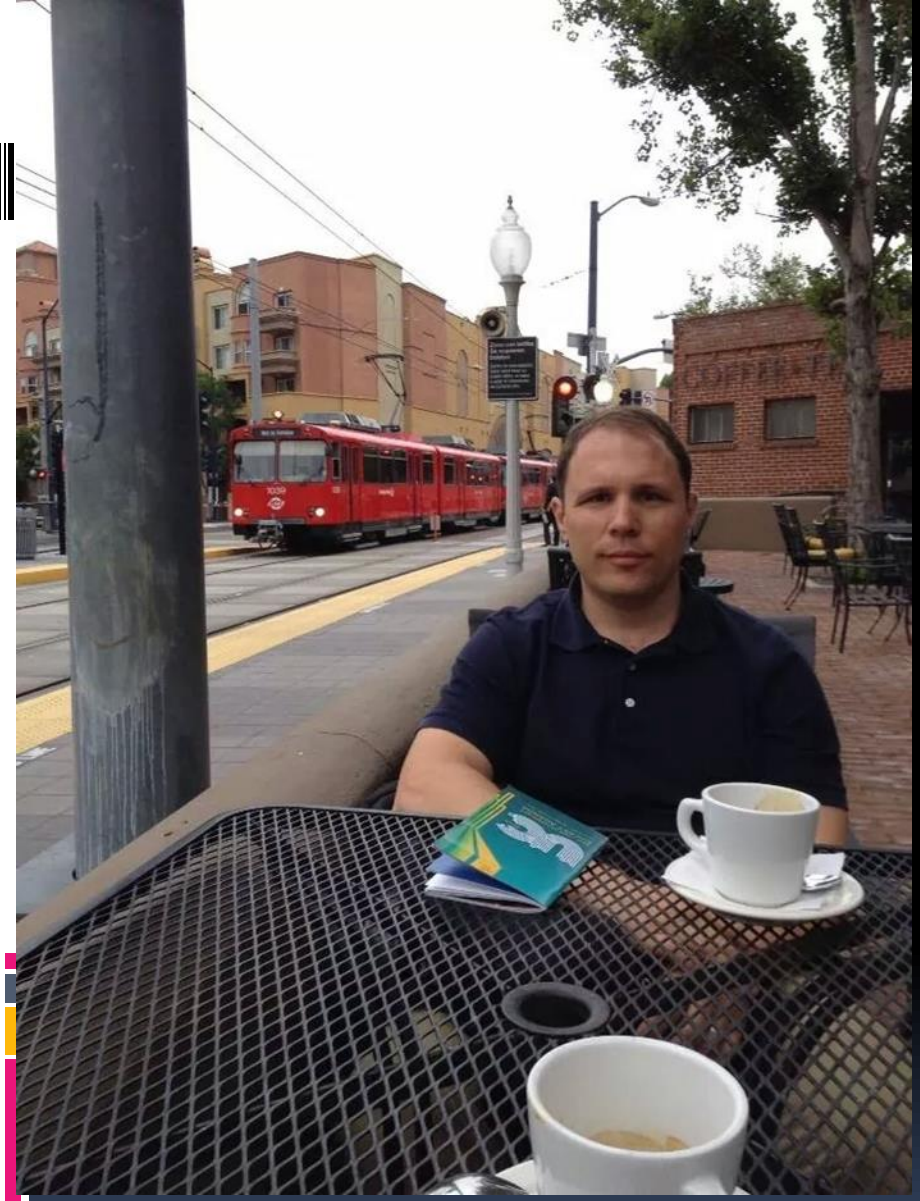
March 31, 2016

GREEN LABS WEBINAR



Housekeeping

- All lines will be muted
- Please type your questions into the chat box as we go and we will address them after the presentation
- We are recording the webinar and will post a recorded version of the webinar online.

Chad Rogers, Department of Environmental Quality

Dan Schoonmaker, West Michigan Sustainable Business Forum

Dr. Sudhakar Reddy, University of Michigan

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Sustainable Lab Program at U-M Leading to Green Labs in Michigan

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March 31, 2016

U-M with……..

- **3,260 Acres - 5 Campuses**
- **43,700 Students**
- **42,300 Faculty & Staff**
- **400 buildings >35 million ft^2**
- **7.6 trillion BTUs energy**
- **710,000 $MTCO_2E$**
- **1.2 billion gallons water**
- **18 thousand tons waste**

Has many challenges…including Sustainability

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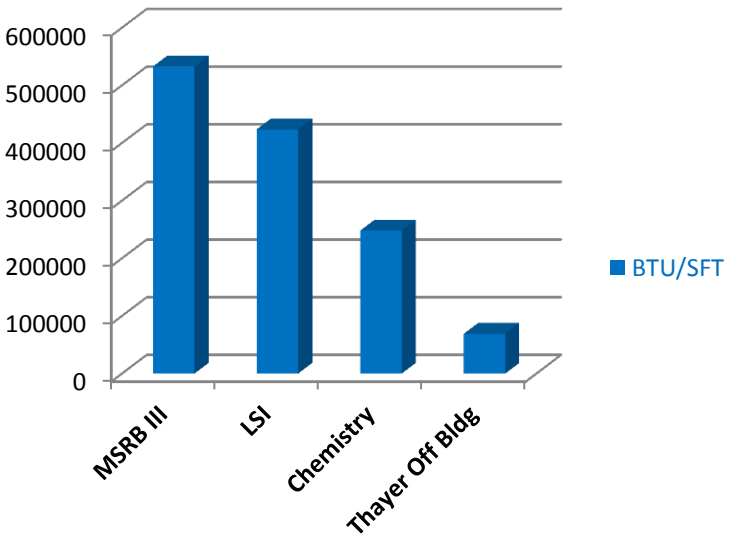
Sustainability in the Labs..Background

- According to EPA estimates laboratories consume 4-10 more energy when compared with a class room environment
- It is true in case of our campus
- *Reasons*: HVAC, Fume hoods, Utilities, Equipment, research and teaching activities
- ***What does this mean us?***
- Providing rich opportunities to save on energy, utilities and achieve waste reduction through green initiatives
- A Sustainable Laboratory not only establishes best lab practices but also improves safety in the lab

Sample Comparison of Energy Consumption on UM campus 2015 (BTU/SFT)



An Ideal Sustainable Lab…

An ideal Sustainable Lab would actively engage in the following:

- P2 & WM
- Green Purchasing
- Green Chemistry
- Green Computing
- Energy and utilities
- Reduce, Recycle & Reuse
- Disposal and Treatment
- Safety

How it all started?

- **2008-09** – Green Chemistry Task Force (GCTF) was formed
- Researched on happenings at:
  - Peer Institutions
  - Government (EPA)/GCI
  - Conferences on Green Chemistry/Sustainability
- **2010/11** – Developed a unique program called Sustainable Lab Recognition Program and rolled out with strong support from Deans and Directors

How it can be achieved?

It has three elements:

- **Engineering Controls:**
  - Big ticket items
  - HVAC improvements
  - Fume hoods CAV to VAVs
  - Occupancy sensors
- **Administrative Controls:**
  - Sustainable lab program
  - Operational/PI/Lab manager
- **Behavioral Controls:**
  - All working in the lab
  - Commitment at personal level

Sustainable lab recognition program

Program Run in a phased manner

- ✓ Initial contact made with the participating lab
- ✓ Questionnaire and equipment list completed by the PI/Lab Manager
- ✓ Office of Campus Sustainability staff visits Lab along with Occupational Safety staff and Energy Management engineer for a walk through
- ✓ A Lab Visit Report is sent with the items of compliance
- ✓ After compliance items have been addressed, Certificate of Recognition is given to the group

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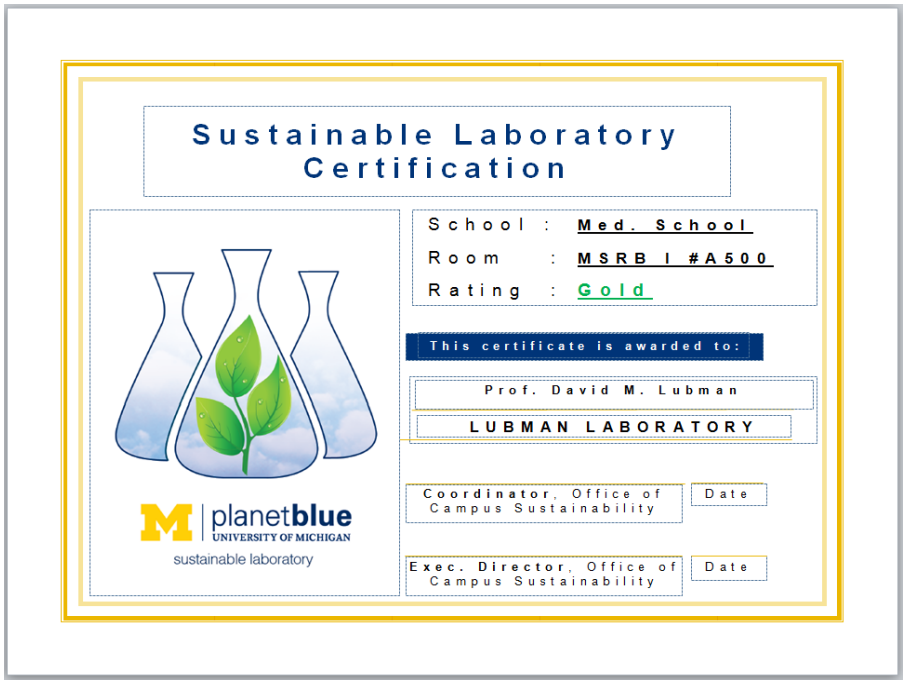
Certificate of recognition



Sustainable Laboratory Certification

School : Med. School
Room : MSRB I #A500
Rating : Gold

This certificate is awarded to:

Prof. David M. Lubman
LUBMAN LABORATORY

Coordinator, Office of Campus Sustainability — Date

Exec. Director, Office of Campus Sustainability — Date

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Certificate

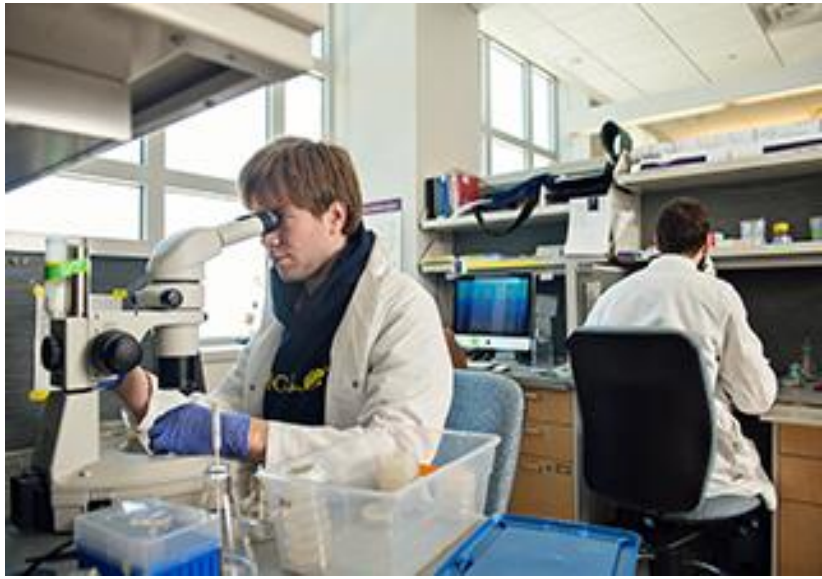
Clock with 12 Green Chemistry Principles

A Lab receiving a certification or recognition

Bartlett Laboratory		
Rooms:2616,2622,2624	Bartlett Laboratory, Chemistry Department	
# of Personnel: 10	PI: Prof. Bart Bartlett	Lab ID#: 519
The Bartlett group focuses on inorganic synthesis to prepare compositionally complex materials that address three chemical challenges in sustainable energy. First, we are preparing semiconducting oxides to harvest solar energy to convert it to hydrogen fuel efficiently. Second, we are synthesizing Li-ion battery nanostructures to store chemical energy, and afford its rapid conversion to electrical energy for high power applications such as automobiles. Third, we are creating small molecule catalysts that store and transfer charge rapidly for making and breaking chemical bonds in overall water splitting. These areas of research are of paramount importance to realize a future with an alternative form of clean, affordable energy.		
Sustainable Lab Rating: **GOLD**	Date Received: 09-05-2012	

Sustainable lab program - Results

- Only 10 labs were engaged in 2011
- It was a hard sell
- Additional research carried out
- Identified a new element behavioral change
- Triggers identified to get results
- *Change in behavior matters!*



Behavioral Change: Triggers identified

- Cue
- Prompt
- Request
- Influence
- Convince
- Draw a big picture
- Communicate
- Offer

Behavior change: B. J. Fogg's model applied

High Motivation & High Ability

Low Motivation & Low Ability

Facilitator

Signal

High Motivation, High Ability, Less Time & Less Cost

Inaction

Spark

More Time & More Cost

Less Time & Less Cost

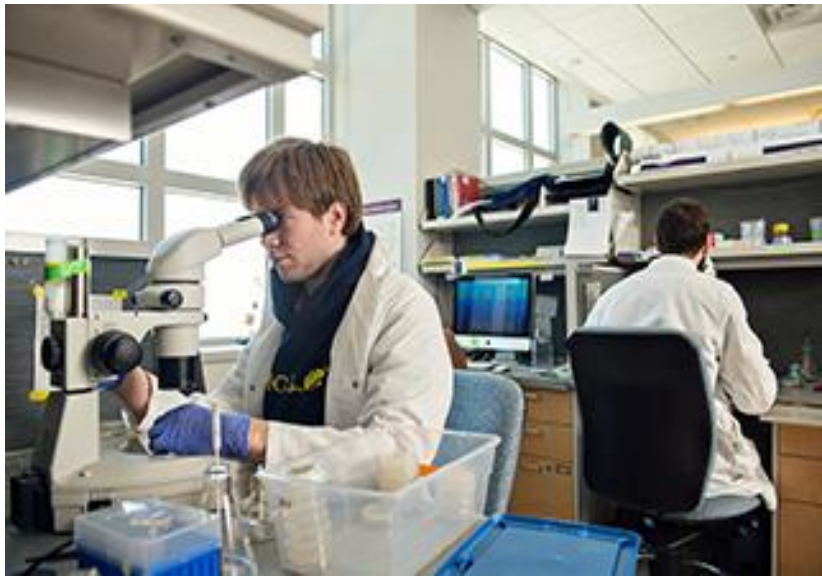
Behavioral triggers applied

- **U-M Goals**
  25% GHG Reduction
  40% Waste Reduction
- Planet Blue Ambassador Program
- Pollution Prevention Reuse/Recycle
- Green Chemistry & Engineering
- Big Picture Connect with Facts/Figures

Triggers Leading to Signal

Sustainable lab program - Results

Fiscal Year	Labs Engaged
2011	10
2012*	15
2013	35
2014	41
2015	40
2016 (projected)	45



Behavioral change model applied

Behavioral change matters!

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Recognition/Awards

Awards received by U-M:

2013: MI Governor Green Chemistry Award

2014: I2SL Go Beyond Award

2015: S-Lab UK, Environmental Improvement Award

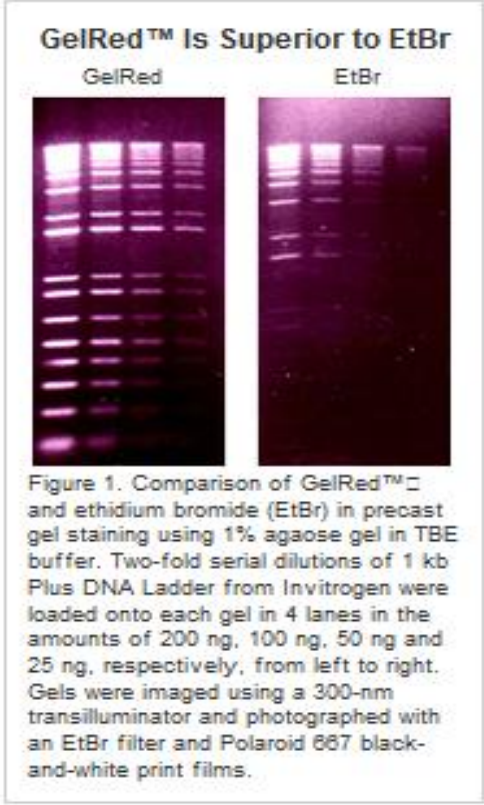
State of Michigan:

- State of Michigan has adapted to this program and
- Organized a series of workshops with support from US EPA
- A few organizations and institutions have initiated the program

Metrics – Green chemistry (Safer products)

- **Safer Alternatives:**
  - Toxic ethidium bromide is being substituted with safer alternative, Gel-Red in Life Sciences labs. Nearly 50 labs have switched to Gel-Red in their DNA research. Solid waste into trash, liquid waste into the drain. A permit for disposal is in place.
  - Green solvents, Cyclopentyl methyl ether and methyl tetrahydrofuran are being used in place of toxic solvents such as dichloromethane and THF
  - Micro scale chemistry adapted where applicable

- **Energy Efficient Reactions:**
  - Sonication and microwave energy sources are employed as alternative reaction conditions



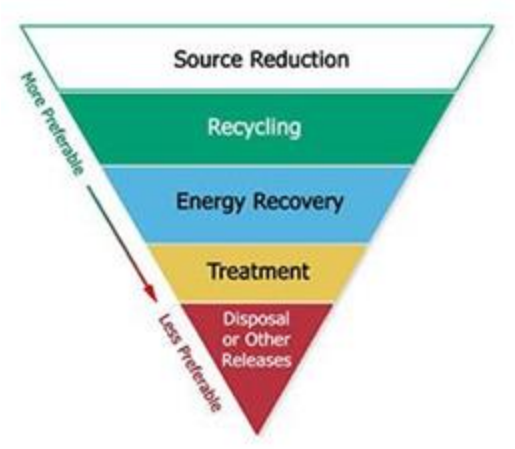
Metrics – Reuse and Recycling

- **Recycling**
  - Solvents recycled: Alcohol, xylene and formalin; 730 gallons/year
  - Pipette tip boxes: 9500 lbs/year
  - Ice packs and Styrofoam boxes: 9000 lbs/year
  - Electronics, universal waste, paper, glass, pens, pencils, packaging materials etc., Several tons/yr
- **ChEM (Chemicals, Equipment and Materials Reuse Program:**
  - In excess of 1200 lbs/year of surplus chemicals, equipment and materials are being redistributed to those in need, saving $65,000 or more

Metrics - Treatment

- **Treatment:**
  - HPLC eluent containing mild buffer can be neutralized and disposed down the drain. >450 gallons/year reduced.
  - Ion chromatograph waste is slightly basic with no toxic metals. It is being neutralized to pH 8 and discarded down the drain in a few labs. 400 gal/yr. haz. waste reduced.
  - Dialysate waste generated in Life Sciences labs is slightly basic and contain salts that can be neutralized to pH 8 to release into the sewer. Approx. 350 gallons/year reduced.
- **Elemental Neutralization:**
  - Acid (HCl and acetic acid only) or basic waste is neutralized in many labs for drain disposal

EPA P2 Hierarchy

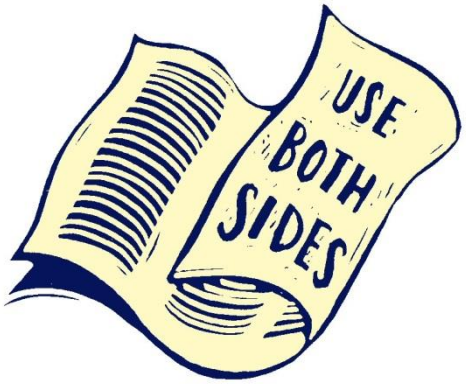


Metrics – Energy conservation

- Turn of lights when leaving lab
- Shut the sash on chemical fume hoods when not in use. A U-M study shows that a researcher uses fume hood for only 2.6 hrs. on an average/day.
- *It is estimated that U-M saves over a million dollars a year through the 'Shut the Sash' program!*

Metrics – Energy conservation

- Power down small equipment when no in use to save on vampire power or standby power
- Shut down computers before leaving the lab. Only 30% of the time we are in lab. Potential energy savings of $120/year per computer in MI.
- Avoid printing. If printing is a must, print on both sides to reduce solid waste by 50%
- Scan documents and recycle paper



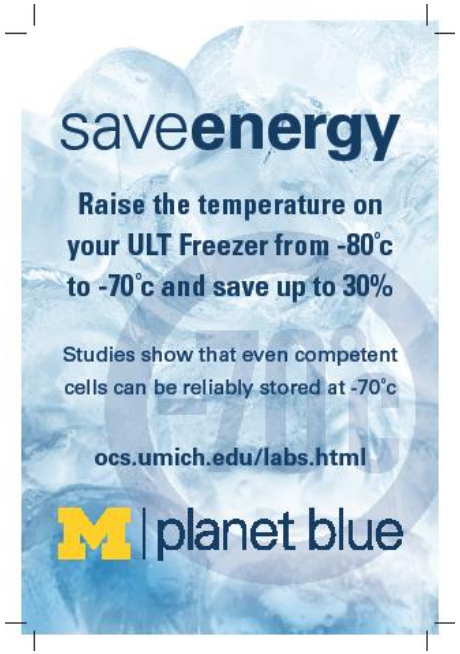
Metrics – Energy conservation

- Drying ovens consume 6 to 8 KWh energy/day ($200 to $260/year). Place timers on these to save 50% of energy
- Power down incubators (4 to 6 KWh/day) when not in use
- Share lab equipment to save on new purchases and maintenance

Drying oven

Metrics – Energy conservation

- Raise ULT freezer temperature from -80 C to -70C to save up to 30% of energy
- All contents are stable at this temperature
- There are 1100 freezers in our campus
- A good energy saving initiative without compromising research



-80 C ULT Freezer

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Metrics – Utilities conservation

- Avoid water aspirators; they consume 2.8 gallons/minute of water. In excess of 100 PIAB local vacuum systems are installed on our campus that run on lab compressed air.
- Avoid single pass water usage for water condensers. Install recirculating chillers.
- Check for leaks and drips. Get them fixed. Water/sewer costs doubled in the last 6 years
- Run dishwashers/autoclaves full

PIAB System

Recirculating Chiller

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Results – Spills and Safety

- **Mercury Spills**
  - As a part of mercury removal program we have collected several hundreds of pounds of elemental mercury and 7000 mercury thermometers for proper disposal
  - Spills due the breakage of mercury devices were **68** in 2002
  - These spills greatly reduced to **5** in this fiscal year of 2016
- **Safety**
  - Best lab practices ensure safety in the laboratory
  - Improved safety in our labs may be seen through less number of accidents/spills in the long run
  - ***Near spills from the labs participated in this program!***

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In summary….

- Sustainable Lab or Green Lab program is very successful when combined with behavioral change model
- To date, we have been successful in engaging 160+ labs (*6000 faculty, staff & students*) in this program and the number is growing
- Invest in Engineering, Administrative and Behavioral change controls in order to bring Sustainable operations into our labs

Acknowledgements

- Green Chemistry Task Force Members
  - Ingrid Walstad (*Bio Safety*)
  - Gregory Marquis (*Hazardous Materials Management*)
  - Ken Keeler(*Office of Campus Sustainability*)
- Andrew Berki, Manager, Office of Campus Sustainability (OCS)
- Terrance Alexander, Director, OSEH and OCS
- Occupational Safety & Env. Health (OSEH) Staff
- Faculty and students from Graham Institute
- Deans, Directors and Facility Managers

Now Dan will take it from here…

Thank you!

WEST MICHIGAN GREEN LABS

REDUCE LAB ENERGY COSTS BY UP TO 50%

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WMSBF Working Groups

- Climate Resiliency
- Solid Waste Task Force
- Sustainable Food Systems
- Energy Finance
- Green Labs

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Michigan Green Labs Initiative

1. Identify areas for environmental improvement.
2. Introduce best practices and methods for source reduction and efficient use of energy, water, chemicals, and materials.
3. Facilitate the implementation of recommended sustainability-focused techniques.

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Michigan Green Labs Initiative

- Source reduction and pollution prevention
- Material reuse and recycling
- Green product sourcing
- Toxics use reduction and green chemistry
- Hazardous substance substitution
- Micro-scale analytics

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Adoption?

- Was it being used?
- Outside of research?
- Business community use?
- Comparison to other sustainability efforts?

- Anecdotally: Limited

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Assumptions

- Where cost reduction and environmental-themed marketing claims are a priority
- Where there are existing pollution prevention initiatives and personnel tasked with carrying out such initiatives
- Among audiences currently involved in or that could become involved with sustainable business forums or similar programs

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Project Background

- Updating self-assessment and accompanying materials
- Green Labs Workshop
- Green Labs Certification
- Establish test case
- Roll-out

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CERTIFIED GREEN LAB AND RESOURCE GUIDE

Introducing Certified Green Lab

Certified Green Lab provides a benchmark for sustainability efforts and a pathway to recognition. Built upon the Michigan Green Labs Initiative Self-Assessment, participating labs are awarded points for successfully adopting and verifying sustainable laboratory practices, and setting goals for improvement. The assessment includes a survey checklist, process and materials inventory, and a goal-setting exercise, plus up to 10 hours of assistance from WMSBF fellows in identifying resources and strategies for addressing problem areas.

All labs that complete the assessment and set improvement goals will be recognized as a Certified Green Lab for one year. Labs must demonstrate minimal effort toward improvement goals to maintain certification. Honorees will receive a certificate and a window sticker. Interested labs will also be recognized in a news release.

Download the Green Labs Self Assessment Here

Self-Serve Resource Response for Green Labs Self Assessment Questions

Green Labs Resource Guide

WMSBF Green Labs Resource Guide

- Water Conservation
- Utility Use
- Refrigeration
- Green Purchasing and Green Chemistry
- Waste Reduction, Disposal and Treatment Guide
- Equipment and Operation
- Education and Communication

Search ...

MEMBER NEWS

5 Lakes Energy ADAC Advanced Green Architecture Alliance for Environmental Sustainability Amway Aquinas College ArtPrize Asterisk Associates Barfly Busy Bea's Services Calvin College CarbonNeutral Company Cascade Engineering Catalyst Partners City of Grand Rapids climate change climate resiliency Clothing Matters Consumers Energy Creative Dining Services crowdfunding Crystal Flash Direct Trade Coffee Club Disher Design Downtown Market Eco Metrics Energy Finance Analytics LLC ERM Ferris State University FTC&H Fulton Street Farmers Market Grand Rapids Community College Grand Rapids Downtown Market Grand Valley State University Greener Grads GVSU Haworth Herman Miller Holland

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Green Labs Certification

- Benchmark for sustainability efforts
- Recognition
- Based off self assessment score
- Renewals required

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Target Audiences

- Research
- Pharmaceutical
- Manufacturing
- Health care
- Government
- Environmental consultants
- Photo
- K12
- Testing

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Test Case

- Proving ground
- 110,000-square-foot facility
- Testing, training, advisory, quality assurance and certification services
- North American sustainability director
- $259,753 electrical bill
- 7.5 million gallon water use.

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- Embedded sustainable business intern for six months
- Started out: Green chemistry, lab equipment efficiency
- Refocused: Recycling, HVAC

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Findings

- Job scope gaps
- Needed
  - A platform for dialogue
  - More access to information, collaboration
  - Means to capture suggestions
  - Team effort on sustainability
    - Sustainability director not best leader for labs
- Value-add:
  - Recycling to save $42,194
  - Fume hood substantial savings

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Three Certified Labs

Company	Responses				
	Yes	*No*	*Partial*	Unknown	N/A
Intertek	*22*	*11*	9	4	10
Perrigo	*27*	*15*	6	4	4
Johnson Controls, Inc.	*31*	*2*	*13*	0	10

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Initial Results, Findings

- Sustainability practice has limited understanding of labs
- Failed to create a sense of urgency
- But there was strong interest…
- Conversation difficult to limit to lab space
- Need to reconcile sustainability /facilities staff and green teams

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Moving Forward

- Promote when we hit five certified labs
- Formalize into a user group
- Host fourth annual workshop in 2016
- Exploratory committee for I2SL state chapter

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Interested in Participating?

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QUESTIONS