Alberta’s Climate Plan
A burden with no benefit

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Friends of Science Society
Global Air Temperatures
Previous Warm & Cold Periods

Climate always changes with no help from Man.
No match before 1960 or after 1995
Climate Models vs Reality

Data points are 5-year averages, surface to 15 km. Model trend is 2.5 X reality.
Canadian Model – World’s Worst

In the tropics the model trend is six times reality
Alberta Climate Plan

- Early Phase-out coal-fired power plants by 2030
- Cap oil sands CO2 emissions at 100 MtCO2/year
- Cut CH4 emissions by 45% by 2025
- Carbon tax
  - $20/tCO2 in 2017
  - $30/tCO2 in 2018
  - 2018: 1.52 $/GJ on natural gas, 6.73 ¢/L on gasoline
- $3.4 billion over 5 years in subsidies to wind and solar
Panel said US IWG central estimate used 2.5% discount rate;
- $62/tCO2 in 2015
- $69/tCO2 in 2020
- IWG actually used 2.5%, 3% and 5%.

International Energy Agency for 2 °C goal.
- $20/tCO2 in 2020
- $100/tCO2 in 2030
Coal-fired Power Plant Phase-out

- Cost about $22 billion
  - $11 billion for replacement gas-fired power plants
  - $11 billion for compensation

- Particle emissions PM2.5 of forest fires are about 1000 times greater than coal plants
Particle Emissions
Climate Sensitivity – Energy Balance

- Transient Climate Response, double CO$_2$, exponential growth $\rightarrow$ 125 yrs.
- Equilibrium climate sensitivity takes 2 – 3 thousand yrs.
- Use IPCC AR5 greenhouse gas forcing
- Use Steven’s aerosol forcing
- CERN CLOUD experiment confirms lower aerosol effect
- Dr. Nic Lewis & Dr. Judith Curry
- Evaluation over 153 years, averages over AMO.
- $\text{TCR} = 1.21 \, ^\circ\text{C}$  $\text{ECS} = 1.45 \, ^\circ\text{C}$
Millennium Scale Natural Cycle

- Dr. Richard Lindzen “Lewis does not take account of natural variability, and I suspect his estimates are high.”
Northern Hemisphere Temperatures

Extra-Tropical Northern Hemisphere (30-90°N) Decadal Mean Temperature
Adapted from Ljungqvist, 2010

Temperature Anomaly (°C)

Year (AD)

RWP
MWP
CWP
DACP
LIA
Use the average of four slopes to determine natural warming from the Little Ice Age
Global Natural Millennium Warming

- Proxies underestimate temperature variability
- ETNH natural millennium warming 0.095 °C/century
- Growing season bias 123%
- Sediment dating bias 112%
- Global variation/ETNH 80%
- Global millennium trend is 0.084 °C/century
- Reduces ECS from 1.45 °C to 1.22 °C
Urban Heat Island Effect

• In the USA, only 11% of stations are in suitable locations, 69% are within 10 m of an artificial heat source.
59% of US Warming is Bogus

Compliant: 0.204 °C/decade
Non-compliant: 0.319 °C/decade
Final Adjusted: 0.324 °C/decade
Urban Heat Island Effect

- McKitrick and Michaels 2007: Almost half of warming over land is due to urban development
- GISS index: 45% of adjustment increase the warming trend
- IPCC Nonsense: “the locations of greatest socioeconomic development are also those that have been most warmed by atmospheric circulation changes.”
- Reduces trend from 1980 by 0.042 °C/decade.
- Reduces ECS to 1.02 °C.
- Reduces TCR to 0.85 °C.
Probability Density Function of ECS

Lewis and Gregory PDF of Equilibrium Climate Sensitivity

Equilibrium Climate Sensitivity (°C)

Probability Density (1°C)

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## Summary ECS and TCR Estimates

<table>
<thead>
<tr>
<th></th>
<th>ECS BE</th>
<th>ECS 5-95%</th>
<th>TCR BE</th>
<th>TRC 5-95%</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA IWG SCC</td>
<td>3.0</td>
<td>1.70 – 7.15</td>
<td>1.8</td>
<td>NA</td>
</tr>
<tr>
<td>IPCC AR5 Forcings</td>
<td>1.64</td>
<td>1.05 – 4.05</td>
<td>1.33</td>
<td>0.90 – 2.50</td>
</tr>
<tr>
<td>Stevens Aerosol Forcing</td>
<td>1.45</td>
<td>1.05 – 2.20</td>
<td>1.21</td>
<td>0.90 – 1.65</td>
</tr>
<tr>
<td>With Natural Warming &amp; UHIE</td>
<td>1.02</td>
<td>0.60 – 1.75</td>
<td>0.85</td>
<td>0.55 – 1.30</td>
</tr>
</tbody>
</table>

IWG SCC high 95% estimate of ECS is 4.1 times too high!

BE = Best Estimate
AGW by 2100

- TCR of $0.85 \, ^\circ C$ gives $0.57 \, ^\circ C$ now to 2100
  - Assuming exponential CO$_2$ increase
- IPCC RCP8.5 forecasts $3.5 \, ^\circ C$ now to 2100
Greenhouse Effect Change

HadCRUT4: TCR = 0.74 °C [0.20 – 1.29 °C]
UHI Corrected: TCR = 0.41 °C [0.0 – 0.82 °C]
The IWG uses three economic models:
- FUND, PAGE and DICE
- PAGE and DICE have no CO2 fertilization effect
- The DICE model assumes that the optimum climate at 1900, near end of Little Ice Age.
- Dr. Robert Mendelsohn: PAGE has “uncalibrated probabilistic damage function”.
- PAGE “explicitly does not include adaptation”
Social Cost (Benefit) of CO₂ using FUND

Social Cost of Carbon vs Climate Sensitivity
FUND Integrated Assessment Model

- ECS best estimate: red square 1.02 °C
- 17-83% range: thick red line
- 5-95% range: thin red line
- N. Lewis 2015 adjusted for millennium cyclic warming & urban warming

Social Cost of Carbon (\$/tCO₂)

Equilibrium Climate Sensitivity (°C/2XCO₂)
Probability Density Function of SCC

Best Est. red square -16.6
Likely thick line 17-83% CI
Very likely thin line 5-95% CI
Net Benefit of CO2 Emissions

- In Canada, net benefits of CO2 increase throughout the 21st century.
- Globally, net benefits likely between 11 and 19 US$/tCO2.
- Global benefits CDN$ 490 billion/yr to 600 billion/yr.
Effect of Discount Rate on SCC

- The US OMB recommends 3% to 7% discount rates.

<table>
<thead>
<tr>
<th>Year</th>
<th>Discount Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.5%</td>
</tr>
<tr>
<td>2020</td>
<td>70.8</td>
</tr>
<tr>
<td></td>
<td>3%</td>
</tr>
<tr>
<td>2020</td>
<td>48.0</td>
</tr>
<tr>
<td></td>
<td>5%</td>
</tr>
<tr>
<td>2020</td>
<td>13.7</td>
</tr>
<tr>
<td>2030</td>
<td>83.4</td>
</tr>
<tr>
<td></td>
<td>3%</td>
</tr>
<tr>
<td>2030</td>
<td>57.1</td>
</tr>
<tr>
<td></td>
<td>5%</td>
</tr>
<tr>
<td>2030</td>
<td>18.3</td>
</tr>
<tr>
<td>IWG on SCC (July 2015)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Discount Rate</th>
<th>2.5%</th>
<th>3%</th>
<th>5%</th>
<th>7%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>5.86</td>
<td>3.33</td>
<td>-0.75</td>
<td>-1.1</td>
<td></td>
</tr>
<tr>
<td>2030</td>
<td>6.45</td>
<td>3.90</td>
<td>-0.55</td>
<td>-1.01</td>
<td></td>
</tr>
</tbody>
</table>

Dayaratna, KcKitrick & Kreutz (April 2016)
Transfer Wealth to the Wealthy

- IWG: world’s income/person in 2100 will be 5 X today despite warming.
- Carbon taxes and trading transfers wealth from us to the very wealthy.
- Carbon taxes increases costs of all goods & services
  - Regressive, hurts the poor
  - Benefits banks and crony capitalists.
Affect of Alberta’s Climate Plan

- Compared to business-as-usual;
  - Reduce CO$_2$e emissions by 50 MtCO$_2$e by 2030
    - Total CO$_2$e emissions will be 63,100 MtCO$_2$e by 2030
  - Reduce CO$_2$ by 0.026 ppm by 2030
    - Expected CO$_2$ 449 ppm by 2030
  - Reduce global temperatures by 0.00007 °C
    - Insignificant and undetectable
IPCC 5th Report – Ignores the Sun

- The IPCC ignored 123 peer-reviewed article published 2008 – 2012 that show the Sun is a major climate driver.
- Also, 288 papers in 2014, 2015, 43 in 1st H 2016 show sun-climate link
- IPCC: “The forcing from changes in total solar irradiance alone does not seem to account for these observations, implying the existence of an amplifying mechanism”
- Then, ignores solar effects.
The Sun and Temperature Proxies

Solar proxy C14 vs temperature O18 over 3000 years.
IPCC 5th Report - Extremes

- complete reversal from AR4 on trends in drought, hurricanes, floods.
- no significant trend in global tropical cyclone frequency.
- No trend in the magnitude and/or frequency of floods.
- no trends in droughts.
Hurricanes: No Relation to Temperature

No significant trend of hurricane energy
Tornadoes require a cold front colliding with warm air. Northern warming makes tornadoes less likely.
Benefits of Warming

- Longer growing season
- Greater area of arable land
- Lower heating costs
- Fewer cold-related deaths and illness
- Low cost of outdoor activity
  - Lower construction costs
  - Lower road maintenance costs
- Reduced tropics to pole temperature gradient
  - Fewer severe storms
CO2 is Plant Food

- CO2 increases since 1950 have enhance crop yields by 16%.
- A 50% increase in CO2 causes a 23% increase in wheat yields in dry conditions.
- A 300 ppm CO2 increase would raise the productivity of woody plants by about 50%.
- CO2 fertilization added $3.2 Trillion to global crop yields 1961 to 2011. Will add $9.8 Trillion value by 2050.

Canada’s GDP = $1.8 Trillion
CO2 is Greening the Planet

- CO2 fertilization caused 70% of growing-season leaf area greening trend from 1982 to 2014 over 25-50% of the world’s vegetated area. Greening was 11% over 33 years. (April 25, 2016)
Warming Reduces Deaths

- In U.K., death records show cold kill 10X as many as heat.
- In U.S.A, cold kill twice as many as heat.
- Death rate in Canada is 100 deaths/day greater in January than July.
- Study of 13 countries: Cold weather kills 20 times as many people as hot weather.
Alberta Wind Power – Extreme Variability

Average Q3 2012 total demand = 8415 MW.
## Alberta's Electricity Generation - 2015

<table>
<thead>
<tr>
<th>Generation Fuel</th>
<th>Gigawatt Hours</th>
<th>Share by Fuel Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>41,378</td>
<td>51%</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>32,215</td>
<td>39%</td>
</tr>
<tr>
<td>Wind</td>
<td>3,816</td>
<td>4.7%</td>
</tr>
<tr>
<td>Biomass</td>
<td>2,149</td>
<td>2.6%</td>
</tr>
<tr>
<td>Hydro</td>
<td>1,745</td>
<td>2.1%</td>
</tr>
<tr>
<td>Fuel oil &amp; waste heat</td>
<td>318</td>
<td>0.4%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>81,621</strong></td>
<td></td>
</tr>
</tbody>
</table>
Wind Farm Subsidies

- “Save the Planet” from Global Warming.
- Ontario Feed-in tariffs 12.8 ¢/kWh
- Federal tax credits
- Alberta R&D tax credits
- Alberta transmission lines for wind
- Renewable Energy Certificates
Alberta Wind Power

- 2015 average Wind capacity factor: 33%
- Wind capacity factor during annual peak demand: 7%
- Dec. 26, 2015; Wind CF: 3.9%, 0.6% of total generation.
- Southern Alberta Transmission Reinforcement (for wind power) cost: $2.5 billion.
- Wind transmission costs are 2 – 3 time greater than for conventional power.
## Ontario Solar Feed-in Tariffs

<table>
<thead>
<tr>
<th>Type</th>
<th>Size</th>
<th>Price (¢/kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar (PV) Rootop</td>
<td>&lt;10 kW</td>
<td>29.4 – 31.3</td>
</tr>
<tr>
<td>Solar (PV) Rootop</td>
<td>&gt;10 kW &lt;500 kW</td>
<td>22.5 – 24.2</td>
</tr>
<tr>
<td>Solar (PV) Non-Rootop</td>
<td>&lt;10 kW</td>
<td>21.4</td>
</tr>
<tr>
<td>Solar (PV) Non-Rootop</td>
<td>&gt;10 kW &lt;500 kW</td>
<td>20.9</td>
</tr>
<tr>
<td>ENMAX energy charge June 2016</td>
<td>&gt;10 kW &lt;500 kW</td>
<td>3.5</td>
</tr>
</tbody>
</table>

*Ontario solar FIT costs up to 9 times the cost of Alberta electricity.*
Electricity Prices

Global Electricity Prices in 2015
Selected Countries

<table>
<thead>
<tr>
<th>Country</th>
<th>U.S. cents/KWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Italy</td>
<td>16</td>
</tr>
<tr>
<td>Germany</td>
<td>15</td>
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<tr>
<td>UK</td>
<td>13</td>
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<tr>
<td>Spain</td>
<td>12</td>
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<tr>
<td>US</td>
<td>10</td>
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<td>France</td>
<td>9</td>
</tr>
<tr>
<td>Poland</td>
<td>8</td>
</tr>
<tr>
<td>Australia</td>
<td>7</td>
</tr>
<tr>
<td>Canada</td>
<td>6</td>
</tr>
</tbody>
</table>
Electricity Prices vs Solar+Wind Capacity

Electricity Cost vs Installed Solar and Wind Capacity Per Capita

\[ y = 0.019x + 11.979 \]

\[ R^2 = 0.854 \]

Source: Eurostat, 2014
Carbon dioxide is a wonderful by-product of fossil fuel use.
Social benefit of CO₂ is about US$17/tCO₂.
Expected warming by 2100 is trivial 0.6 °C or less.
Don’t subsidize wind or solar.
Alberta’s climate plan will be a burden with no benefit.
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