

## Greenhouse Energy Audit Overview

Thomas A. Dudek and Jeanne M. Himmelein

The Michigan greenhouse industry is valued at more than \$400 million, according to the 2010 USDA Floriculture Crops Summary. Michigan's floriculture industry is the state's second-largest agricultural income generator (behind dairy production).

One of the major expenses for greenhouse producers is energy, which typically contributes 10 to 15 percent of an operation's total expenses. To manage energy usage costs, MSU Extension and AgBioResearch personnel developed a greenhouse energy audit process. The audit identifies how current energy is used for operating a greenhouse, including heating systems, cooling systems, lighting, water heating, irrigation, and ventilation and compares the current use to energy-efficient alternatives.

A completed energy audit provides data that a greenhouse owner can use to make informed decisions about equipment upgrades. Additionally, some energy efficiency grant and loan opportunities are available that may require an energy audit as part of the application process. Energy audits completed by MSU-trained auditors qualify for this purpose.



Examples of energy consumables evaluated

### What is a Greenhouse Energy Audit?

Through an energy audit greenhouse growers evaluate their operations' current energy consumption and identify potentially energy-efficient alternatives. A successful audit requires information from the owner and dialogue with a trained auditor.

The process involves information gathering, the auditor and owner have a sit down meeting followed by a greenhouse walkthrough. Based on greenhouse size, the on-site assessment may take two to four hours to complete. The greenhouse owner supplies the following information:

1. One year of utility bills, including natural gas, propane, electricity and water for all meters.
2. Structural layouts including dimensions, coverings and description of the physical location.
3. Hours of operation per structure, per day, week, month or year.
4. Heating and cooling equipment descriptions, age, manufacturer, model, BTU output and run-time.
5. Each structure's heating and cooling temperature regimen.
6. Water well sizes, pump sizes and run times; for municipal systems, one year of water bills.
7. Alternative fuel usage per year, such as wood, wood pellets, etc.
8. Diesel/gasoline, propane usage per year, amount and cost/gallon.
9. Hot water heater sizes, models, numbers, storage tank sizes and gallons used.
10. Pumps, compressors, and motors in use including sizes, run-times, ages, manufacturers and models.
11. Ventilation and circulation fans in use, quantity, sizes, run-times per year and age.
12. Lighting for each structure, inside and outside, including number of fixtures, lamp types, wattages and hours used per day.
13. Proposed improvements for equipment or energy upgrades of interest or under consideration.

To contact an expert in your area, visit [people.msue.msu.edu](http://people.msue.msu.edu), or call 888-MSUE4MI (888-678-3364).

## Example Results of a Greenhouse Energy Audit Section

A completed greenhouse energy audit document provides the owner with a facilities narrative, information about energy usage sources and costs, an energy analysis and discussion of energy improvements and an energy conservation summary. This summary includes any energy savings, cost savings, cost of improvements and payback periods.

Example of a lighting and system analysis with conservation options

Lighting	Current				Energy Conservation Measure						
	Watts	#	Demand (hours/day)	Usage (kWh)	W	#	Capital (\$)	Usage (kWh)	Reduction (kWh)	Savings (\$/year)	Payback (years)
Front Checkout	60	20	0.05	22	15	20	49.40	5.5	16.5	1.76	28.1
Bathroom	Motion sensor		6.6	185			50.00	28.1	156.9	16.80	3.0
Office	60	4	2.6	252	59	4	70.00	224	28	3.00	23.3
Loft Storage	60	6	0.11	16	59	6	105.00	14.2	1.8	0.19	552
Shop	60	2	3.7	180	59	2	35.00	159.4	20.6	2.21	15.8
Bathroom	100	1	2.14	78	23	1	1.89	18	60	6.42	0.3
Breakroom	60	2	2.5	121	59	2	35.00	107.7	13.3	1.42	24.6

System	Location	Savings (MMBTU)	Savings (kWh)	Savings (/year)	Cost to Implement	Payback (years)
Proposed Lighting	Non-growing Areas	40.3	11,814	\$945	\$863	0.9
Motion Sensors	Non-growing Areas	45.6	13,355	\$1,068	\$2,000	1.9
Water Heaters	Non-growing Areas	13.0	3,806	\$451	\$1,050	2.3
Unit Heaters	1&2, Teens, & Shipping	1,389.7	407,321	\$13,897	\$29,900	2.2
Energy Curtains	1&2, 100s, & 220s	1,924.4	564,042	\$19,244	\$103,620	5.4
Weatherization	200s, 210s, 220s, 230s,	459.9	134,797	\$4,599	\$2,000	0.4
<b>Totals</b>	<b>Totals</b>	<b>3,877.0</b>	<b>1,136,334</b>	<b>\$40,301</b>	<b>\$139,633</b>	<b>3.5</b>

### Schedule an Energy Audit

To learn more about greenhouse energy cost reduction strategies or to find an MSU-certified greenhouse energy auditor, visit [www.flor.hrt.msu.edu/energy](http://www.flor.hrt.msu.edu/energy).

The costs for conducting an energy audit vary by area. There are opportunities for subsidizing the cost of energy audits conducted by certified Michigan farm energy auditors through Consumers Energy or DTE. To find out more information, contact one of the MSU-certified greenhouse energy auditors at the website listed above.

For additional information about the greenhouse energy audit project, contact:

Jeanne Himmelein, MSU Extension Educator, [himmele1@anr.msu.edu](mailto:himmele1@anr.msu.edu), 269-384-8010 or  
 Thomas A. Dudek, Senior MSU Extension Educator, [dudek@anr.msu.edu](mailto:dudek@anr.msu.edu), 616-994-4580 or  
 Aluel Go, Manager-Mi Farm Energy Audit Program, [goaluel@msu.edu](mailto:goaluel@msu.edu), 517-214-6128

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Michigan State University  
**AgBioResearch**  
[www.agbioresearch.msu.edu](http://www.agbioresearch.msu.edu)

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