ONTARIO TREES THAT SEQUESTER CARBON DIOXIDE AND OTHER ATMOSPHERIC POLLUTANTS

Sequester Efficiency Comparison

(Based on a 15 cm diameter tree)

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Type 1: Sequesters carbon dioxide, carbon monoxide, ozone, nitrogen dioxide, sulphur dioxide, particulates

TREE whole tree + roots	CO_2 absorbed to grow tree* (kg)	CO_2 absorbed per year (kg/yr)
American Basswood	174	9.7
Eastern Hemlock	93	6.2
American Elm	136	5.6

Type 2: Sequesters carbon dioxide, ozone ,nitrogen and sulphur dioxides

TREE whole tree + roots	CO_2 absorbed to grow tree* (kg)	CO_2 absorbed per year (kg/yr)
American Chestnut	95	4.6
White Ash	99	4.1
Yellow Birch	112	3.7

Type 3: Sequesters carbon dioxide and some atmospheric pollutants

TREE whole tree + roots	CO_2 absorbed to grow tree* (kg)	CO_2 absorbed per year (kg/yr)
Hackberry	140	5.9
Silver Maple	105	5.8
Bur Oak	123	4.6
White Oak	127	4.2
Ash	99	4.1
Red Maple	105	3.9
Sugar Maple	100	3.0

- **Grow tree to a 15 cm diameter**

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ENVIRONMENTAL BENEFITS FROM ENERGY CONSERVATION

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Energy conservation programs are essential to the mitigation of climate change effects that threaten to transform our existing ecological landscape. The reduction of carbon dioxide (CO_2) into the atmosphere is the paramount concern that needs to be addressed immediately since it is known to be the major factor in the warming of the earth and the increasing acidification of the oceans. The efficiency of energy conservation projects can be analysed as a function of;

- the reduction in electrical energy (kWh) demand from fossil fuel generating stations
- the corresponding reduction in CO_2 emissions (kg) from these fossil fuel power plants

There is a need in the conservation movement to establish a common metric for discussing energy use and CO_2 emissions. The proposed metric is how much CO_2 is emitted per kilowatt hour of electricity (kg CO_2/kWh) for various types of electrical power generation. Conversely, for each kilowatt of power (kWh) conserved, we can then assess how much CO_2 is saved from going into the atmosphere.

Ontario Energy Sources and CO_2 Emissions

The primary sources of electrical power for the province of Ontario are;

- nuclear (56.4%)
- water power (22.3%)
- natural gas (14.6%)
- wind (3%)
- coal and oil (2.8%)
- solar and biomass (0.9%)

Toronto consumes about 20% of Ontario's electrical power.

The following Table summarizes how many kilograms of CO_2 are produced per kWh when generating electricity from various sources.

Electricity Source	Kg CO_2/ MBTU*	Kg CO_2/kWh
Coal: Anthracite Bitumous Lignite	*103.5* *93.4* 96.4	0.35 0.32 0.33
Kerosene	75	0.26
Fuel Oil	74	0.25
Gasoline	71.3	0.24
LPG	63.0	0.22
Natural Gas	53.0	0.18
Propane	62.0	0.21
Biomass: municipal waste	90.7	0.31
Biogas: methane	52.0	0.18
Biofuels: Ethanol Vegetable Oil	68.4 81.6	0.23 0.28
Nuclear		0.07**
Wind		0.01**
Solar		0.03**
Hydropower		0

*emission factor; 3412 BTU = 1 kWh

**equivalent amount used to create source

Case Study: Large Buildings

A 2010 study of the power consumption for 260 large buildings (~ 100,000 ft^2 and larger) across Canada was conducted by the Real Property Association of Canada. 59% were from Ontario. The average energy consumed per year was about 26.9 ekWh/ft^2/year* for Ontario, and about 30.1 ekWh/ft^2/year for the GTA region. There are about 120 "large" buildings in the GTA. By comparison, GTA condominiums consume on average about 26.4 ekWh/ft^2/year.

An example of the estimated power consumption in the GTA by these "large" buildings can be made assuming an average size of about 500,000 ft^2. Thus the total power consumed is estimated at around 1.8 GWh/year (ie:1.8 x 10^9 kWh/year). If these buildings could conserve only 10% of this power, that would translate into a savings of about 0.18 x 10^9 kWh/year. From the above Table, assuming these buildings are deriving their electrical power in the downtown core of Toronto from a natural gas fired plant, this amounts to a savings of about 30,000 metric tonnes of CO_2 per year.

It has been found that those condominiums with sub metering (ie: each unit monitors its own hydro consumption) result in a net power reduction of about 20%. From an individual owner's perspective, the economic benefit is somewhat low (about 5%) due to the delivery charges passed on to owners, but the environmental benefit is significant. Taking the 410,000 condo units in the GTA with existing sub metering, reported savings average about 110 kWh /month per unit. This translates into 1320 kWh/year. Thus the savings in power consumed amounts to about 5.4 x 10^8 kWh/year. Again, assuming a natural gas fired power plant model, this amounts to about 97,000 metric tonnes of CO_2 saved from going into the atmosphere.

*equivalent kilowatt hours of power used per square foot of area per year

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