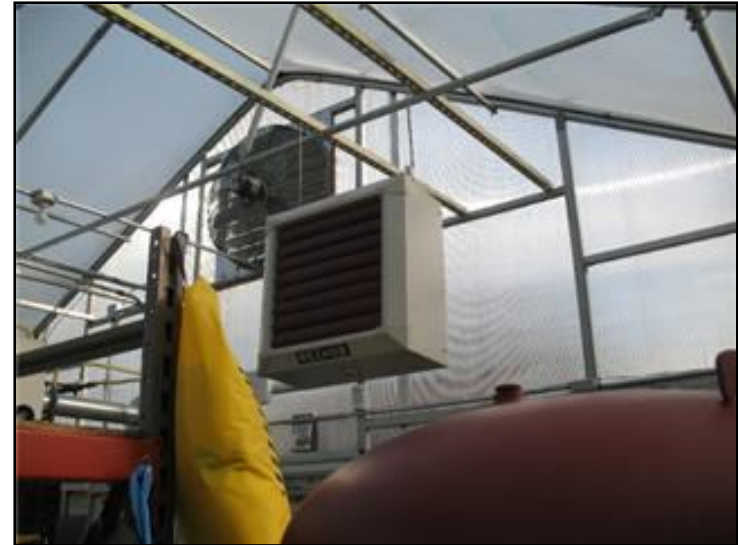
- Demonstration of a propane-fired 5 kWe / 14 kWth “microCHP” system
- Small greenhouse (lettuce) 25 miles south of Pittsburgh
- Project demonstrates 2 benefits: viable return on investment through avoided life-cycle energy costs; and enhanced air quality



# Combined Heat and Power

**PROPANE**  
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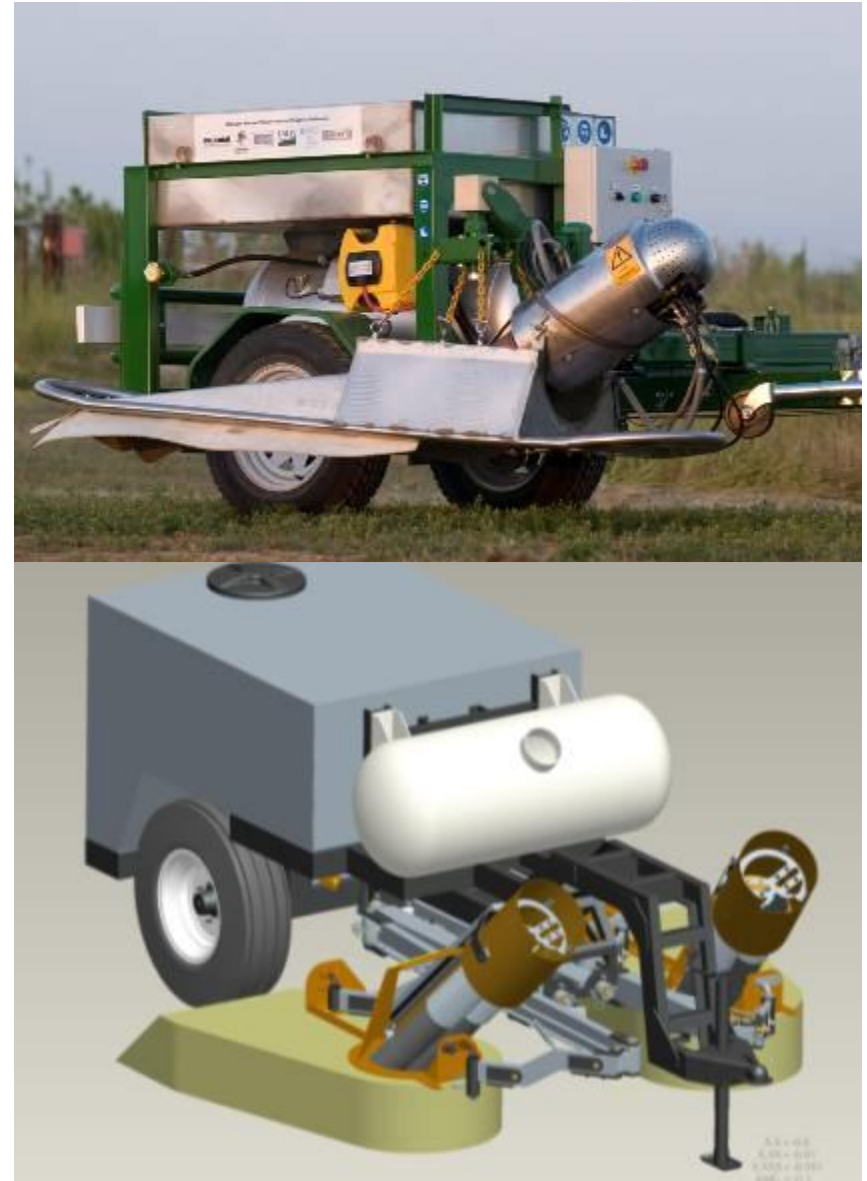
- The microCHP system produces electricity and heat with single fuel
- Hot water is generated by the waste heat of the propane engine and then circulated thru buffer tank to a hydronic fan coil unit during cool weather months



# Steam Weed Control

**PROPANE**  
EXCEPTIONAL ENERGY<sup>®</sup>

- **Batchen - Australia**
- **Testing and demonstrations conducted in 2006-07**
- **U.S. producers are showing interest in the concept and the technology**
- **A larger capacity unit is being designed for the U.S. market**



# Flame Weed Control

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## University of Nebraska

- 1.7 million certified organic crop acres in U.S.
- Testing variables such as travel speed, weed species, maturity, crop injury and yield.
- Parallel project with engineering to study improvements to equipment



# Flame Weed Control

**PROPANE**  
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## 2007-08 results

- **Common broadleaf weeds can be controlled with ~7 gallons per acre (GPA)**
- **Grass weeds require 6 to 20 GPA.**
- **Flame treatment early in the season provides 5-6 weeks of weed control before re-growth occurs**
- **USDA/NRCS CIG Grant to expand field evaluations**



# Soil Sanitation

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## Gas Technology Institute (GTI)

- Methyl Bromide Alternative
- Steam or Aerated Steam Shows Most Promise
- Results verified in GTI laboratory
- Field evaluation 2008-09 in conjunction with UC Davis, through USDA grant



# Soil Nematode Control

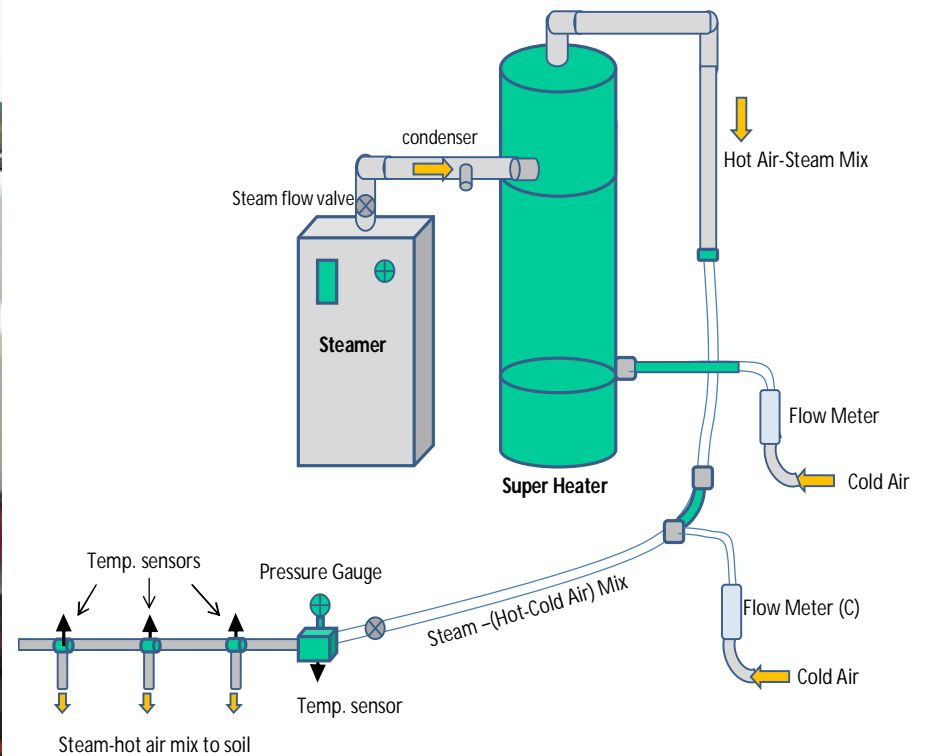
## Superheated Steam Controls Nematode Population

- Nematodes are harmful to plant roots and crop yield/quality
- Evaluating field delivery systems to identify best delivery method and determine treatment cost





# Steam Delivery Experiments



# Heat Sanitation

**PROPANE**  
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## TEMP-AIR “Thermal Remediation” (MN)

- Thermal (Pest) Remediation in grain and other ag structures
- Kansas State and Purdue University testing the use of hot air to control



# Heat Sanitation

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- **Purdue Results**
  - Insect mortality at all life cycles is achieved at 55C (131F) for 3 hours, on red flour beetle and maize weevil
  - Mold also reduced
- **Kansas State testing ongoing**
  - USDA Methyl Bromide Transition Grant



# Reducing Tick Populations

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## Connecticut Ag Experiment Station

- Torches control invasive Barberry
- No soil disturbance
- No chemical residue
- Reduction of mice/tick populations expected

# Orchard Heating Evaluation

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Study conducted to evaluate the heat and smoke released by:

- AgHeat propane heaters
- Shell casing propane heaters
- Diesel-burning smudge pot heaters



• 2.25 acre orchard heating installation included

- Burners placed every three trees in every other row
- Two 1,000-gallon propane tanks

Two propane vaporizers

- Underground piping, sub-main, and main propane distribution system
- Orchard fan

# Orchard Heating (NW U.S.)

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## Key Conclusions:

- **AgHeat propane heaters**
  - Provided the greatest temperature rise on less fuel
  - Produced the least smoke emissions
  - Diesel heaters produced 3-4 times more smoke than that of the propane heaters

# Irrigation Engine Field Evaluation



## University of Nebraska

- Published performance standard does not reflect improvements in engine technology
- Conducted laboratory and field tests of new propane engines



### COMPUTING THE COST OF PUMPING IRRIGATION WATER

By  
Dorel Martin  
Irrigation and Water Resource Engineer  
Regional Systems Engineering Department  
Lincoln, NE 68583-0129

The rising price of fuel has prompted many producers to focus on the cost of pumping irrigation water. This document provides a simple method to estimate the cost of pumping water and a means to compare the amount of energy used to what a well maintained and properly designed pumping plant would require. These results can help determine if it is feasible to repair the pumping plant or if an alternate energy source might be desirable. Additional information regarding the time required to repay costs for repairing the pumping plant and factors to analyze alternate energy sources is included in the references listed at the end of the article.

#### Background

The cost of pumping irrigation water for an acre of land (3 acres) is computed by:

$$\$/\text{Acre} = \left[ \frac{0.114 \times (\text{Lift} + 2.31 \times \text{Psi})}{K_p} \right] \times \left[ \frac{100}{P_e} \right] \times \left[ \frac{D_n}{E_a} \right] \times C_e \quad (1)$$

where:

- Lift = distance water is lifted from the groundwater aquifer or surface water source, feet
- Psi = discharge pressure at the pump, psi
- $K_p$  = energy conversion factor equal to the work produced per unit of energy consumed by a well designed and maintained pumping plant, water horsepower hours per unit of energy
- $P_e$  = performance rating of the pumping plant
- $D_n$  = net depth of irrigation water pumped, inches
- $E_a$  = application efficiency, %
- $C_e$  = cost per unit of energy, \$ / unit of energy

The amount of work that can be obtained from a unit of energy with a well designed and maintained pumping plant is represented by the energy conversion factors ( $K_p$ ) listed in Table 1.

Table 1. Energy conversion factors for a well designed and maintained pumping plant

Energy Source	Value of $K_p$	Units of $K_p$ Factor
Diesel	12.5	water horsepower hours / gallon
Gasoline	8.86	water horsepower hours / gallon
Propane	6.89	water horsepower hours / gallon
Natural Gas	61.7	water horsepower hours / 1000 ft <sup>3</sup>
Electricity	0.887	water horsepower hours / kilowatt hour

#### Lift

The pumping lift depends on the location of the water source relative to the elevation of the pump discharge. For groundwater the lift depends on the distance from the pump base to the water level when not pumping (called the



Extension is a Division of the Institute of Agriculture and Natural Resources at the University of Nebraska-Lincoln cooperating with the Counties and the United States Department of Agriculture

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# Propane Engine Evaluation

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## Irrigation in Agriculture

- New engines beat standard
- Economics favors propane over diesel
- ~1.6 gallons of propane will replace 1 gallon of diesel
- Lower operating cost at "typical" diesel vs. propane summer pricing





# Propane Tankless Water Heaters

**PROPANE**  
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- Dairy field test in TN to evaluate:

- durability
- performance
- energy savings



- Less subject to corrosion with lifespan of 20+ years
- Reduce standby energy loss, saving 15-20 % over standard storage heaters

# Education - Training for Operators

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## Refueling Propane

- Equipment
- Propane properties
- Proper transfer procedures
- Safety and security

**PROPANE**  
education & research  
COUNCIL

Dispensing Propane Safely  
into Agricultural Equipment



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# More information

**PROPANE**  
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[www.agpropane.com](http://www.agpropane.com)

- Media room
- Find propane retailers
- Propane research
- Calculate costs
- Find equipment

The screenshot shows the homepage of the Propane Education & Research Council (PERC) website. The header features a blue sky background with the word "Trade" in the top right corner. Below the header is a yellow navigation bar with the text "SAFE - RELIABLE - ENVIRONMENTAL - GOOD VALUE". The main content area is titled "POWERING AMERICAN AGRICULTURE" and includes a paragraph stating that nearly 80% of farms in the United States use propane. Below this, there are four columns of research topics: Thermal Applications, Crop/Food Conditioning, Nutrient Management, and Power Generation. Each column has a small image and a brief description. On the right side, there are three boxes: "Media Room", "Find a Propane Retailer", and "Propane Equipment Partners". At the bottom, there are three large buttons: "PROPANE EXCEPTIONAL ENERGY ON THE FARM", "AGRICULTURE ROADMAP", and "AG PROPANE COST ESTIMATOR".

**Contact Info:**

**[www.propanecouncil.org](http://www.propanecouncil.org)**

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# Questions?

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