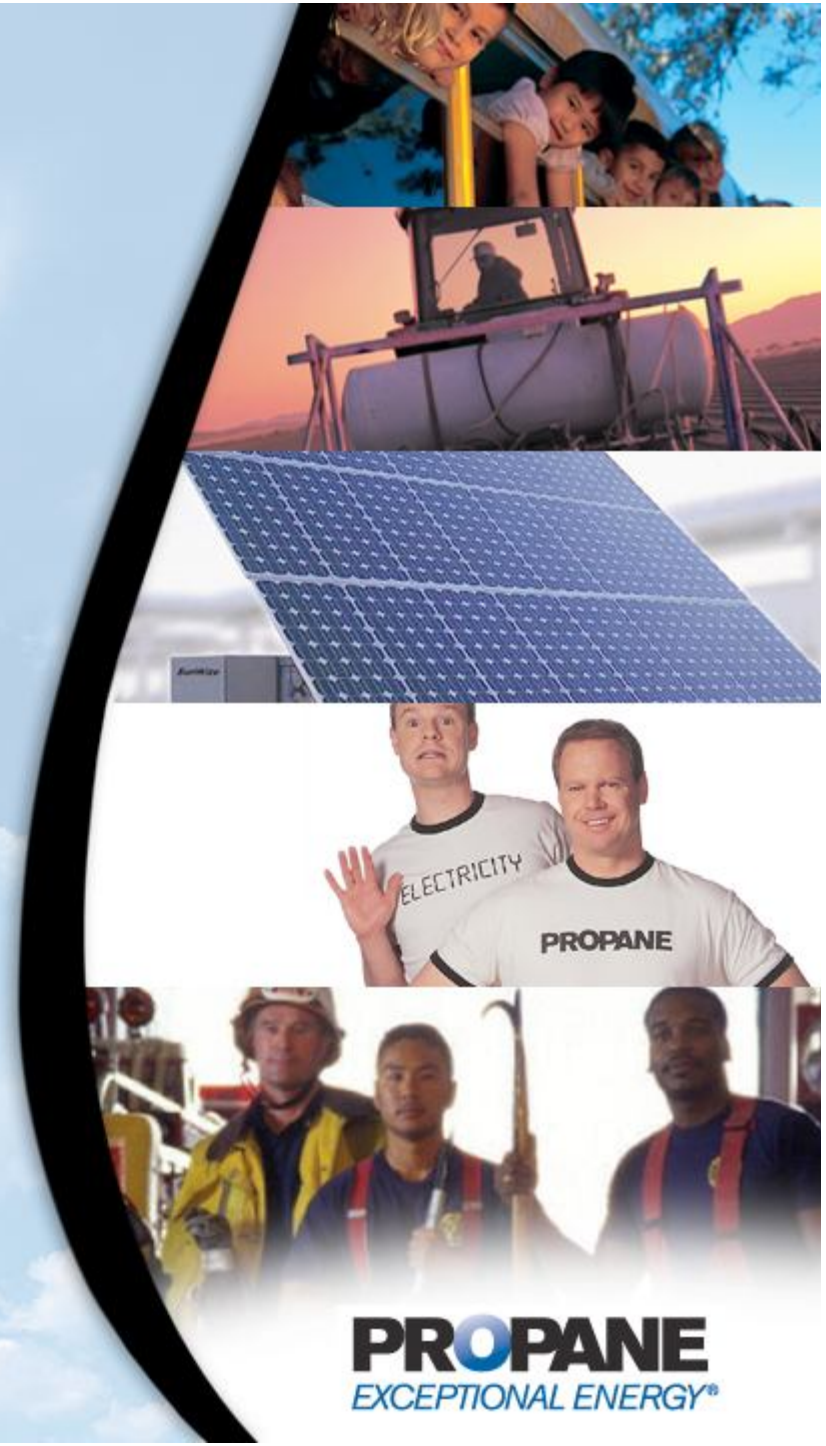
Propane Education & Research Council (PERC)

John Emmitte
PERC Strategic Consultant

6th Heat Treatment Workshop
May 14, 2009



What is Propane?

Ask Hank Hill…

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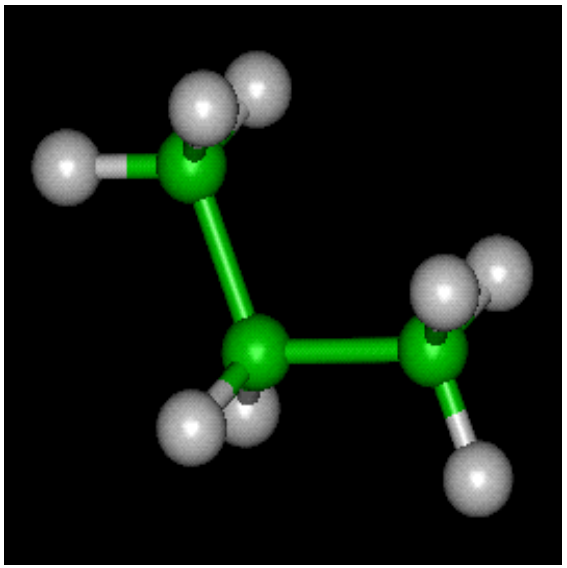
What is Propane?

- Propane is a hydrocarbon (C3H8) sometimes referred to as liquefied petroleum gas, LP-gas or LPG
- Propane is produced from both natural gas processing and crude oil refining



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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.

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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.**

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- **>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**

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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)

Propane Education & Research Council

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?

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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For more information visit:
www.agpropane.com

November 2006

Sample Projects

Steam Weed Control - Conservation Innovation Grant

Lincoln, CA - USDA/NRCS

Steam weeder and propane irrigation system

Continued USDA interest

Combined Heat and Power

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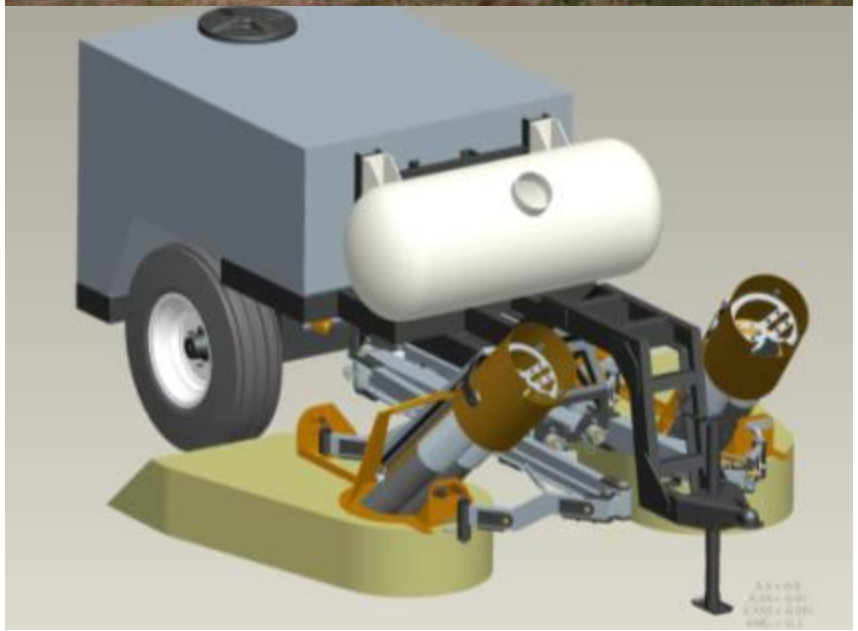
- **Demonstration of a propane-fired 5 kWe / 14 kWth "microCHP" system**
- **Small greenhouse (lettuce) 25 miles south of Pittsburgh**
- **Project demonstrates 2 benefits: viable return on investment through avoided life-cycle energy costs; and enhanced air quality**

Combined Heat and Power

- 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

- **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

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

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

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

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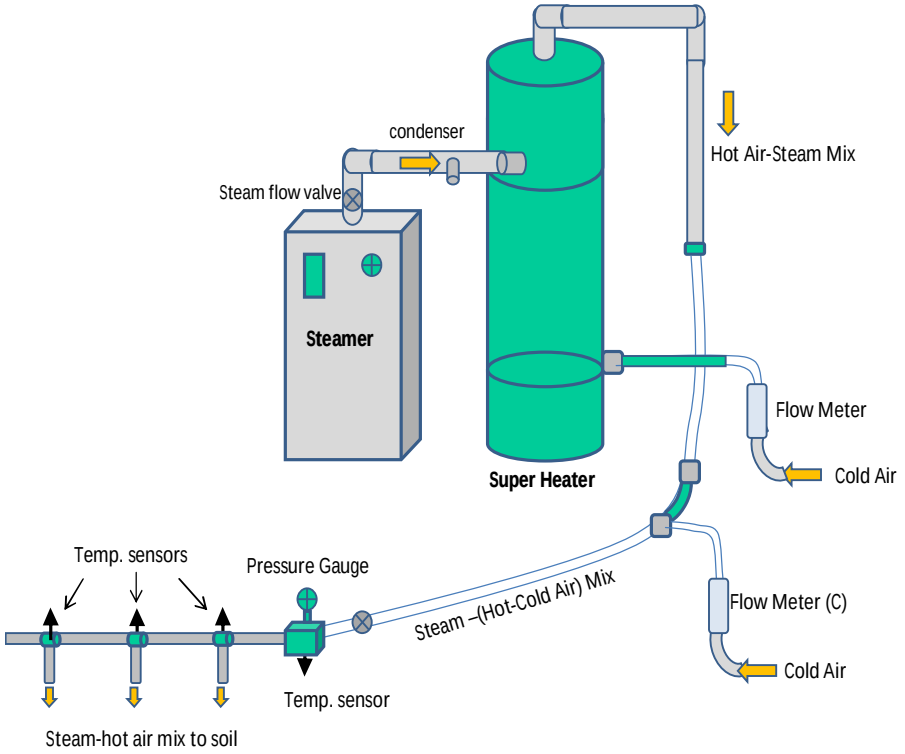
Superheated Steam Controls Nematode Population

- **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

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

- 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

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.)

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

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University of Nebraska

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

Nebraska EXTENSION

COMPUTING THE COST OF PUMPING IRRIGATION WATER

By
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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 ($/acre) is computed by:

$$\$/Acre = \left[\frac{0.114 \times (Lift + 2.31 \times Psi)}{E_f}\right] \times \left[\frac{100}{P_E}\right] \times \left[\frac{D_n}{E_a}\right] \times C_e \qquad (1)$$

where:

Lift = distance water is lifted from the groundwater aquifer or surface water source, feet
Psi = discharge pressure at the pump, psi
E_f = energy conversion factor equal to the work produced per unit of energy consumed by a well designed and managed 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 (E_f) listed in Table 1.

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

Energy Source	Value of E_f	Units of E_f 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 ft³
Electricity	0.885	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

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

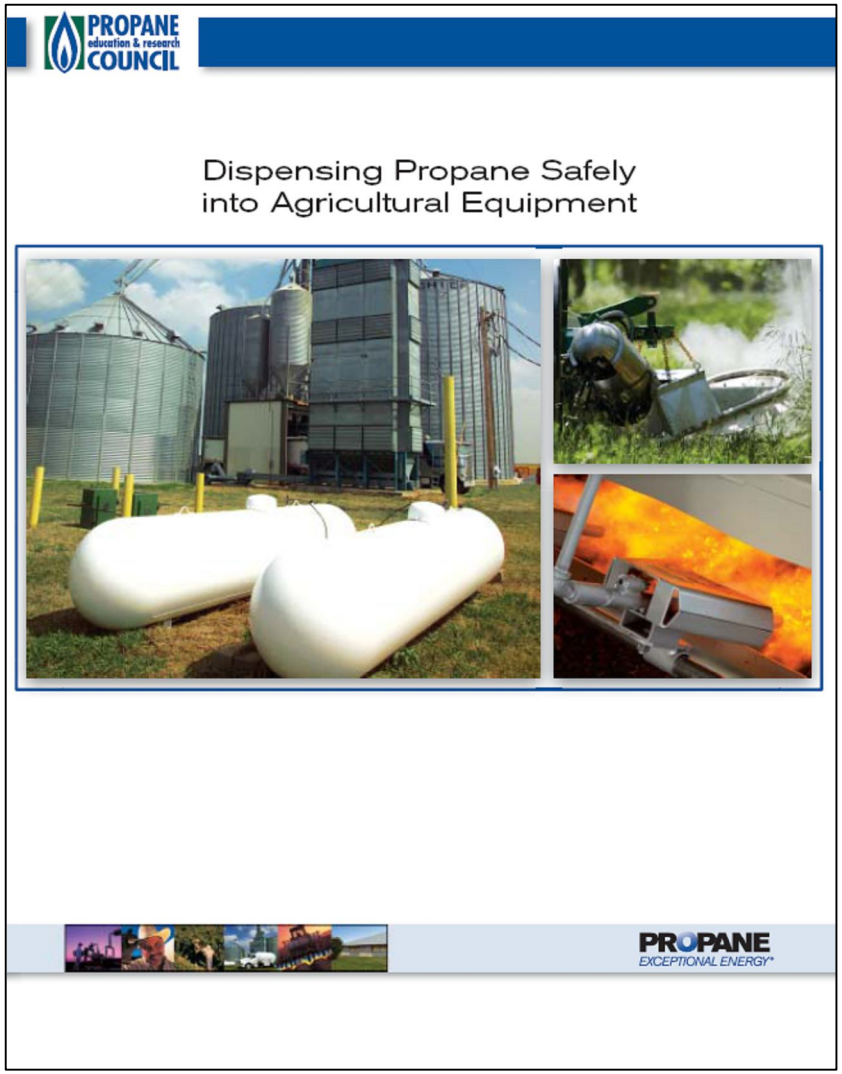
Propane Tankless Water Heaters

- 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

Refueling Propane

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



More information

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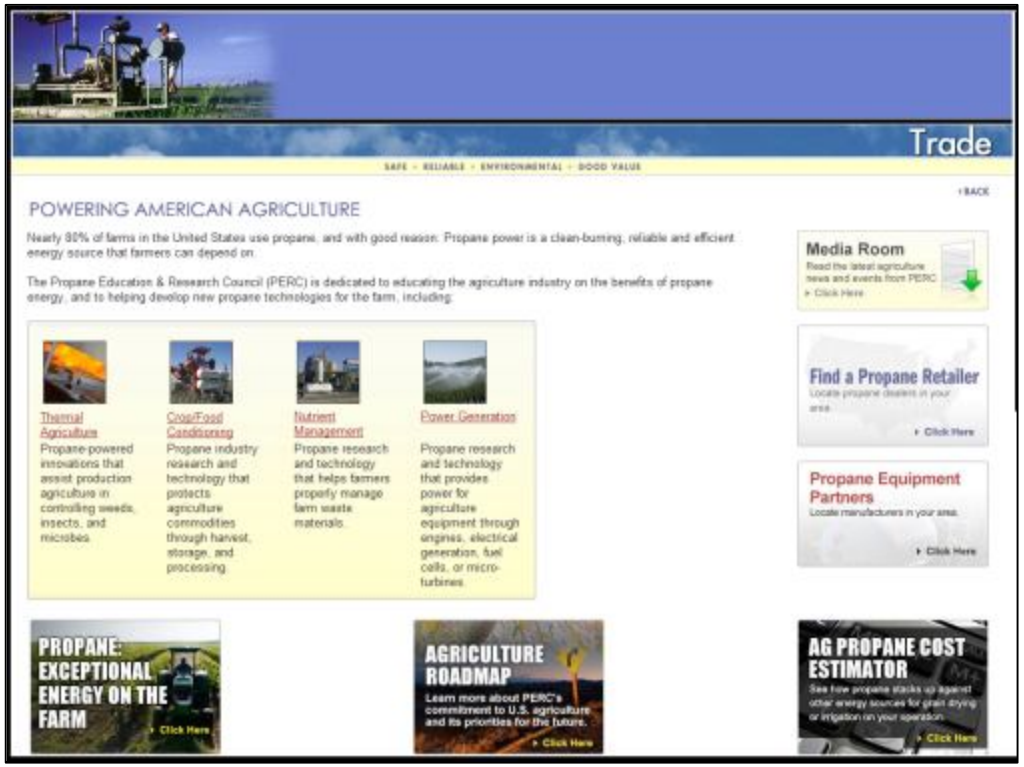
www.agpropane.com

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



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Questions?

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