

## Changing Climate, Changing Attitudes presentation notes

Slide #	Slide Text	Slide Notes
1	Changing Climate, Changing Attitudes	
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3	Changing Climate, Changing Attitudes	
4	I. Climate Change Good or bad?	<ul style="list-style-type: none"> <li>• Are scientist just “crying wolf ” predicting that climate change is a problem?</li> <li>• Canadian misconceptions:               <ol style="list-style-type: none"> <li>1. Climate change is little more than shorter milder winter, a longer growing season</li> <li>2. Positives likely to be offset by negative consequences</li> </ol> </li> </ul>

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5	Atmospheric changes greenhouse gases	<ul style="list-style-type: none"> <li>• The atmosphere is made up of many different gases that surround the earth, and help to support life on the planet.</li> <li>• Greenhouse gasses, including CO<sub>2</sub>, are a normal part of our atmosphere, but over the last 250 years that atmosphere has changed.</li> </ul>
6	The greenhouse effect	<ul style="list-style-type: none"> <li>• Gases of the atmosphere trap the sun's heat near the earth's surface – the greenhouse effect ( We hear the term in relation to climate change but this effect has always existed.</li> <li>• Without greenhouse effect, earth too cold for many life forms – average 34°C colder. Life on earth as we know it would not exist.</li> <li>• Main greenhouse gases in the atmosphere: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), and ozone (O<sub>3</sub>), also tiny particles (called aerosols) in the earth's atmosphere and water or ice particles trap radiation from the sun.</li> </ul>

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7	Climate has always changed	<ul style="list-style-type: none"> <li>• Earth's climate has experienced change many times before. The atmosphere and the greenhouse gases have slowly changed in concentration.</li> <li>• 450 to 350 million years ago, Ontario was intermittently covered in warm shallow seas e.g., rock of Niagara escarpment first formed as coral reefs.</li> <li>• Ice ages - 2 million - 25,000 years ago- Ontario was covered in glaciers, retreating glaciers formed Great Lakes.</li> <li>• The natural changes to the earth's climate usually occurred at a slow rate, giving natural communities time to adapt and adjust.</li> </ul>
8	CO2 sources before the Industrial Revolution	<ul style="list-style-type: none"> <li>• CO2, one of the main greenhouse gases, is released into the atmosphere as part of the natural carbon cycle.</li> <li>• Natural sources of greenhouse gases : volcanoes, forest fires, wetlands, decomposition and respiration</li> </ul> <p>Note that forests can naturally be both sources and sinks: In Canada, fast growing young forests tend to be <b>sinks</b>, while older forests acting as <b>sources</b> releasing CO2 through forest fires and decomposition.</p>

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9	CO2 sinks before the Industrial Revolution	<ul style="list-style-type: none"> <li>• Similarly CO2 is being taken up by natural processes</li> <li>• Natural sinks (or absorbers) of CO2 : the oceans (dissolved into the water), algae (photosynthesis), forests and wetlands (photosynthesis)</li> </ul> <p>Note that forests can naturally be both sources and sinks: In Canada, fast growing young forests tend to be <b>sinks</b>, while older forests acting as <b>sources</b> releasing CO2 through forest fires and decomposition.</p>
10	Before the Industrial Revolution	<ul style="list-style-type: none"> <li>• Natural changes to the earth's climate appear linked to fluctuations in earth's orbit or solar radiation</li> <li>• For thousands of years, the earth's atmosphere has changed very little.</li> <li>• Sources and sinks of greenhouse gases have remained in balance. Generally what was released was absorbed. Very little increase in the amount CO2 in the atmosphere.</li> </ul> <p>Note that forests can naturally be both sources and sinks: In Canada, fast growing young forests tend to be sinks, while older forests start releasing CO2 through forest fires and decomposition.</p>

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11	Today increasing sources of CO <sub>2</sub>	<ul style="list-style-type: none"> <li>• Earth's atmosphere is changing</li> <li>• Human sources of greenhouse gases: deforestation / burning, burning of fossil fuels, cattle production, cement production etc.</li> <li>• Predominantly a hunger for energy (fossil fuels burning) is releasing large amounts of CO<sub>2</sub> into the atmosphere.</li> </ul>
12	Today decreasing sinks for CO <sub>2</sub>	<ul style="list-style-type: none"> <li>• Sinks for greenhouse gases are being removed through deforestation and development and destruction of wetlands</li> <li>• Warmer oceans hold less CO<sub>2</sub>, adding the problem.</li> </ul>
13	Today	<ul style="list-style-type: none"> <li>• earth's atmosphere now no longer in balance</li> </ul>
14	Dramatic increase of carbon dioxide ( <b>CO<sub>2</sub></b> )	<ul style="list-style-type: none"> <li>• concentration of greenhouse gases has increased in the earth's atmosphere since 1800s, when humans starting using fossil fuels (the Industrial Revolution)</li> </ul>
15	The evidence of climate change	<ul style="list-style-type: none"> <li>• scientists are now agreed that human activities are contributing to global CC</li> </ul>

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16	History told by trees and ice	<ul style="list-style-type: none"><li>• Changing CO2 levels in atmosphere measured by looking at air bubbles trapped in ice core samples from glaciers, and ancient coral reefs</li><li>• tree rings from stumps of ancient trees such as this bristlecone pine in California provide clues to the earth's temperatures.</li><li>• recent increase in CO2 in the atmosphere directly linked to increased burning of fossil fuels</li></ul>

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17	Early 1800s	<p><b>How has Ontario changed over time?</b></p> <p>Pre 1800s, before industrialization:</p> <ul style="list-style-type: none"> <li>• homes made out of natural materials such as wood, some brick, animal skins etc.</li> <li>• transportation on foot, by canoe, by horse or carriage</li> <li>• for cooking, warmth, light: wood, sun, candles</li> <li>• farming &amp; industry: people, horse and ox power, small mills run on hydro power</li> <li>• Still extensive forest cover still, with some clearing occurring</li> <li>• CO2 levels have been relatively steady at 280 parts per million (ppm). Parts per million is a way of measure concentrations. For example: If you took two drops of red food colouring and mixed into a bath tub of water you would have created mixture of approximately 2 part per million food colouring to water.</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• All numbers and statistics are for the Province of Ontario</li> <li>• CO2 concentrations are the measured world average during this time period.</li> </ul>

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18	1850s	<p>1850's</p> <ul style="list-style-type: none"> <li>• Increase in use of fossil fuel – coal – Industrial Revolution</li> <li>• The Industrial Revolution was dramatic change in tools and energy sources used to manufacture items.</li> <li>• The prominent changes included a shift from: <ul style="list-style-type: none"> <li>Hand tools to machines</li> <li>Human and animal power to steam and coal energy</li> <li>Economy from agriculture to manufacturing</li> </ul> </li> </ul> <p>Changes in Ontario:</p> <ul style="list-style-type: none"> <li>• for cooking, warmth and light: wood, coal, candles</li> <li>• transportation: foot, horse, carriage, steam powered train and ship</li> <li>• settlement of towns, forest area reduced - cleared for agriculture, logged for timbers for construction of ships, bridges, etc.</li> <li>• people working on farms, logging, factories</li> <li>• greater production of CO<sub>2</sub> as a result of industrialization all over the western world starts to increase CO<sub>2</sub> in the atmosphere.</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• All numbers and statistics are for the Province of Ontario</li> <li>• CO<sub>2</sub> concentrations are the measured world average during this time period.</li> </ul>

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19	Early 1900s	1900: <ul style="list-style-type: none"> <li>• settlement pattern shifting – more people living in villages, towns and new cities, working in factories, mines and farms.</li> <li>• Forests shrinking – wood used for construction of factories and houses</li> <li>• industries powered by coal and hydro</li> <li>• transportation: first cars and street cars appear, foot, horse, carriage, first bicycles</li> <li>• warmth and light – coal, oil lanterns</li> <li>• CO2 levels up to 300ppm.</li> <li>• 1910 – 4000 passenger cars registered in Ontario</li> </ul>

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20	1950s	<p>1950s –</p> <ul style="list-style-type: none"> <li>• Modern consumer society dominates Canada and the rest of the western world.</li> <li>• Industries are now manufacturing consumer goods and transporting them worldwide by ship and train.</li> <li>• Oil based industry, transportation, heating of homes</li> <li>• (Oil formed as deposits from dead plants and other organic matter, millions of years old – a carbon sink about to become a source)</li> <li>• Transportation: car, bus, truck, train, plane, ship</li> <li>• Electricity generated from oil, coal, hydro</li> <li>• 887,000 passenger cars registered in Ontario</li> </ul> <hr/> <p>All numbers and statistics are for the Province of Ontario CO2 concentrations are the measured world average during this time period.</p>

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21	Today	<p data-bbox="646 298 1010 337">Present day (2004)</p> <ul data-bbox="695 347 1955 971" style="list-style-type: none"> <li data-bbox="695 347 1255 386">• most Ontarians live in cities</li> <li data-bbox="695 396 1885 483">• Most activities dependent on fossil fuels: heating and cooling buildings, cars, industries, transportation, etc.</li> <li data-bbox="695 493 1927 581">• Some electricity generated from hydro, nuclear, and very small percentage renewable sources eg. wind</li> <li data-bbox="695 591 1955 678">• nuclear plants do not produce CO<sub>2</sub> emissions, but produce toxic radioactive by-products</li> <li data-bbox="695 688 1591 727">• Western society utterly dependent on energy</li> <li data-bbox="695 737 1906 824">• CO<sub>2</sub> concentrations in the atmosphere higher than ever – 379 ppm (2004).</li> <li data-bbox="695 834 1892 922">• Canadians have nearly 18 million cars on the road – almost 7 million of these are in Ontario</li> <li data-bbox="695 932 1682 971">• 15 billion litres of gas were sold in 2002 in Ontario</li> </ul> <p data-bbox="646 980 1703 1068"><b>What has caused the increased production of CO<sub>2</sub> ?</b> <b>Fossil fuel use.</b></p> <hr data-bbox="646 1117 1969 1123"/> <p data-bbox="646 1133 1948 1263">All numbers and statistics are for the Province of Ontario CO<sub>2</sub> concentrations are the measured world average during this time period (2004).</p>

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22	Other impacts of fossil fuels	<ul style="list-style-type: none"> <li>• Culture of energy consumption and reliance on fossil fuels has other costs besides climate change</li> <li>• Extracting and refining of fossil fuels is expensive and polluting.</li> <li>• Transportation of fossil fuels is also polluting – tanker trucks travel long distances, oil tanker accidents produce huge oil spills which pollute the water and harm wildlife</li> <li>• Burning of fossil fuels to make electricity produces still other air pollutants, some of which cause acid rain</li> <li>• Burning of fossil fuels produces smog which decreases air quality and affects people’s health</li> </ul>
23	Energy reliant	<ul style="list-style-type: none"> <li>• Society is reliant on energy</li> <li>• In Ontario, we get our energy from various sources, including nuclear plants, hydro plants, and fossil fuel plants (mostly coal).</li> <li>• About 25% of Ontario energy is generated from coal fired electricity plants – the greenhouse gases produced from these plants is equivalent to the emissions from 6.2 million cars.</li> <li>• Every time we use an electric appliance it is contributing to greenhouse gas emissions</li> </ul>

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24	II. The impacts of climate change	<ul style="list-style-type: none"><li>• Scientists agree that global warming will be damaging and costly</li><li>• Observed impacts are elaborated in the 2001 Intergovernmental Panel on climate Change (IPCC) report</li><li>• Many uncertainties due to multiple factors which influence global climate, many of which we do not fully understand</li></ul>

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25	Intergovernmental Panel on Climate Change (IPCC), 2001 report	<ul style="list-style-type: none"> <li>• Global atmospheric CO<sub>2</sub> has increased since the mid 1850's – clearly linked to Industrial Revolution and increased use of fossil fuels</li> <li>• Hundreds of respected scientists from all over the world collaborated to produce the Intergovernmental Panel on Climate Change (IPCC) report in 2001. This report concluded that the earth's climate was definitely changing because of human activities. (<a href="http://www.ipcc.ch">http://www.ipcc.ch</a>)</li> <li>• Main IPCC scientific findings</li> <li>• The global average surface temperature has increased over the 20th century by about .6°C (1°C in the Arctic). (During the last ice age the average global temperature was only 2.2°C cooler than today.)</li> <li>• Snow cover and ice extent have decreased in the northern hemisphere: mountain glaciers are retreating, Arctic sea ice thickness is declining and snow and ice cover have decreased.</li> <li>• Global average sea level has risen and ocean heat content has increased: sea level has risen 10-20 cm during the 20th century and ocean heat content has increased since the late 1950s</li> </ul> <p>The scientific debate around climate change is now focused on what types of changes to the climate we can predict and how quickly they may occur.</p> <hr/> <p>Click on “movie icon” to view the “Is climate change happening” video.</p>

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26	Severe weather	<ul style="list-style-type: none"> <li>• As the atmosphere warms, climate becomes hotter but also more unstable</li> <li>• <i>Frequency, intensity and duration</i> of extreme weather events, such as winter storms, ice storms and tornadoes, increased steadily over the 20th century.</li> <li>• 1 in 5 Canadians was directly affected by a weather disaster between 1996 and 2000.</li> <li>• Steady loss of wetlands over the years has reduced capacity of land to absorb floodwaters</li> </ul>
27	Drought	<ul style="list-style-type: none"> <li>• Droughts affect agricultural activities, reduce quality and quantity of ground water level, increase risk of forest fire, reduce hydro power potential.</li> <li>• 2001 drought in the Canadian prairies estimated to have cost the Canadian economy \$5 billion in agricultural losses</li> <li>• Great Lakes and other lake levels continue to drop due to increasing evaporation</li> </ul>

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28	Global meltdown	<ul style="list-style-type: none"><li>• <b>Nine of the ten hottest years on record were in the 1990s</b></li><li>• Globally 1998 was the hottest year on record to date (2003)</li><li>• The effects of temperature increase seem to be more pronounced in the Arctic:<ul style="list-style-type: none"><li>• Canadian Arctic temperatures in 1998 were 5°C higher than average</li></ul></li><li>• Continued decrease in extent and thickness of sea ice, permafrost thawing, coastal erosion, and altered species distribution.</li></ul>

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29	Sea level rise	<ul style="list-style-type: none"> <li>• Higher global temperatures are melting polar icecaps and warming the oceans, increasing their mass and raising sea levels</li> <li>• Increase of 10-20cm observed during the last century</li> <li>• Sea level rise increases coastal erosion, causes billions of dollars worth of damage to buildings and infrastructure, damages coastal ecosystems and forces communities to adapt and relocate.</li> <li>• Rising sea level adds to the problem of coastal erosion due to human activities on coastlines worldwide. The costs of building sea walls and dikes to protect infrastructure is enormous. The Thames Barrier in London UK was built to protect the city from flooding. The project took 8 years and cost over 2.3 billion dollars to build.</li> <li>• Eight to ten million people live within one metre of high tide in <b>each</b> of the unprotected river deltas of Bangladesh, Egypt and Vietnam.</li> <li>• Half a million people live in archipelagos and coral atoll nations that lie almost entirely within three metres of sea level, such as the Maldives, the Marshall Islands, Tuvalu, Kiribati and Tokelau.</li> </ul>

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30	Ecosystems and wildlife in jeopardy	<ul style="list-style-type: none"> <li>• Populations of wildlife affected directly due to temperature changes and severe weather, or indirectly through changes in vegetation and habitat</li> <li>• Hotter drier summers shrink wetland ecosystems already under pressure from development</li> <li>• Difficult for wildlife to migrate and shift their range due to fragmentation and loss of habitat</li> <li>• Increase in rates of extinction already reported by the journal <i>Nature</i>: One million species could go extinct by 2050.</li> </ul>
31	Smog	<ul style="list-style-type: none"> <li>• Air pollution closely related to climate change</li> <li>• Higher temperatures and more electricity generation for air conditioners increase ground-level smog, contributing to increased asthma and other respiratory diseases.</li> <li>• According to the Ontario Medical Association, smog and poor air quality costs Ontario almost <b>\$10 billion annually</b> in health care costs and lost work time alone.</li> </ul>

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32	People's health	<ul style="list-style-type: none"><li>• Warmer temperatures and milder winters seem beneficial to people, but can have negative consequences<ul style="list-style-type: none"><li>• Hotter summers mean increased heat stress</li><li>• Increased injuries from climate-related severe weather events such as floods</li><li>• Disease carriers sensitive to climate are already expanding their range northwards, e.g. Malaria, Dengue Fever, West Nile virus and Lyme Disease</li></ul></li></ul>

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33	Increasing economic losses	<ul style="list-style-type: none"> <li>• The economic costs of climate change are high and increasing</li> <li>• repairing damage from severe weather events, dealing with increased crop failure from disease and drought, health related costs</li> <li>• rising insurance rates to cover potential losses related to severe weather etc.</li> <li>• prior to 1988, global insurance industry never had claims for more than \$1billion for any one incident, but between 1988 and 1996 there were `` 15 events, resulting in several companies going out of business.</li> </ul> <hr/> <p>Click on the “graph” icon to see a graph of direct economic losses due to natural disasters</p>
	Link to graph notes	<ul style="list-style-type: none"> <li>• \$ adjusted to 2000 values.</li> </ul>

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34	The Future changing temperatures	<ul style="list-style-type: none"> <li>• While the global scientific community is agreed that humans are causing our climate to change, there is still about what those changes will be, and where and when they will</li> <li>• Many scientists around the world are developing models to predict what kind of climate changes we can expect</li> <li>• Based on past observations, scientists predict that the average temperature in Ontario will rise by as much as 2-4°C by the year 2060</li> <li>• Higher maximum temperatures predicted globally – Canada longer frost-free season</li> <li>• Negative impacts: greater heat stress for humans, livestock, plants and wildlife,</li> <li>• Warmer climate provides opportunity for disease vectors (carriers) to move north, could have negative impacts on human health, agriculture and forestry industries.</li> </ul> <hr/> <p>Click on the map to start and stop the animation. Approximate dates to stop 2020, 2050 and then 2100. If you let it run to the end it will automatically rewind.</p>

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35	The future Severe weather and drought	What can we expect? <ul style="list-style-type: none"> <li>• more intense precipitations events likely over many areas globally, including Canada and Ontario</li> <li>• increased flood, landslide and avalanche damage expected</li> <li>• at the same time, scientists predict increased summer drying over most mid-latitude continental interiors, and increased risk of drought</li> <li>• will have impact on agriculture, forestry</li> <li>• drop in Great Lakes levels expected, resulting in economic losses to shipping industry, recreation, etc.</li> </ul>
36	III. Putting the brakes on climate change	

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37	Energy junkies	<ul style="list-style-type: none"><li>• The main issue is energy consumption</li><li>• Our society has to rethink and redo the way we get and use energy – reduce our dependence on fossil fuels.</li><li>• North Americans use <b><i>twice as much energy per person</i></b> as Europeans</li></ul> <hr/> <p>Click on the “graph” icon to see a graphical comparison of energy use.</p>

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38	Kyoto Protocol: responding to climate change	<p>Kyoto protocol:</p> <ul style="list-style-type: none"> <li>• December 1997, representatives of over 160 countries met in Kyoto, Japan</li> <li>• Kyoto is an an international agreement on climate change that limits global greenhouse gas emissions to 5% below 1990 levels by the period 2008-2012</li> <li>• To become legally binding the protocol required ratification by countries representing 55% of the global CO2 emissions – by September 2004, enough countries had ratified the protocol for it to come into effect.</li> <li>• United States has not agreed to ratify the agreement claiming Kyoto is flawed, it does not address the CO2 emissions in developing countries and it is asserted that needed reduction in carbon dioxide would result in economic hardship for the country.</li> </ul>
39	Aims of Kyoto	<ul style="list-style-type: none"> <li>• Richer countries have the available resources and scientific infrastructure to develop and implement technology that can reduce carbon dioxide emissions.</li> <li>• Developing countries do not have these resources. By making new technologies available to developing countries they can “skip” ahead to more climate friendly use of energy.</li> </ul>

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40	Canada's commitment	<ul style="list-style-type: none"> <li>• Canada signed the Kyoto Protocol in 1998, and ratified in December 2002 and reaffirmed by the Paul Martin government (speech from the throne) 2004</li> <li>• “Ratification” defines the international act whereby a state indicates its consent to be bound to a treaty if the parties intended to show their consent by such an act. The institution of ratification grants states the necessary time-frame to seek the required approval for the treaty on the domestic level and to enact the necessary legislation to give domestic effect to that treaty.</li> <li>• Some provinces unhappy with decision, fearing negative impact on jobs and economy</li> <li>• Canadian government produced Climate Change Plan for Canada in 2002 - identifies key areas for action and estimates costs involved in meeting Kyoto targets. Includes a challenge to all Canadians to reduce their GHG emissions by one tonne (One-Tonne Challenge) . On average, this is a 20 % reduction per person.</li> <li>• Several Canadian scientists involved in Intergovernmental Panel on Climate Change (IPCC) report and international research on climate change.</li> </ul> <p>Click on the “graph icon” to see a graphical explanation of the carbon dioxide reductions needed to meet our Kyoto Protocol commitment.  Click on the “One-Tonne Challenge” and you will go directly to the website (<a href="http://www.climatechange.gc.ca/onetonne/english/">http://www.climatechange.gc.ca/onetonne/english/</a>)  Kyoto Protocol website: <a href="http://www.climatechange.gc.ca/cop/cop6_hague/english/overview_e.html">http://www.climatechange.gc.ca/cop/cop6_hague/english/overview_e.html</a></p>

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	Link to Kyoto graph notes	<ul style="list-style-type: none"> <li>• Kyoto protocol states that countries will reduce carbon dioxide emissions to 10% of 1990 levels.</li> <li>• Since 1990 Canadian emissions of carbon dioxide have steadily increased. To reach our emission target Canadians will need to produce 140- 185 mega tones less carbon dioxide.</li> <li>• How much is a mega ton?</li> </ul>
41	IV. Solutions How can we make a difference?	

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42	Energy revolution conservation	<p>The Energy Revolution will match the Industrial Revolution of the 1800s in the great changes it will bring to our society.</p> <ul style="list-style-type: none"> <li>• Canada's EnerGuide program helps consumers and homeowners choose energy efficient appliances.</li> <li>• Homeowners can have an energy audit done to find out how to reduce heat loss.</li> </ul> <p>EnerGuide website: <a href="http://oee.nrcan.gc.ca/energuide/index.cfm">http://oee.nrcan.gc.ca/energuide/index.cfm</a></p>
43	Energy revolution passive solar	<ul style="list-style-type: none"> <li>• Solar power – huge source of power – <b>every hour</b> the sun showers the earth with more energy than the entire human population consumes! – most bounces back into space.</li> <li>• Direct / passive uses of solar power : hanging clothes to dry , lighting buildings through windows, heating water,</li> </ul>

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44	Energy Revolution Solar Power	<ul style="list-style-type: none"> <li>• Photovoltaic cells convert the sun's energy into electricity, which can be stored in batteries and used to power lights, appliances etc.</li> <li>• In Canada, greatest potential for solar power is in remote areas too expensive to connect to the grid, e.g. the north. With rising energy prices many people are choosing to integrate solar energy into homes connected to the electricity grid.</li> </ul>
45	Energy revolution tree planting	<ul style="list-style-type: none"> <li>• Planting trees provides shade – passive cooling if planted near buildings; also shade protects people from harmful UV rays.</li> <li>• Tree planting benefits wildlife through habitat improvement, also the vegetation acts as a natural sink for atmospheric CO<sub>2</sub>.</li> </ul>

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46	Energy revolution wind power	<ul style="list-style-type: none"> <li>• Ontario Power Generation (OPG) and other energy distributors offer green energy options for businesses which include energy generated from renewable sources such as micro hydro stations, and wind.</li> <li>• Toronto's first wind turbine built in 2002 by WindShare</li> <li>• Total number of utility scale wind turbines in Ontario (December 2003) = 9.</li> <li>• Toronto's turbine unique –first in North America in a downtown urban setting</li> <li>• Wind power more popular in Europe, growing at 40% per year.</li> <li>• Denmark - wind provides more than 17% of that nation's electricity and many employment opportunities.</li> <li>• Ontario has the potential to produce 3,000MW of wind power (5% of the province's power - Canadian Wind Energy Association (CanWEA))</li> </ul>

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47	Energy revolution hydrogen power	<ul style="list-style-type: none"> <li>• Canadian industry involved in research and development of new technologies to reduce greenhouse gas emissions.</li> <li>• Globaltech developed the Hydrogen Fuel Injection system (HFI) , a combustion enhancement system retrofitted on transport trucks to reduce fuel consumption / emissions (website: <a href="http://www.globaltech.ca/">http://www.globaltech.ca/</a>)</li> <li>• Ballard - leader in fuel cell research: producing electricity by combining hydrogen fuel with oxygen from air, producing only water and heat as by-products.</li> <li>• Ballard's prototype fuel cell transit buses have been demonstrated in Vancouver, as well as in the US and Europe.</li> </ul>
48	Transportation choices public transit	<ul style="list-style-type: none"> <li>• Municipalities across Canada are promoting their public transit systems as a means of reducing traffic and controlling smog.</li> <li>• Fewer cars on the road mean fewer greenhouse gas emissions.</li> </ul>

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49	Transportation choices carpool	<ul style="list-style-type: none"> <li>• As individuals, car drivers have a lot to contribute toward controlling climate change.</li> <li>• Car owners can buy the smallest, most fuel efficient car for their needs, and buy second hand (reduce greenhouse emissions associated with manufacturing new cars)</li> <li>• Use public transit, foot, bicycle when car not really needed</li> <li>• Carpooling helps to reduce the number of cars on the roads, and thus CO2 emissions.</li> <li>• Ontario has carpool stations for commuters along several major highways.</li> <li>• Some people belong to a car co-op whereby they share the use of a car with other members.</li> <li>• Ontario Drive Clean program launched in 1999 to cut smog-causing emissions from vehicle sources will help.</li> </ul>

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50	Transportation choices hybrid cars	<ul style="list-style-type: none"> <li>• Hybrid cars are expensive but they are becoming more reasonable all the time (made by Honda, Toyota, etc.).               <ul style="list-style-type: none"> <li>• combine gasoline engine with a battery-powered electric motor</li> <li>• therefore they use less gas, produce fewer emissions.</li> </ul> </li> <li>• Other companies are looking to launch hybrid models over the next few years, moving from the perception of “just a Green” car to an affordable, money saving, practical alternative.</li> </ul>
51	Transportation choices cycling	<ul style="list-style-type: none"> <li>• Cycling viable option to car use for short distances – can be faster than driving if traffic is heavy</li> <li>• Health benefits to riding bikes</li> <li>• Save money on gas</li> <li>• Bike lanes in many cities to accommodate and encourage cycling.</li> </ul>
52	Transportation choices walking	<ul style="list-style-type: none"> <li>• Other forms of alternative transportation: roller blades, skateboards, walking – all emissions free!</li> <li>• Good exercise</li> </ul>

Slide #	Slide Text	Slide Notes
53	Smart consumption food	<ul style="list-style-type: none"> <li>• there are many other small actions all of us can take at home or at work to reduce greenhouse gas emissions - almost everything we do consumes energy</li> <li>• Buy organically grown foods wherever possible – responsible agriculture nurtures soils, which hold a lot of carbon. Irresponsible agricultural practices can make soil a carbon source.</li> <li>• Buy foods which are not over packaged – <b>packaging</b> takes energy to make and dispose of</li> <li>• Buy local – <b>distribution</b> of food needs large amounts of carbon dioxide releasing fossil fuels</li> </ul>
54	Smart consumption water	<ul style="list-style-type: none"> <li>• It takes energy to purify water, pump it to the tap and heat it</li> <li>• Turning off taps, and getting rid of leaks cuts down on domestic water use</li> <li>• Put the water heater at a lower setting</li> <li>• Buy energy and water efficient appliances</li> </ul>

Slide #	Slide Text	Slide Notes
55	Smart consumption consumer goods	<ul style="list-style-type: none"> <li>• Everything we buy takes energy to produce, package and transport</li> <li>• Buy only what you need</li> <li>• Try to buy goods that are not overpackaged</li> <li>• Look for appliances identified with the energy star logo (see top left)</li> <li>• Buy used clothing, furniture and other goods whenever possible</li> </ul>
56	Smart consumption forestry products	<ul style="list-style-type: none"> <li>• Buy recycled paper products wherever possible, thus reducing the need to log forests. Remember that healthy forests can be carbon sinks</li> <li>• Recycle your paper goods</li> </ul>
57	V. It's in your hands	<ul style="list-style-type: none"> <li>• scientists are not 100% certain about how quickly climate change will occur, and what impact it will have on human and natural communities on the earth</li> <li>• waiting and doing nothing, could cost us far more than taking action now –this is a key message of the Kyoto Protocol</li> </ul>

Slide #	Slide Text	Slide Notes
58	Choices	<ul style="list-style-type: none"> <li>• We are at a turning point in the history of the earth now</li> <li>• <b>Option 1 – do nothing</b></li> <li>• continue to consume energy from non-renewable resources at increasing rates</li> <li>• ignore impacts on the other human and natural communities with whom we share this planet</li> <li>• continue daily life as usual: take long showers, leave lights on, drive big cars, live in huge houses</li> <li>• <b>Option 2 – do something</b></li> <li>• join the millions of people around the world trying to live and work in a way that sustains life on earth - reduce greenhouse gas emissions at home and work</li> <li>• use our purchasing power to encourage industry and governments to do the same. (Example (not directly linked to climate change: People are more aware that pesticides in food are harmful to peoples health. Organic vegetable and fruit are marketed as pesticide free. People are buying less “regular” grown vegetables and are asking for organically grown produce. As a result in areas where people have created this demand for organic produce, more produce is available in retail outlets).</li> <li>• Actions that reduce the emission of greenhouse gases reduce the risk of climate change, improve the quality of our air (reduction of smog), water and soil (reduced transportation and use of fossil fuels will reduce spills and contamination) , improve habitat for wildlife (plant trees and reducing the use of paper products).</li> </ul>

Slide #	Slide Text	Slide Notes
59	Sustainable communities	<ul style="list-style-type: none"> <li>• The goal is learning to live more sustainably.*</li> <li>• No need to return to the stone age - clean, renewable sources of energy will enable us to continue to enjoy a comfortable standard of living without compromising the quality of our environment and the composition of the earth's atmosphere.</li> <li>• up to each of us to take the steps that we can to move into this new era of living in harmony with the planet.</li> </ul> <p>* Sustainable development is as defined by the United nations as “meeting the needs of the present generation without compromising the ability of future generations to meet their own needs.”</p> <hr/> <ul style="list-style-type: none"> <li>• Click on “movie icon” to see the animated clip “Handle with Care”.</li> </ul>