GEOTHERMAL HEAT PUMP WORKSHOP

- APRIL 29-30, 2009
- SALT LAKE CITY LIBRARY
- 210 EAST 400 SOUTH
- SALT LAKE CITY, UT 84111

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“GEOTHERMAL TECHNOLOGIES & UTILITY LEADERSHIP ROLES IN PROMOTING RURAL DEVELOPMENT”

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Geothermal Energy

- **Geothermal Heat Pumps: space heating & cooling**
- **Direct Use: process heat, water heat**
- **Geothermal Electricity Generation**

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Why (or Why Not) Install a GHP System?

- **Advantages**

- ❑ **Improved efficiency = low energy consumption (mechanical advantages and no direct fuel demand)**
- ❑ **All electric - can be powered by renewable electricity**
- ❑ **Lower life cycle cost**
- ❑ **No outdoor equipment (ease of maintenance)**
- ❑ **Lower maintenance cost**

- **Disadvantages**

- ❑ **Higher first cost than (many) conventional systems**
- ❑ **Not all system types are feasible in all locations**
- ❑ **Limited pool of qualified designers and installers**

Heat Pump -- Performance

- **Typical heat pumps can produce 3 units of heating or cooling for every 1 unit of operating electricity**
- **More efficient models have dual-speed compressor systems and increased heat exchange area, and thus cost significantly more**
- **Efficiency depends on the incoming temperature of the heat recovery fluid (air versus ground)**
- **Units are available that meet EPA's Energy Star rating**

Source: Shonder, ORNL

Elements of Successful GHP Project

1. **Experienced and qualified designer and installer**
   - ❑ **Conventional HVAC experience is not sufficient**
2. **Permits and regulations**
   - ❑ **Significant for groundwater (open-loop) systems**
3. **Thorough Resource Assessment**
   - ❑ **Larger systems need testing**
4. **Design and Engineering**
   - ❑ **All systems require use of proven design software**
5. **Economic Analysis**
   - ❑ **Savings from GHP are highly dependent on natural gas, fuel oil, and electric rates**

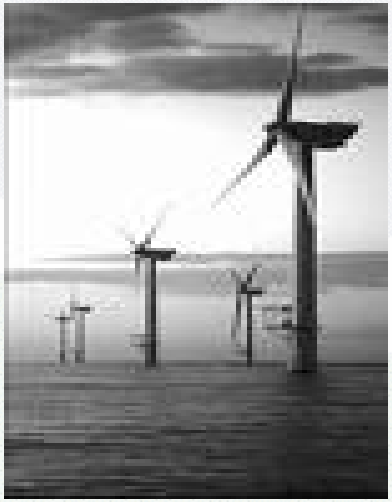
IGSHPA's Guidelines for Evaluating Installers

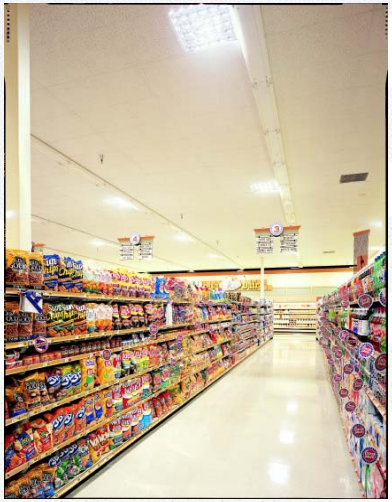
- **Follow the installation procedures established by IGSHPA (only available for closed loop systems)**
- **Use installers accredited by IGSHPA or other institutions that trains and certifies contractors (such as a manufacturer).**
- **Ask for and check references**
- **Get several estimates in writing**
- **Get a warranty that guarantees performance that covers the installed system—not just the heat pump itself.**
- **Insist on a written contract that includes all terms, including costs and start-stop dates.**

Under-qualified contractors are one of the most common sources of performance problems

Rural Business and Cooperative Programs

- Technical Assistance
- Loans
- Grants
- Loan Guarantees





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Technical Assistance

- Group organizational development assistance
- Feasibility studies review
- Business plan guidance & review
- Board development
- Cooperative education
- Resource
- Guidance on Application development

Your Home Town Company
WEST LIBERTY FOODS

Intermediary Relending Loans

- Funds to organizations for:
  - Revolving loan fund startup or recapitalization to assist community and business development
  - ‘Gap’ financing

Rural Business Enterprise Grants

- To support the development of small and emerging business enterprises in rural areas.
- Public bodies, non-profit corporations, Native American Tribes

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Use of Grant Funds

- Buy and develop land
- Construction, conversion, repairs and modernization of buildings, plants and equipment
- Loans for start up and WC
- **Technical assistance**
- Reasonable fees and charges for professional services
- RLF
- Training in conjunction with TA
- Create, expand, and operate rural distance learning networks or program

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Rural Business Opportunity Grants

- Funds to public bodies, non-profit corporations, Native American Tribes, cooperatives
- Technical assistance and planning for business development in rural areas

Value-Added Agricultural Products Market Development (VAPG) Grants

- **Purpose:** To assist with marketing of value-added products.

- **Eligible Recipients:** Independent producers, agricultural produce group, farmer or rancher cooperative, or majority controlled producer-based business venture.

Cardinal Ethanol $300,000

Renewable Energy Technologies

- **Wind**
  - **Large**
  - **Small**
- **Geothermal**
  - **Direct Use**
  - **Electrical Generation**
- **Solar**
  - **Photovoltaic**
  - **Thermal**
- **Biomass**
  - **Bioenergy**
  - **Digesters**
- **Hydrogen**
- **Hydro electric sources**
- **Energy Efficiency**

Energy Efficiency Improvement
HVAC System Improvements

- The project consists of purchasing, installing, and operating new heat pumps to replace inefficient heating/cooling units. The technology of the replacement units will provide 49% energy savings.

Energy Efficiency Improvement
HVAC System Improvements

Purpose	Borrower Contribution	9006 Grant	Other *	Total	
Purchase & Install Heat Pumps	17,895	4,870	-	22,765	100.0%
	-	-	-	-	0.0%
	-	-	-	-	0.0%
	-	-	-	-	0.0%
	-	-	-	-	0.0%
	-	-	-	-	0.0%
		-	-	-	0.0%
Total =	**17,895**	**4,870**	**-**	**22,765**	
Percent Contribution =	78.6%	21.4%	0.0%		

Source	Type of Assistance	Amount	Rates & Terms	Comment
Applicant	Cash	$17,895		project came in over budget
				$4,870 was approved grant amount

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What Agricultural Producers Are Eligible?

- **Must directly engage in production of agricultural products.**
- **At least 50% of gross income must be from their agriculture business *(IRS income tax forms used to verify)***
- **Citizenship**
- **No federal court judgments, delinquent taxes, delinquent federal debt, never been debarred.**
- **Certification of demonstrated financial need**
- **Satisfactory progress on previously funded project (s).**

What Small Businesses are Eligible?

- **Meets the definition of a small business according to SBA - Go to the index table at: http://sba.gov/size/index.html**
- **A private entity including a sole proprietorship, partnership, corporation, cooperative, & electric utility**
- **Citizenship**
- **No federal court judgments, delinquent taxes, federal debt, never been debarred.**
- **Certification of demonstrated financial need.**
- **Satisfactory progress on previously funded project (s).**

What projects are eligible?

- The project must be to make ***improvements*** to existing energy systems ***or*** to ***update*** systems such as any dryers, electric motors, heating and cooling etc
- Pre-commercial or commercially available and known technology
- Technically feasible
- Applicant must be owner of the system

	Renewable Energy Project	**Energy Efficiency** Improvements Project
Description	A process that PRODUCES energy from a renewable energy source.	Improvements to a facility or process that REDUCE energy consumption.
***Minimum* grant** *(no more than **25%** of total eligible project costs)*	$ 2,500	$ 2,500
***Maximum* grant** *(no more than **25%** of total eligible project costs)*	$ 500,000	$ 250,000

What are Eligible Costs?

- Post after date of application for construction or project improvements,
  except residential
- Energy audits or assessments
- Permit & License fees
- Business plans
- Technical Reports
- Professional service fees, except for application preparation
- Feasibility studies
  If applicable

When are FY 2009 Grant Applications due?

- NOFA has not been announced
- You can begin anytime to prepare your application documents, including a score sheet, and technical report for FY09 funds

There could be changes for FY09 NOFA

PLEASE READ IT

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Guarantee Loans

- Guaranteed loan applications can be submitted ????????
- Additional eligible costs will be for Working Capital and Land Acquisition (guaranteed loans only)
- $25 million maximum guaranteed loan
- Combination grant and guaranteed loans will also be available

(up to 75% of total eligible costs for Loan & Grant combo)

Evaluation Criteria Scoring Guideline

1. **Quantity of Energy Replaced, Saved or Generated**
   - Quantity of Energy Replaced
   - Energy Savings
   - Energy Generated
2. **Environmental benefits**
3. **Commercial availability** & provided with a 5 year or longer warranty
4. **Technical Report**
5. **Readiness: (Grants only)**: Percent for matching of funds: 50-75%; 75-100%; 100% & up
6. **Small Agricultural Producer/Very Small Rural Business:** Ag producer: less than $600,000 in the preceding year, less than $200,000 in the preceding year, Very Small Rural Business as < less $1 million in annual receipts
7. **Simplified application:** *Total project cost is less than $200,000*
8. **Previous grantees & borrowers:** *Not received any ENERGY funds last 2 FY*
9. **Return on Investment:** <4 years, <8years & <12 yrs
10. **Loan Rate (Guaranteed Loans only; 4280.129 (e)):** Loan is below the Prime Rate (WSJ) plus 1.5 percent, **or** Loan below the Prime Rate (WSJ) plus 1 percent,

Components of the Technical Report

1. Qualifications of the project team
2. Agreements and Permits
3. Energy or Resource Assessment
4. Design and Engineering
5. Project Development Schedule
6. Project Economic Assessment
7. Equipment Procurement
8. Equipment Installation
9. Operation and Maintenance
10. Dismantling & disposal of project components

reasons for an energy audit

- ***Needed to determine eligibility***
- ***Needed to determine*** **if improvements eligible for funding**
- ***Needed to answer*** **score sheet questions**
- ***Needed to determine*** **technical feasibility**

Energy Assessment or Energy Audit

- Energy audit required when total eligible project costs exceeds $50,000.
- Energy assessment required when total eligible project $50,000 or less.
- If audit done instead of assessment when total eligible project costs are < $50,000 - Extra 5 pts in scoring

Light Types

- Incandescent
- Fluorescent
  - Compact
  - Tube
  - T8
- High Intensity Discharge
- Light Emitting Diode

	Incandescent 100 Watt	T8 Fluorescent
# of fixtures	30	20
Installed cost	$450	$2,400
Cost to operate for 2 years	$1,918 X 2 = $3,856	$511 X 2 = $1,022
Total cost over 2 years	$4,286	$3,422
Savings over 2 yr period		+$800

Ontario Ministry of Agriculture; Food and Rural Affairs

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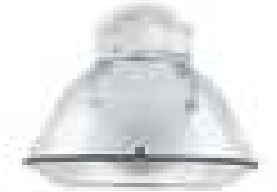

Poultry Audit

Energy Efficiency Improvements	Annual Electricity Savings (kWh)		Annual Energy Savings (Million Btu)	Estimated Installed Cost [a]	Annual Energy Cost Savings [b]		Payback in Years [a / b]
Lighting	42,407		144.7	$2,365	$3,423		0.7

Productivity Improvements – Energy	Annual Electricity Savings or (Increase) (kWh)	Annual Propane Savings (Gallons)	Annual Energy Savings (Increase) (Million Btu)
Insulate Side Walls		2,238	205.0
Insulate Brood Curtain		1,279	117.2
Seal Air Leaks		959	87.8
Install Circulation Fans		639	58.5
Install Radiant Tube Heaters		1,918	175.7
Add Tunnel Ventilation	(11,042)		(37.7)
Install Controllers		416	38.1

Energy savings and productivity increases are not cumulative because some of the improvements offset the benefits of others.

For instance, the productivity benefit potential of insulating side walls (2% increase production potential) and sealing air leaks (2% increase production potential), will not add up to a 4% production increase because the benefits are interactive. In this case, insulating side walls will actually seal up some of the air leaks.

Productivity Improvements – Financial	Estimated Annual % Production Increase[1]	Estimated Annual Weight Gain (Pounds)		Estimated Installed Cost [a]	Annual Energy Cost Savings [b]	Estimated Annual Production Benefit [c]	Payback in Years a / (b+c)
Insulate Side Walls	2%	40,458		$27,000	$3,357	$2,023	5.0
Insulate Brood Curtain	3%	60,687		$600	$1,918	$3,034	0.1
Seal Air Leaks	2%	40,458		$1,500	$1,439	$2,023	0.4
Install Circulation Fans	5%	101,145		$11,364	$959	$5,057	1.9
Install Radiant Tube Heaters	3%	60,687		$26,025	$2,878	$3,034	4.4
Add Tunnel Ventilation	3%	60,687		$2,800	($891)	$3,034	1.3
Install Controllers	2%	33,000		$8,840	$623	$1,650	3.9

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