

## Green Building & Energy Efficiency Basics – Municipal and Commercial Buildings

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## *Green Building & Energy Efficiency Basics – Municipal and Commercial Buildings*

The year of systems.

We've stressed over and over again the importance of strong and healthy systems. Just as in a building's basic systems, a body's systems are interconnected.

They are either dependent on each other or are have an effect on each other. In design and construction as in biology we call this synergies. Give examples of body systems.

In buildings the same thing is going on. Give example of buildings system synergies.

The problem for us humans is that the interconnected-ness is complex.

This complexity confuses us and leads to apathy. Things don't get done.

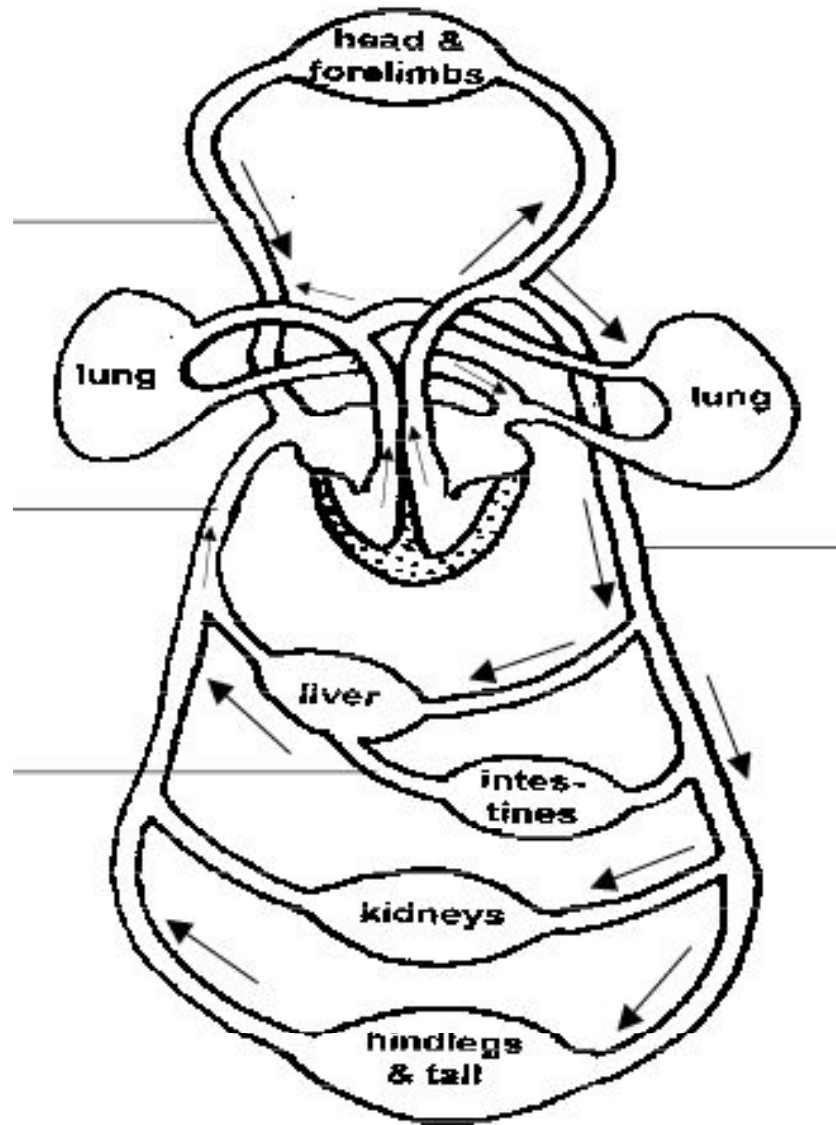
Many of us in this room are responsible for the budgets and performance of buildings. Some are old, some are brand new. The newer tend to have more efficient systems, but that is not always the case.

We're involved in an old building over 300000 sf with over 65 disparate cooling systems which obviously need some coordination. Another building we toured recently and likely to become involved with is quite new. But it too will need attention to operate more efficiently.

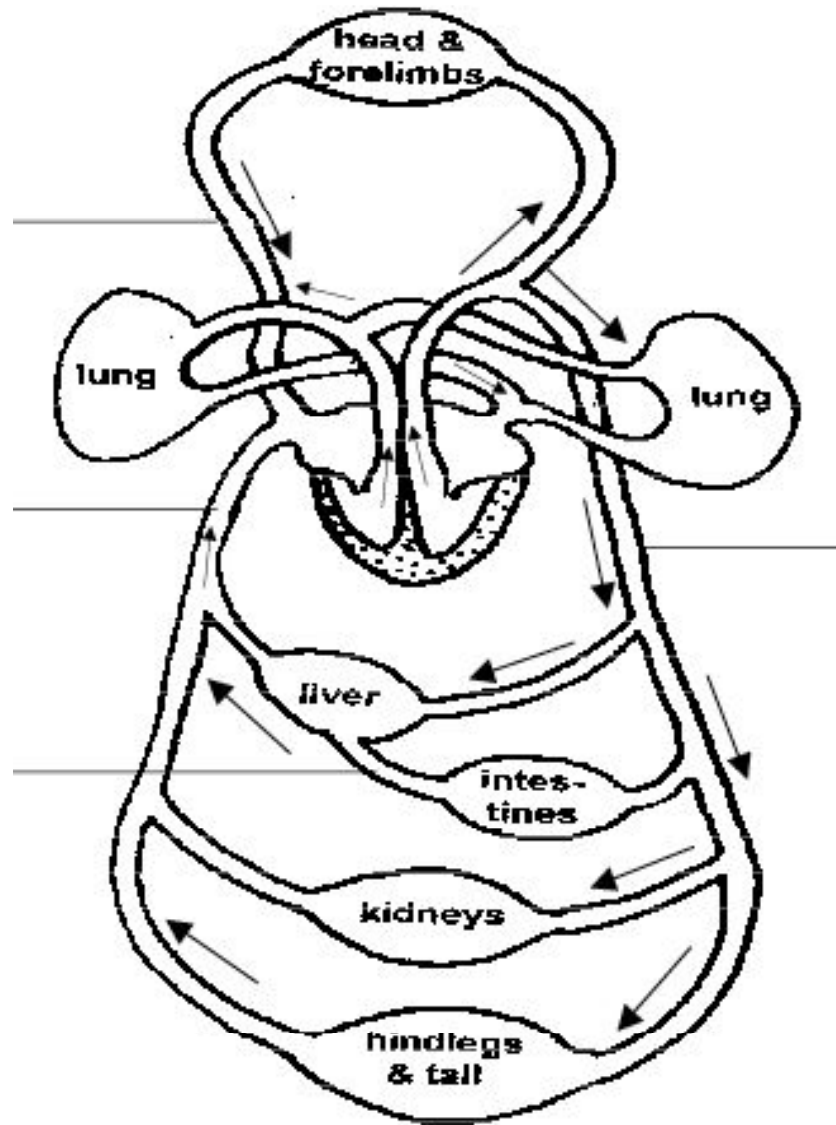
# Systems

# Synergies

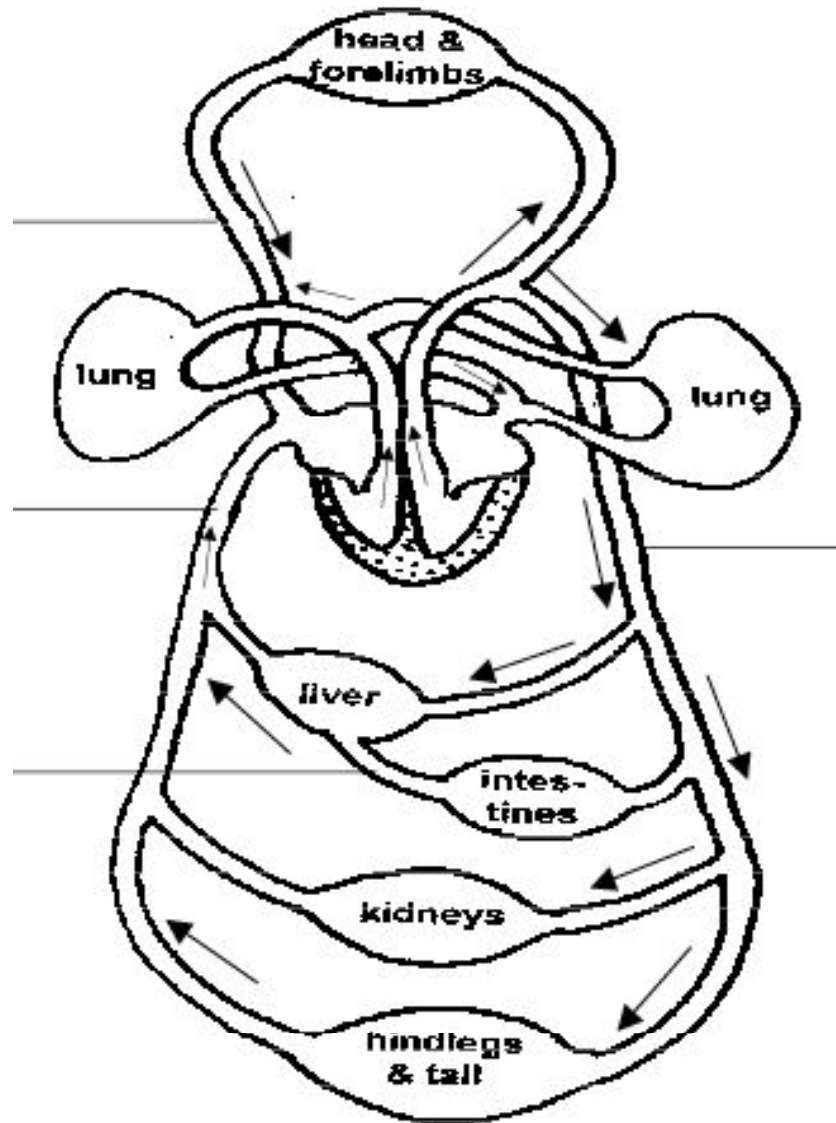
*Green Building & Energy Efficiency Basics – Municipal and Commercial Buildings*



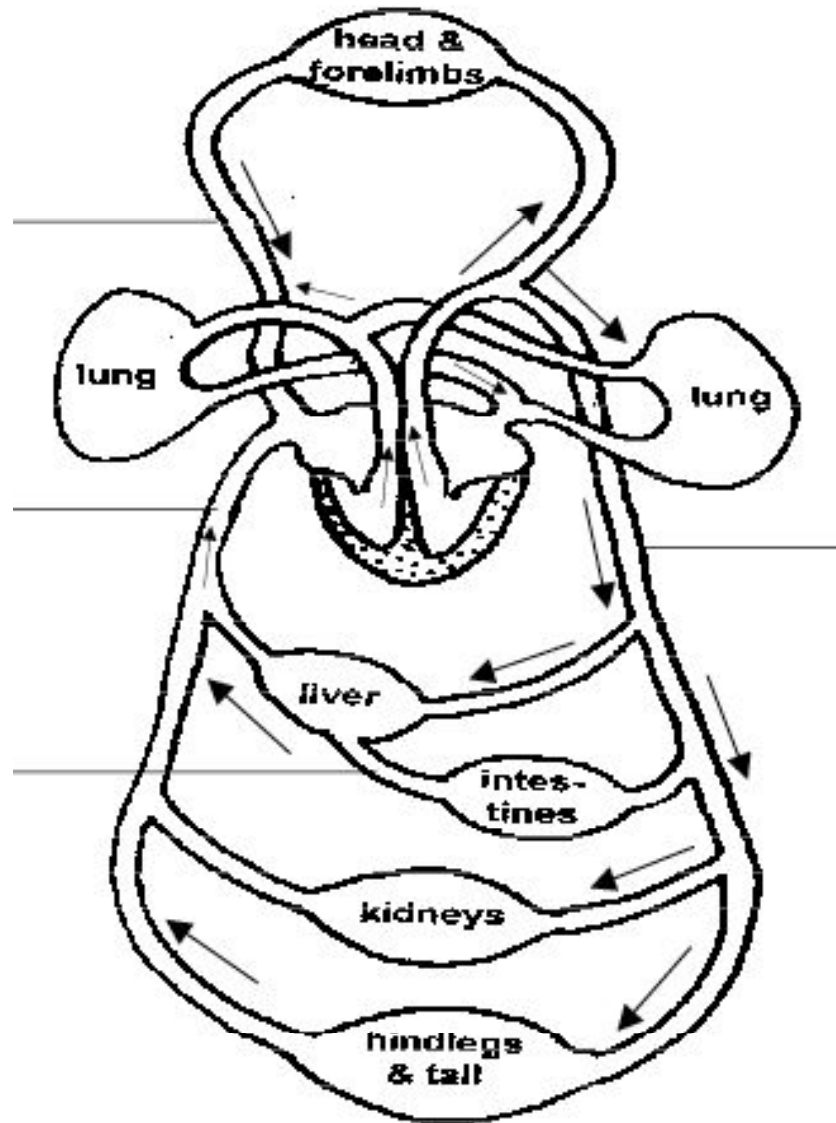
- Nervous



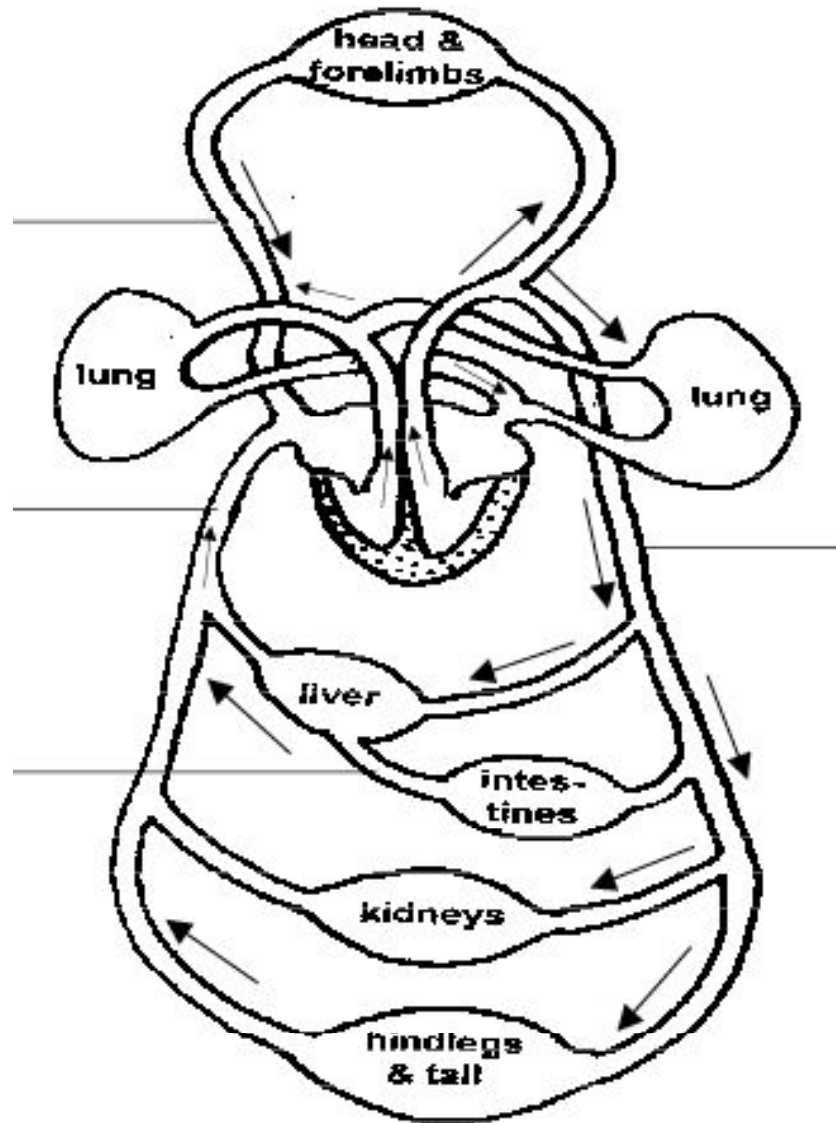
- Nervous
- Digestive



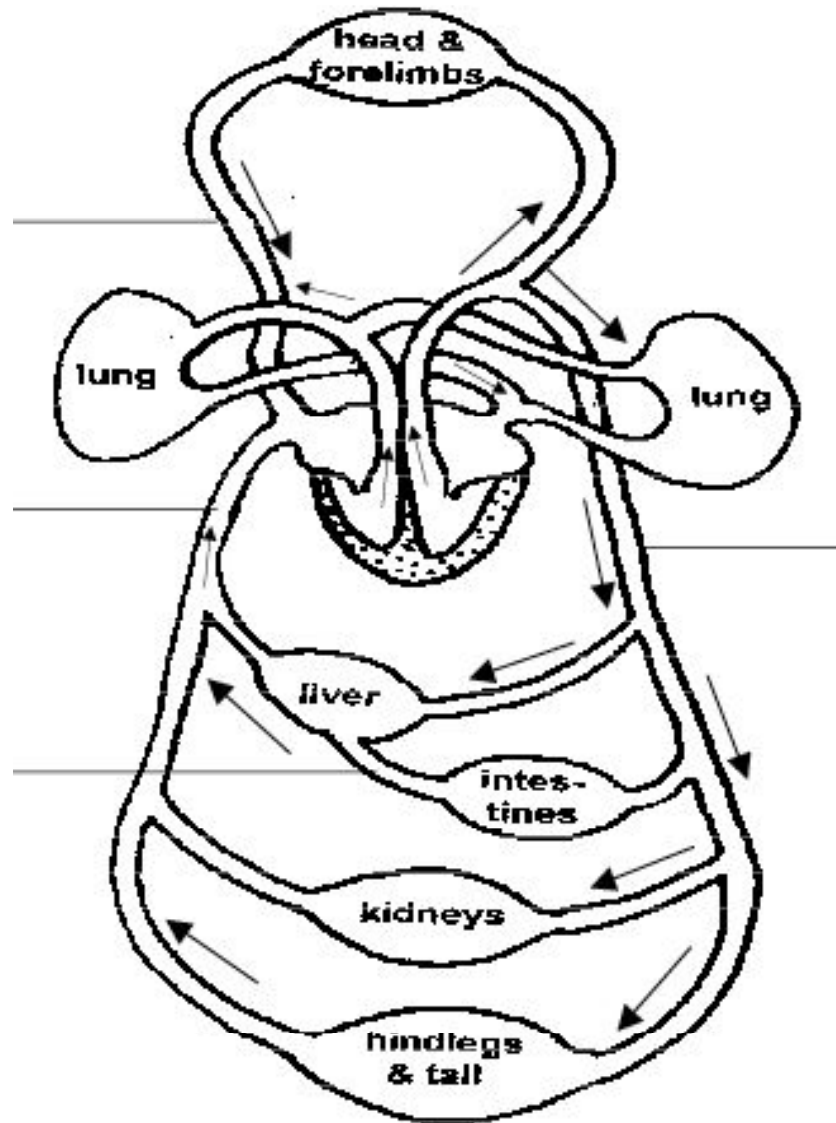
- Nervous
- Digestive
- Respiratory



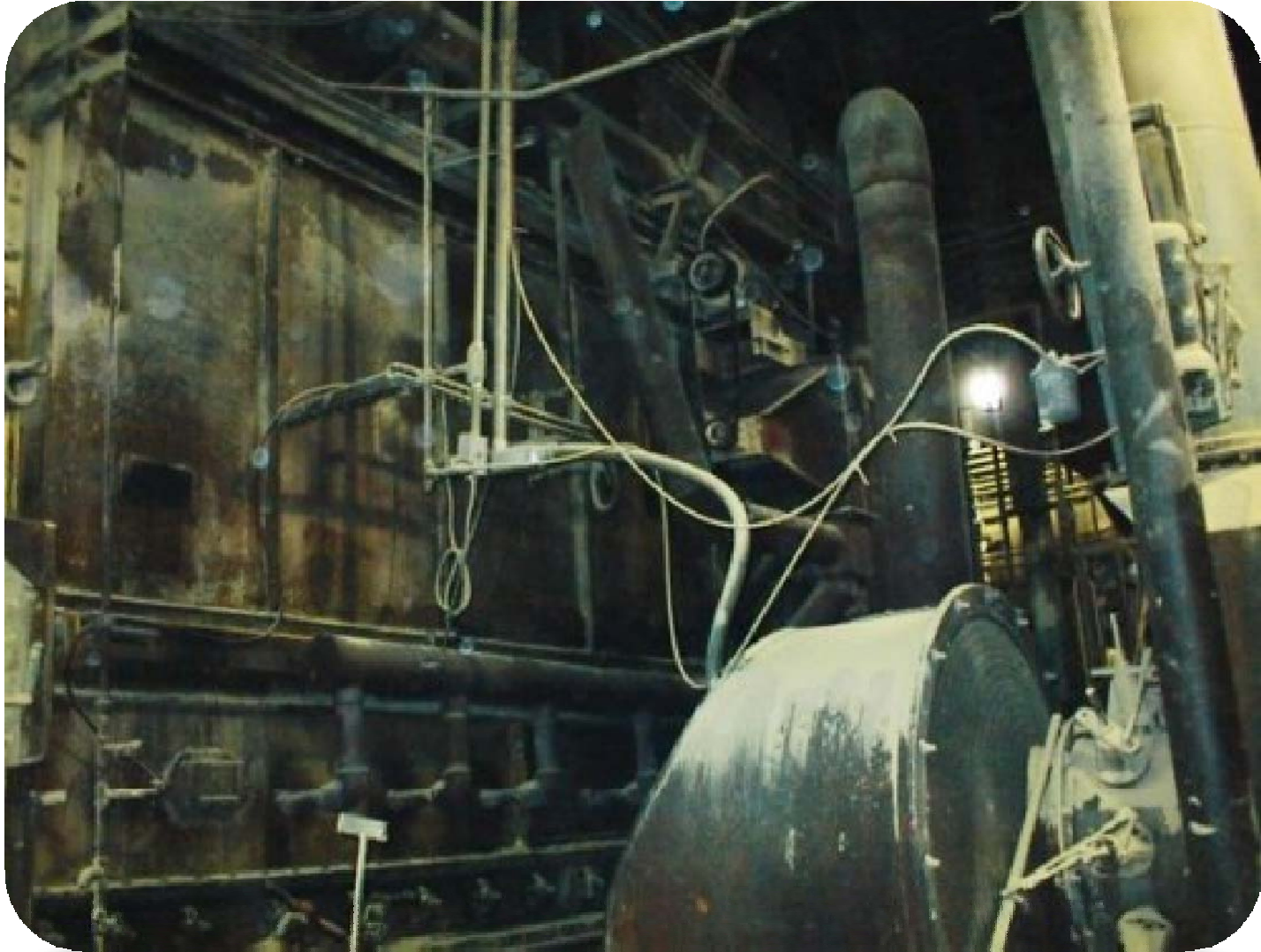
- Nervous
- Digestive
- Respiratory
- Immune
- Muscular
- Endocrine
- Skeletal
- And more



- Nervous
- Digestive
- Respiratory
- Immune
- Muscular
- Endocrine
- Skeletal
- And more

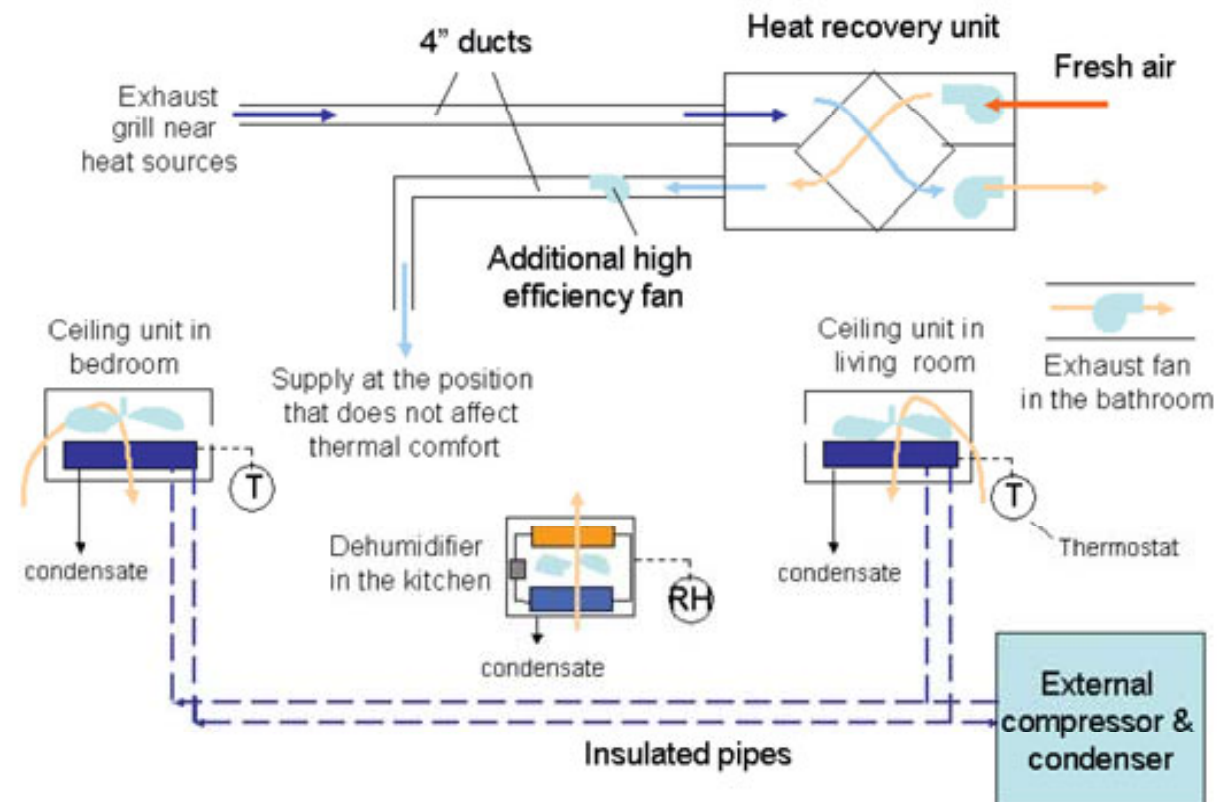


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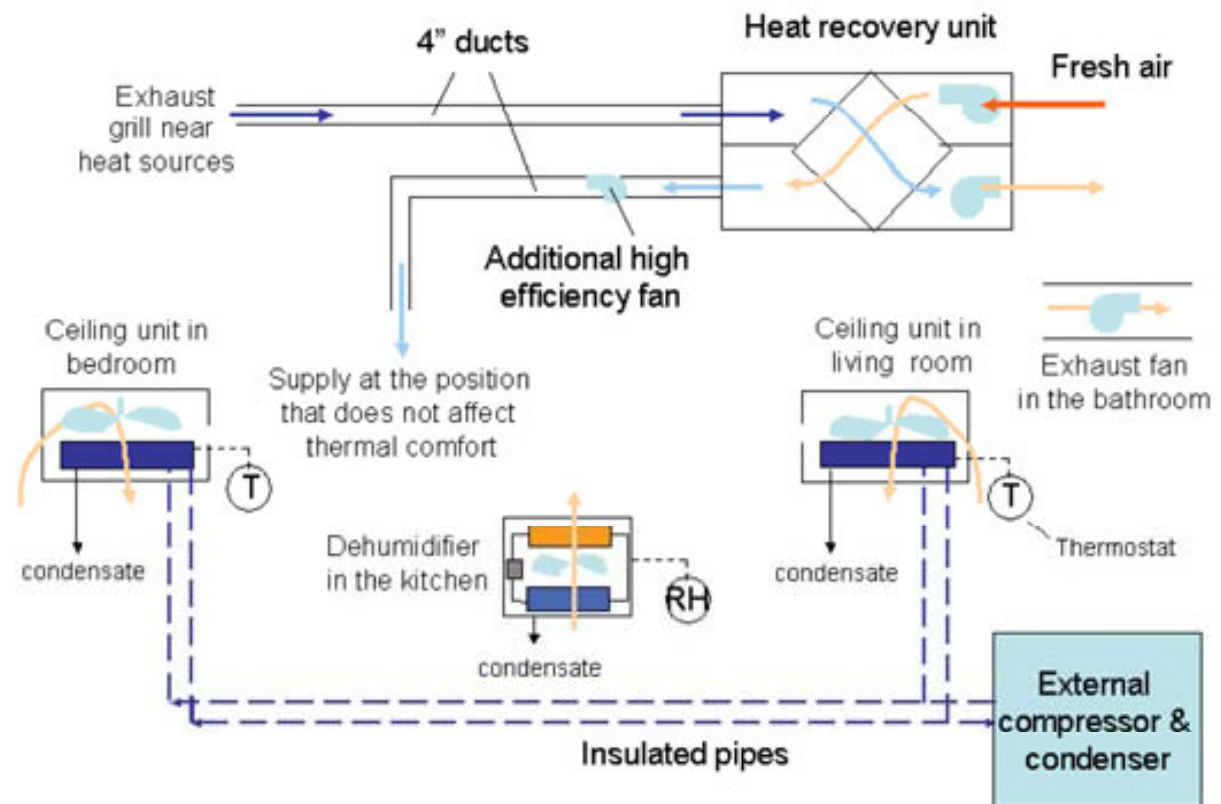
## Green Building & Energy Efficiency Basics – Municipal and Commercial Buildings

- Mechanical
- Electrical
- Controls



## Green Building & Energy Efficiency Basics – Municipal and Commercial Buildings

- Mechanical
- Electrical
- Controls
- Envelope
- Walls, roof
- Glazing
- Lighting
- External and Internal Inputs



Interconnectedness

=

Complexity

=

Paralysis

# Energy Efficiency

# Energy Efficiency

## Old vs New

## ***High Performance (Green) Buildings***

*Exterior and Site  
Conditions*

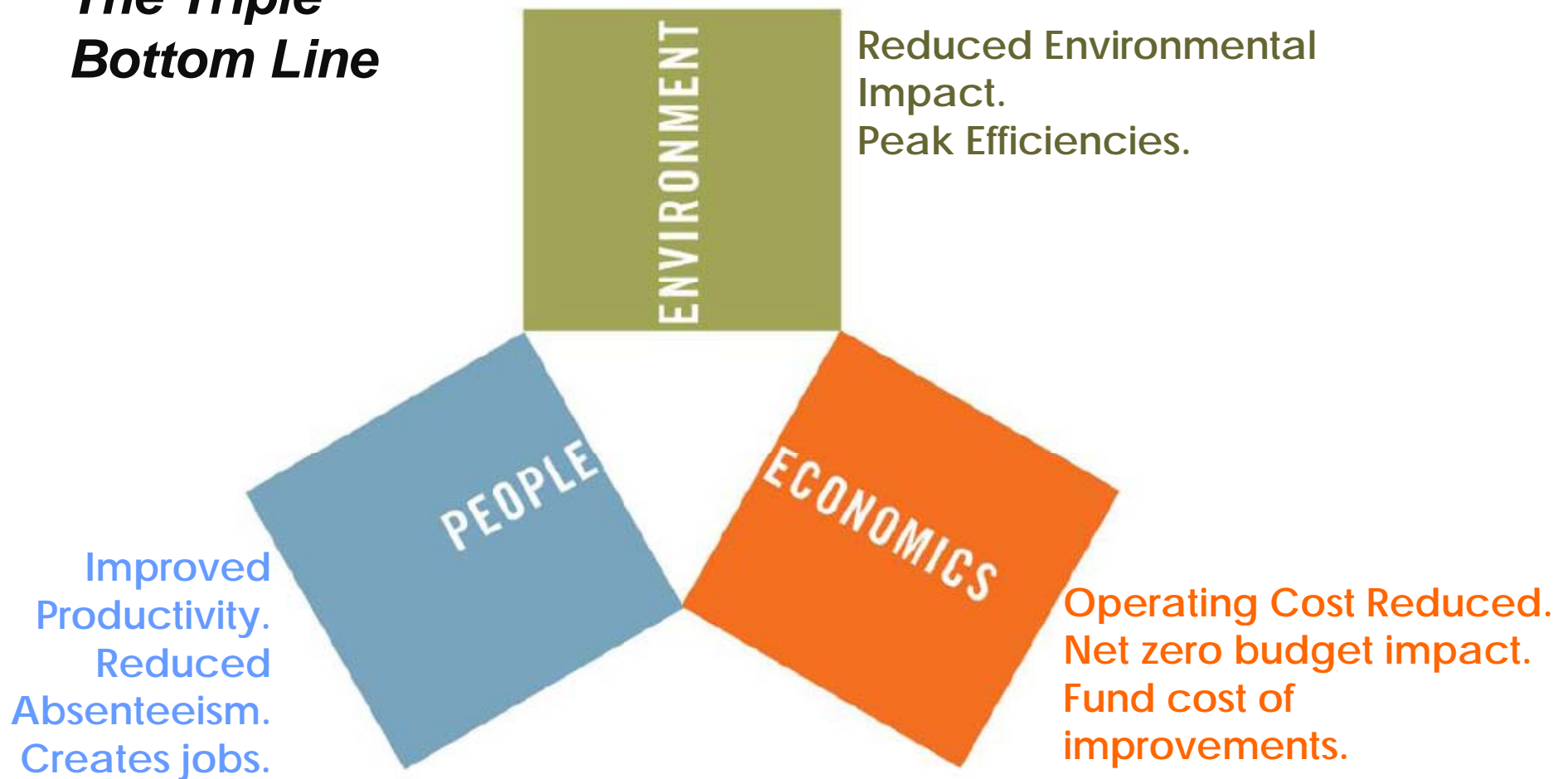
*Water  
Conservation*

*Energy Conservation  
and Building Efficiency*

*Material  
and Resources*

*Indoor  
Environmental  
Quality*

## ***Benefits of High Performance Buildings - The Triple Bottom Line***



## *High Performance (Green) Buildings*

*Energy Conservation  
and Building Efficiency*



LEED® New Construction

LEED® Commercial Interiors

LEED® Core & Shell

LEED® Existing Buildings : Operations & Maintenance



## **LEED® Existing Buildings : Operations & Maintenance**

- Rewards for energy efficiency upgrades.
- Uses Energy Star Performance Rating System
- Rewards for other “green building” best practices.
- Provides for ongoing energy use measurement.



## LEED® Existing Buildings : **Operations & Maintenance**

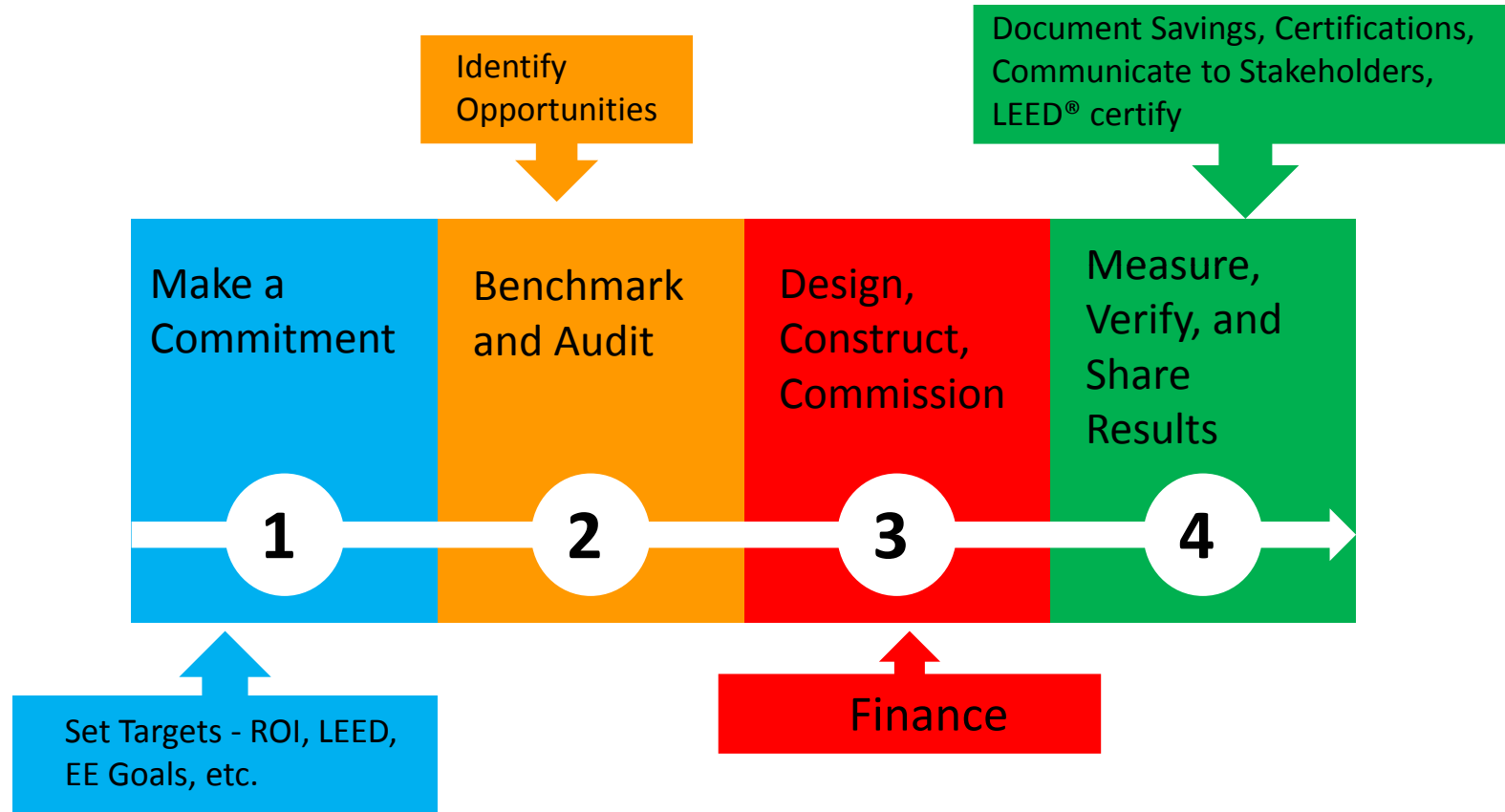
- 1,250 Registered Projects
  - 50 Certified Projects



## **Payback Model – The Economics of Energy Efficiency**

- Capital is invested into high performance building systems
- Building system retrofits reduce operating costs
  - Lower Utility Bills (Gas, Electric, Water)
  - Reduced Maintenance Costs (Equipment and Labor)
- An efficiency “Payback” is the length of time it takes for annual operating cost savings to equal the initial investment
- Typically, **3-5 year paybacks** can be expected for a comprehensive HVAC, controls and lighting retrofit (20-33% ROI)
- After the payback period is complete, the institution continues to benefit from the reduced operating budget

## Roadmap to Energy Efficiency



## Make a Commitment

### 1

- Adopt a policy that announces goals and objectives
- Develop an Energy Master Plan
  - Comprehensive strategy for investment in energy efficiency
  - Establish an “Energy Team”, assign responsibilities
  - Set financial criteria for energy efficiency investments (ROI)
  - Develop set operating parameters for all facilities
  - Require retrofit scheduling that reflects
    - ROI goals and guidelines
    - existing facility master plan
    - building systems point of life-cycle update
    - priority set by benchmarking facilities

## Make a Commitment

1

“The Missouri Botanical Garden shall pursue energy efficiency projects that deliver a return on investment that exceeds the rate of return on the endowment funds. Building Envelop systems should have less than a 15 year payback. HVAC systems should have less than a 10 years payback. Lighting systems should have less than a 7 year payback.”



Benchmark  
and Audit

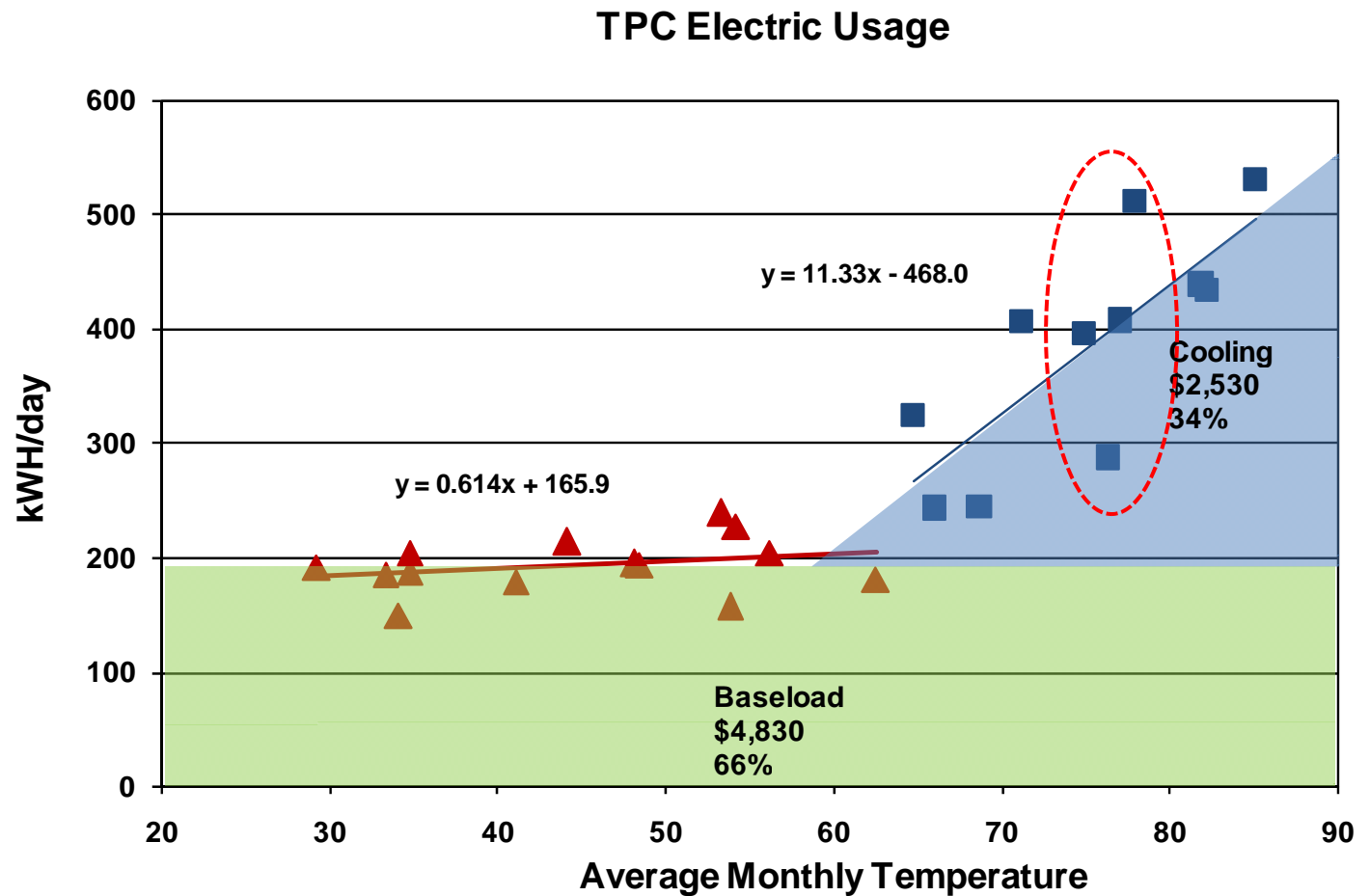
2

- Develop a weather normalized baseline of energy consumption for each facility
- Benchmark performance against national database of similar buildings
- Create an Energy Use Index of all facilities to identify the “hogs”
- Ground work for future certifications

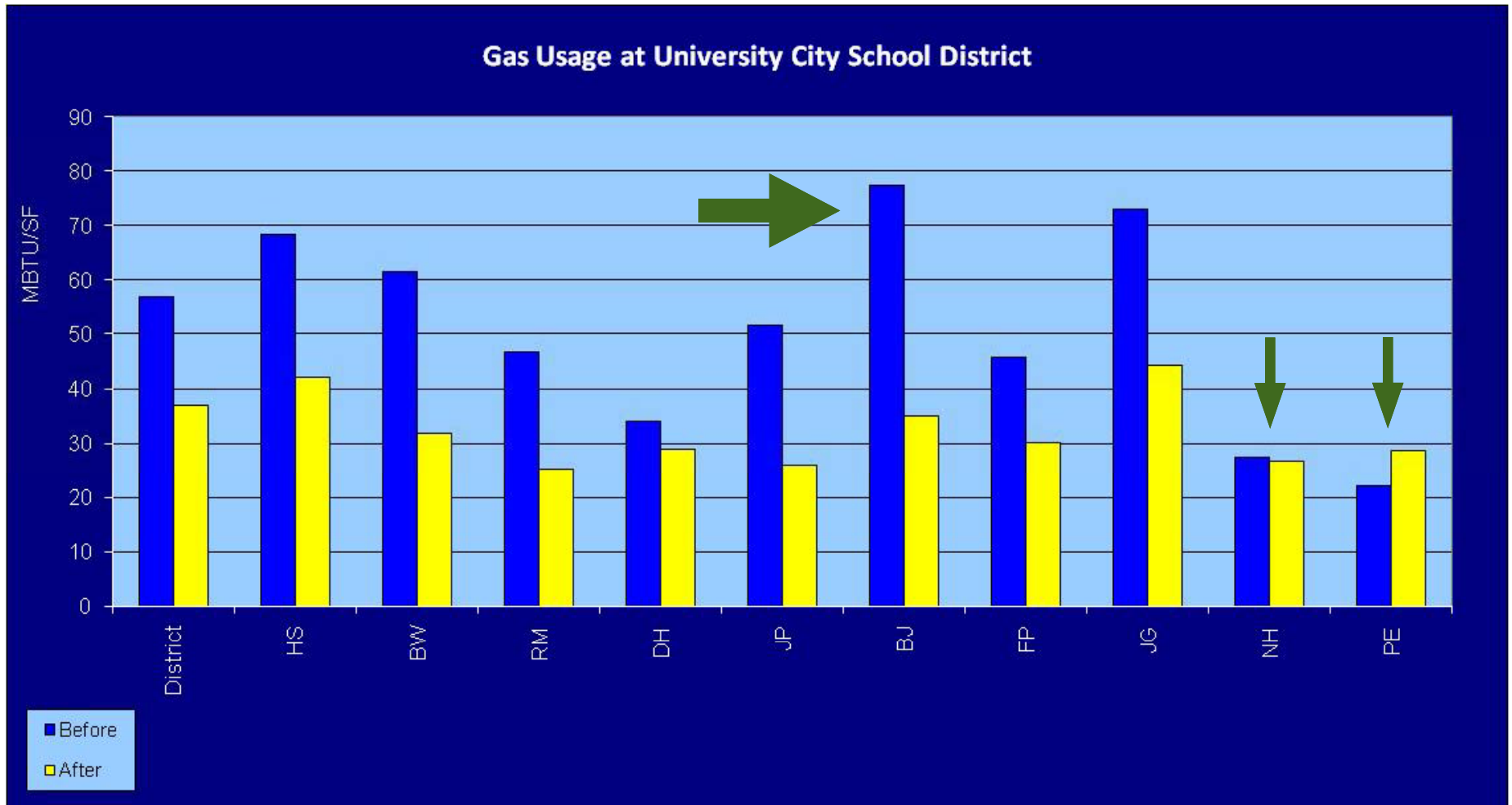
Benchmark and Audit

2

- Develop a weather normalized baseline of energy consumption for each facility



# Green Building & Energy Efficiency Basics – Municipal and Commercial Buildings



Benchmark  
and Audit

2

- Conduct full audit of building systems – HVAC, lighting, controls, and envelope
- Loads analysis and review of building systems design
- Recommendations for energy efficiency improvements, with payback analyses

Design  
and Construct

3

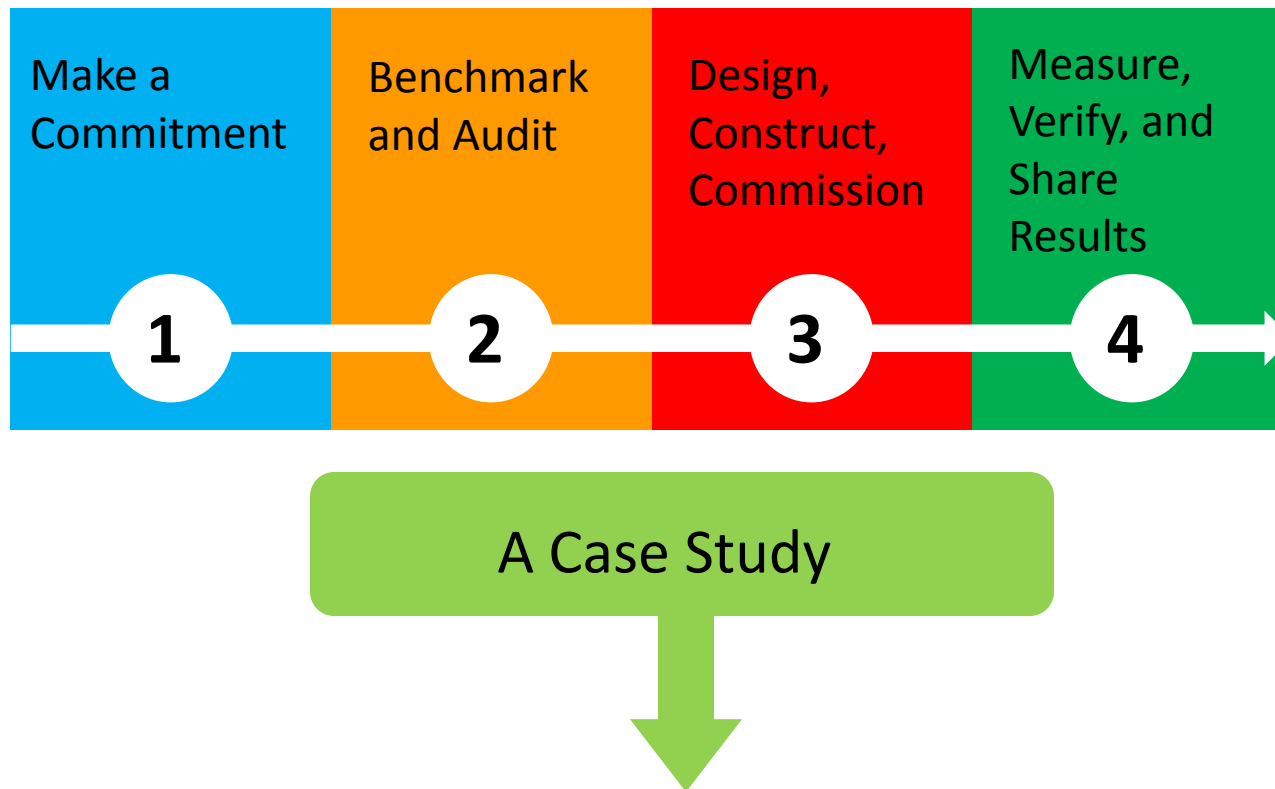
- Scope energy conservation measures according to master plan criteria
- Design to minimize future maintenance costs
  - Integrate HVAC, lighting, and envelope retrofit design – whole building design
- Construction management services for bidding, demolition, and installation
- Perform commissioning when appropriate

Measure,  
Verify, and  
Share Results

4

- Document savings on an annual basis
- Provide maintenance and operations training
- Tax benefits and other efficiency incentives (federal/state/utility)
- Apply for LEED and Energy Star certifications
- Assess changes in carbon footprint
- Communicate results to relevant stakeholders

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## Case Study: Danforth Plant Science Center

- Energy expenditures were higher than desirable.
- Audit was conducted in 2002, retrofit began in 2004
- More than 35 discrete Energy Conservation Measures were identified and implemented, at a cost of \$503,400
- Saving through Sept. 2008 exceed \$844K, with annual saving > \$250k (50%+ ROI)
- Investments fully recovered after 3 years, savings now paying forward



## Case Study: Danforth Plant Science Center

- Overhauled building heating and hot water systems by installing 4 high efficiency modular boilers, one domestic hot water heater and two heat exchangers to replace inefficient boilers and heaters



- Due to the reduction of loads through other ECMs, and the oversizing for original equipment, 30 MM BTU of boiler capacity was replaced with 8 MM BTU of capacity

## Case Study: Danforth Plant Science Center

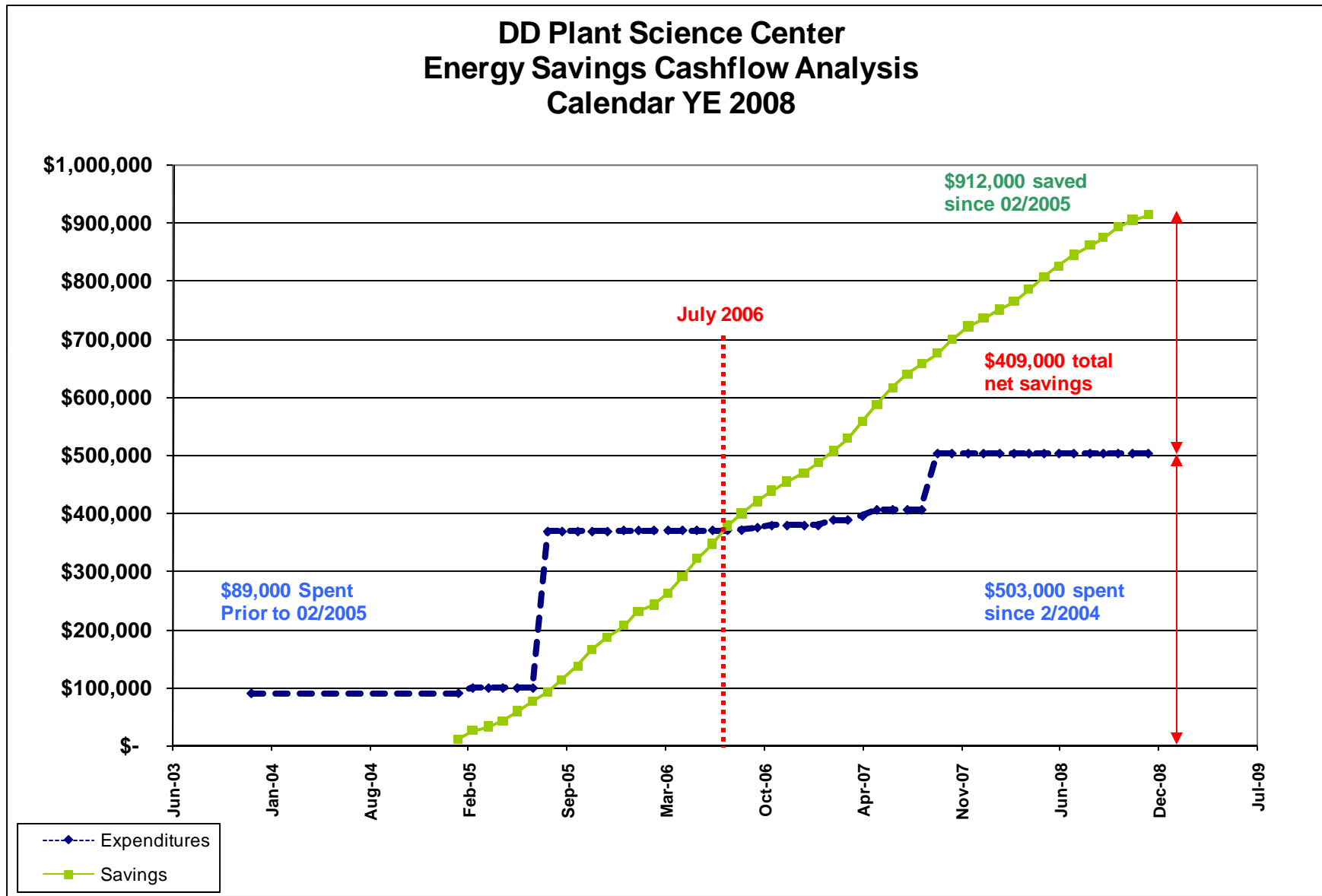


- Comprehensive rebalancing of building ventilation through better outdoor air control, unoccupied period outdoor air setbacks, and operational changes by occupants

- Load profiling informed operational changes that reduced peak KW demand charges [eliminated peak hour greenhouse lighting]



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## **Soliciting Proposals**

- Sorting through the Alphabet Soup
  - RFP (Request for Proposal) vs. RFQ (Request for Qualifications)
  - Performance Contracting vs. Professional Services
  - Design-Build vs. Design-Bid-Build
- The importance of independence
- Safeguard the competitive bid process

## **Energy Efficiency Incentives**

- Ameren Programs
  - Standard Incentives (Lighting, Motors, HVAC, and Refrigeration)
  - Custom Incentives (\$0.05/first year KWH saved)
  - Maximum incentive per facility is \$250,000
  - Maximum incentive per customer is \$500,000
  - Access with the assistance of a Trade Ally
  - [Ameren.com/EnergyEfficiency](http://Ameren.com/EnergyEfficiency)
- State of Missouri Energy Revolving Fund
  - Low Interest Loans, paid back with energy savings
  - Not defined as debt - does not count against debt limits or require a public vote or bond issuance
  - \$1MM/customer, maximum 15 year term
  - [Dnr.mo.gov/energy/financial/loan.htm](http://Dnr.mo.gov/energy/financial/loan.htm)

## **Energy Efficiency Incentives**

- Federal Tax Deduction for Commercial Buildings
  - \$1.80/SQFT - \$0.60 for lighting, \$0.60 for envelope, \$0.60 for HVAC
  - Not available to Municipal Clients directly, but can be passed onto the designer

## **Incentivizing Green Development**

- [Greenplaybook.org](http://Greenplaybook.org)
- Green Building Initiatives, Programs, and policies in Government
  - [Usgbc.org/DisplayPage.aspx?CMSPageID=1852](http://Usgbc.org/DisplayPage.aspx?CMSPageID=1852)

## Case Study

- The Ann Arbor Municipal Energy Fund
  - The Municipal Energy Fund was established in 1998 to be a self-sustaining source of funds for investment in energy-efficient retrofits at city facilities, so the City would be able to continually reduce its operating costs over time....
  - [www.a2gov.org/government/publicservices/systems\\_planning/energy/Pages/EnergyFund.aspx](http://www.a2gov.org/government/publicservices/systems_planning/energy/Pages/EnergyFund.aspx)

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EST. 1908

# MAPLEWOOD

MISSOURI



SHOP DINE BOWL

HOME

COMMUNITY

GOVERNMENT

DEPARTMENTS

search our site... SEARCH

**SHOP**  
stores where shoppers delight

**DINE**  
award-winning restaurants

**ENJOY**  
a multitude of entertainment



 NEWSLETTERS

 e-COMMERCE

 EMERGENCY

E-Services

- Events
- Newsletter
- Meeting Notices, Agendas & Minutes
- E-News Signup
- Municipal Code
- Zoning Map

## NEWS & ANNOUNCEMENTS VIEW ALL

**Maplewood Community Betterment Foundation (MCBF) Concert Series** Come and join in on the fun! Every fourth Wednesday May through September. [Additional info...]

**Let Them Eat Art** Mardi Gras meets the Christmas Tree Walk [Additional info...]

**National Night Out** The Maplewood Police put on some party! [Additional info...]

**Maple Days** Four Days of fun for all! [Additional info...]

**Art Outside** Three days of art by regional artists, kids' activities, live music and fun! [Additional info...]

**June 2009**

S	M	T	W	T	F	S
31	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>
	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>	<u>12</u>
	<u>14</u>	<u>15</u>	<u>16</u>	<u>17</u>	<u>18</u>	<u>19</u>
	<u>21</u>	<u>22</u>	<u>23</u>	<u>24</u>	<u>25</u>	<u>26</u>
	<u>28</u>	<u>29</u>	<u>30</u>	1	2	3
						4

**May 23 - Sep. 7**  
Maplewood Family Aquatic Center Opens!

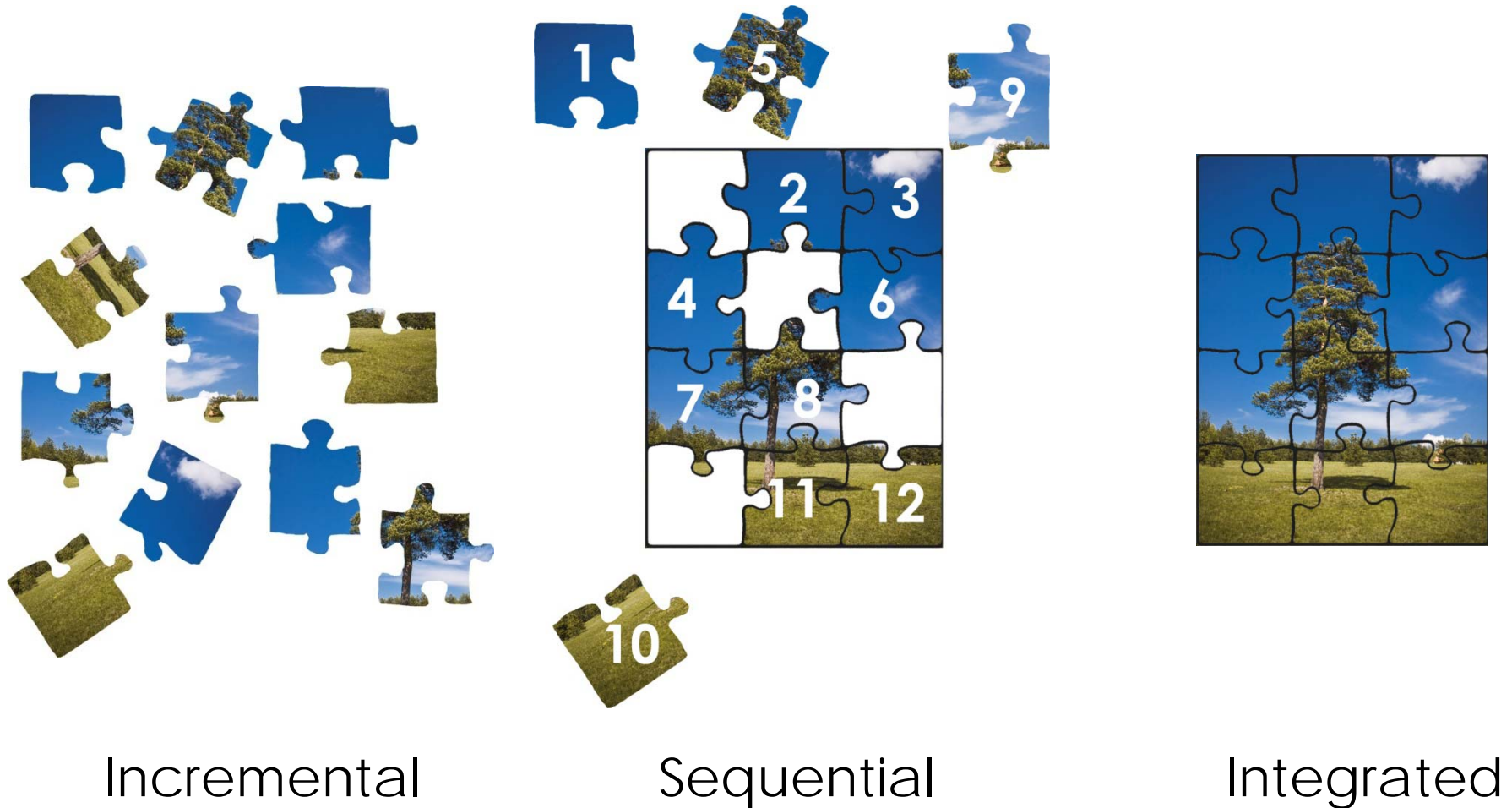
**June 18**  
Park Board Meeting

**June 24**  
Maplewood Community Betterment Foundation (MCBF) Concert Series  
Every fourth Wednesday from May through September

(VIEW ALL)

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# Holistic Approach





National League of Cities

*Green Cities*  
**Conference & Expo**  
LOCAL GOVERNMENTS CREATING A SUSTAINABLE FUTURE 2009

# Referenced Websites

# Green Building & Energy Efficiency Basics – Municipal and Commercial Buildings

## **Green Building and Energy Efficiency Measures for Municipal and Commercial Buildings**

### **Referenced Website List**

Establishing a Sustainability Commission

(<http://www.eugene->

[or.gov/portal/server.pt/gateway/PTARGS\\_0\\_2\\_254207\\_0\\_0\\_18/Sustainability%20Commission%20job%20description.pdf](http://www.eugene-or.gov/portal/server.pt/gateway/PTARGS_0_2_254207_0_0_18/Sustainability%20Commission%20job%20description.pdf))

Sample Sustainability Commission website

([www.portlandonline.com/bps/index.cfm?c=41460](http://www.portlandonline.com/bps/index.cfm?c=41460))

Sustainable Community Resources

(<http://www.sustainable.org/>)

(<http://www.greenplaybook.org/buildings/index.htm>)

(<http://www.fypower.org/bpg/index.html?b=institutional>)

(<http://www.usmayors.org/pressreleases/uploads/ClimateBestPractices061209.pdf>)

([http://www.energystar.gov/index.cfm?c=government.bus\\_government\\_local](http://www.energystar.gov/index.cfm?c=government.bus_government_local))

(<http://www1.eere.energy.gov/buildings/>)

Engaging Constituents

(<http://www.icleiusa.org/action-center/engaging-your-community/outreach-and-communications-guide>)

Report Progress

(<http://paloalto.visiblestrategies.com/>)

Endorse U.S. Mayors Climate Protection Agreement

([www.usmayors.org/climateprotection/documents/mcpAgreement.pdf](http://www.usmayors.org/climateprotection/documents/mcpAgreement.pdf))

Framework for Green Buildings and Sustainable Community Development

(<http://www.usgbc.org/DisplayPage.aspx?CategoryID=19>)

Sample Green Building Ordinance

([http://www.pvpc.org/val\\_vision/html/toolbox/Part%20III%20Strategies/Model%20Bylaws/Model%20Green%20Building%20Standards.rtf](http://www.pvpc.org/val_vision/html/toolbox/Part%20III%20Strategies/Model%20Bylaws/Model%20Green%20Building%20Standards.rtf))

Adopting an Energy Code

([http://www.energycodes.gov/implement/tech\\_assist\\_reports.stm](http://www.energycodes.gov/implement/tech_assist_reports.stm))

Inventory municipal Carbon Footprint

(<http://www.parkcity.org/onlineservices/documents/PCMCCarbonFootprintExecutiveSummary.pdf>)

Measurement and Verification

([http://www.ghgprotocol.org/files/ghg\\_project\\_protocol.pdf](http://www.ghgprotocol.org/files/ghg_project_protocol.pdf))

State and Federal Incentives

(<http://www.dsireusa.org/>)

(<http://www.goodtobegreen.com/financialincentives.aspx>)

Incentivizing Green Commercial development

Permitting

([http://egov.cityofchicago.org/webportal/COCWebPortal/COC\\_EDITORIAL/GreenPermitBrochure1.pdf](http://egov.cityofchicago.org/webportal/COCWebPortal/COC_EDITORIAL/GreenPermitBrochure1.pdf))

Density

(<http://www.seattle.gov/dpd/GreenBuilding/OurProgram/PublicPolicyInitiatives/DevelopmentIncentives/default.asp>)

Zoning ([http://bloomington.in.gov/sections/viewSection.php?section\\_id=446](http://bloomington.in.gov/sections/viewSection.php?section_id=446))

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[www.edg-stl.com](http://www.edg-stl.com)

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