UNIVERSITÉ BISHOP'S UNIVERSITY

AMERESCO

Bishop's University energy efficiency project:

The next step towards a

Carbon Neutral Campus

Context

Energy Efficiency Project

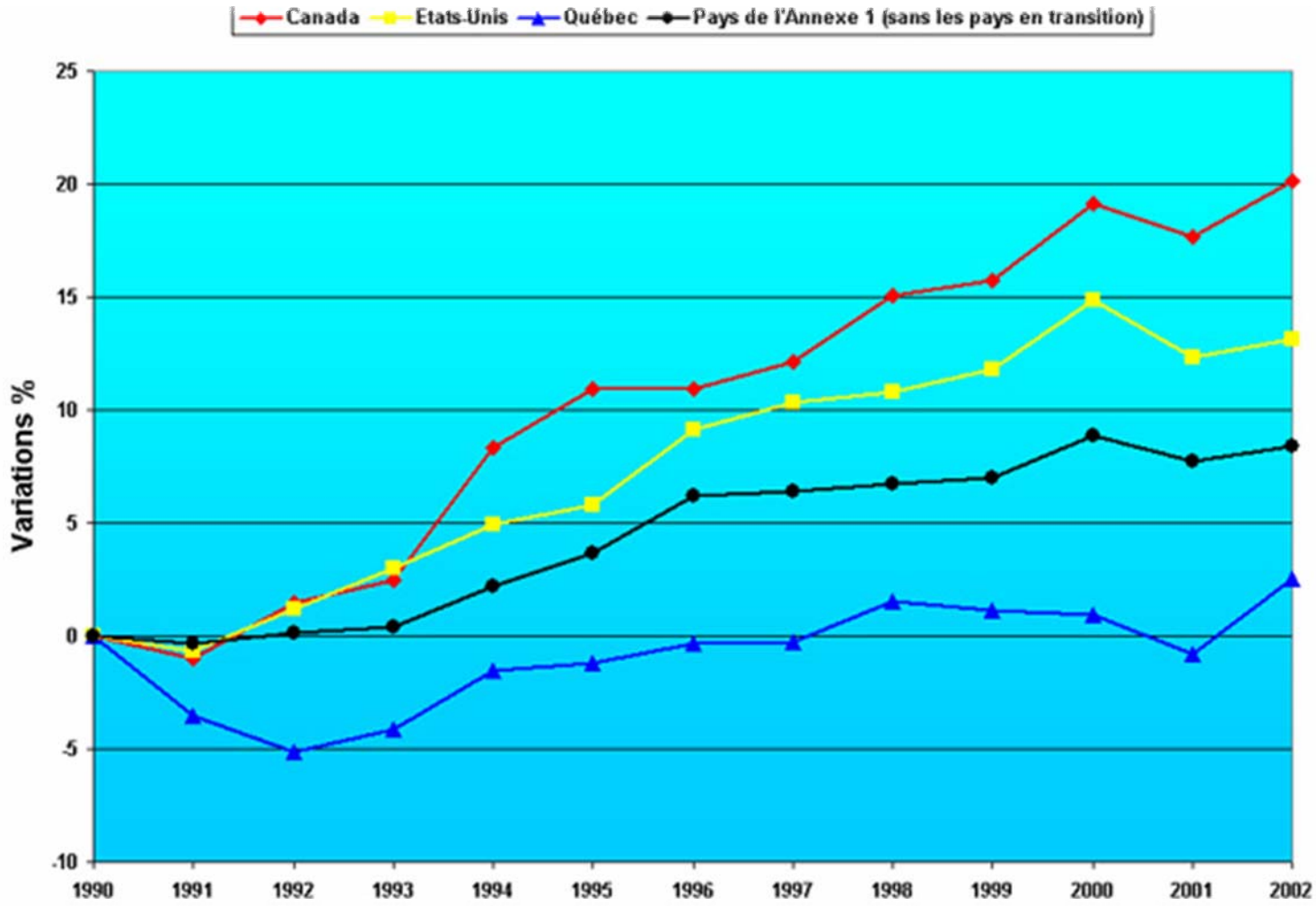
- Process started in 2008 by Bishop's University
- 3 Energy Services Company submitted bids for a comprehensive turn-key energy efficiency project
- 2010: contract awarded to Ameresco after a detailed feasibility study was submitted and approved by BU
- Project in 2 phases:

  2010-2011: Decentralisation of heating systems

  2011-2012: Geothermal heating system
- Project monitoring and energy savings calculations for following 10 years

The threat of global warming

Evolution of GHG emissions



Canada

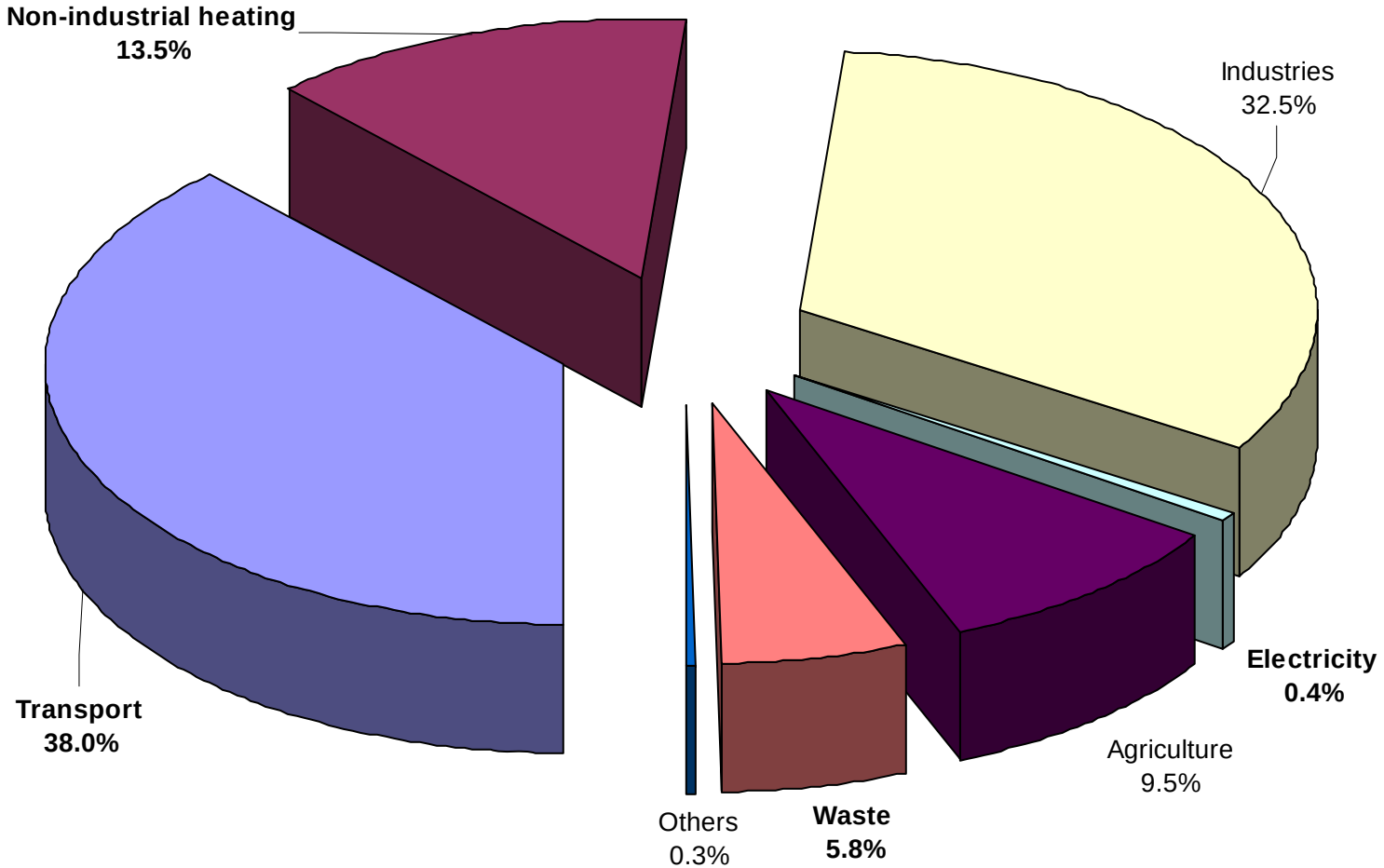
USA

Developped countries

Québec

http://www.mddep.gouv.qc.ca/changements/ges/2002/index.htm

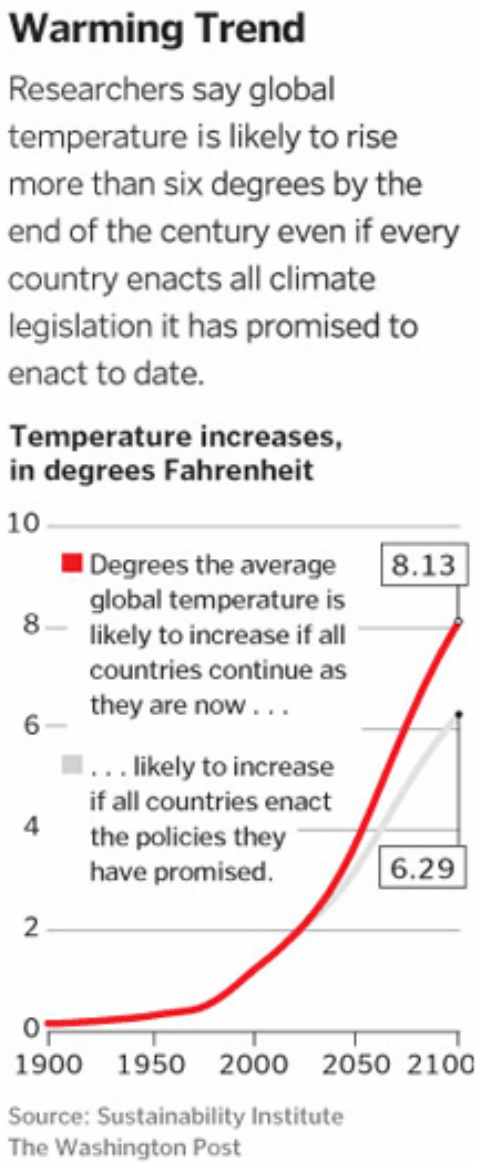
GHG emissions by source (Québec, 2000)



In bold: Where BU is taking action (everywhere we can!)

http://www.mddep.gouv.qc.ca/changements/ges/index.htm

On the threshold



The scientific community agrees that if the planet's temperature increases by more than 3.6 °F, consequences will be disastrous and irreversible.

In 2007, the planet's temperature had already increased by 1.3 °F since the industrial revolution.

Even if all countries enact the policies they have promised, the temperature rise will reach more than 6 °F in year 2100.

http://www.washingtonpost.com/wp-dyn/content/article/2009/09/24/AR2009092402602.html

Bishop’s is taking action

- **Eliminating heating oil use** and **reducing natural gas use** with new decentralized **geothermal** heating system
- **Reducing electricity use** with high efficiency lighting and automated building controls for heating, air conditioning and ventilation systems
- **Reducing waste** with composting, recycling and by promoting better practices
- **Reducing GHG emissions for transportation** with new electric carts instead of fuel-driven carts

Energy conservation measures

Geothermal heating system

Geothermal heating system

Geothermal energy ???

- Below 50 feet, ground temperature is low but nearly constant in depth and in time (49 °F measured at the soccer field)
- This “low-grade” energy can be converted to “high-grade” or usable energy by using heat pumps
- Heat pumps convert free “low-grade” energy to usable energy with the use of electricity
- Electricity use is only 25-50% of energy produced (50-75% comes from the ground)

Geothermal heating system

Heat pumps

Electricity from Hydro-Québec

25%

Heat pump

100%

Usable energy for heating

75%

Free energy from the ground

Geothermal heating system

Geothermal wells

- 500 feet deep in the ground
- Closed-circuit piping with circulating fluid to retrieve the ground's thermal energy

Geothermal heating system

In practical terms…

57 geothermal wells in the soccer field

+ 2 big heat pumps in the old heating plant

+ 11 smaller heat pumps in the various buildings

+ 1 big underground loop connecting all buildings to the heating plant

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= The first geothermal district heating system in Canada!

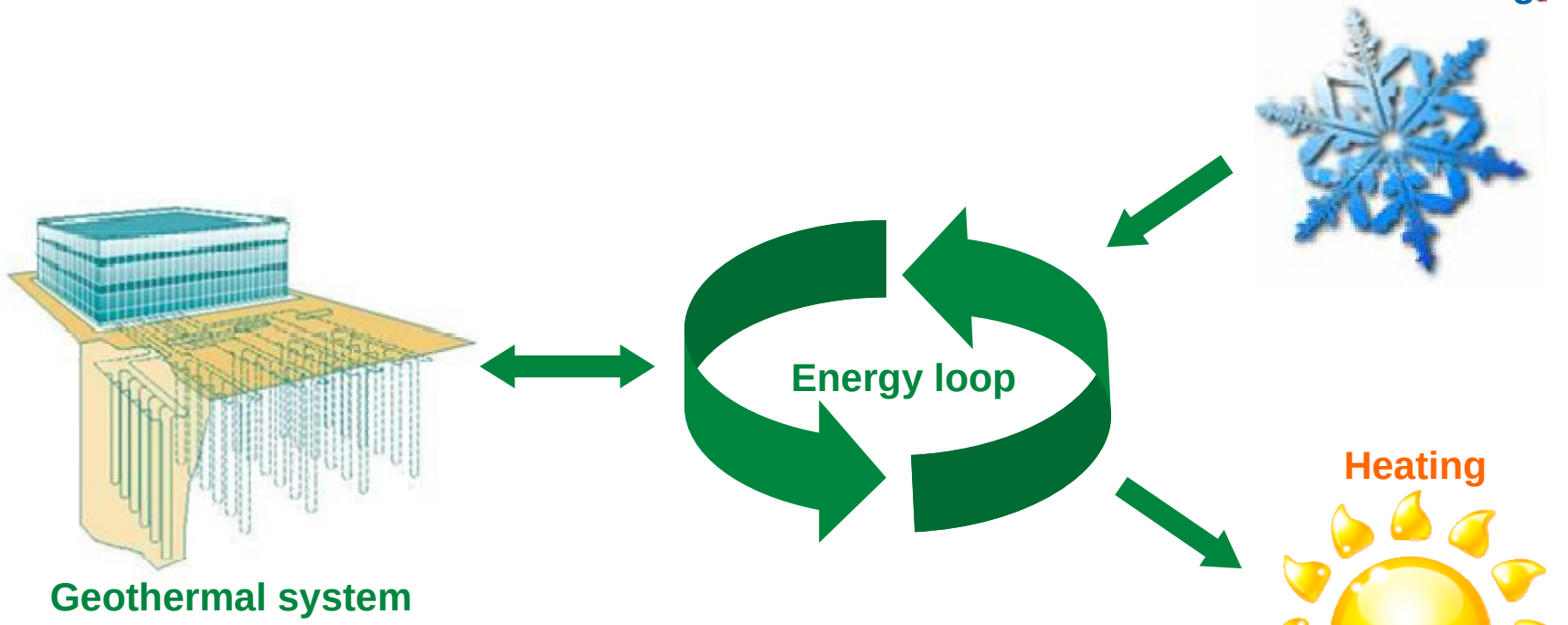
Geothermal heating system

Underground energy loop

- Every building can take energy from the loop or reject energy in the loop
- If a building needs heat, it takes heat from the loop
- If a building needs air conditioning, it gives heat to the loop
- The geothermal system balances the loop it there is too much or not enough heat in the loop
- Modular system, future buildings can be connected to the loop

Geothermal heating system

Underground energy loop



Geothermal heating system

Savings

- **62% of greenhouse gases emissions**
  - 2,364 tons of CO_2 per year
  - Equivalent to removing **1,478 cars** from the road
  - Equivalent to planting **14,167 trees**
- **1,011,000 cubic meters of natural gas per year**
  - Equivalent to heating 337 big single family houses (2,000 sq.ft. each)
- **325,000$ in energy savings per year**

High efficiency lighting

High efficiency lighting

Complete upgrade of lighting equipment

- Upgrade of fluorescent lighting fixtures to more efficient technology
  - T8 lamps (smaller tube with higher output)
  - Electronic ballasts
- Upgrade of exit signs to LED technology
- Upgrade of incandescent lighting to compact fluorescent technology

High efficiency lighting

Savings

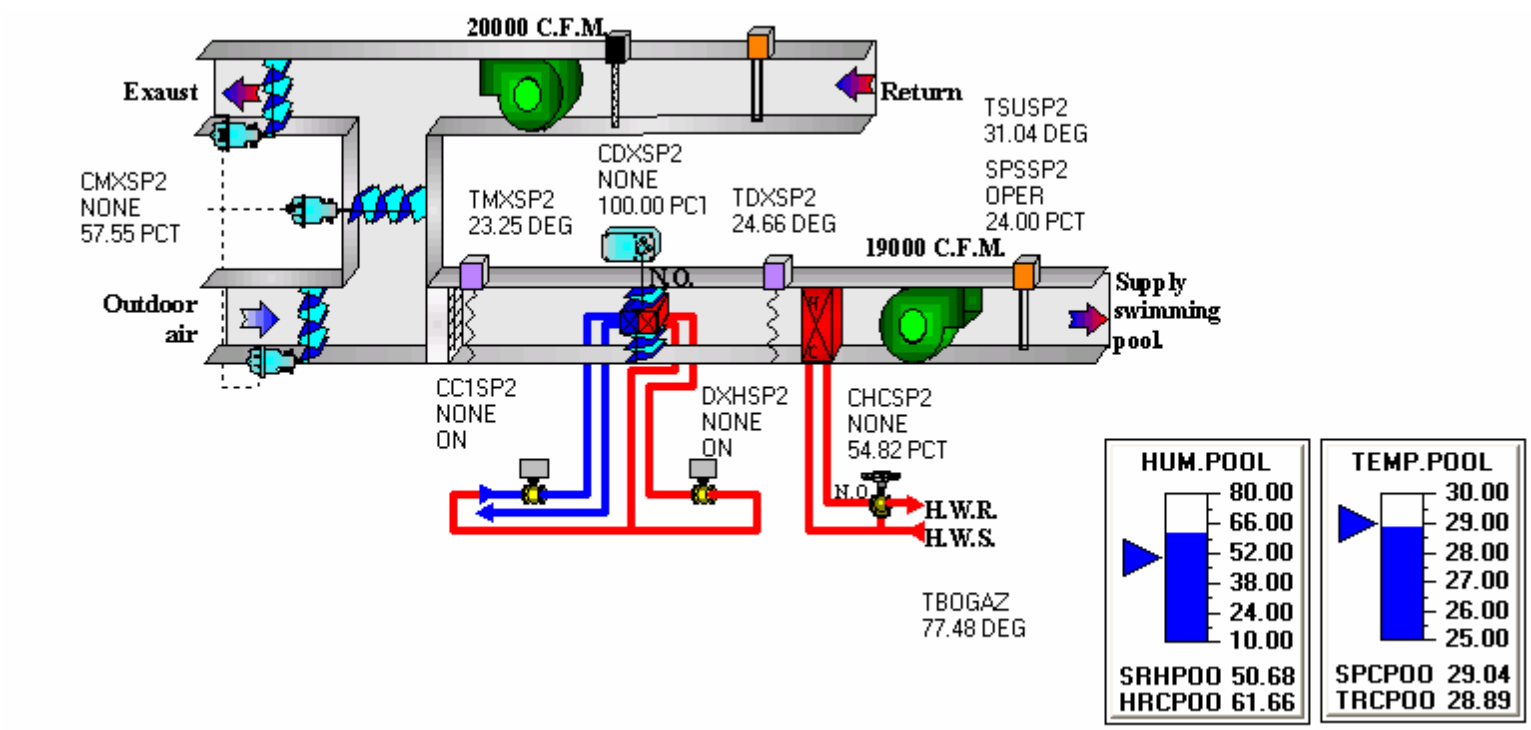
- **400,000 kWh per year**
  - Equivalent to 22 average households using only electricity (family of 4 in a 2,000 sq.ft. house)
- **26,000$ in energy savings per year**
- **Long-term maintenance savings because of longer life expectancy of new lamps**

Automated control system

Automated control system

Existing system

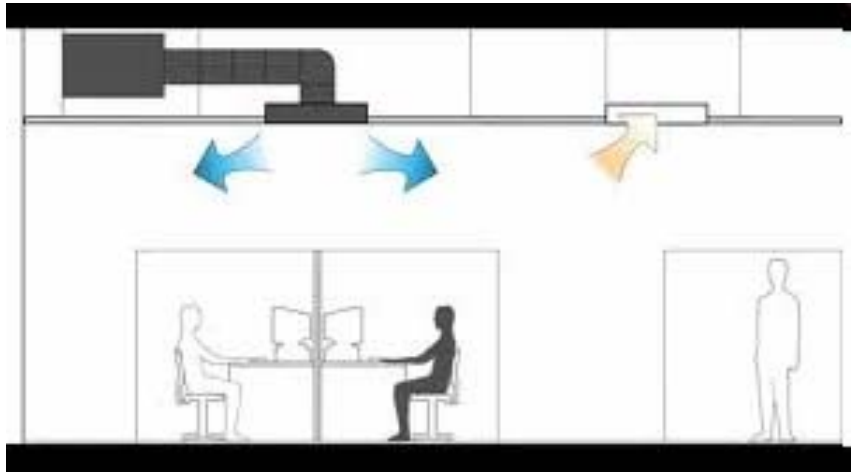
➡ Automated control of ventilation, heating & air-conditioning



Automated control system

How to improve

➡ Controlling the precise volume of air delivered to the rooms to match the needs

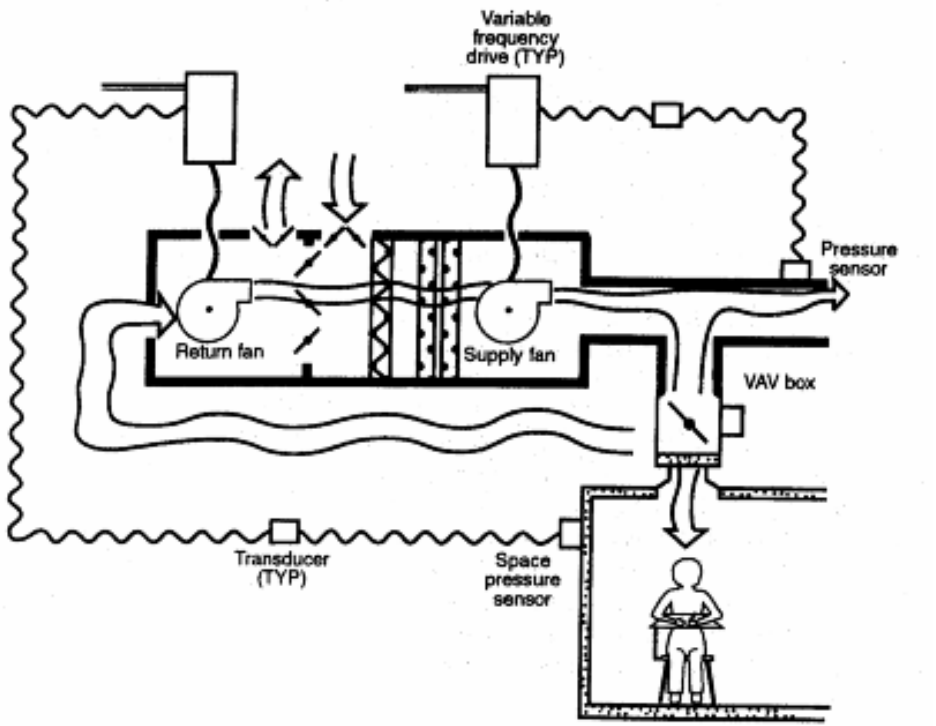


Constant air volume system

Automated control system

How to improve

- Controlling the precise volume of air delivered to the rooms to match the needs



Variable air volume system

Automated control system

How to improve

➡ Example: squash courts in Price Sports Center

- 6 courts with constant air volume, each room has a main air supply duct
- Each court will be equipped with a motion detector that will control a motorised damper located in the main supply duct
- Court unoccupied = minimum air supply
- Court occupied = maximum air supply

Automated control system

Other ways to improve

- Stopping ventilation systems at night
- Controlling fresh air intake with CO_2 probes
- Controlling supplied air temperature based on outside air temperature
- Etc.

Automated control system

Savings

- **675,000 kWh of electricity per year**
  - Equivalent to 38 average households using only electricity (family of 4 in a 2,000 sq.ft. house)
- **49,000 cubic meters of natural gas per year**
  - Equivalent to heating 16 big single family houses (2,000 sq.ft. each)
- **43,000 $ in energy savings per year**

Continuing energy efficiency

Continuing energy efficiency

Making future projects energy efficient

- Ameresco can act as a consultant to Bishop's University for all new major construction or renovation projects
- Integrating the environmental vision of the University in all future projects
- Making sure all parties move in the same direction, towards a carbon neutral campus

Continuing energy efficiency

Making existing systems match changing needs

➡ Review all major heating, ventilation, and air-conditioning systems to make sure they match the current needs

- Modify systems based on findings
- Correct mechanical and electrical problems
- Optimize controls
- Discover new energy conservation measures
- Train operators and maintenance personnel

Continuing energy efficiency

Integrating new ideas

- Special budget ready for implementing new energy conservation measures
- New ideas from Ameresco, University staff, students, etc.
- Ideas will be analysed by Ameresco to calculate potential savings and estimate implementation costs
- Ideas must present an interesting payback period (< 10 years approx.)

Savings summary

Next step towards a CARBON NEUTRAL CAMPUS

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AMERESCO

1 051 554 m^3	- 64%	
168 175 litre	100%	
1 554 246 kWh	+ 17%	
GHG	2 364 Tonnes	66%

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AMERESCO
Vert • Pur • Durable

Questions