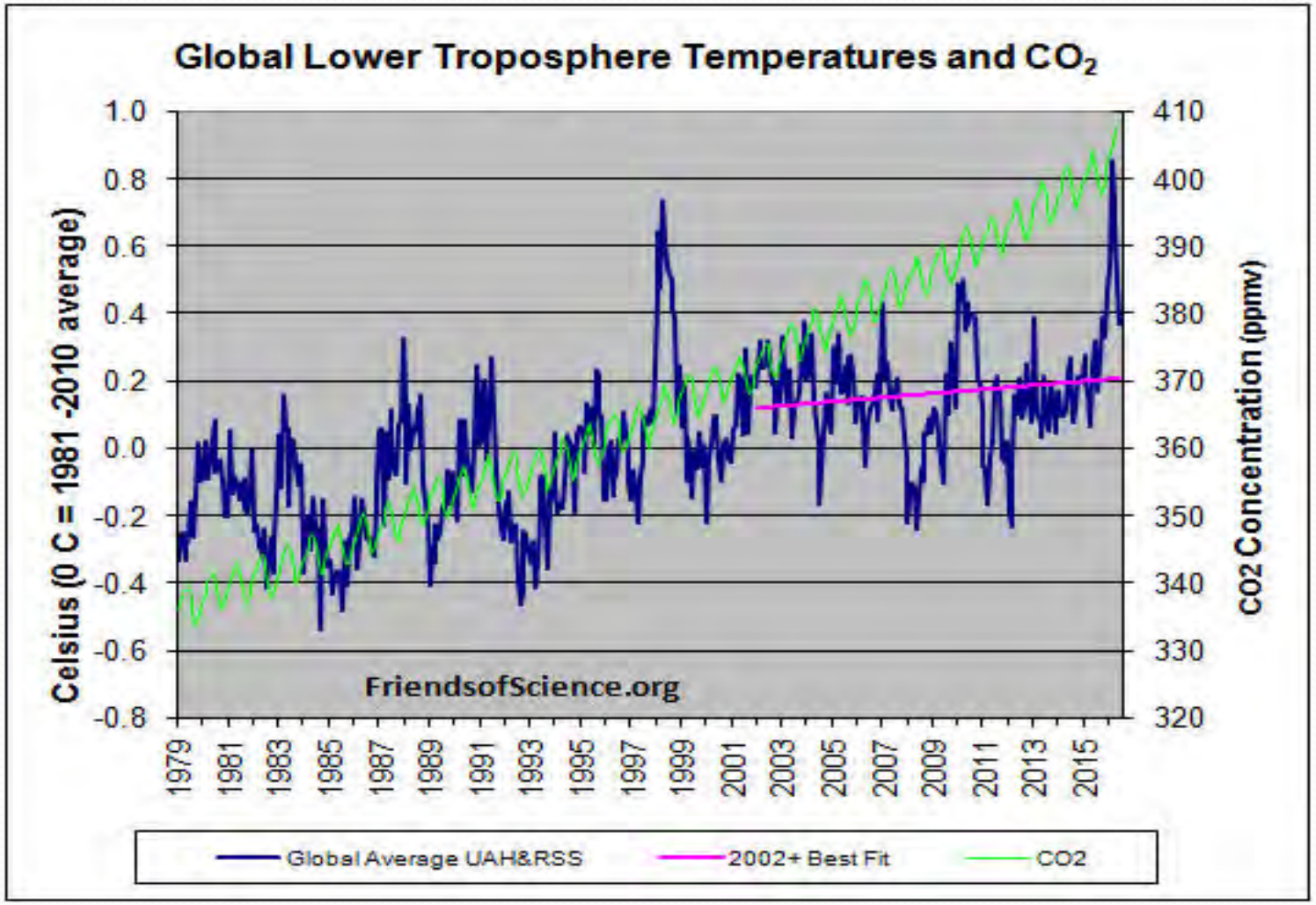
Alberta's Climate Plan

A burden with no benefit

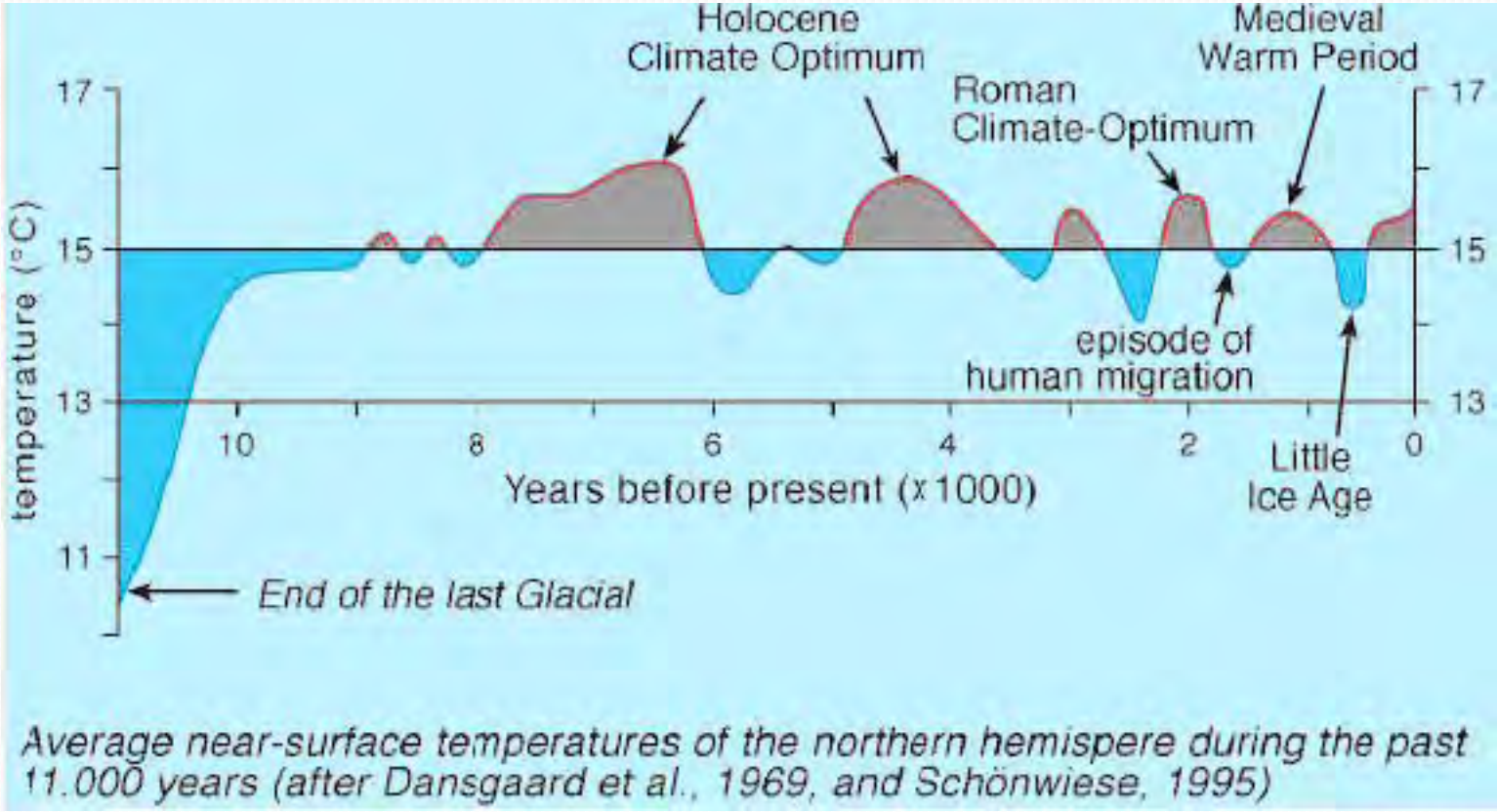
Ken Gregory, Ba.A.Sc.
Friends of Science Society
July 25, 2016.

Global Air Temperatures



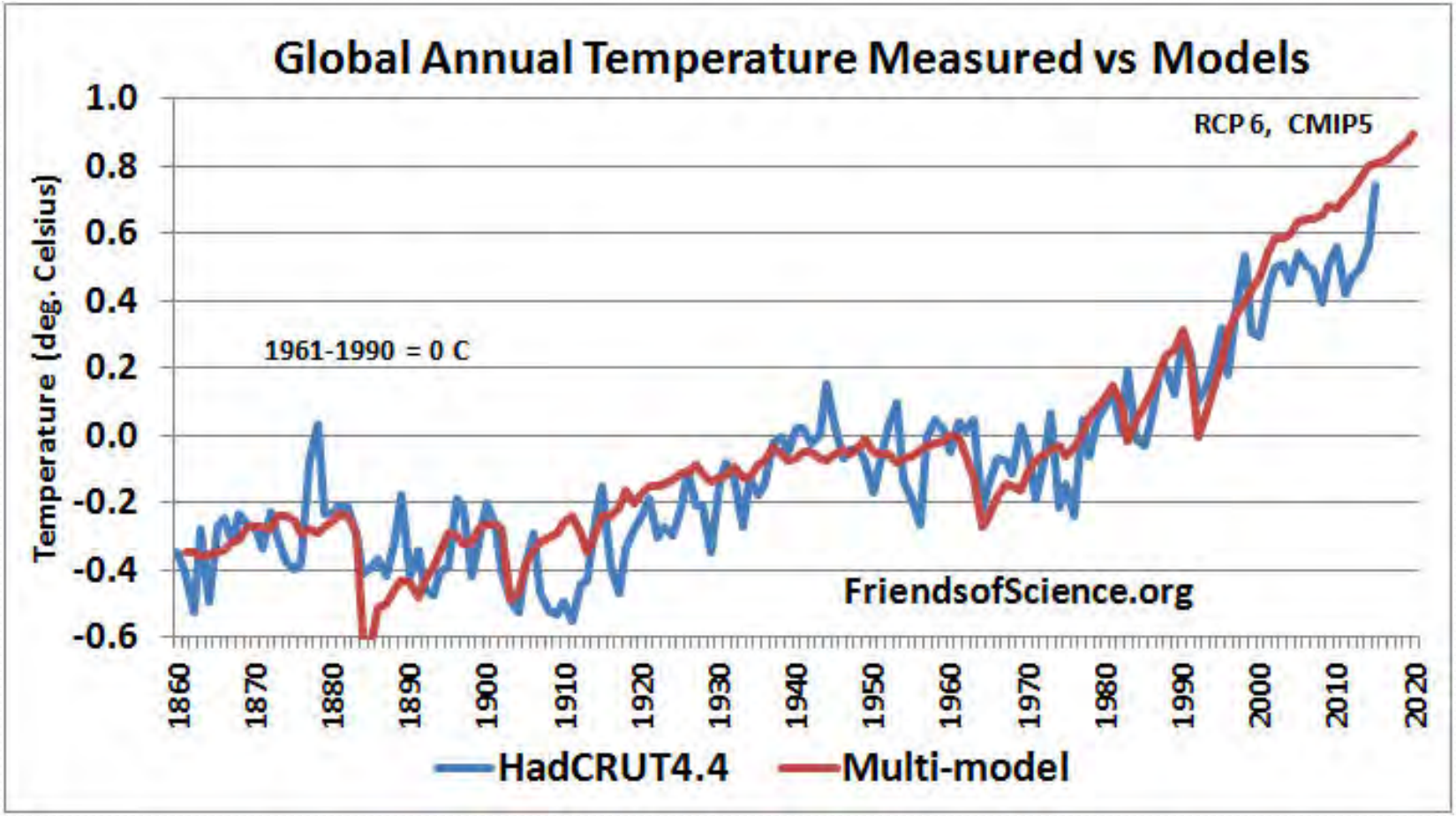
Previous Warm & Cold Periods

Climate always changes with no help from Man.



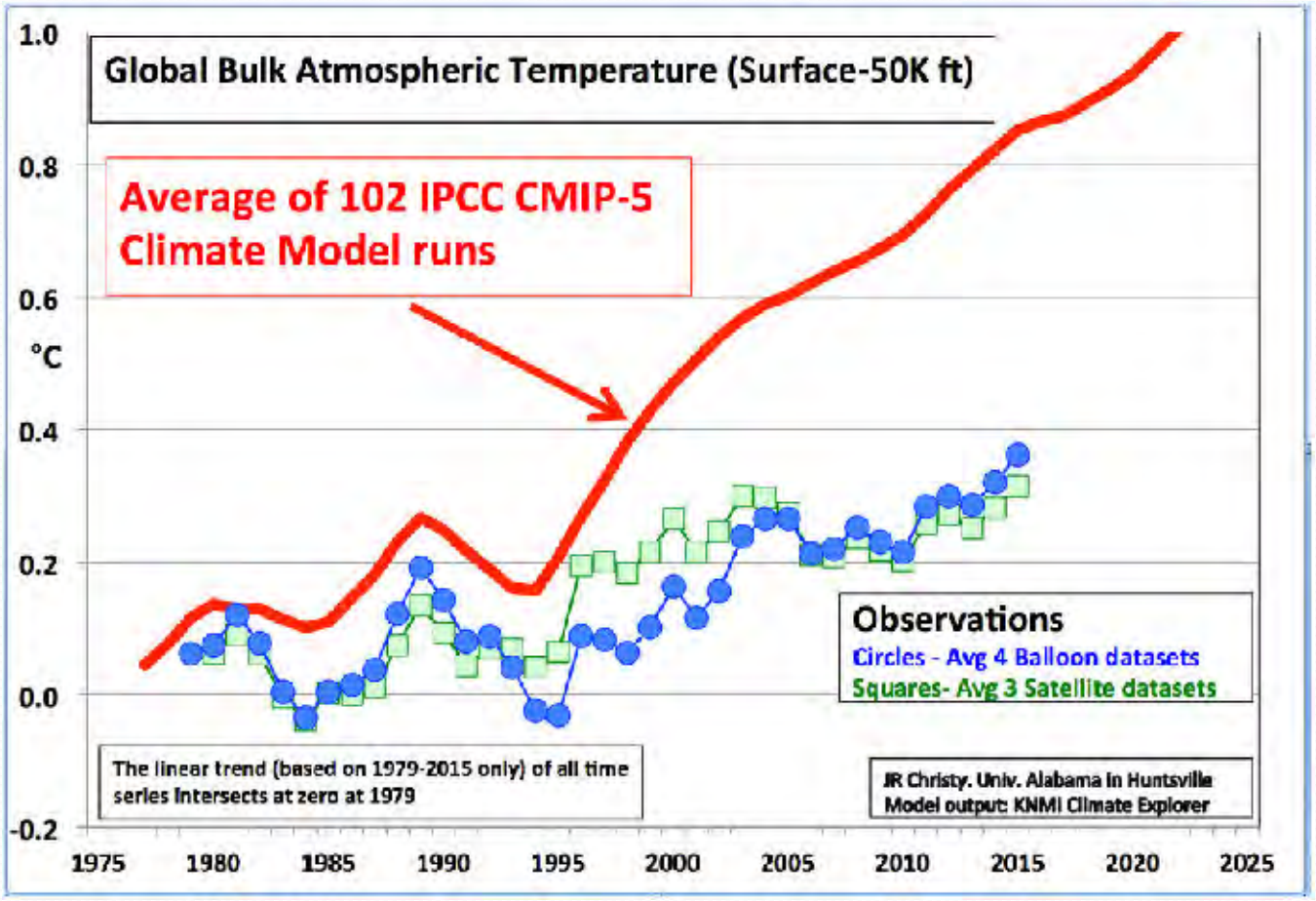
Average near-surface temperatures of the northern hemispere during the past 11.000 years (after Dansgaard et al., 1969, and Schönwiese, 1995)

Surface Temperature vs Models



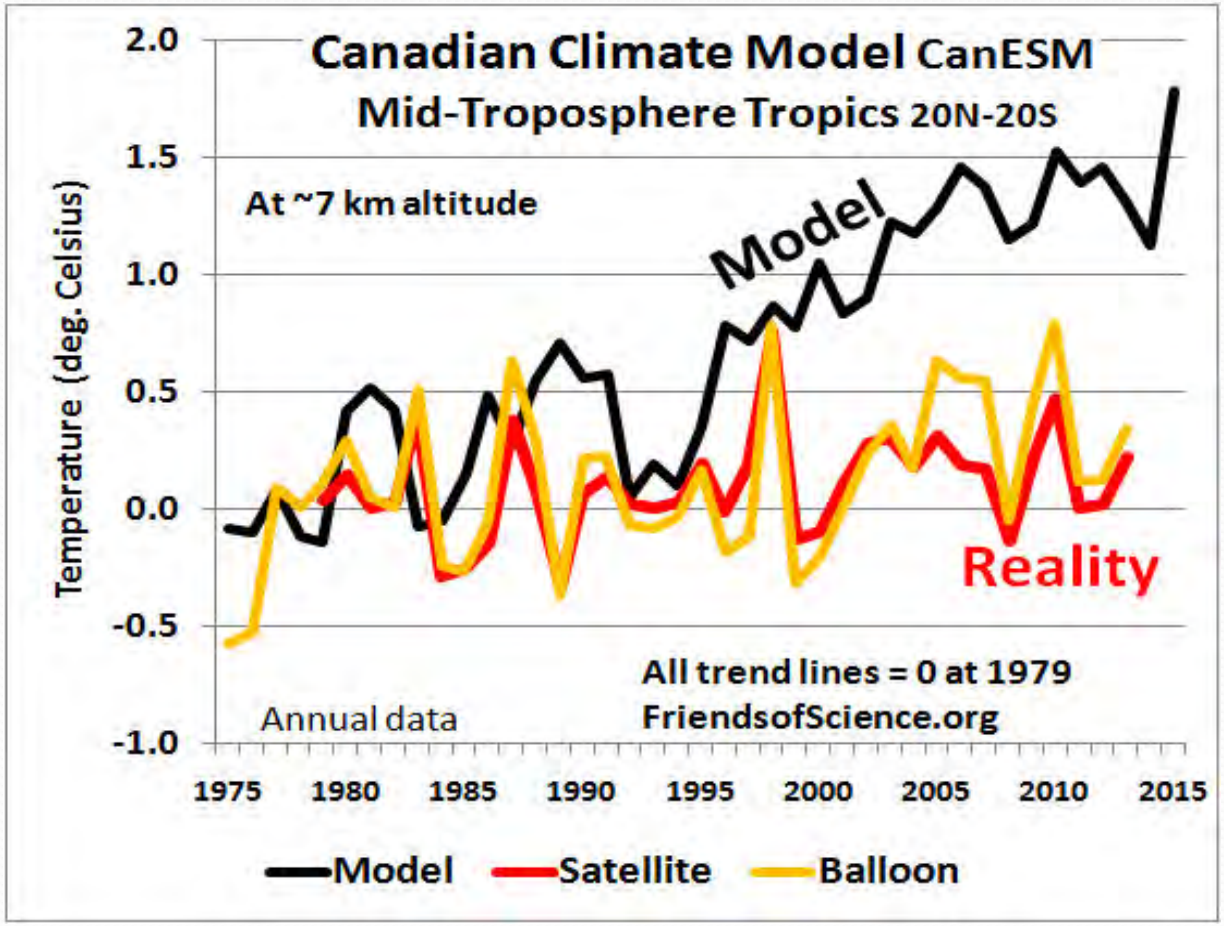
No match before 1960 or after 1995

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 CO_2 emissions at 100 $MtCO_2$/year
- Cut CH_4 emissions by 45% by 2025
- Carbon tax
  - \$20/tCO_2 in 2017
  - \$30/tCO_2 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

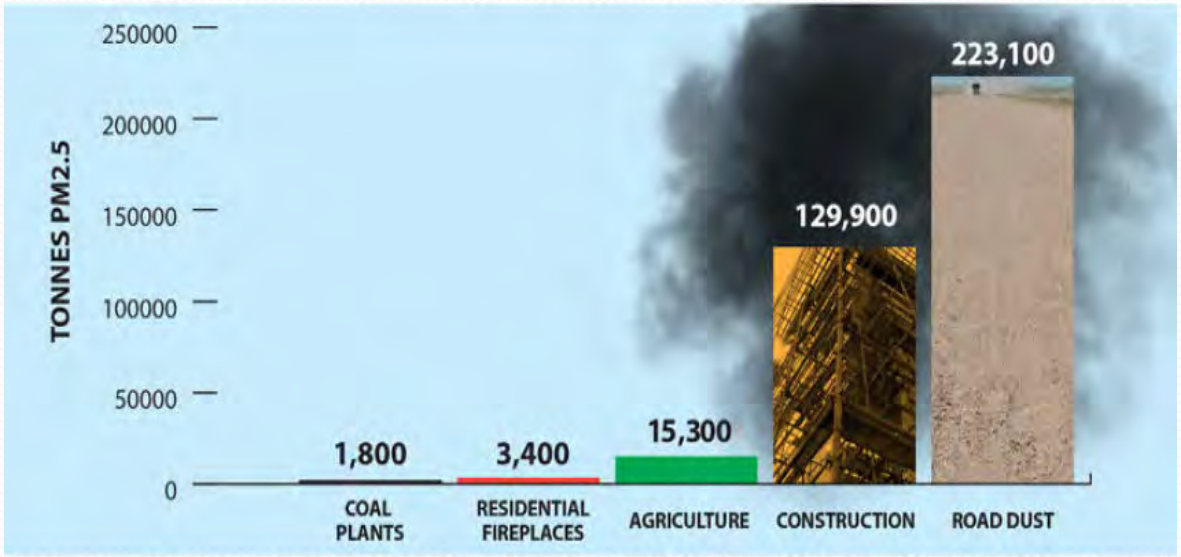
Climate Panel Social Cost of Carbon

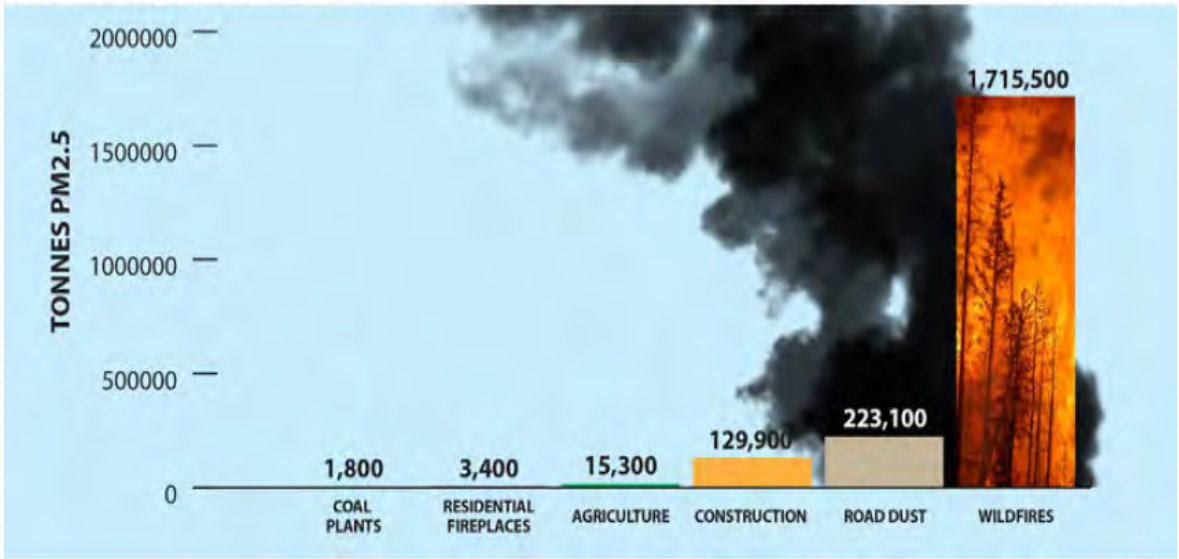
- Panel said US IWG central estimate used 2.5% discount rate;
  - $62/tCO2 in 2015
  - $69/tCO2 in 2020
  - IWG actually used 2.5%, 3% and 5%.
- International Energy Agency for 2 °C goal.
  - $20/tCO2 in 2020
  - $100/tCO2 in 2030

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





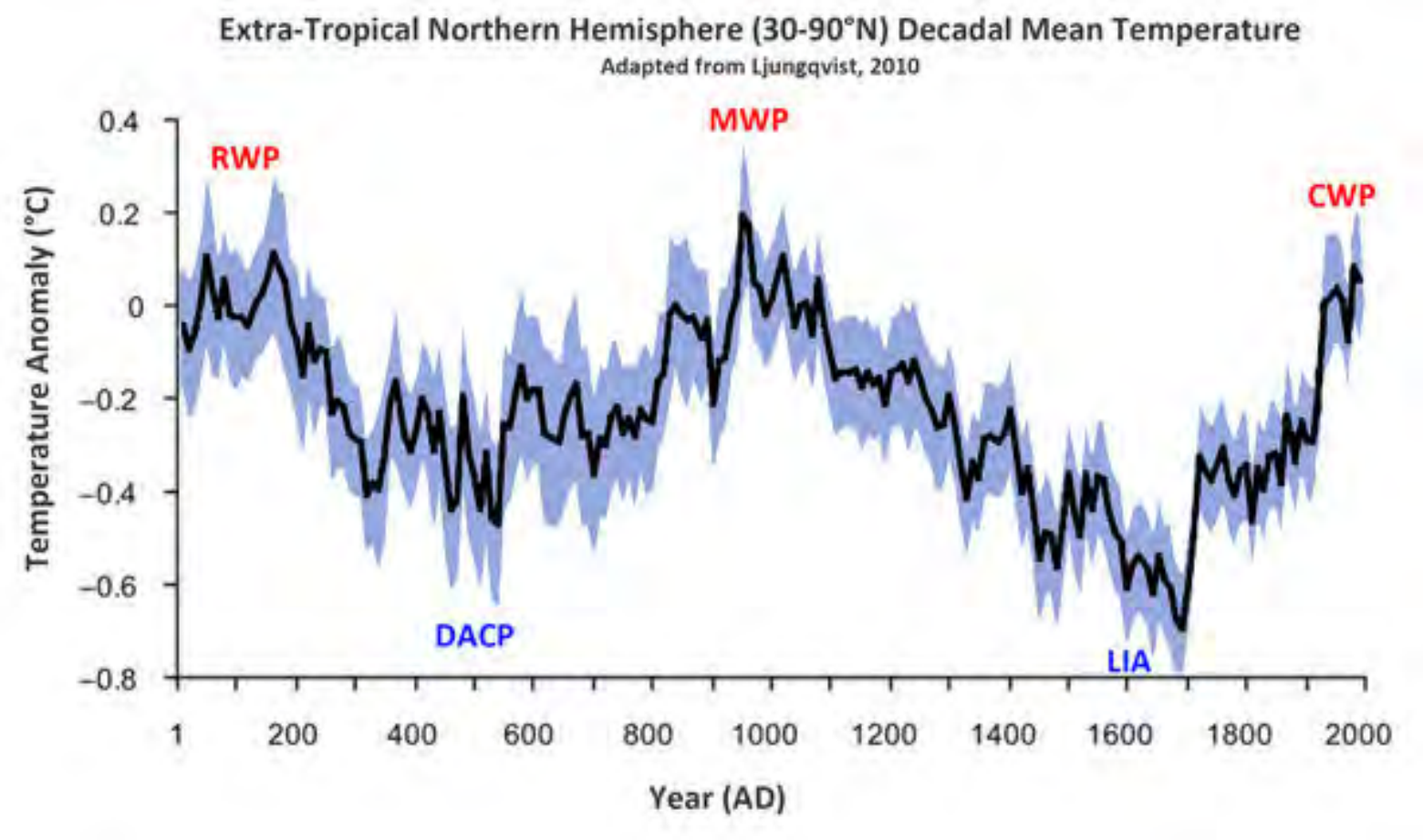
Climate Sensitivity – Energy Balance

- Transient Climate Response, double CO_2, exponential growth → 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.
- TCR = 1.21 °C ECS = 1.45 °C

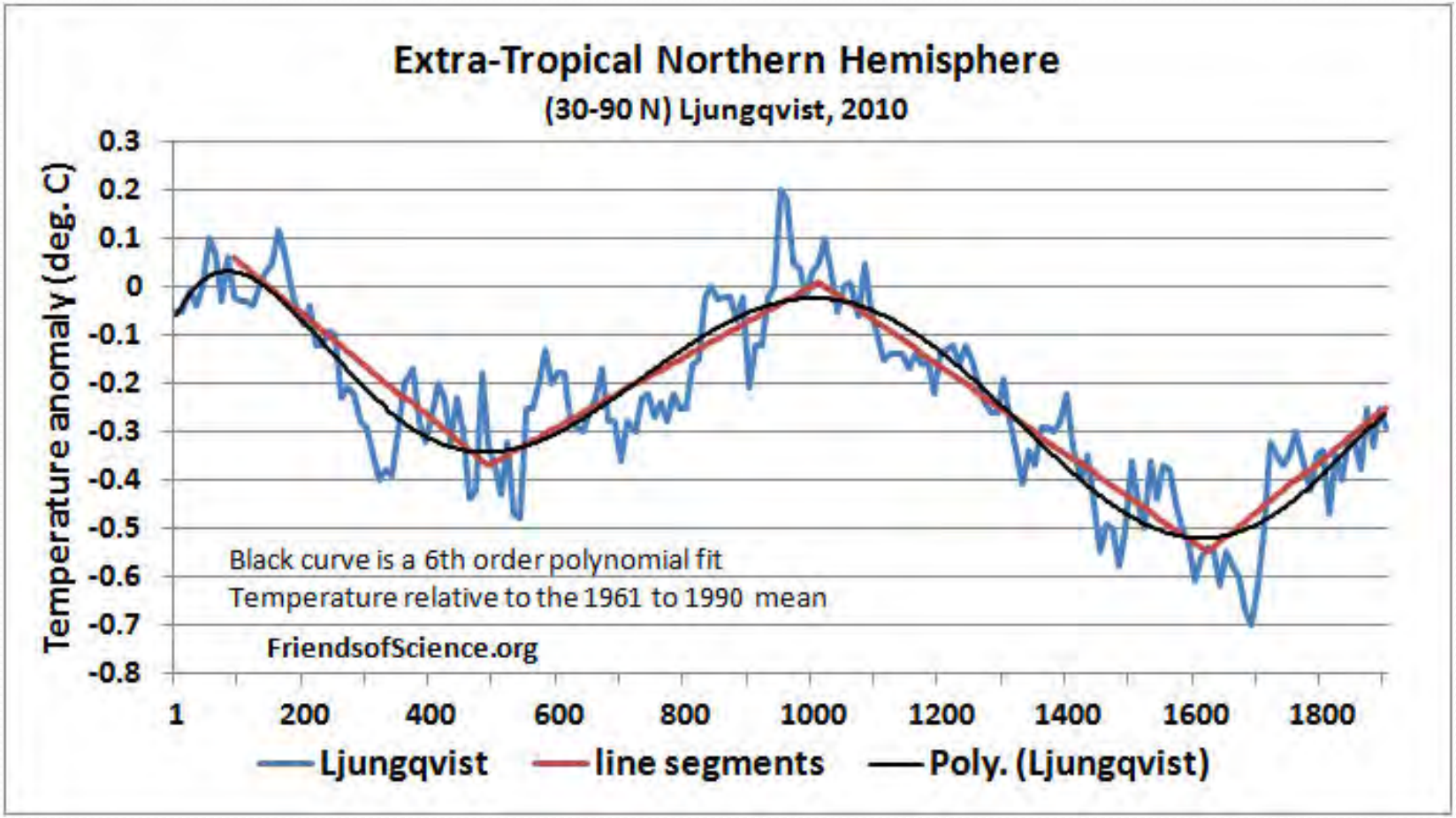
Millennium Scale Natural Cycle

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

Northern Hemisphere Temperatures



Millennium Cycle



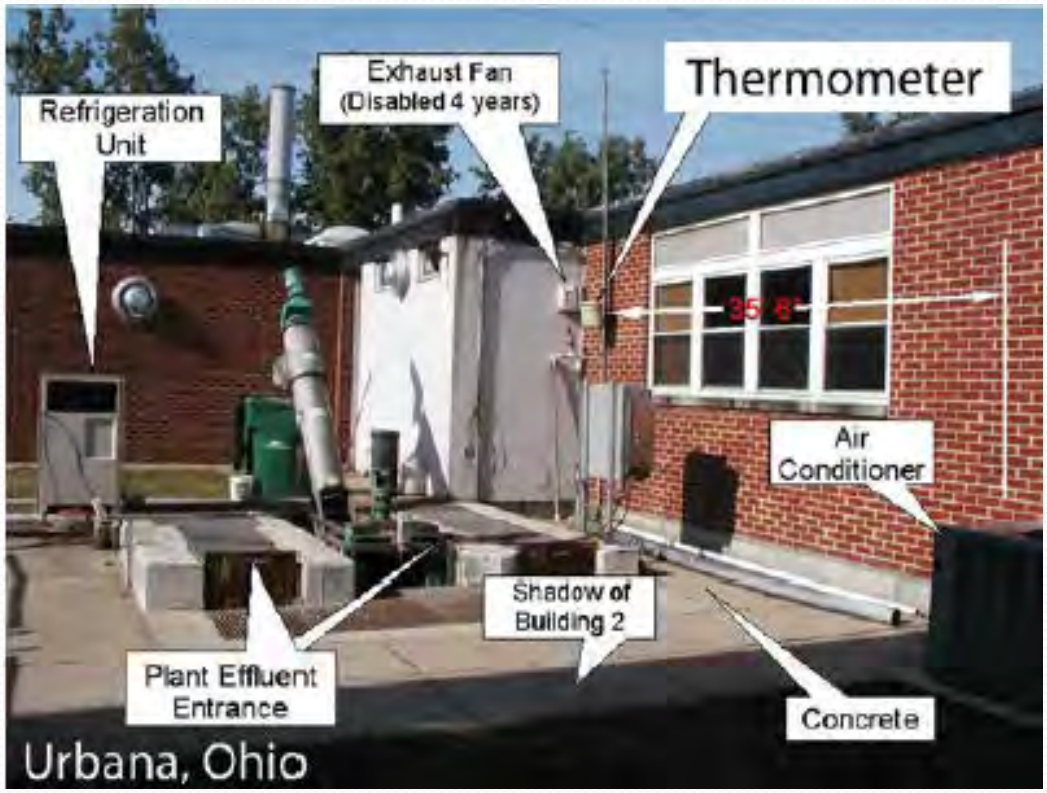
Use the average of four slopes to determine natural warming from the Little Ice Age

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

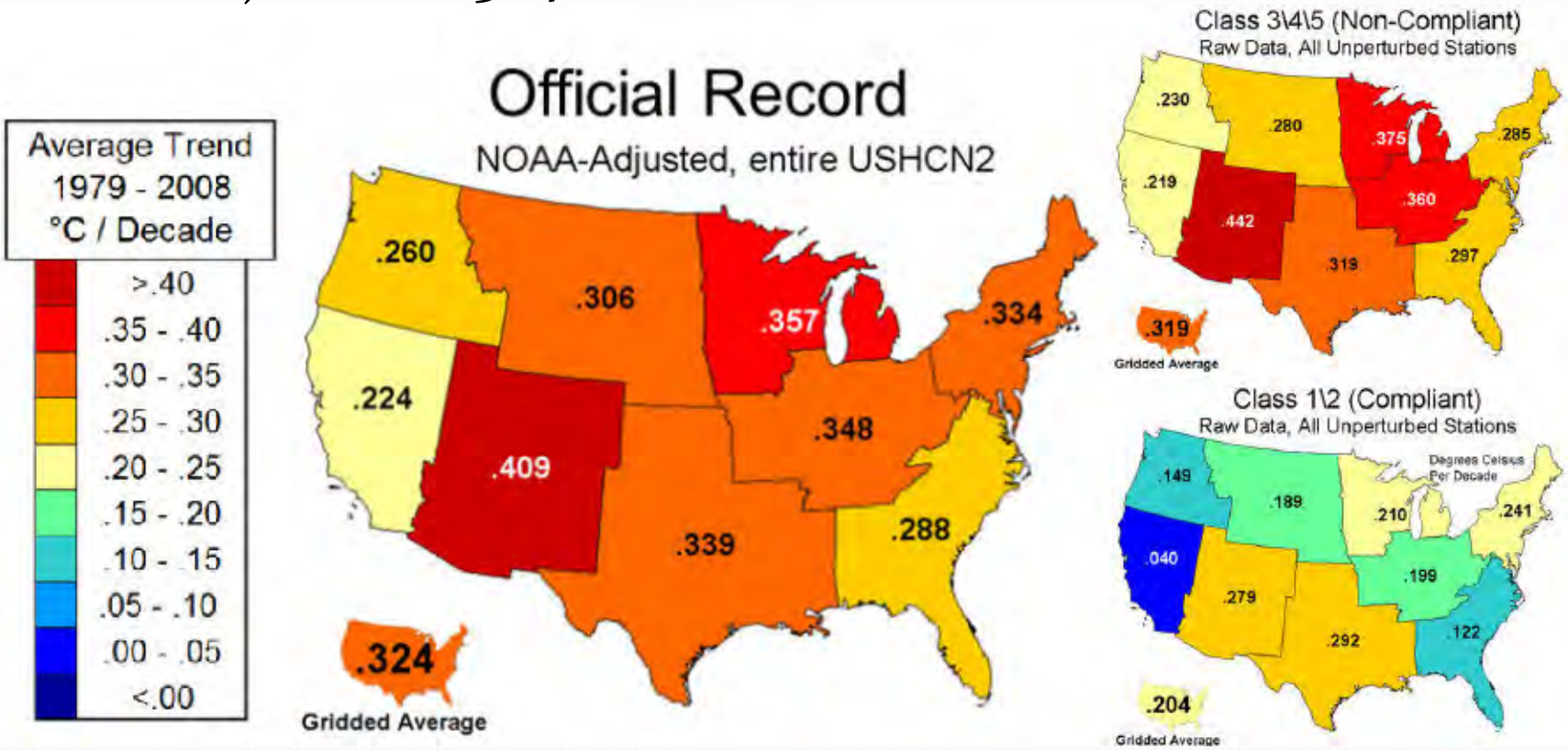
Urban Heat Island Effect

•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

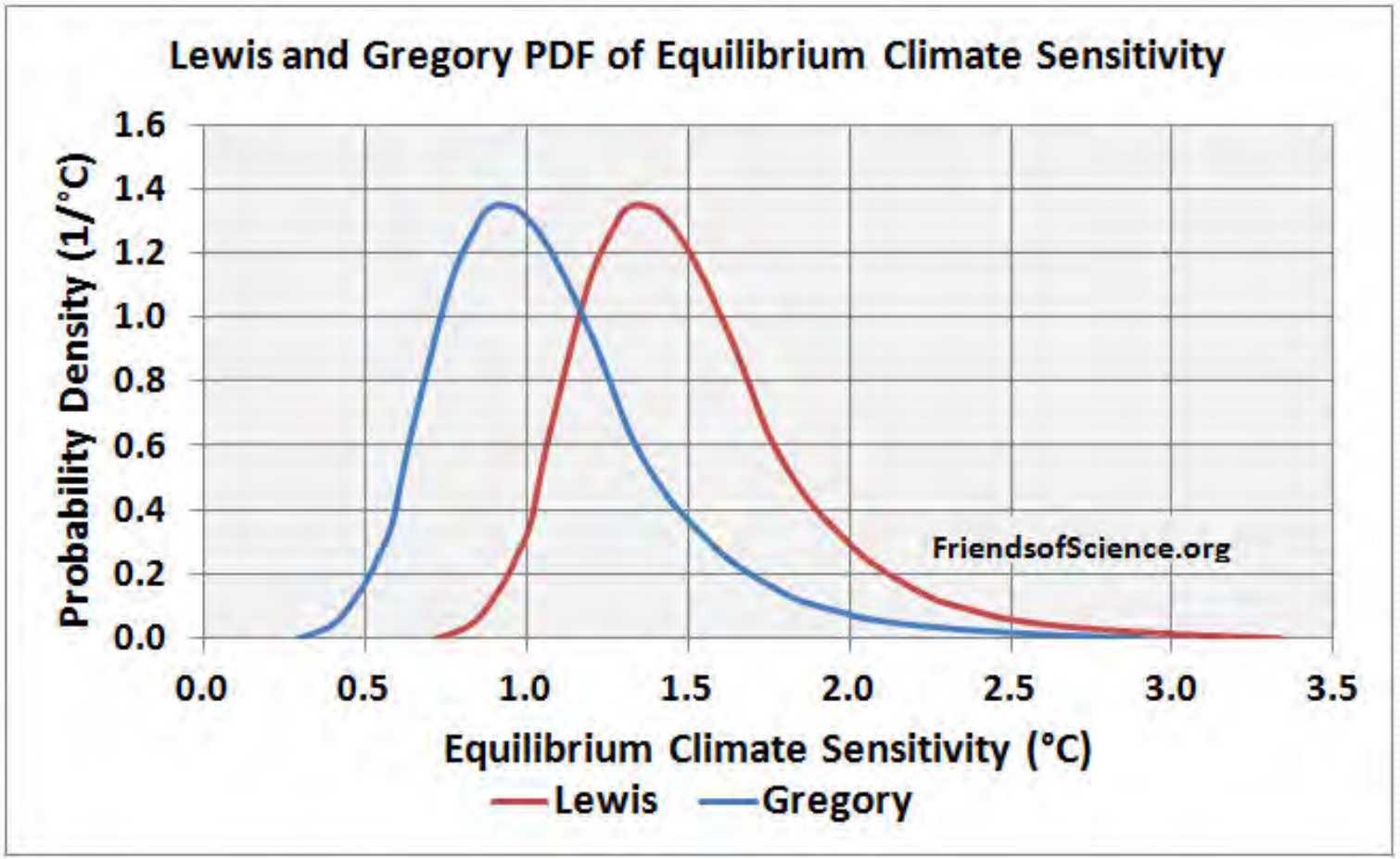
Compliant: 0.204 °C/decade
Non-compliant: 0.319 °C/decade
Final Adjusted: 0.324 °C/decade



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



Summary ECS and TCR Estimates

	ECS BE	ECS 5-95%	TCR BE	TRC 5-95%
USA IWG SCC	**3.0**	**1.70 – 7.15**	**1.8**	**NA**
IPCC AR5 Forcings	**1.64**	**1.05 – 4.05**	**1.33**	**0.90 – 2.50**
Stevens Aerosol Forcing	**1.45**	**1.05 – 2.20**	**1.21**	**0.90 – 1.65**
With Natural Warming & UHIE	**1.02**	**0.60 – 1.75**	**0.85**	**0.55 – 1.30**

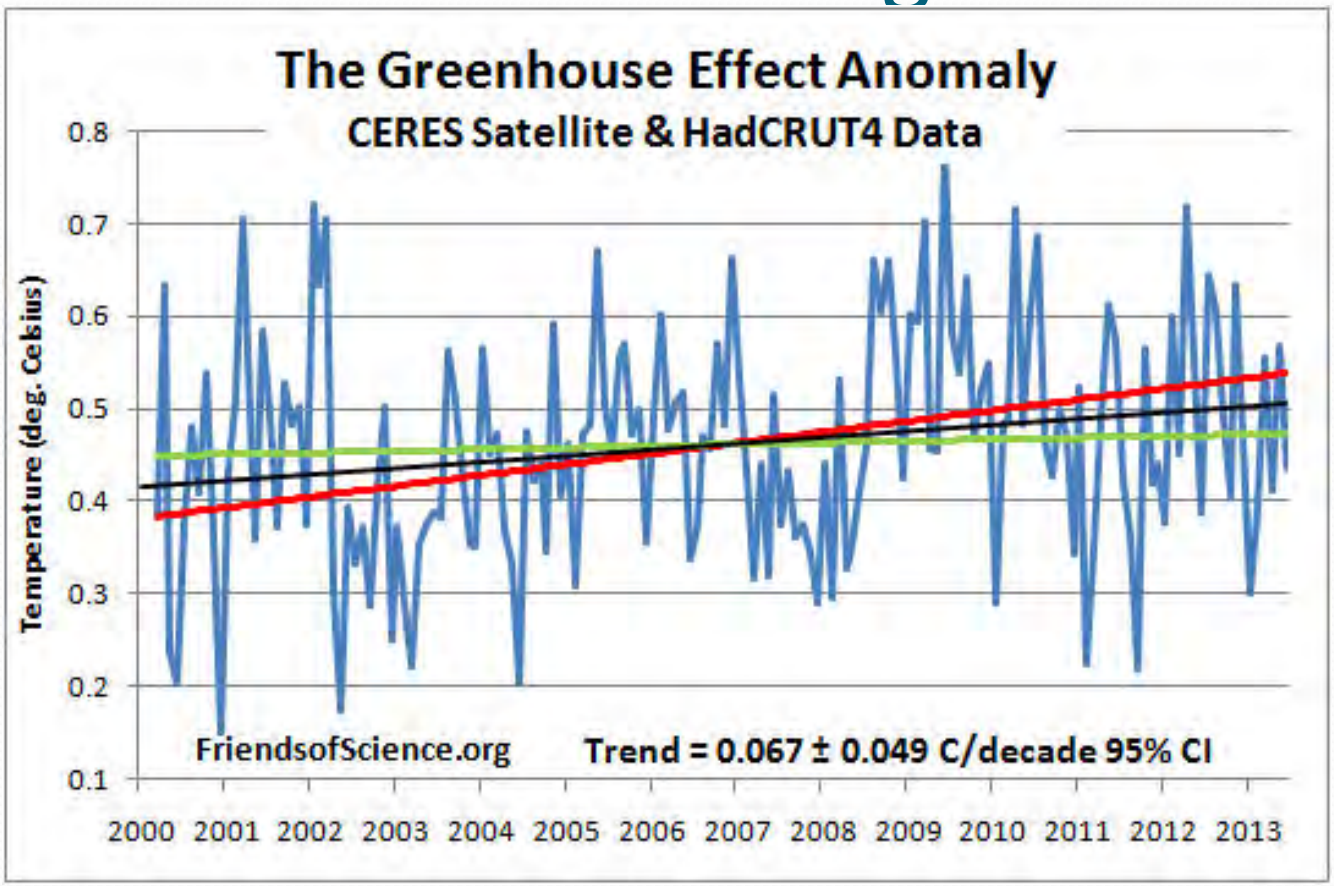
IWG SCC high 95% estimate of ECS is 4.1 times too high!

BE = Best Estimate

AGW by 2100

- TCR of 0.85 °C gives 0.57 °C now to 2100
  - Assuming exponential CO_2 increase
- IPCC RCP8.5 forecasts 3.5 °C now to 2100

Greenhouse Effect Change

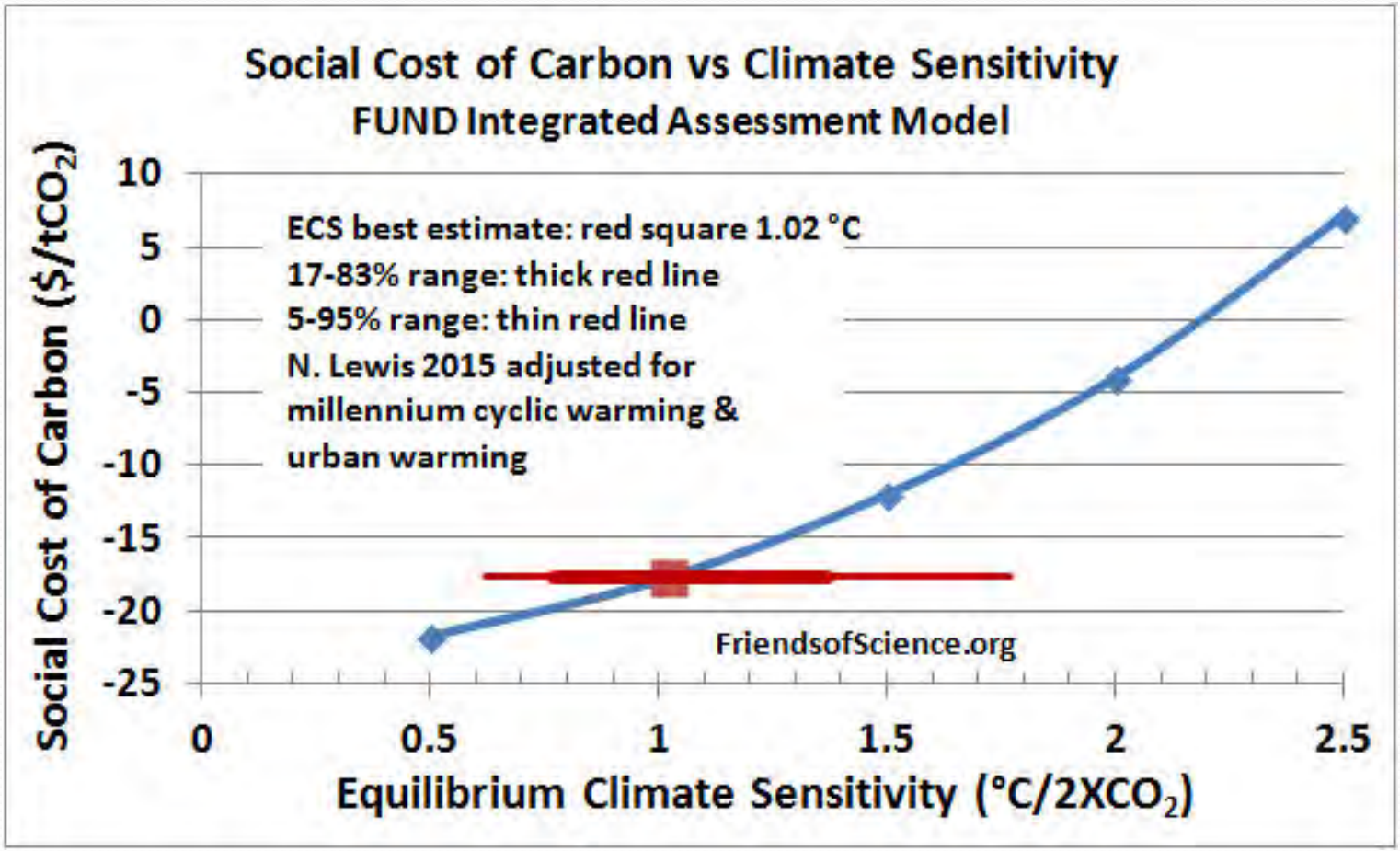


HadCRUT4: TCR = 0.74 °C [0.20 – 1.29 °C]
UHI Corrected: TCR = 0.41 °C [0.0 – 0.82 °C]

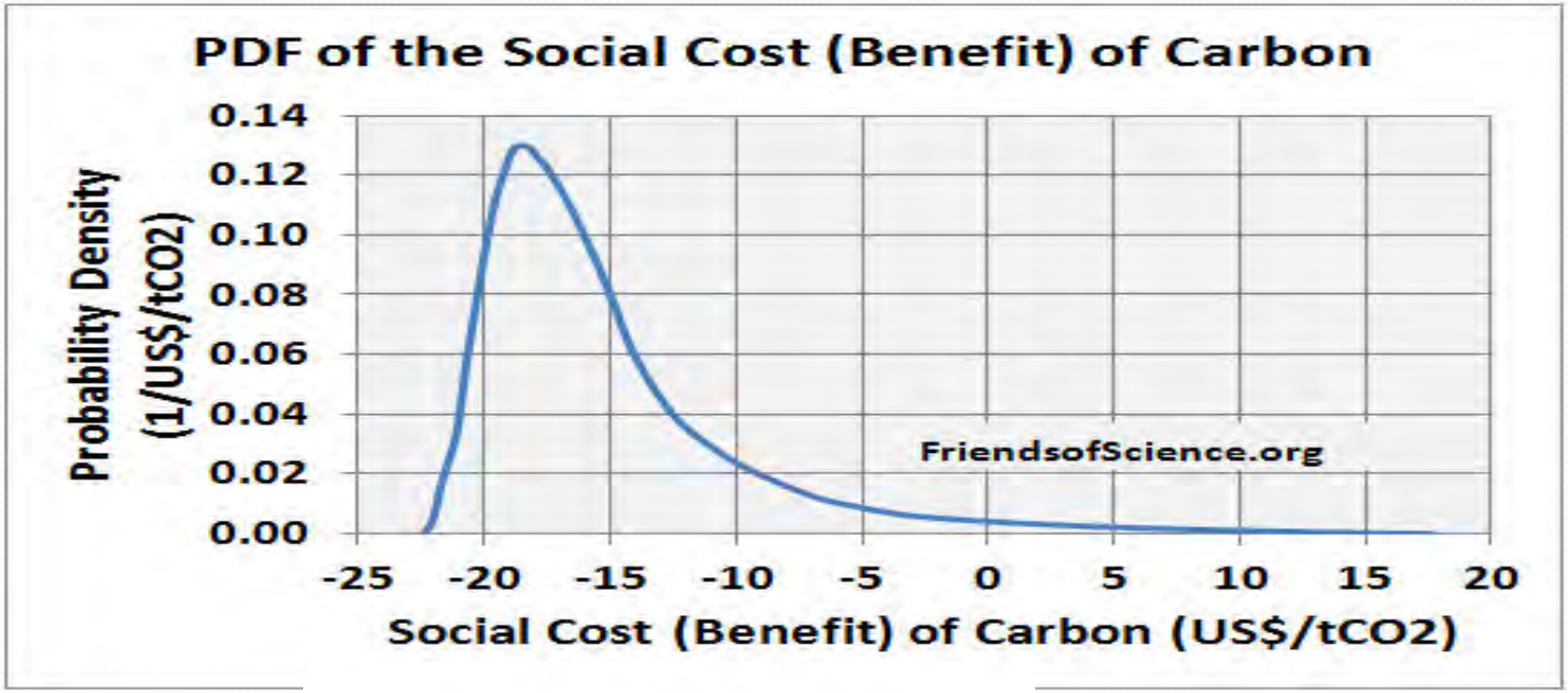
SCC Models Omit Benefits of CO2

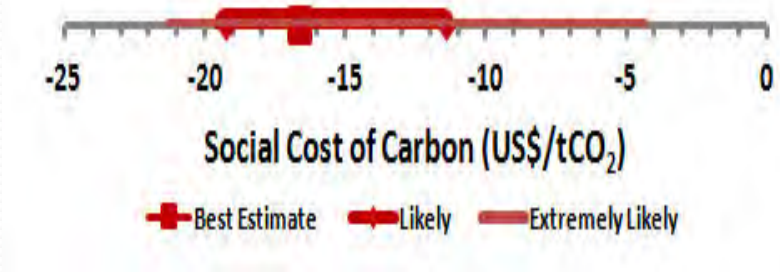
- The IWG uses three economic models:
  - FUND, PAGE and DICE
- PAGE and DICE have no CO2 fertilization effect
- The DICE model assumes that the optimum climate at 1900, near end of Little Ice Age.
- Dr. Robert Mendelsohn: PAGE has “uncalibrated probabilistic damage function”.
- PAGE “explicitly does not include adaptation”

Social Cost (Benefit) of CO_2 using FUND



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 CO_2 Emissions

- In Canada, net benefits of CO_2 increase throughout the 21st century.
- Globally, net benefits likely between 11 and 19 US$/t$CO_2$.
- Global benefits CDN$ 490 billion/yr to 600 billion/yr.

Effect of Discount Rate on SCC

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

in 2014 US$

IWG SCC with 3 IAMs, High CS

US$/tCO$_2$	Discount Rate		
Year	2.5%	3%	5%
2020	70.8	48.0	13.7
2030	83.4	57.1	18.3

IWG on SCC (July 2015)

FUND SCC with L&C 2015 ESC distribution

US$/tCO$_2$	Discount Rate			
Year	2.5%	3%	5%	7%
2020	5.86	3.33	-0.75	-1.1
2030	6.45	3.90	-0.55	-1.01

Dayaratna, KcKitrick & Kreutzer (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

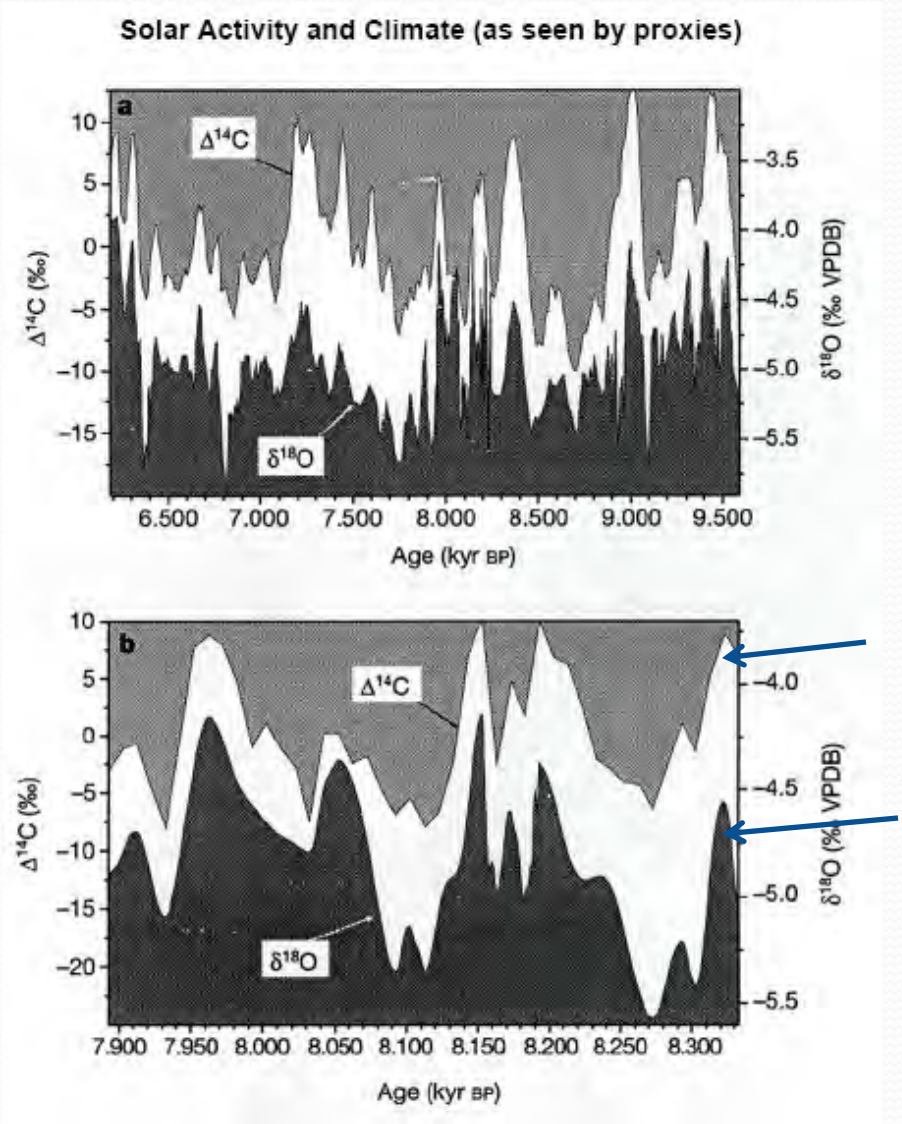
- Compared to business-as-usual;
  - Reduce CO_2e emissions by 50 $MtCO_2e$ by 2030
    - Total CO_2e emissions will be 63,100 $MtCO_2e$ by 2030
  - Reduce CO_2 by 0.026 ppm by 2030
    - Expected CO_2 449 ppm by 2030
  - Reduce global temperatures by 0.00007 °C
    - Insignificant and undetectable

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.



The Sun

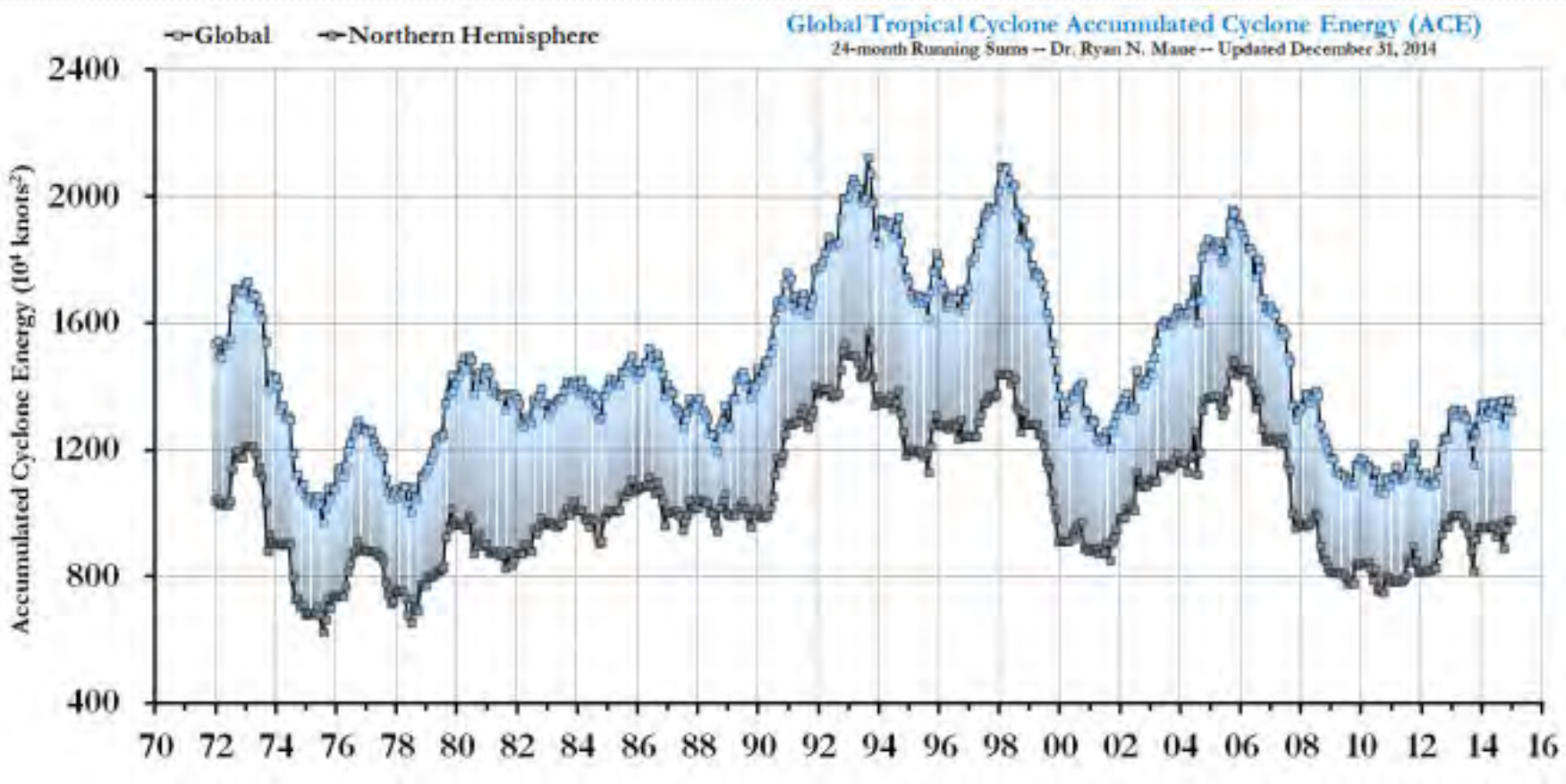
Temperature

IPCC 5th Report - Extremes

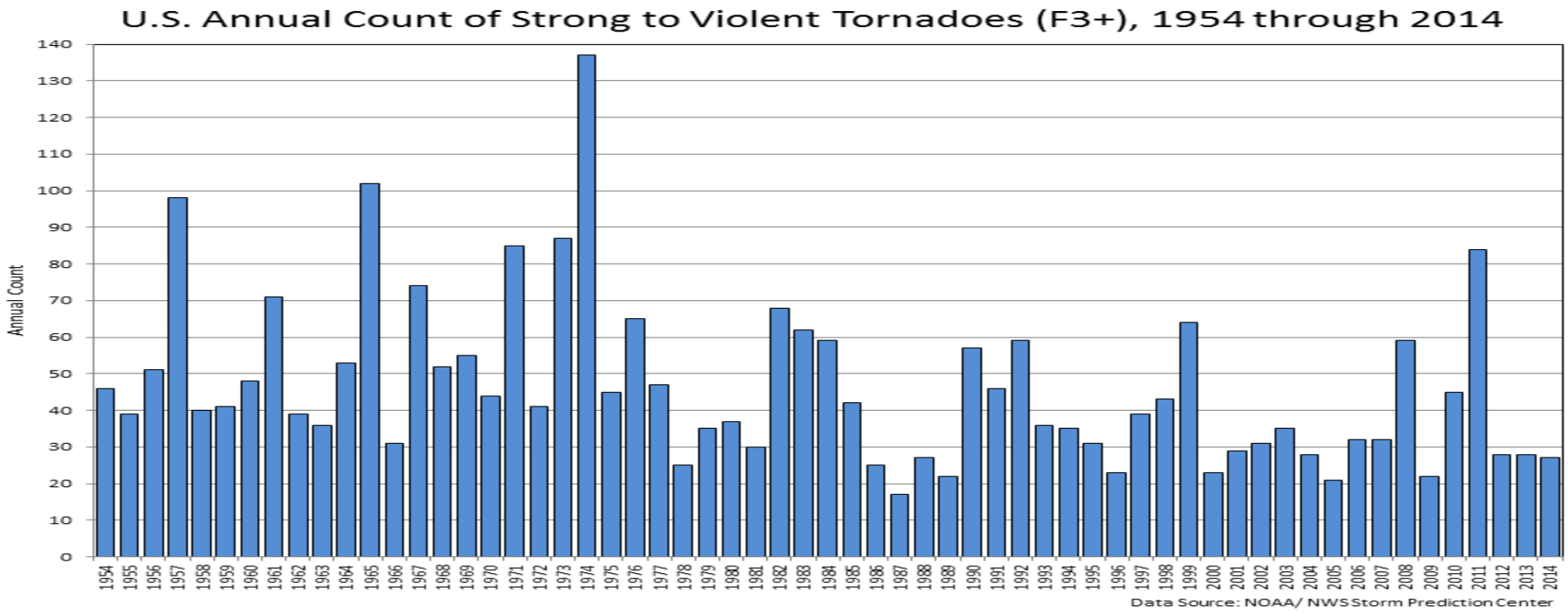
- **complete reversal from AR4 on trends in drought, hurricanes, floods.**
- no significant trend in global tropical cyclone frequency.
- No trend in the magnitude and/or frequency of floods.
- no trends in droughts.

Hurricanes: No Relation to Temperature

No significant trend of hurricane energy



Tornado Trend Declines with Warming



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

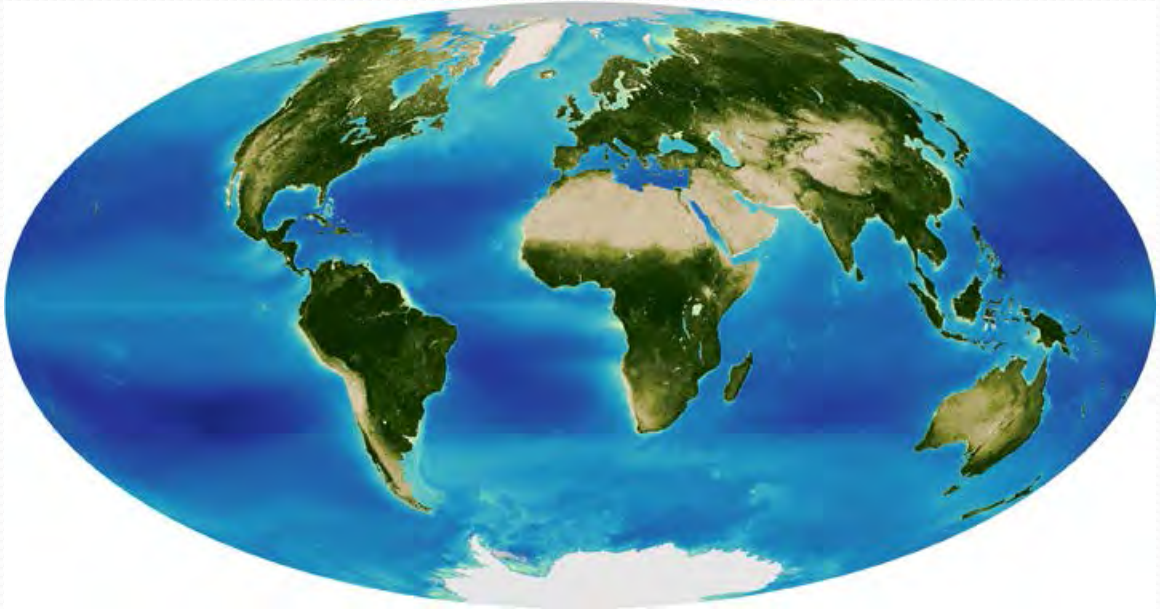
CO2 is Plant Food

- CO2 increases since 1950 have enhance crop yields by 16%.
- A 50% increase in CO_2 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

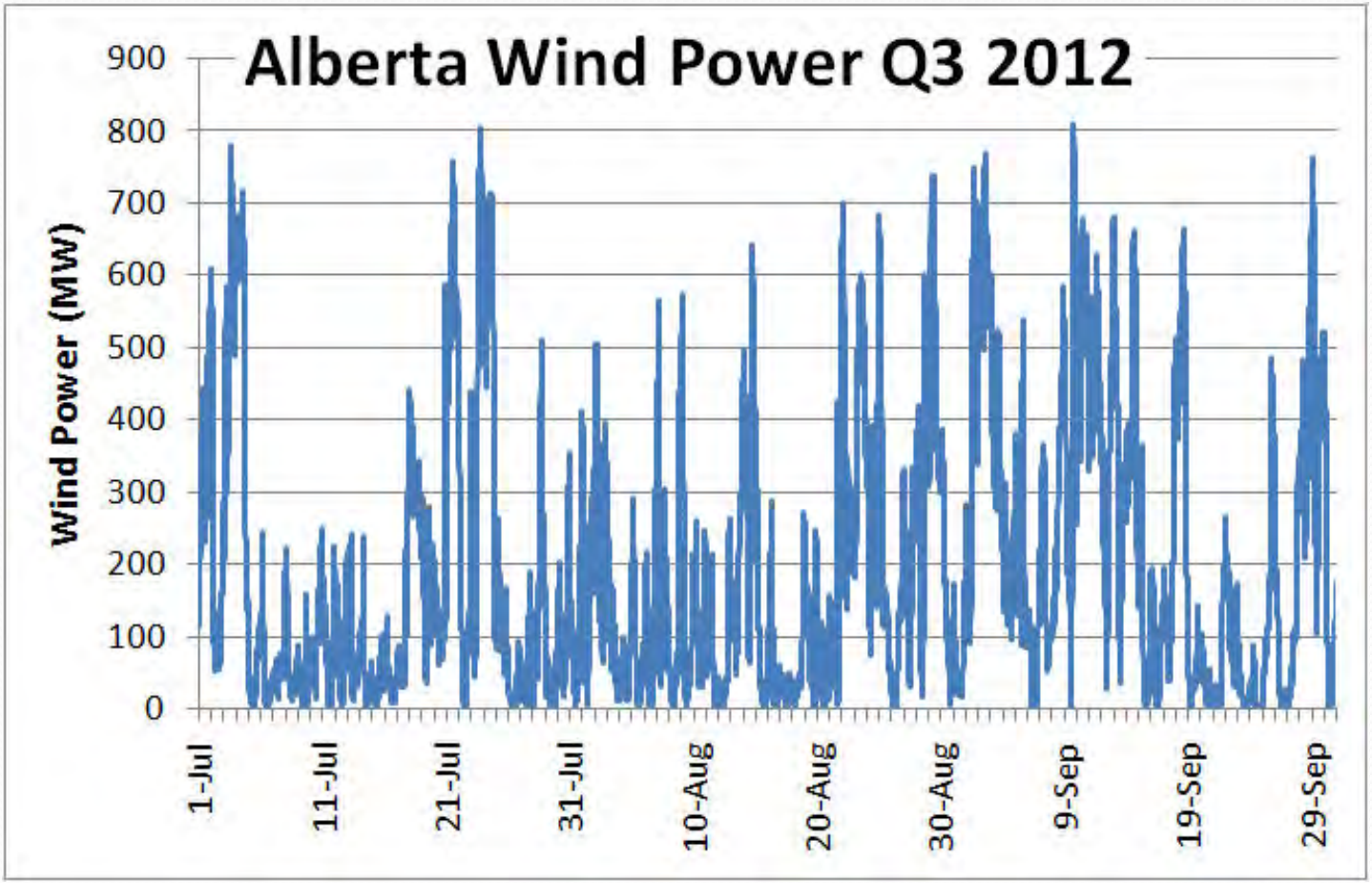
- CO2 fertilization caused 70% of growing-season leaf area greening trend from 1982 to 2014 over 25-50% of the world's vegetated area. Greening was 11% over 33 years. (April 25, 2016)



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

Generation Fuel	Gigawatt Hours	Share by Fuel Type
Coal	41,378	51%
Natural Gas	32,215	39%
Wind	3,816	4.7%
Biomass	2,149	2.6%
Hydro	1,745	2.1%
Fuel oil & waste heat	318	0.4%
TOTAL	81,621	

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

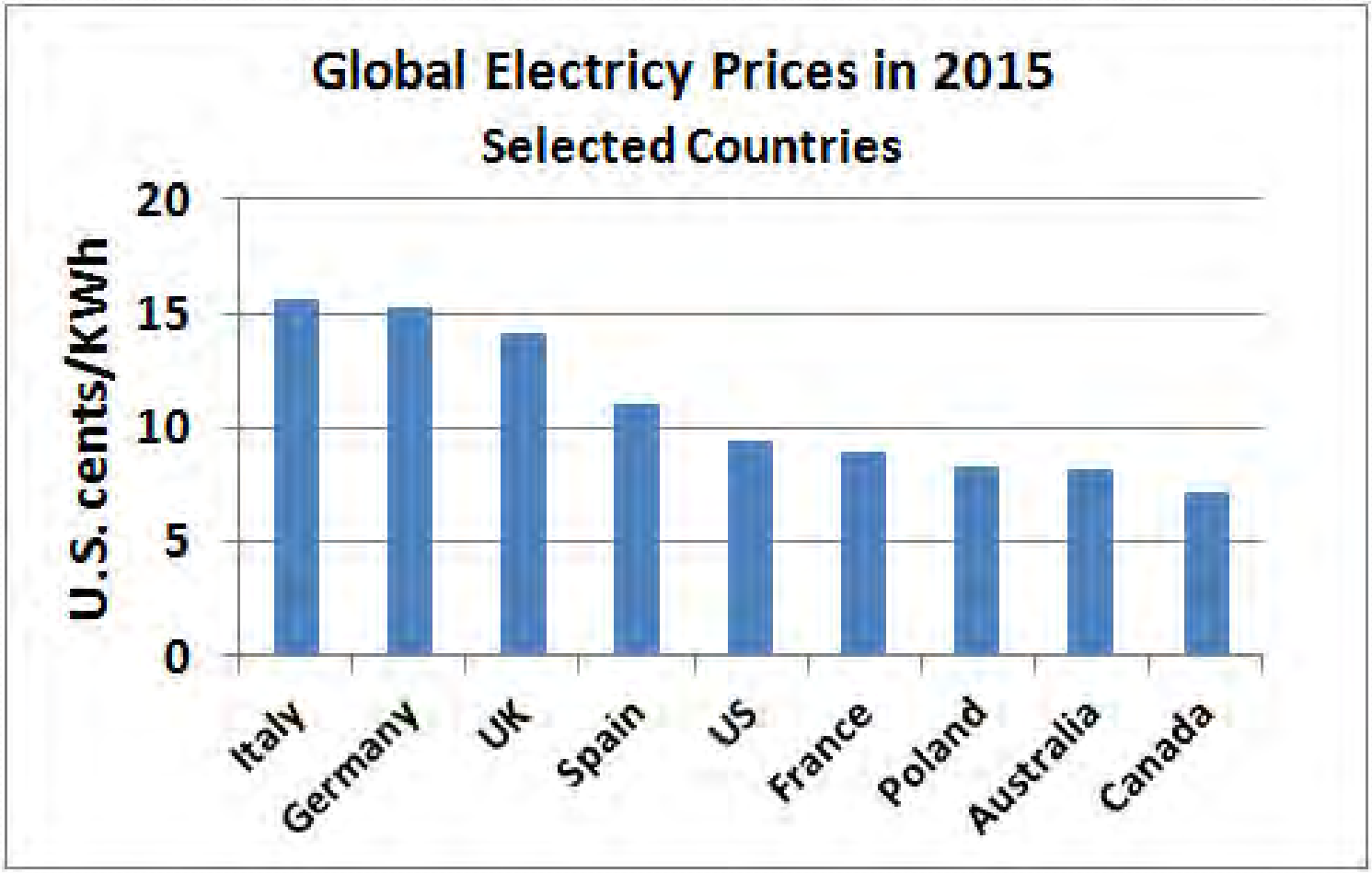
Alberta Wind Power

- 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.

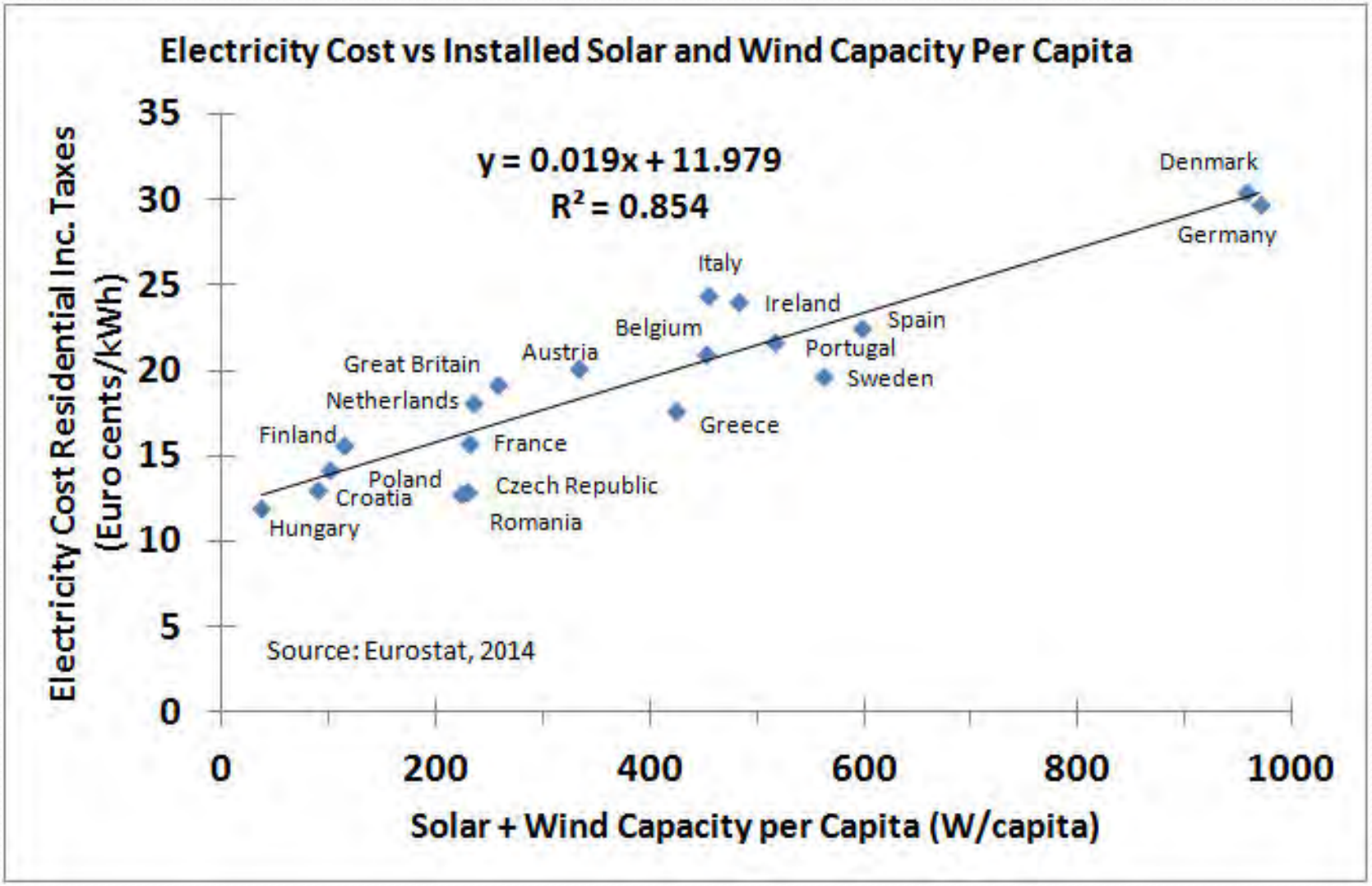
Ontario Solar Feed-in Tariffs

Type	Size	Price (¢/kWh)
Solar (PV) Rootop	< 10 kW	29.4 – 31.3
Solar (PV) Rootop	>10 kW <500 kW	22.5 – 24.2
Solar (PV) Non-Rootop	< 10 kW	21.4
Solar (PV) Non-Rootop	>10 kW <500 kW	20.9
ENMAX energy charge June 2016		3.5
Ontario solar FIT costs up to 9 times the cost of Alberta electricity.		

Electricity Prices



Electricity Prices vs Solar+Wind Capacity



Summary

- Carbon dioxide is a wonderful by-product of fossil fuel use.
- Social benefit of CO_2 is about US$17/t$CO_2$.
- 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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