Welcome to the Introduction to Ground Source Heat Pumps Workshop

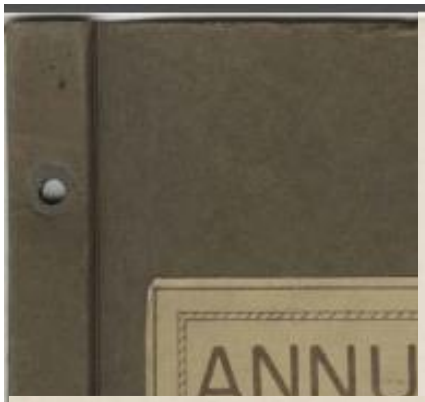
John Ignosh
Biological Systems Engineering
Virginia Cooperative Extension
Virginia Tech
Harrisonburg, VA

Virginia Cooperative Extension
A partnership of Virginia Tech and Virginia State University www.ext.vt.edu

Thank you to our host:

Holiday Lake 4-H Educational Center

Sources:
https://**holidaylake4h**.com/
http://en.wikipedia.org/wiki/Holiday_Lake_4-H_Educational_Center



b. 4-H Club Members

The specialist gave training to seven groups totaling 635 4-H club members and leaders during the year. Most of the training meetings were held at summer 4-H camps or at the state 4-H short course. Lectures, pictures, and handicraft work was given to train these leaders in planning farm wiring, proper lighting practices and the selection, care, and operation of electrical equipment for the farm and farm home. The leaders trained in this way promoted the 4-H rural electrification contest in 7 counties and thereby qualified a state winner who was awarded a free trip to the club congress in Chicago to compete for national honors.

The most successful and worthwhile 4-H leader training activity during the year was a course on wiring given to 15 leaders from 7 counties at Holiday Lake 4-H Camp. During a four-day training period, these leaders completely and satisfactorily wired the twenty buildings at the camp. They were given instruction in both planning the wiring system and making the installation. During the training period the boys prepared their own meals and lived at the camp. Their contribution of labor saved the club department a considerable sum in wiring the camp, and at the same time, provided adequate facilities for future leader training groups at this camp.

xtension Work, Agricultural Engineering
Division, V. P. I., Blacksburg, VA, pages

PROJECT NO. 10

DISCOVERY TOOLS

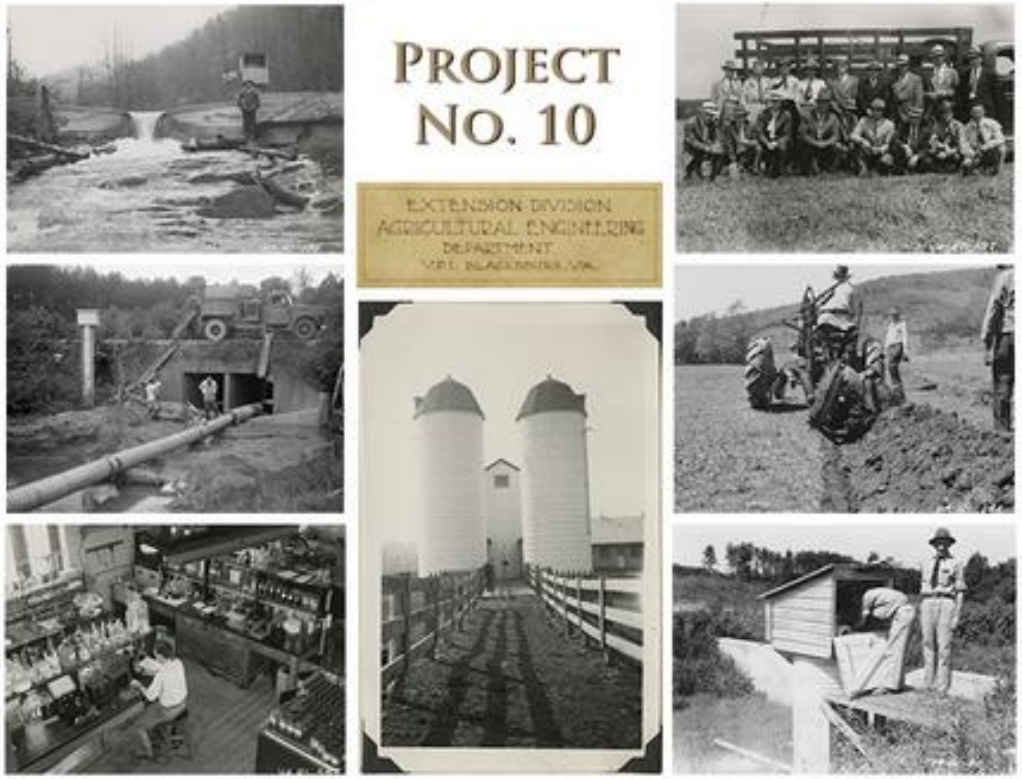
Simple Keyword Search
Advanced Keyword Search
Filtered Search
Activities by Location
Timeline of Activities
View All Titles (764)

AREAS OF WORK

Soil and Water Conservation
Household Engineering
Farm Operating Equipment
Rural Electrification
Rural Architecture
Other Initiatives

Department of Agricultural Engineering

Biological Systems Engineering



Photographs and documents representing the history of Agricultural Engineering and Cooperative Extension at Virginia Tech.

W. Cully Hession
Professor

Sources:
Project No. 10 Site:
https://dcr.emd.vt.edu/vital/access/manager/Repository/vatech:58513?exact=sm_electrification%3A%22Electricity_on_the_Farm%22

CENTER for WATERSHED STUDIES at VIRGINIA TECH
StREAM Lab
Virginia Agricultural Experiment Station
Virginia Cooperative Extension
Biological Systems Engineering

E-253 MAY, 1926

VIRGINIA POLYTECHNIC INSTITUTE

VIRGINIA AGRICULTURAL [redacted] EXTENSION DIVISION

The Use of Explosives on the Farm

By

CHAS. E. SEITZ, Agricultural Engineer

and

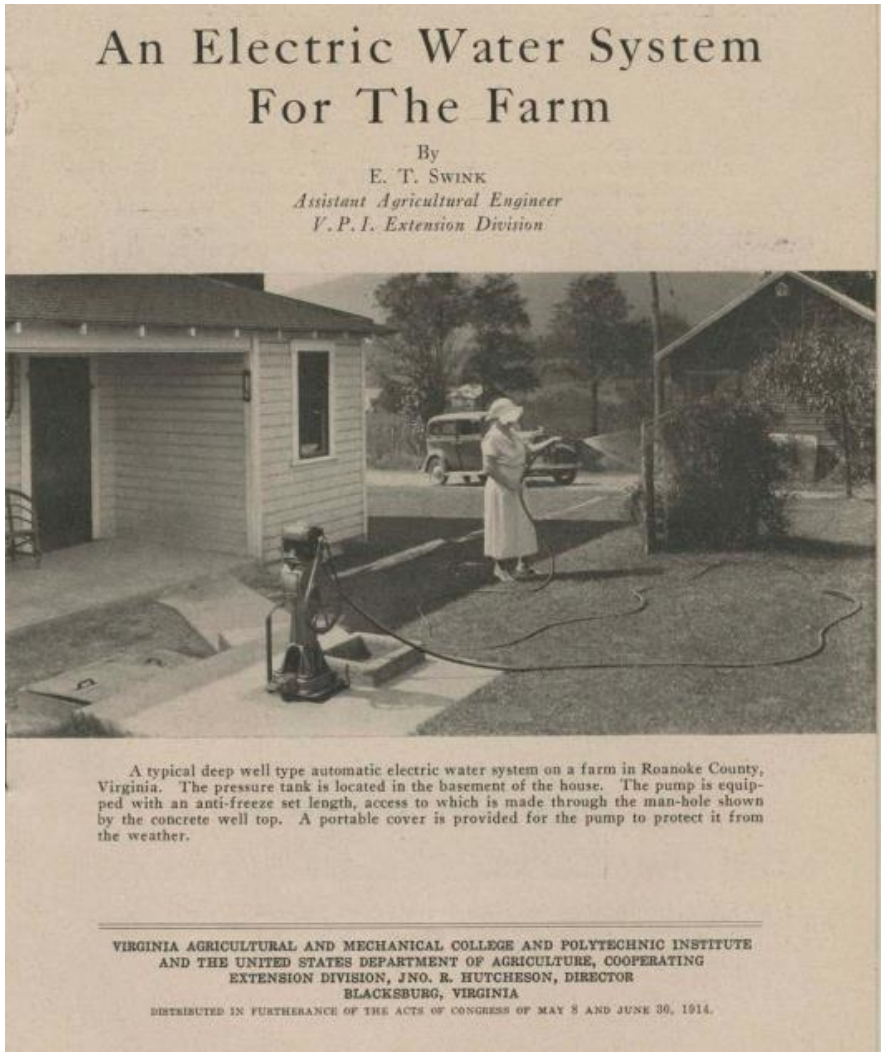
J. B. COLE, Assistant Agricultural Engineer

Virginia Agricultural and Mechanical College and Polytechnic Institute and the United States Department of Agriculture, co-operating.

Extension Division, Jno. R. Hutcheson, Director, Blacksburg, Virginia

Source:
Project No. 10 Site:
https://dcr.emd.vt.edu/vital/access/services/Download/vatech:58397/Project10_Resource?view=true

1940 – 2015 *75 years*

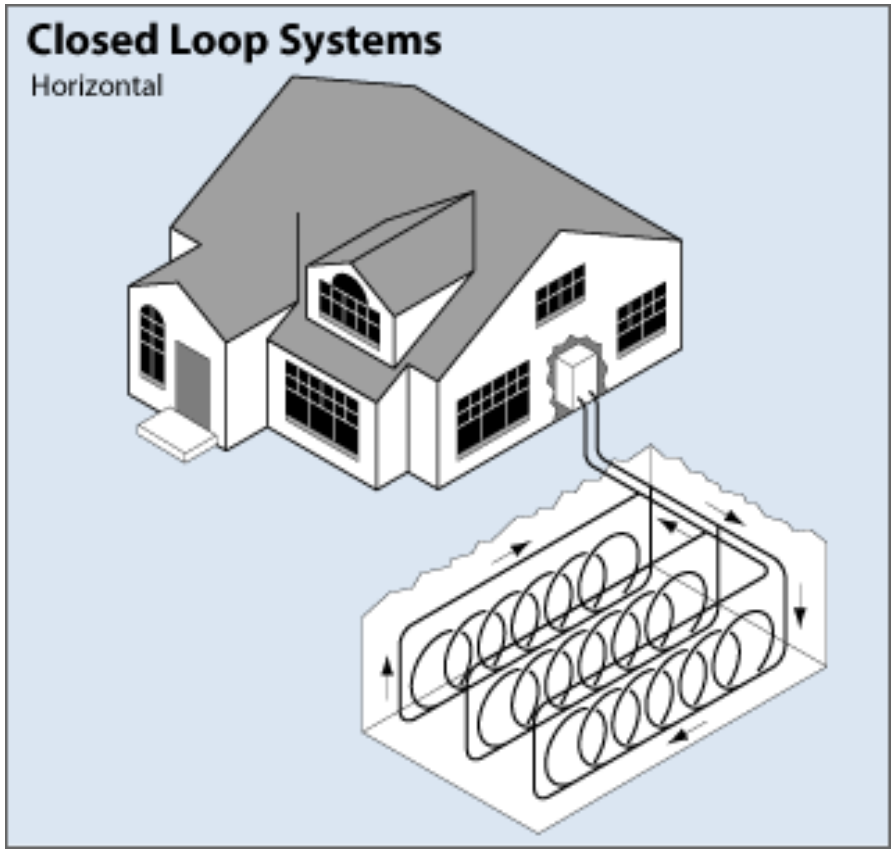


An Electric Water System For The Farm

By
E. T. Swink
Assistant Agricultural Engineer
V. P. I. Extension Division

A typical deep well type automatic electric water system on a farm in Roanoke County, Virginia. The pressure tank is located in the basement of the house. The pump is equipped with an anti-freeze set length, access to which is made through the man-hole shown by the concrete well top. A portable cover is provided for the pump to protect it from the weather.

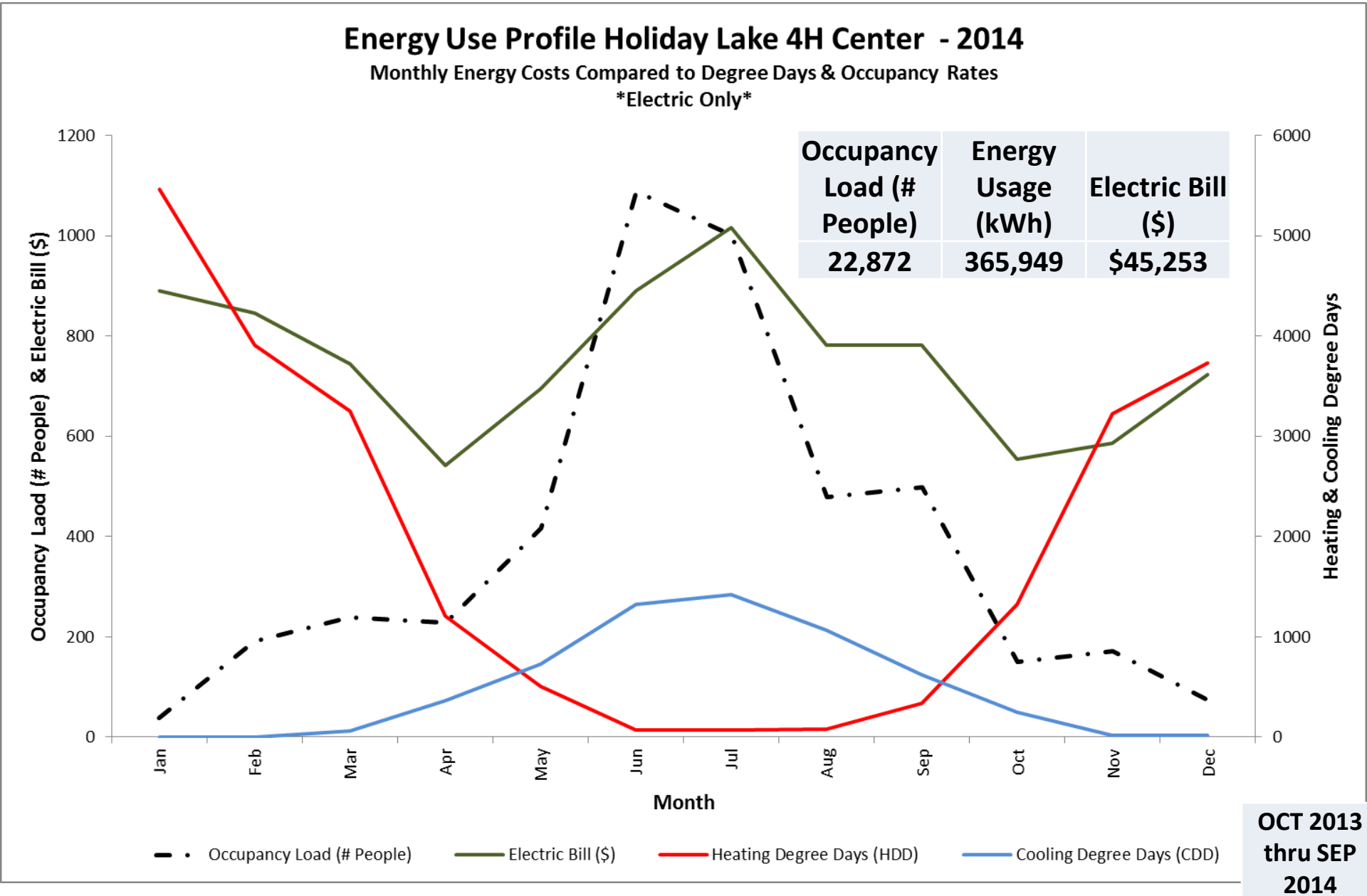
VIRGINIA AGRICULTURAL AND MECHANICAL COLLEGE AND POLYTECHNIC INSTITUTE
AND THE UNITED STATES DEPARTMENT OF AGRICULTURE, COOPERATING
EXTENSION DIVISION, JNO. R. HUTCHESON, DIRECTOR
BLACKSBURG, VIRGINIA
DISTRIBUTED IN FURTHERANCE OF THE ACTS OF CONGRESS OF MAY 8 AND JUNE 30, 1914.



Source:
1940, Swink, E. T., "An Electric Water System for the Farm", Circular E -324, Agricultural Engineering Department, Extension Division, V. P. I., Blacksburg, VA. Accessed at: https://dcr.emd.vt.edu/vital/access/services/Download/vatech:58513/Project10_Resource?view=true

Geothermal Heatpumps, US Department of Energy, http://energy.gov/energysaver/articles/geothermal-heat-pumps

Draft – kWh energy usage 4H Center



OCT 2013 thru SEP 2014

<u>Thank you to our workshop sponsors:</u>

Virginia Tobacco Indemnification and Community Revitalization Commission

2014-2015

AGRICULTURAL ENERGY EFFICIENCY INITIATIVE

Program for Southside and Southwest Virginia

Funded by a 2014 grant from the
Virginia Tobacco Indemnification and Revitalization Commission
and is supported by
VCE Community Viability and the
Virginia Tech Biological Systems Engineering Department

Biological Systems Engineering

Virginia Cooperative Extension
Virginia Tech • Virginia State University

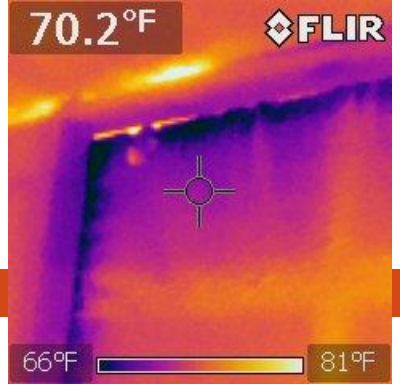
General Agenda

- Start 9:30AM
  - John Ignosh, Extension & Overview of the Ag Energy Efficiency Initiative program
  - Bryan Branch, Center Director, Holliday Lake 4H Center
  - David Faulkner, Natural Resource Economist, USDA NRCS
  - Dr. Guney Olgun, Research Assistant Professor, Geotechnical Engineering, Civil & Environmental Engineering, Virginia Tech
  - Danna Revis, Office of Environmental Health Services, VDH
- Lunch break
  - Erin Ling, Virginia Master Well Owner Network (Short Video)
  - Project experiences:
    - Dr. Joyce Latimer, Extension Specialist Horticulture, Virginia Tech
    - Bob Lane, Seafood Engineering, Extension Specialist, Biological Systems Engineering, Virginia Tech
    - David Faulkner, Natural Resource Economist, USDA NRCS
- Adjourn by 3:30

On-Farm Energy Efficiency Program

A Pilot Program for Southside and Southwest Virginia

Virginia Tobacco Indemnification and Revitalization Commission



- In 2007, farmers spent:
  - $156M in fuel , $52M in electricity and other utilities, $208M in total
- A 10% increase in energy efficiency would have produced nearly $21 million additional income to Virginia farms in 2007

How can we find those opportunities?

- Provides research-based information related to best management practices concerning energy via Virginia Cooperative Extension workshops, factsheets, webinars, etc.
- Train energy assessors, energy use BMPs, thermography tools, fuel purchasing, etc.
- Secure grant funding from the Virginia Tobacco Indemnification and Community Revitalization Commission (2010-2012)

2010 - 2012 Impacts

- 58 energy audits completed
- 19 counties throughout Southside and Southwest Virginia
- Completed energy audit reports have identified farm specific energy conservation measures to save:
  - 1,258,776 (kWh) in electrical usage;
  - 603,315 (gallons) propane fuel;
  - 19,336 (gallons) fuel oil;
  - 63,298 Million BTUs;
  - 4,315 (MTCO2e) greenhouse gas emission reductions;
  - $1,178,917 energy savings
  - Approximately 76% of the recommended energy conservation measures have a payback period shorter than five years.

2014-2015 Agricultural Energy Efficiency Initiative: **Objectives**

- > 60 agricultural operations including aquaculture, tobacco, dairy, poultry, swine, greenhouse, lumber/sawmill, and on-farm food value-added agribusinesses will improve farm energy efficiency and/or have an opportunity to explore renewable energy
- > 300 agricultural entrepreneurs will increase their understanding of energy efficient operations.

General Strategy

ENERGY ACTION PYRAMID

COMPLEXITY AND COST

ALTERNATIVE ENERGY

Choices such as installing solar, wind, geothermal, micro hydro or biofuels systems

EFFICIENCY: Investment in Longer Term Energy Savings

Choices such as:

- Installing energy efficient lighting, fixtures, windows, doors, appliances, and equipment
- Installing water-efficient appliances and fixtures
- Investing in items with Energy Star, EnergyGuide or WaterSense labels
- Insulating homes

CONSERVATION: Simple Everyday Actions

Behaviors such as:

- Turning off lights, equipment, fans, and appliances when not in use
- Adjusting thermostats in heated or cooled spaces
- Using powerstrips to control for phantom electrical loads
- Caulking and weatherstripping around windows and doors
- Landscaping with native and xeric plants, and utilizing rain water

ASSESSMENT: Assess your personal objectives and your energy and water use to determine cost-effective strategies for implementing conservation and efficiency measures and integrating renewable energy systems in your home.

Source:

http://www.ces.ncsu.edu/wp-co
Con_PyramidRev1.pdf

2014-2015 Agricultural Energy Efficiency Initiative: Program Activities

Agricultural Energy Efficiency Project Website

- Energy Benchmarking
- Farm Energy 101 Modules

Agricultural Energy Efficiency Project Workshop Series

- Agricultural Production Systems (Greenhouses, Tobacco, Dairy, etc.)
- Emergency Backup Power Generation Systems
- Renewable Energy Technologies & Applications (solar, RETScreen, small wind, biomass, etc.)
- Forest Product Industries (Lean Manufacturing, etc.)

Validation of Energy Savings

- Monitor performance of some of the recommended retrofits

2014-2015 Agricultural Energy Efficiency Initiative:
Energy Audits, Feasibility Studies, and Retrofit/Renewable Implementation

$5,000 per program participant funds will be used toward:

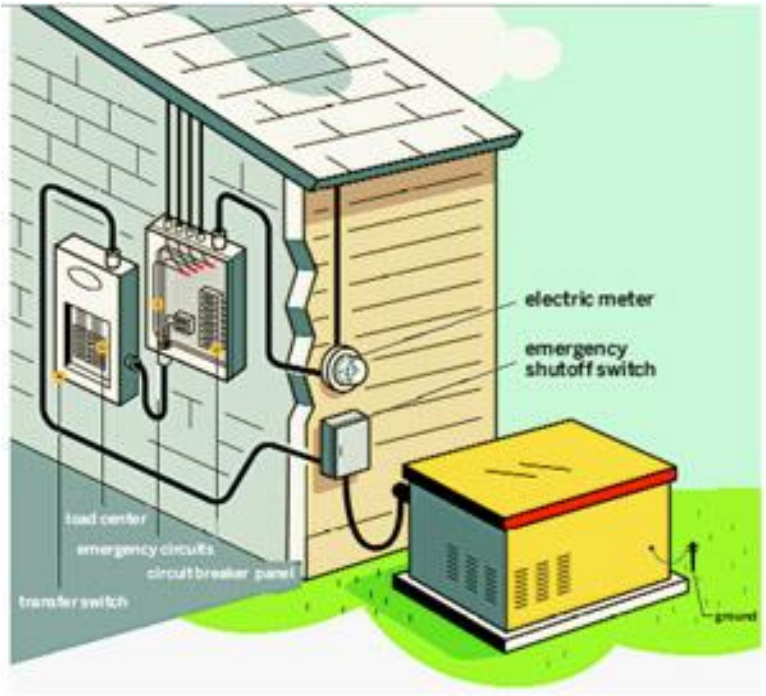
- the energy audit process
- development of a renewable energy feasibility study
- and/or implementation

- **Energy Audits** - ASABE S612 Farm Energy Audit Criteria (Completed by an NRCS Technical Service Provider), or ASHRAE Level II Energy Audit (completed by a Professional Engineer or Certified Energy Manager), as appropriate for entity type.
- **Renewable Energy Feasibility Studies** - Producers who completed the energy audit process and, based on the owner's management goals, have **implemented all relevant energy efficiency retrofit opportunities having a simple payback period of less than 5 years,** may then use the cost-share program to partially fund a renewable feasibility study. The feasibility study must **satisfy the criteria for the USDA Rural Development REAP program,** and where appropriate, include a screening model output from **RETScreen Clean Energy Project Analysis Software.**
- **Implementation Cost-Share Program -** Energy-cost saving opportunities identified in the audit report are eligible for a cost-share from funds remaining in the participant's $5,000 allocation.
- **NOTE:** Cost-share percentage increases (from 25% to 50%) with participation in educational programming (either workshops, mailed fact sheets, and later *"Farm Energy 101 Modules"* online content)

2014-2015 Agricultural Energy Efficiency Initiative:
Agricultural Energy Efficiency Project Workshop Series

Emergency Backup Power Generation Systems (at least 1 workshop)

- During previous project, some participants expressed interest in emergency power systems.
- Interest also grew with outages from *El Derecho* event in June 2012
- Fair amount of confusion between role of: energy efficiency, renewables in backup power (e.g., most net-metered solar PV systems won't energize grid during outage (exceptions)), and emergency power systems.
- Plan to host workshop on Emergency Backup Power Generation Systems



RETScreen® International
Empowering Cleaner Energy Decisions

HEAT PUMP

The energy performance of a heat pump system is influenced by a number of factors. For example, these may include design elements such as the heat pump capacity, the heating seasonal efficiency and/or the cooling seasonal coefficient of performance (COP), as well as the source of heat and/or "cold" (i.e. air or ground). In the case of ground-source (or geothermal) heat pumps (GSHP), the energy performance is also influenced by the ground heat exchanger (GHX) type (i.e. horizontal or vertical ground-coupled closed loop or groundwater) and length, as well as the site conditions such as the soil type and the earth temperature. Other factors include the size and the type of the heating/cooling load (i.e. space and/or process heating/cooling, single or multiple zones, single or multiple buildings). The energy performance of a district heating/cooling (multiple buildings) system will also be influenced by the design supply and return temperatures, and the distribution line pipe sizing. Refer to the following schematics for more information: Refer to the following schematics for more information: Ground-Source Heat Pump - Vertical Closed Loop, Ground-Source Heat Pump - Horizontal Closed Loop, Ground-Source Heat Pump - Groundwater, Air-Source Heat Pump.

Click here to download RETScreen Suite

Training material

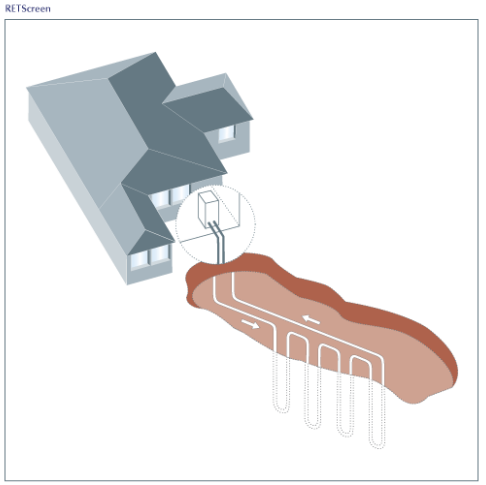
RETScreen - Ground-Source Heat Pump Project - Presentation slides (6.08 MB)
RETScreen - Ground-Source Heat Pump Project - Voice & slides - 1/4 (1.90 MB)
RETScreen - Ground-Source Heat Pump Project - Voice & slides - 2/4 (1.58 MB)
RETScreen - Ground-Source Heat Pump Project - Voice & slides - 3/4 (1.72 MB)
RETScreen - Ground-Source Heat Pump Project - Voice & slides - 4/4 (1.57 MB)
RETScreen - Ground-Source Heat Pump Project Analysis - Speaker's notes

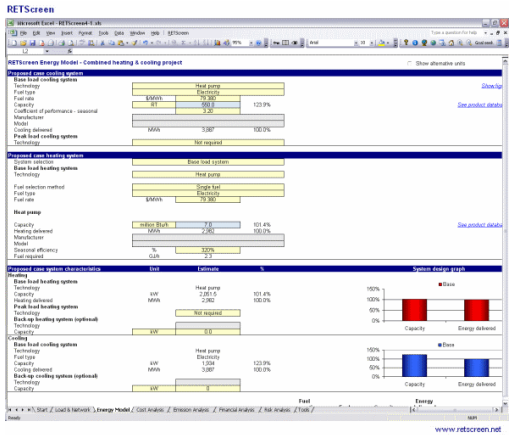
e-Textbook / Guides

RETScreen - Ground-Source Heat Pump Project - e-Textbook chapter (2.28 MB)
RETScreen - Ground-Source Heat Pump Project (V3) - User manual (725 KB)
Refrigeration and Heat Pumps - Guide (3.27 MB)

Case studies / Templates

Combined heating & cooling - Heat pump - Air-source - Commercial / United States of America
Combined heating & cooling - Heat pump - Air-source - House
Combined heating & cooling - Heat pump - Ground-source - Office / Canada
Combined heating & cooling - Heat pump - Ground-source - Office / Germany
Combined heating & cooling - Heat pump - Ground-source - Office - Storage room / Canada
Combined heating & cooling - Heat pump - Ground-source - Office - Warehouse / Canada
Combined heating & cooling - Heat pump - Ground-source - Penitentiary / Canada
Combined heating & cooling - Heat pump - Ground-source - Residential / United States of America
Combined heating & cooling - Heat pump - Ground-source - School / Canada
Combined heating & cooling - Heat pump - Ground-source - School / United States of America
Combined heating & cooling - Heat pump - Ground-source - Warehouse





Source:
RETScreen GSHP Site:
http://www.retscreen.net/ang/g_ground.php

RETScreen® International
Clean Energy Decision Support Centre
www.retscreen.net

Clean Energy Project Analysis

RETScreen® Engineering & Cases Textbook

Third Edition

Natural Resources Canada | Ressources naturelles Canada

Canada

CHAPTERS

RETScreen – GSHP Project Analysis - e-Textbook chapter

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GROUND-SOURCE HEAT PUMP PROJECT ANALYSIS
CHAPTER

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Canada

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