



# **Green Technologies for Green Communities**

## Science Public Lecture

Presented by

www.**greenengineers**.com

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University of Ottawa

# Green Technology

- The term **technology** refers to the application of knowledge for practical purposes.
- The field of **green technology** covers an evolving group of methods and materials, from techniques for generating energy to non-toxic cleaning products.
- The anticipation is that this field will bring innovation and changes in our daily life of similar impact to the **information technology** over the last two decades.
- **Examples:** Energy; Buildings; Chemistry, Computing; Nano-technology; Purchasing, etc.
- **Development Via:** Sustainability; Innovation; Source Reduction by Changing Patterns of Production and Consumption.

# Why Green Technologies?

**Green Technologies concept helps communities make infrastructure choices that will:**

- Save money ! Make money!
- Create more jobs!
- Improve service delivery!
- Improve human health and quality of life!
- And importantly protect the environment!

# Approaches!

- Green Infrastructure.
- Low Impact and Sustainable Development.
- Alternative Technologies.
- Green Buildings.



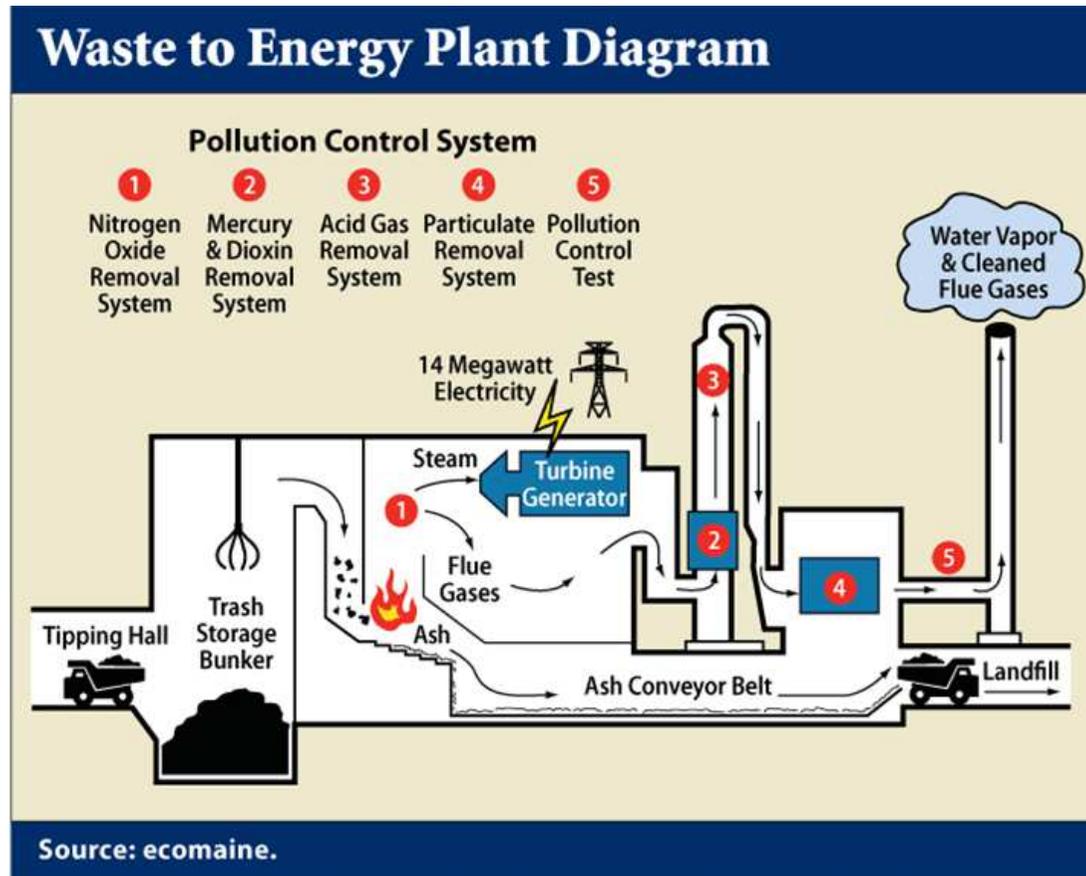
# Energy Production

Cities may use wind turbines or solar panels to run the street and traffic lights and save thousands a year on electricity bills!



# West to Energy!

Cities may use new technologies at its waste plants to burn methane gas to generate electricity, savings millions per year!

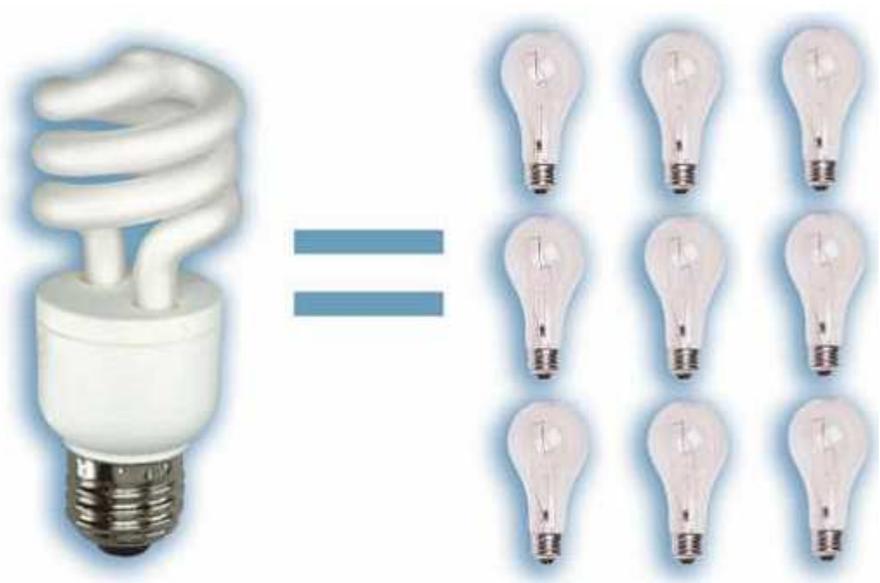
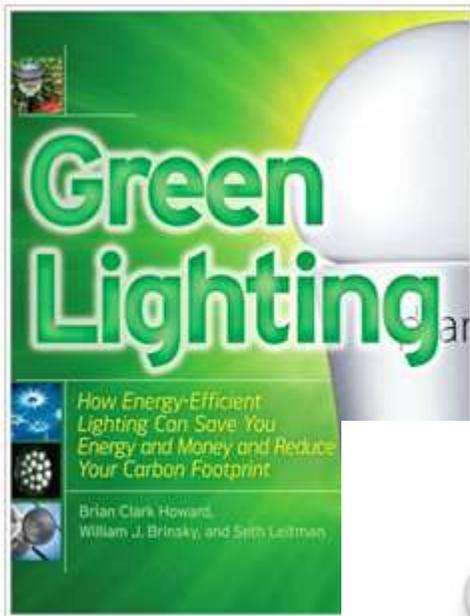


# Energy Efficiency!

Energy efficiency is one of the least flashy but most promising ways to cut carbon dioxide emissions. In addition

- Cities may invest in energy efficient lighting in municipal buildings and will save \$\$\$\$ in electricity bills.
- Cities will be saving tens of thousands of dollars a year by replacing their traffic lights and street lights with energy efficient lamps, which are 40% more efficient and save between 70 to 80% of the operating cost.

One way to cut the electric bill down is to switch your light bulbs from the old traditional type, to the new energy-efficient type. Estimates have suggested that we may save up to 60% on lighting bill over time!



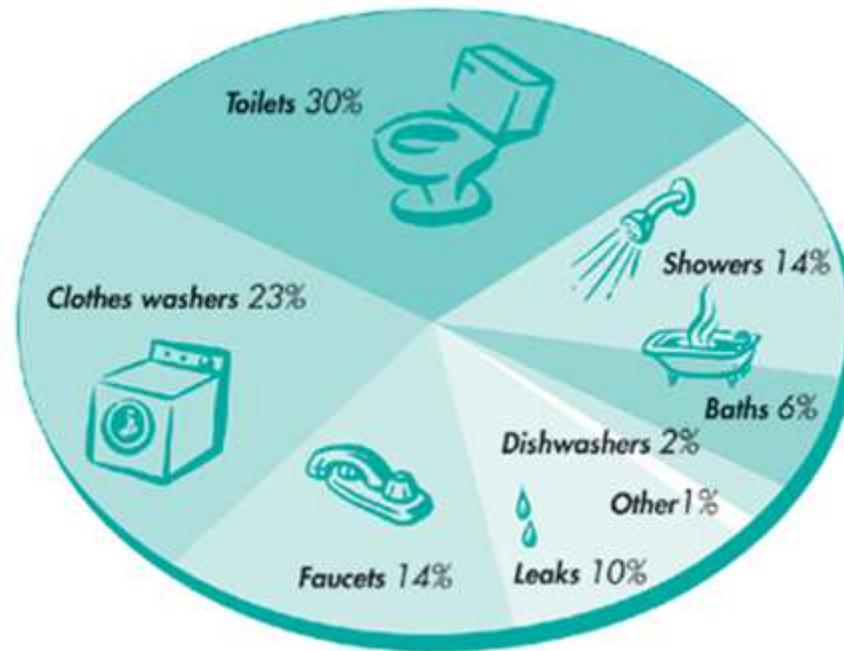
The new streetlight system with light-emitting diodes will be 40% more energy efficient and cost the city 70% less in operating cost per year.

- “Green” LED-based Street Light!
- Conventional Street Light!



# Water Conservation

Cities may promote water conservation and save \$\$\$ through reducing the size of new filtration and storage facilities, cutting the average residential water bill by \$\$ a year!



# Heat Production

Schools and various buildings in various places now heat with wood biomass, which increases comfort, support improvements in indoor air quality, lowers costs, and benefited the local economy. Some cities use a district energy system to heat a significant part of their downtown.



# Free and Clean Heat from the Sun!

(Alternative Heating Solutions: Cansolair)



**WHEN THE SUN  
IS SHINING, THE  
CANSOLAIR  
PANEL HEATS  
UP, SUPPLYING  
FREE HEAT  
YEAR-ROUND**



# Fuel Conservation

Cities may save \$\$\$\$ in heavy equipment and diesel rates by shutting off equipment during breaks and lunch periods. Biomass heating systems burn plant or other organic matter—such as wood chips, agricultural residues or even waste—to generate heat.

**THE WORLD IS ADDICTED TO OIL.  
IT'S TIME FOR AN INTERVENTION.**



# FUEL

CHANGE YOUR FUEL...CHANGE THE WORLD

# Green Buildings!

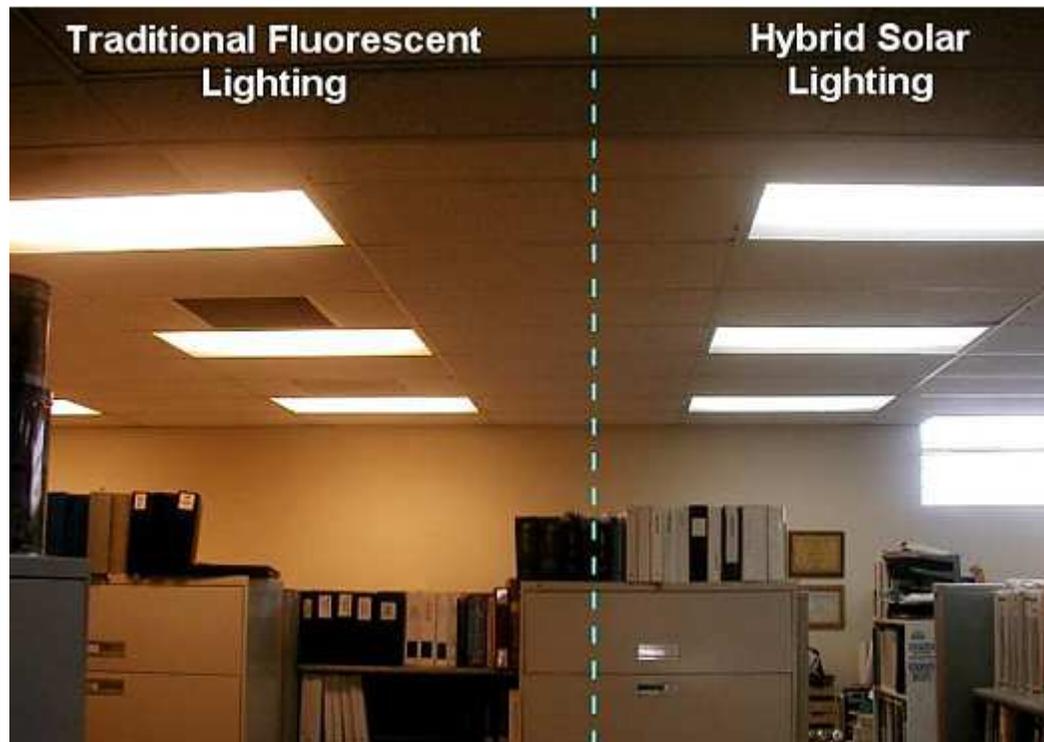
- Uses a facility-wide digital control system.
- Hybrid solar day lighting.
- Solar thermal system for water heating.
- Auto dimming fluorescent lights.
- Recycled content materials.
- Green building rating system certified.

## Specifications for Residential Energy Savings in Greensburg, Kansas

### International Energy Conservation Code (IECC) 2003 (with 2004 Supplement)

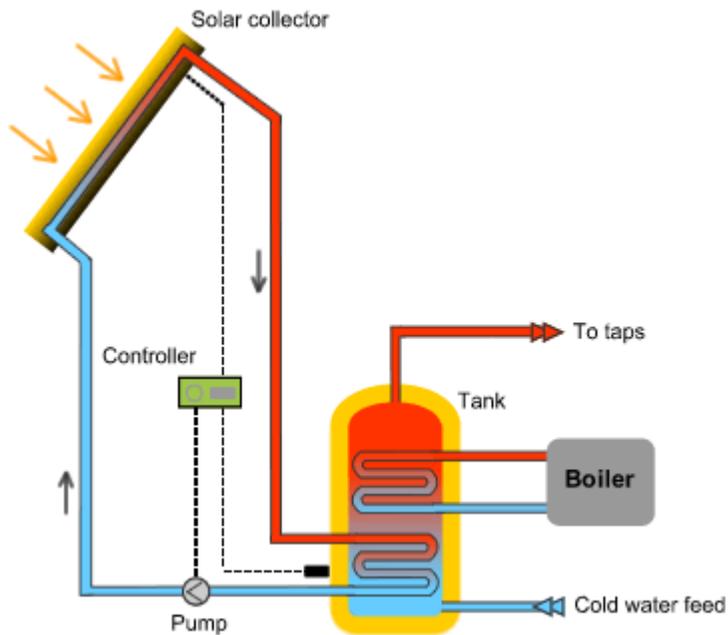
Feature or Factor	Basic Efficiency Package (30% energy savings)	High Efficiency Package (40% energy savings)	Premium Efficiency Package (50% energy savings)
Insulation			
Walls	R-19	R-21	R-19 + R-5 Foam
Roof	R-40	R-50	R-50
Basement	R-10	R-10	R-10
Windows	Double-glazed, low-e	Double-glazed, low-e, argon-filled	Double-glazed, low-e, argon-filled
U-value	0.30	0.28	0.28
Solar rating	0.37	0.37	0.37
Lighting			
Compact fluorescents	50%	80%	80%
Heating			
efficiency rating (AFUE,%) <sup>a</sup>	90+	90+	90+
Air-conditioning			
efficiency rating (SEER, Btu/watt- hour) <sup>b</sup>	14	18	18
Appliances			
Water heater	Standard Tank—gas	Standard Tank—gas	ENERGY STAR Tankless—gas
Energy factor <sup>c</sup>	0.61	0.61	0.80
Ventilation	Exhaust	Supply	Balanced

# Hybrid Solar Lighting



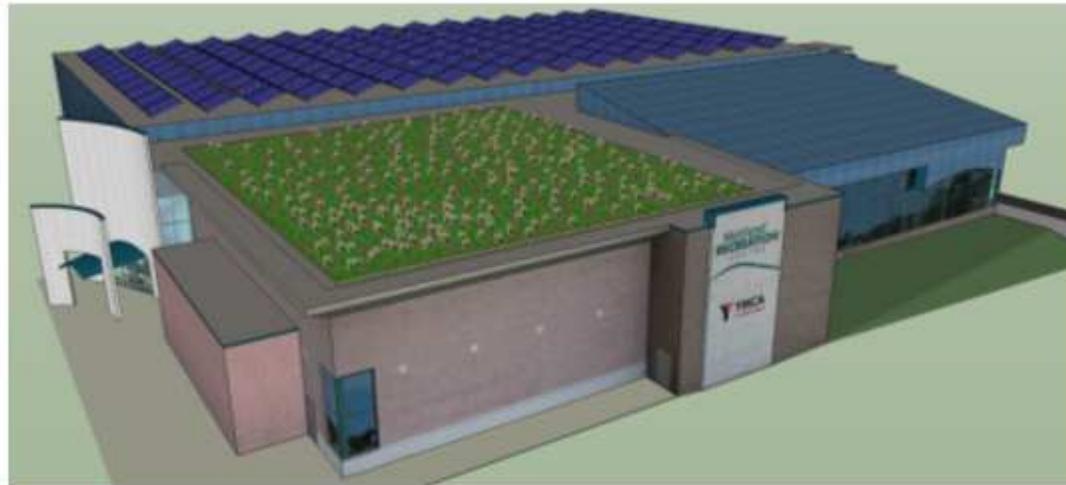
# Solar Thermal System for Water Heating

Solar water heating is one of the most cost-effective applications of solar energy, providing hot water for showers, laundry, dishes, and space heating. A solar water heating system can save a family as much as 65% of their hot water heating costs. A typical family may save approximately 2700 kWh or \$325 per year by supplementing their electric water heater with a solar thermal water heater system.



# Components of a Green Building!

Geothermal; Solar Energy; Green Roofs; Natural Lighting  
Water and Electrical Efficient Appliances; Rain Gardens  
Green Building Materials; Grey Water!



# A Green Building in Ottawa!

## Centre for Construction Excellence, Algonquin College

The design has targeted **LEED Platinum**, using on-site renewable energy generation, a green roof, rainwater capture and reuse, green computing, sustainable materials choices and a variety of other green strategies.



## **LEED: Leadership in Energy and Environmental Design**

A suite of rating systems for the design, construction and operation of high performance green buildings, homes and neighborhoods.

- In general, about 40% of all energy consumed in buildings. Energy use goes toward heating, cooling, lighting, and many other household or building needs.
- The production of this energy is also responsible for about 40% of all CO2 emissions. Because there is so much energy used by buildings, making them more efficient can make a big positive impact on the environment.
- One way that community may make sure their buildings are green is by seeking LEED certification for their projects.
- **Source:** US Green Buildings Council.

See the Solar Panels!

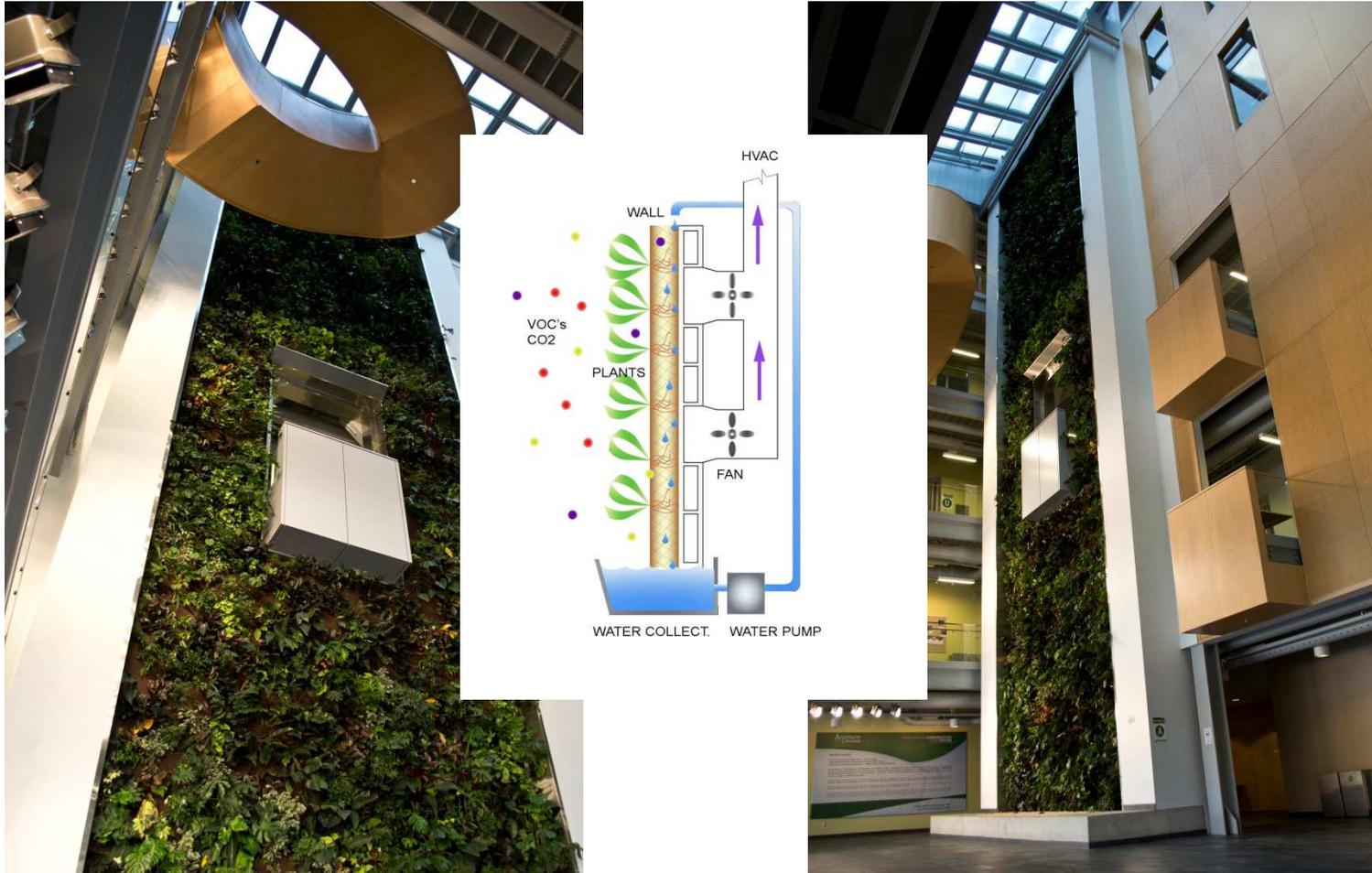


# The LED Lighting System



# The Bio-Wall!

Live plants cover the vertical surfaces of interior or exterior walls. Not only do these living walls create a **beautiful** surface, but they help **insulate** the building, **clean** the air, and enhance property **value**!

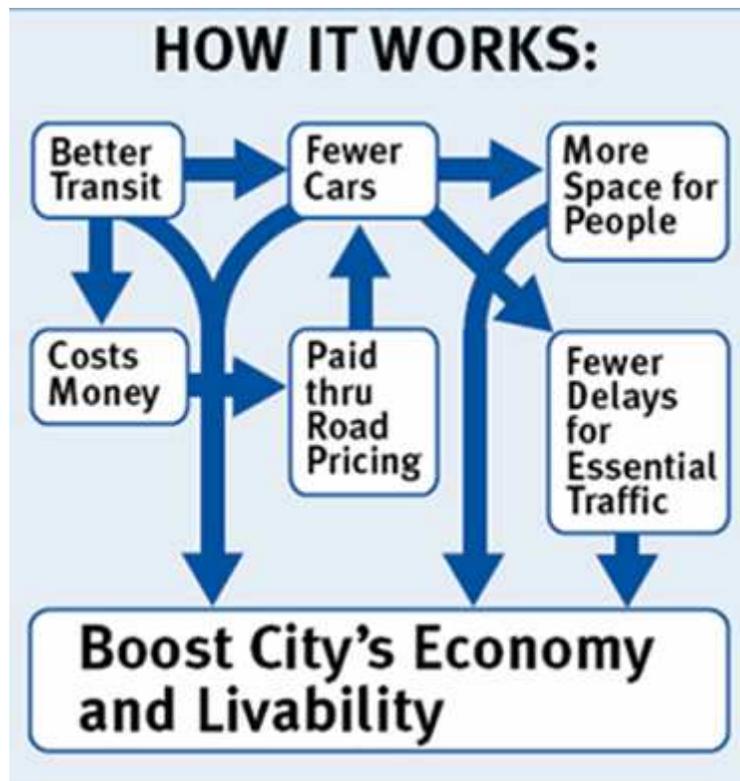


More!



# Transportation Alternatives!

The transportation sector is the largest single source of greenhouse gas emissions.



# System Approach

- **Design:** Green buildings, low impact development, green infrastructure.
- **Hardware:** Biomass, alternative energy, highly efficient equipment/machinery
- **Behaviors:** Conservation, operations, management

# Research Alternatives

- What are they?
- Where have they been used effectively?
- What are the economic, environmental and social benefits and drawbacks?
- Which technologists are doing this type of work?
- What are the life cycle costing implications?
- What is most appropriate for this community?

# Examples!

- Alternative methods of sewage processing.
- Storm water source reduction.
- Highly efficient pumps and motors.
- Energy audits and renovation for historic buildings.
- Alternative fuels for town vehicles.
- Repair of underground water lines.
- Alternate sources of energy: wind, solar, etc.
- Green building components for new construction.
- Best practices for municipal garage management.

# Education!

- Engaging the youth in the community in green technologies has already begun with the establishment of Green Clubs at high schools.
- Involvement of the youth at all ages should be encouraged.
- Many organizations offer training materials, curricula, activities, and ideas in these areas for youth.
- At the University of Ottawa we already establish the student group: [www.greenengineers.ca](http://www.greenengineers.ca).

Wind Energy: Contra Rotating Concept! uOttawa's Students Project  
Features: Efficient; Low Noise; Clean Output Power  
([www.greenengineers.ca](http://www.greenengineers.ca))



# Solar Energy uOttawa's Student Project



# Outreach!

- Several national organization including University of Ottawa has partnered with the Museum of Science and Technology in Ottawa to establish the “Energy: Power to Choose” exhibition.
- The University built three energy systems for the exhibition including:
  - Interactive human hamster wheel
  - contra-rotating wind turbine, and
  - Microhydro system.
- See: [www.greenengineers.ca](http://www.greenengineers.ca).

# Energy: Power to Choose!

## Museum of Science and Technology, Ottawa



uOttawa's Enrichment Program  
May, every year! Grade 8 and above  
Robots and Green Engineering Things!



# Engineering Student Activities



- Robot and Green Robot!
- Solar Tracker!
- Batteries!
- Lighting Systems!
- Solar Panels!
- Wind Turbine!
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