

**EE 4016 - Introduction to Design
for Sustainability**

Dr. Lotfi Belkhir
Chair in Eco-Entrepreneurship
XCEEi, School of Engineering Practice

Sept 20, 2012 1
Copyright McMaster University

We Must Act Decisively.... Now!

❑ **John Doerr on “Going Green”**

[http://www.ted.com/talks/lang/en/
john doerr sees salvation and profit in greentech.html](http://www.ted.com/talks/lang/en/john_doerr_sees_salvation_and_profit_in_greentech.html)

What is SUSTAINABILITY?

3

United Nations Definition:

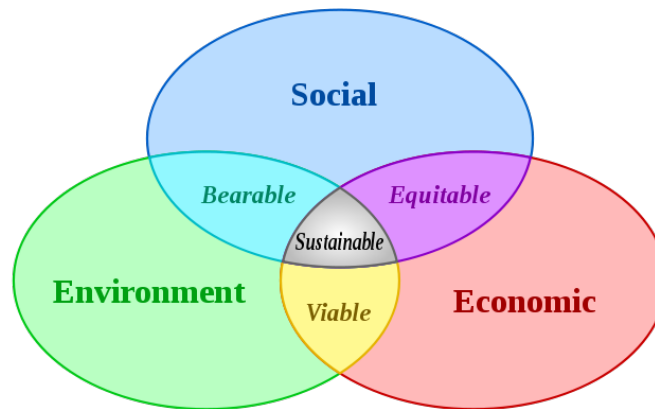
“sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”

United Nations, March 28, 1987

4

The Triple Bottom Line

The 3 Pillars of Sustainability - *World Summit 2005*



5

Anthro-centric

Or

Physico-centric

6

Constrained-growth
or
Resource Maintenance

7

Constrained Growth Approach

*“Sustainable Development is the
pursuit of growth subject to
environmental constraints”*

Sandra Batie, 1989:1084

8

Resource Maintenance Approach

“Economic development (not growth) of our economic system through qualitative changes in dynamic equilibrium with the environment”

Daly and Cobb, 1989:71

9

Alternative World View (Batie, 1989)

- ❑ Perception that biosphere imposes limits on economic growth
- ❑ Expression of lack of faith in Science & Technology as leading to human betterment
- ❑ Extreme aversion to environmental risk
- ❑ Support for redistributive justice and egalitarian ethics and policies
- ❑ Concern over population growth
- ❑ Faith in the wisdom of human capital development
- ❑ Put Survival of species, protection of the environment and minority culture ahead of economic growth

10

Five Sustainable Competences

- ❑ **Triple Bottom Line**
 - Design and evaluate complex open-ended engineering systems using a triple-bottom line of sustainability dimensions: social, economic and environmental
- ❑ **Tools & Metrics**
 - ability to use and interpret sustainability metrics and tools
- ❑ **Stakeholders**
 - Work with a broad range of stakeholders and consider the needs of present and future generations in developing solution(s) to an engineering problem

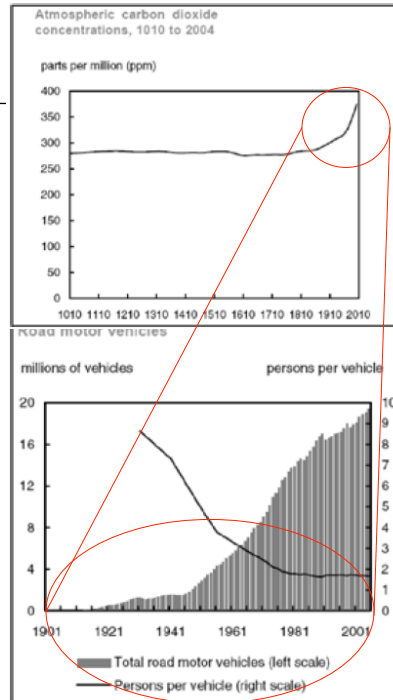
11

Five Sustainable Competences – Part 2

- ❑ **Complexity**
 - Work within complex systems (environmental, social, economic or technological) using sustainability considerations and understand the limitations due to uncertainty
- ❑ **Sustainability Ethics & Responsibility**
 - Deal ethically with uncertainties, diversity, intra and inter-generational equity and other non-technical challenges which affect engineering decision-making

12

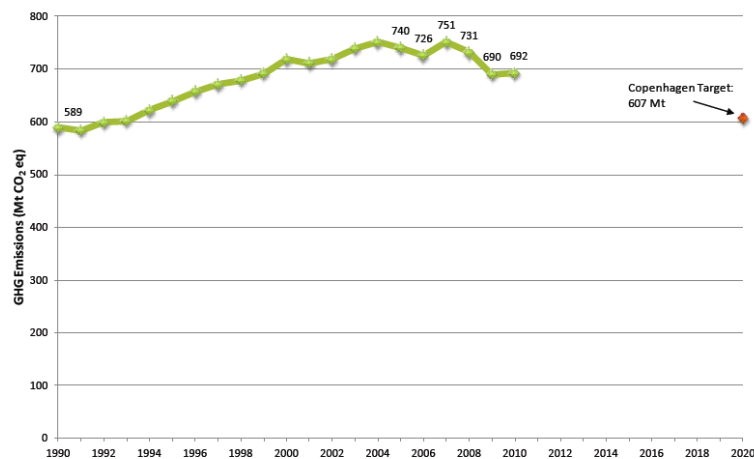
Environmental Impacts



Source: <http://www.8-80cities.org/resources/8-80-tools.html>

13

Canada GHE Emissions from 1990 - 2010

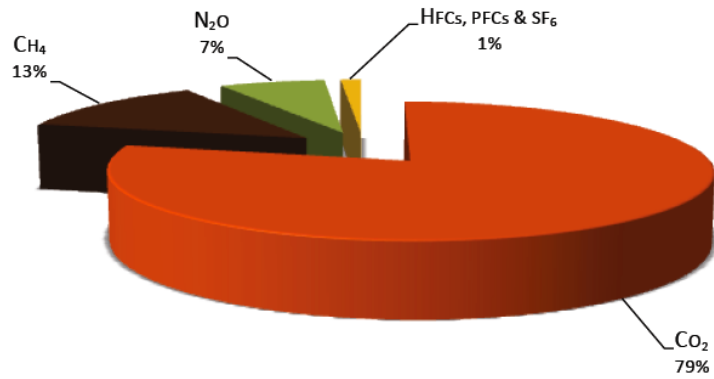


* The 607-Mt target is equal to 17% below the 2005 emissions level of 731 Mt reported in *The National Inventory Report: Greenhouse Gas Sources and Sinks in Canada 1990-2008*, published in April 2010.

Source: Environment Canada <http://www.ec.gc.ca/publications>

14

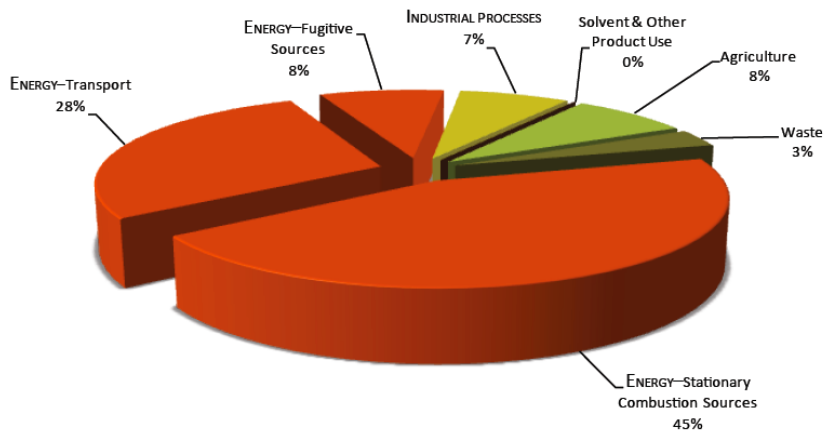
Emissions Breakdown by Gas



Source: Environment Canada <http://www.ec.gc.ca/publications>

15

Emissions Breakdown by Sector



Source: Environment Canada <http://www.ec.gc.ca/publications>

16

Impacts of Science & Technology

- **Examples of S&T innovations that harmed the environment?**

- **Examples of S&T innovations that benefited the environment?**

17

When Does Knowledge become Wisdom?

- Grand Challenges for Engineers:
<http://www.nae.edu/Activities/Projects/grand-challenges-project/57302/57305.aspx>

18