

DIRE



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CONSEQUENCES

Destroying Alberta's Affordable Power Advantage

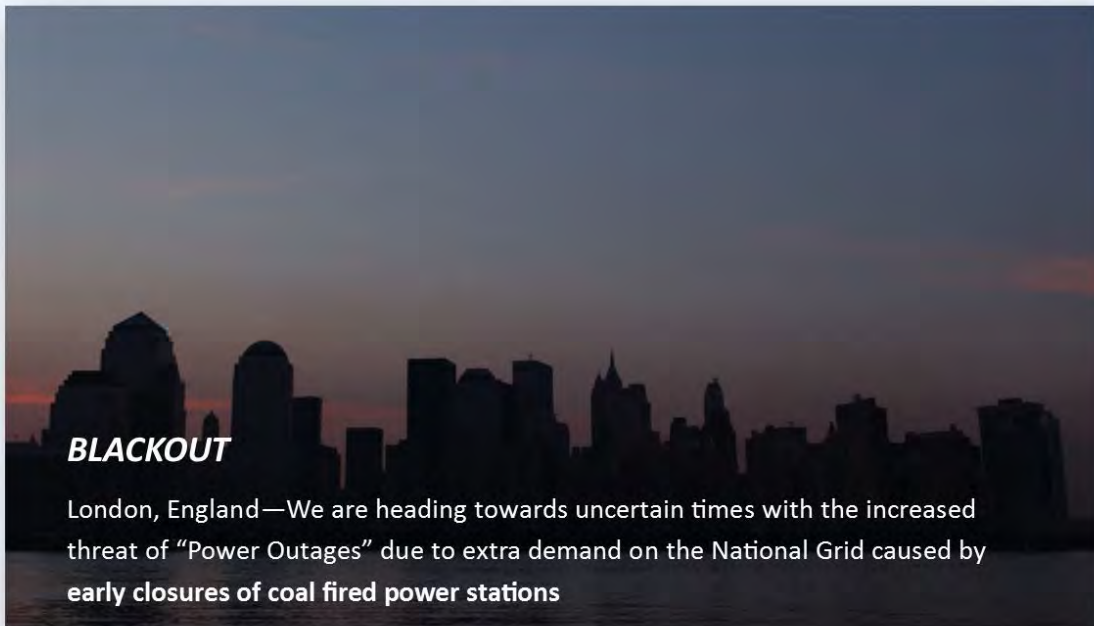
Critical Review of the Claims of
Accelerated Coal Phase-out Activists

September 2016



BLACKOUT

London, England—We are heading towards uncertain times with the increased threat of “Power Outages” due to extra demand on the National Grid caused by early closures of coal fired power stations



Friends of Science Society is a non-profit organization established in 2002 to review and question the Kyoto Accord, its scientific validity and its potential economic impact. The matter was debated in Alberta's APEGA professional journal between Friends of Science Society scientific advisers and Pembina Institute in 2002.

<https://friendsofscience.org/assets/documents/KyotoAPEGA2002REV1.pdf>

Since then, Friends of Science Society's cadre of dedicated volunteers, comprised mainly of active and retired earth, atmospheric and solar scientists, engineers, and other professionals, have produced a volume of work that is posted on our website (www.friendsofscience.org) offering climate science insights and education to policy makers and the public.

We have assembled a vibrant international network of climate science reviewers, economists, industry experts, and many esteemed climate scientists from around the world to offer a critical mass of current scientific data and assessments on global climate and climate change issues for policy makers and the public. We also do extensive literature research on these scientific subjects, issuing bi-weekly summaries to our members on climate science and global climate change politics. We issue comprehensive reports for the public, videos, blog postings and policy analysis by expert commentators.

It is our opinion that the sun is the main direct and indirect driver of climate change, not carbon dioxide (CO₂). Climate change is real and partially human-caused, but in our view, the best use of public funds is in mitigation of noxious pollutants, which will benefit the environment, human health and constructively reduce aerosols. Climate change occurs on long-term time scales; politicians can't stop climate change.

Friends of Science Society
P.O. Box 23167, Mission P.O.
Calgary, Alberta
Canada T2S 3B1
Toll-free Telephone: 1-888-789-9597
Web: friendsofscience.org
E-mail: [contact\(at\)friendsofscience\(dot\)org](mailto:contact(at)friendsofscience(dot)org)

Cover: London blackout - <https://www.dalepowersolutions.com/uk-headed-for-more-power-cuts-this-winter/>

PREAMBLE

Disputing the Claims of Pembina Institute on Accelerated Coal Phase-out

The 2015 Alberta Climate Plan set a coal phase-out deadline of 2030.¹ Pembina Institute and other anti-coal groups issued a new report in September 2016 demanding a more accelerated coal phase-out, claiming that lives are at risk and that there would be cost savings in terms of public health and climate change benefits. Pembina Institute's report "Breathing in the Benefits" claims: *"Logic states that if reducing coal-fired electricity reduces health impacts, then conversely the burning of coal for electric energy must cause health impacts."*

Yet virtually every major Western OECD nation uses coal, some use it in great quantity, and those countries using modern coal emissions management technology have only seen **health benefits and longevity soar due to the advanced, modern medical services, all of which rely almost entirely on access to affordable, reliable electrical power.** By contrast, those that have rapidly phased-out coal in favor of unreliable, expensive renewables have seen power prices surge while socio-economic and health complications and costs have cascaded down into job loss, energy poverty, vast numbers of premature deaths and long-term health/nutritional impacts for food-rationed children. Due to the addition of natural gas-fired power plants to backup wind and solar, emissions have not been significantly reduced in the UK or Germany or Ontario; indeed, Germany has returned to coal as a power source, increasing emissions, despite its vast wind and solar farms.

Certainly, one can observe the difference between the coal-fired Western nations and the tragic personal and public health problems of developing nations that lack affordable, reliable electricity; one can see that there are fundamental health benefits like pumped, treated water, proper sewage systems, evening home and street lighting that are only possible with affordable, reliable power.

Despite the frequently cited climate change claim that "decarbonization" by phasing out coal is a recommendation of the Intergovernmental Panel on Climate Change (IPCC), the IPCC itself tells us that it makes no such recommendations, leaving countries and regions to decide on what local power generation sources make sense.² Coal makes sense for Alberta as we have abundant resources of high quality and a number of existing high efficiency, low emissions coal-fired power plants. Pembina Institute's arguments against it are not supported by the evidence.

¹ <http://www.alberta.ca/climate-coal-electricity.aspx>

² <https://friendsofsciencecalgary.wordpress.com/2015/11/05/a-matter-of-public-interest-on-the-ipcc-does-it-recommend-or-not-recommend-that-is-the-question/>

DIRE CONSEQUENCES: DESTROYING ALBERTA'S AFFORDABLE POWER ADVANTAGE

EXECUTIVE SUMMARY

Affordable energy is an Alberta Advantage, one we have enjoyed for years, thanks to an abundant, high quality coal supply (which Albertans own), willing investors, responsible industry and ever-improving, sensible air quality regulations and mitigation techniques.

Energy runs through every aspect of modern society. Reliable, safe, low-cost energy enables our robust health, our economic well-being and high environmental standards.

We challenge the claims of the Alberta government and anti-coal activist advisors like the Pembina Institute and their recent report *“Breathing in the Benefits.”* The problem with affordable, reliable energy is like the Joni Mitchell song: *“... you don't know what you've got till it's gone.”*

However, if the Alberta NDP government is going to make drastic changes to the electrical power system, the public should be well informed of the facts prior to agreeing to change a system that is working well and providing reliable, affordable power. Is the claim of improved air quality and reduced costs justified based on the evidence? Will we face the dire consequences of energy poverty, industrial collapse, and burdensome taxes as we have seen in Ontario, the UK, and the EU?

Most importantly, does Alberta have a crucial air quality problem and if so, is coal the primary contributing factor?

At this time, the estimates we have from independent experts indicate that the costs of phasing out coal earlier than the existing federal legislation will be in the order of \$22 billion along with \$1 million per megawatt (MW) to connect renewable wind/solar to the system, additional billions in transmission lines, and an additional ~\$900 million per year in subsidies to wind and solar producers of 'free' energy.

We foresee dire consequences beyond these untenable costs. There are multiple examples of governments which have pursued similar misguided policies to the substantial detriment of their citizens; there are no examples of positive outcomes.

The coal-fired power plants targeted for closure by 2030 have a total capacity of 6299 MW. To maintain system power capacity and back up any new wind and solar generation, Alberta will need the equivalent of eight x 800 MW plants (each similar to the natural gas-fired Shepard Energy Center that began operation in 2015). The Shepard plant took seven years to plan, permit and build. Any new ones would no doubt follow a similar timeline. Without immediate action to replace shuttered coal capacity, Albertans could soon be facing a lack of capacity – leading to blackouts. However, investors are gun-shy due to the province having turned federal legislation upside down. Who would invest in such an uncertain market?

Summary of Findings

- Health impact models are not reliable as they must be validated against empirical evidence and actual patient data. The evidence presented in this report shows that Pembina's modelled results make no sense when compared with real world facts and data.
- Actual patient records do not reflect the Pembina Institute's anti-coal claims; ground level contaminants are a much greater contributor to poor air quality and to respiratory disease than coal-fired power plants.
- The highest rates of asthma do not correlate to a proximity to coal-fired power plants as evidenced by the rates in the Edmonton Region being some of the lowest in Alberta whilst being downwind of three large power plants. Some of the highest asthma rates are in the Pincher Creek area.
- Alberta and Canada enjoy some of the cleanest air on the planet according to the World Health Organization.³
- Industrial emitters appear to be well within emissions standards with few, if any, short-term exceedances.
- The costs associated with coal phase-out are exorbitant and the outcome will not be substantially 'cleaner' air, nor a more reliable or efficient power system.
- Within the urban heat island of Edmonton, where Pembina has pointed out there may be a higher risk to human health, emissions maps show that the same kinds of emissions from coal plants occur within the city itself, some in large quantities. These may be within approved levels, but they cannot be excluded from this conversation.
- Foreign financial forces are interfering in Alberta's energy policies according to research by Vivian Krause. Pembina Institute has received grants from the foreign Oak Foundation which Pembina thanks in its first anti-coal report. These possible conflicts of interests should be investigated by the appropriate authorities.
- Phasing out coal will have dire consequences for Alberta including energy poverty, job loss and the potential for lack of capacity; and accelerated phase-out would heighten the risk of blackout.

³ <http://www.cbc.ca/news/health/canada-s-air-quality-3rd-best-in-world-1.980695>

In terms of climate change, the Alberta climate plan and coal phase-out might result in a 0.00007-degree Celsius reduction in potential warming by 2030 according to Friends of Science Society analysis⁴ – an insignificant and immeasurable ‘benefit’ paid for with a tremendous social and financial burden

Will coal phase-out actually improve health? Are there dire unintended consequences? Is coal the sole or even the major cause of air pollution issues and does Alberta have an air pollution problem to begin with? And ultimately, is it worth the cost? Let’s look at the evidence over the ideology.



It is noteworthy that the UK government’s Committee on the Medical Effects of Air Pollution also studied the issue and concluded: “For the most part, people will not notice or suffer from any serious or lasting ill effects from levels of pollution that are commonly experienced in the UK, even when levels are described as ‘high’ or ‘very high’ according to the current criteria... Perhaps surprisingly, long term exposure to air pollution is unlikely to be a cause of the increased number of people now suffering from asthma in the UK.”

<http://www.advisorybodies.doh.gov.uk/comeap/index.htm>

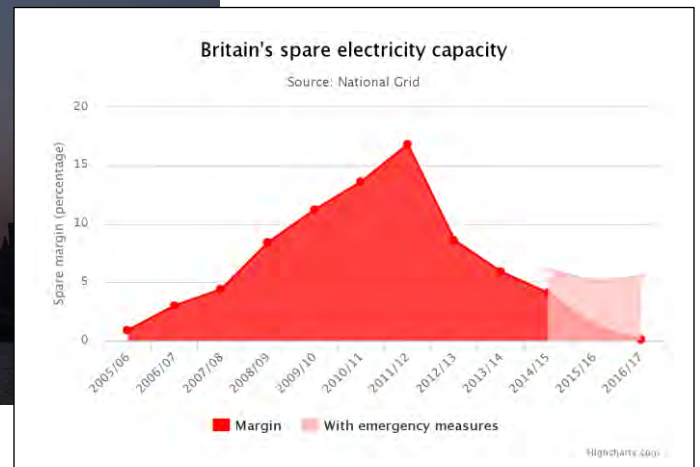
⁴ https://friendsofscience.org/assets/documents/AB_Climate%20Plan_Economic_Impact_Gregory_Tech.pdf

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DIRE CONSEQUENCES: DESTROYING ALBERTA'S AFFORDABLE POWER ADVANTAGE

London, England faces blackouts due to rapid coal phase-out and wide-scale addition of renewables to power grid.



From Capacity to Catastrophe

1. ACCELERATED COAL PHASE-OUT PUTS ALBERTANS AT RISK

Pembina Institute and anti-coal allies are advocating for an even more accelerated phase-out of coal-fired power plants,⁵ in advance of the NDP government's 2030 mandate. This puts Alberta industry and Alberta families at risk of dangerous lack of power capacity and reliability of the power system, along with a cascade of socio-economic catastrophes ranging from heat-or-eat poverty for individuals to long-term economic drought as industry steers clear of unreliable power markets.

Pembina Institute claims accelerated coal phase-out would have health and mortality benefits; the UK experience shows that the opposite is true. Serious health, nutrition, socio-economic and mental health problems are on the rise. Energy poverty leads to nutritional deficits with long-term health impacts for children.

⁵ <https://www.pembina.org/pub/breathing-benefits>

In the space of three years, the UK has gone from having a comfortable surplus capacity of power, to a time of power rationing. Power companies are being paid subsidies (by taxpayers) to keep power available in reserve, while manufacturing industries are being paid to cut production and shut off.⁶ Ironically diesel generators are subsidized to try and prevent such blackouts, but these have more polluting emissions than coal plants.⁷ The recent Brexit vote may increase the shortfall with respect to imported power.⁸

Even ‘green’ Denmark is facing serious challenges as it tries to go ‘fossil-free’ – one of those challenges being risk of blackout.⁹

Poor power quality (dips and surges) caused by the addition of volatile wind and solar can cause serious damage to industry and business operations that are reliant on computers, just-in-time production or high precision operations. This is particularly true if there is no suitable back-up natural gas power generation to backstop those variations – however, research in Europe shows that the outcome of adding natural gas backstop power plants is increased emissions,^{10 11} the exact opposite of the greenhouse gas (GHG) reductions promised by Pembina and anti-coal allies.

A dramatic drop in power generation capacity does not lead to blackouts of an hour or two, but potentially days.¹² The costs to industry are in the billions of dollars. Once without capacity, there is no easy or quick fix.

We urge Albertans to oppose the Pembina Institute’s call for accelerated phase out of coal-fired power, and to ask the government of Alberta to reconsider the goal of phasing out coal by 2030, and return, instead, to the federal coal phase-out schedule and legislation. Contrary to popular opinion, these did not preclude future coal-fired power plants as long as they met emissions standards.¹³ The intention according to Environment Canada’s Regulatory Impact Analysis Statement (RIAS) was to spur innovation in carbon capture and by doing so, stimulate an estimated \$4.7 billion in benefits from using captured carbon

⁶ <http://www.bbc.com/news/business-33527967>

⁷ <http://www.telegraph.co.uk/business/2016/06/01/plans-to-curb-diesel-power-could-raise-risk-of-blackouts/>

⁸ <http://www.thetimes.co.uk/tto/business/industries/utilities/article4701374.ece>

⁹ <http://link.springer.com/article/10.1140/epjp/i2016-16161-0>

¹⁰ <http://link.springer.com/article/10.1140/epjp/i2016-16329-6>

¹¹ <http://link.springer.com/article/10.1140/epjp/i2016-16173-8>

¹² <http://www.raeng.org.uk/publications/reports/counting-the-cost>

¹³ <https://www.ec.gc.ca/lcpe-cepa/eng/regulations/detailReg.cfm?intReg=209> “The Reduction of Carbon Dioxide Emissions from Coal-fired Generation of Electricity Regulations (the Regulations) will set a stringent performance standard for new coal-fired electricity generation units and those that have reached the end of their useful life. The level of the performance standard will be fixed at 420 tonnes of carbon dioxide per gigawatt hour (CO₂/GWh). This approach will implement a permanent shift to lower- or non-emitting types of generation, such as high-efficiency natural gas, renewable energy, **or fossil fuel-fired power with carbon capture and storage (CCS).**” (emphasis added)

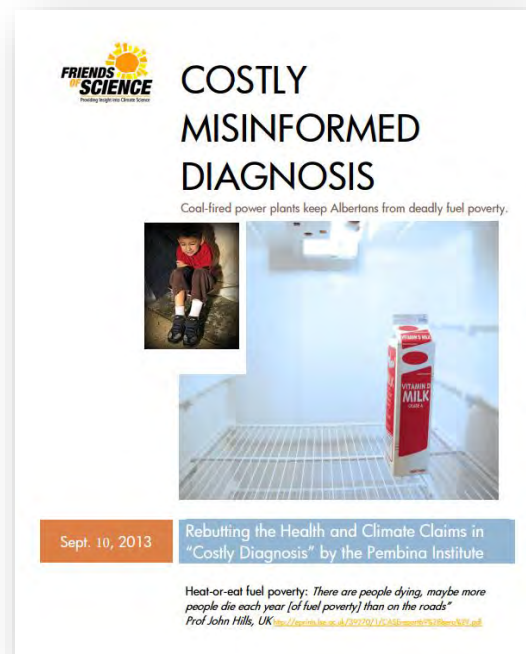
dioxide (CO₂) to pump into depleted wells and recover valuable oil resources.¹⁴ This important context is excluded from Pembina Institute's reference to RIAS.

The consequences of rapid destruction of Alberta's affordable, reliable power generation system will be dire for all concerned.

2. COLD KILLS – ENERGY POVERTY EXACERBATES HEALTH AND NUTRITION ISSUES

1.1 Family Health A peer-reviewed study in the American Journal of Public Health by Bhattacharya et al (2003),¹⁵ covering the period from 1980 to 1998, found a direct correlation between seasonal temperature, heating costs, family nutrition, and exacerbating health issues.

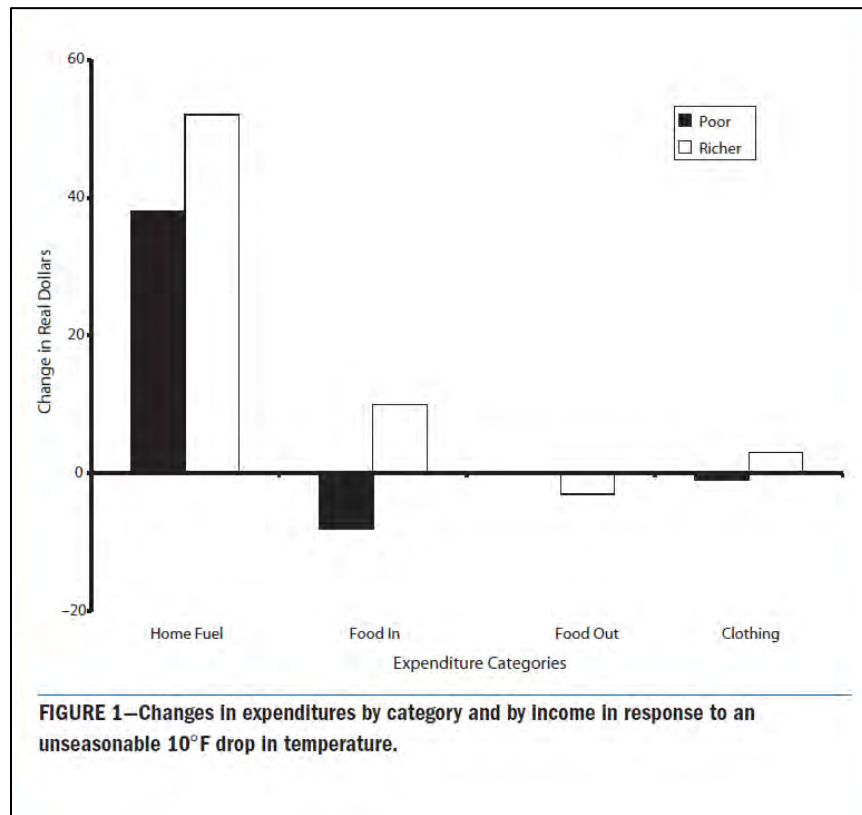
*“We found that poor families reduced their expenditures on food in response to unusually cold weather, whereas richer families did not. Among poor families, we estimated that a monthly temperature that was 10°F colder than normal would result in a reduction in expenditures on food in the home of \$11 per month and an increase in fuel expenditures of \$37 per month. In poor households, adults and children alike reduced their caloric intake by 10% during the winter months, whereas members of richer families did not reduce their caloric intake during the winter. **It is striking that these nutritional outcomes corresponded so closely with expenditure outcomes.**”* Bhattacharya et al 2003



“A Costly Misinformed Diagnosis” Friends of Science Society’s 2013 response to Pembina Institute’s anti-coal claims:
https://www.friendsofscience.org/assets/documents/costly_misinformed_diagnosis.pdf

¹⁴ http://publications.gc.ca/collections/collection_2012/gazette/SP2-2-146-19.pdf

¹⁵ Bhattacharya, et al., 2003 *American Journal of Public Health (Am J Public Health)*. 2003;93:1149–1154)



Rising energy costs lead to a drop in food expenditures and often nutritional deficiencies.

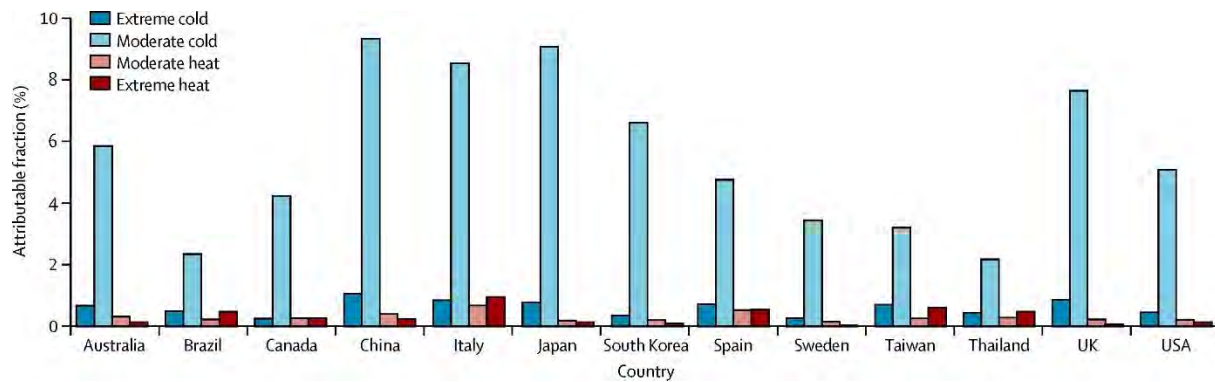
Source: Bhattacharya, et al., 2003 *American Journal of Public Health* (*Am J Public Health*. 2003;93:1149–1154)

1.2 Mortality In a long-term study of some **74 million deaths from 1985-2012 in 384 locations in 13 countries**, by Gasparrini et al (2015)¹⁶ published in *The Lancet* and funded by the UK Medical Research Council, it was found that **cold temperatures are responsible for 17 times as many deaths as hot temperatures.**



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¹⁶ DOI: [http://dx.doi.org/10.1016/S0140-6736\(15\)60897-2](http://dx.doi.org/10.1016/S0140-6736(15)60897-2)



Source: *The Lancet* Volume 386, Issue 9991, Pages 369-375 (July 2015)
DOI: 10.1016/S0140-6736(14)62114-0

A study of 74 million deaths from 1985-2012 in 384 locations in 13 countries cold temperatures are responsible for 17 times as many deaths as hot temperatures.

1.3 Mental Health According to a synthesis of studies on energy poverty, the German relief agency Caritas¹⁷ reports that “Living in cold and damp housing contributes to a variety of different mental health stressors. These include:

- **chronic thermal discomfort**, where people report feeling cold and shivery all day and often through the night
- worry about energy bills and what these will be, particularly when bills are only issued quarterly
- concern about falling into debt
- enduring the discomfort of cutting back on food and other items in order to save for energy bills
- **concern that cold is damaging people’s physical health, especially where households have children**
- “spatial shrink” and the stress which results from living in only one or two rooms that can be affordably heated
- stigma within one’s community
- damage to possessions that are affected by damp and mold, such as clothes, curtains, and furniture
- **the absence of any solution or sense of control over the problem.**



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¹⁷ <http://www.caritas-germany.org/focus/currentissues/when-energy-is-not-affordable-health-and-wellbeing-impacts-o>

1.4 Increased Health Costs – According to the UK Royal College of Nursing website:

IMPACTS OF LIVING WITHOUT ENOUGH ENERGY: EFFECTS ON WELLBEING

“The direct and indirect health impacts of living in cold homes are considerable, as set out in a landmark report by Professor Michael Marmot in 2011 for Friends of the Earth. They include:

- 24,000 excess winter deaths. According to the World Health Organisation **at least 30% are attributed to cold temperatures in the home** – averaging at least 7,200 deaths every year in the UK.
- A variety of respiratory illnesses - adults and children, including double the risk of asthma in children
- Increased risk of heart attack and stroke
- Low weight gain in infants
- A wide range of associated emotional & mental health and well-being issues including quadruple the risk of multiple mental health problems in young people
- Poor diet and nutrition as a result of ‘heat or eat’ choices
- Falls and accidents
- Worsening of existing health conditions or slow recovery from illness

According to the UK’s Chief Medical Officer, the National Health Service (NHS) spends £850 million a year treating the illnesses caused by living in cold homes. Recent analysis by Age UK puts the costs to the NHS in England at **around £1.3 billion a year.** When these significant health impacts are considered alongside the wider well-being, development, social and educational needs of individuals and families an even more worrying picture emerges.”

1.5 Job Loss – Loss of Economic Competitiveness

In countries that have phased out, or attempted to phase-out coal-fired power plants, many large employers have left for more conducive operating environments, taking their carbon footprints with them and leaving job losses in their wake.

UK Member of European Parliament Roger Helmer spoke passionately about the economic destruction and job loss of the ‘industrial massacre’ since the



inception of EU Climate Change policies which included coal phase-out and a ‘rush-to-renewables.’ Handelsblatt Magazine¹⁸ reported in March 24, 2016 that: “Germany’s massive push into renewable energy has a dark side. As green policies drive up the cost of power, entire industries are shrinking.

“We have a policy that is exporting jobs, exporting investment, exporting manufacturing, and increasing CO₂ emissions at the same time.

Mr. Commissioner, if that is not madness, what is?” – Roger Helmer UK MEP¹⁹

1.6 Rebates don’t keep up

Albertans have been told that low income earners and the vulnerable will receive a carbon tax rebate to help them pay the additional costs associate with implementing the carbon tax.

Environment Minister Shannon Phillips has boldly claimed that renewables “... lower the cost of power for consumers” – though we do not find this in any jurisdiction we have researched.



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Advocates for the alleviation of poverty like Megan Hooft are denouncing Ontario’s offering of:

“Low-income homeowners will be able to take advantage of a dedicated fund to help with the purchase and installation of energy-efficient technologies, such as boiler replacements and lighting retrofits... Further, the province will offer a rebate to low and moderate income households to help replace their older cars with new or used electric vehicles or plug-in hybrids.”²⁰

Such offerings blithely ignore the fact that few poor people have any spare money to buy new appliances in order to get a rebate, and few can even dream of an electric vehicle or

¹⁸ <https://global.handelsblatt.com/edition/396/ressort/companies-markets/article/how-to-kill-an-industry>

¹⁹ <http://www.ukipmeps.org> | Join UKIP: <http://ukip.org>
• European Parliament, Brussels, 26 January 2015

²⁰ http://www.huffingtonpost.ca/megan-hooft/energy-poverty-ontario_b_10447512.html

hybrid, most of which are, sadly, subsidized by tax breaks for the wealthy owners, and those taxes are paid by the poor.

As noted in health and energy poverty studies referred to at the beginning of this report, rebate and support programs never seem to catch up with the health, nutritional and energy needs of the poor.

Dr. Benny Peiser testified of the destructive downward spiral of a subsidy circus when he presented testimony to the US Senate on Environment and Public Works on Dec. 2, 2014:

The EU's unilateral climate policy is absurd: first consumers are forced to pay ever increasing subsidies for costly wind and solar energy; secondly they are asked to subsidise nuclear energy too; then, thirdly, they are forced to pay increasingly uneconomic coal and gas plants to back up power needed by intermittent wind and solar energy; fourthly, consumers are additionally hit by multi-billion subsidies that become necessary to upgrade the national grids; fifthly, the cost of power is made even more expensive by adding a unilateral Emissions Trading Scheme. Finally, because Europe has created such a foolish scheme that is crippling its heavy industries, consumers are forced to pay even more billions in subsidising almost the entire manufacturing sector.²¹

At the end of it all, there is only one taxpayer. To pay taxes, the taxpayer also needs a job.

²¹ <http://www.thegwpf.com/content/uploads/2014/12/Peiser-Senate-Testimony-2.pdf>

3. FACT CHECK - AIR QUALITY AND THE COAL-HEALTH CLAIMS

“What we know about renewables is that they lower the price for consumers.”

- Shannon Phillips, Minister of Environment for Alberta
Calgary Herald, Sept. 14, 2016

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Since 2013, the Pembina Institute²² and associated groups have demanded that Alberta should phase-out coal earlier than the federal schedule, claiming it would improve health, reduce premature deaths, and save on medical costs to Alberta taxpayers. Now, the same anti-coal activists are calling for an accelerated phase-out schedule, even earlier than the Alberta government’s 2030 end date.

Curiously, their proposed replacement is wind and solar – also known as ‘renewables’ – on the inaccurate claim that these do not have polluting emissions. Indeed, unless backed-up 24/7 by hydro or nuclear (Alberta’s hydro capacity is nominal; nuclear non-existent; interties to Saskatchewan and BC are limited) substantial emissions by natural gas backstop facilities will be emitted in order for wind or solar to access the power system.

Though carbon dioxide emissions will be reduced by using natural gas, there will be other fossil fuel emissions,²³ the power generation system will be challenged in terms of reliability, costs will necessarily rise as Albertans will be faced with more than \$22 billion²⁴ to phase-out coal and replace it with 100% equivalent natural gas capacity, and



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²² “A Costly Diagnosis: Subsidizing coal power with Albertans’ health (2013). <http://www.pembina.org/pub/2424>

²³ This article reviews the methane emissions inherent in natural gas use as a back-up to wind and solar, concluding that most wind and solar farms are really just large gas power plants, and thus methane is not a bridge to greener world but a gangplank to climate catastrophe. <http://www.energypost.eu/wind-solars-achilles-heel-methane-meltdown-porter-ranch-means-energy-transition/> (Note: Friends of Science do not hold the view that humans are causing catastrophic warming through fossil fuels use, but the math and information is very insightful.)

²⁴ To replace coal with equivalent natural gas capacity requires the construction of eight x 800 MW natural gas plants; Shepard Energy Center (800 MW capacity) in Calgary cost \$1.4 Billion; compensation for stranded assets based on publicly filed records is estimated at \$11 billion; The Alberta NDP have launched a \$ 2billion lawsuit over PPAs.

this will divert billions of tax dollars from necessities like health care, education and infrastructure spending.

Though the stated objective is to reduce greenhouse gases (GHGs), other than carbon dioxide, there are serious doubts as to whether wind generation even results in lowered GHG emissions, since it must be backed up by methane rich natural gas. Natural gas peaking plants burn less efficiently, as they ramp up and down to compensate for varying levels of wind/solar volatility.

The addition of wind and solar to the system will require approximately \$1 Million per megawatt (MW) to integrate plus billions in transmission line costs to remote locations.²⁵ As Alberta's existing power prices are so low, it is estimated that an additional \$900 million per year (based on \$35/MW hour)²⁶ will be required to subsidize wind and solar for their intermittent and unreliable output. Most of this money will be paid to out of province developers.

As the permitting and construction process for new conventional natural gas plants takes at least seven years, it is unclear on what basis the Pembina Institute thinks Alberta's power needs could be met by even earlier closing of coal-fired plants. Once the carbon tax comes into play in 2017, the oldest coal-fired power plants will quickly become very unprofitable and will be closed. This will also reduce the carbon tax pool of money to finance renewables as coal is a large emitter of carbon dioxide.

Within short order, and before 2030, industry experts predict that Alberta may end up lacking sufficient capacity to generate enough power for our needs. This happened in the space of a few short years in the UK. The addition of renewables like wind and solar will not help – wind and solar only work when Mother Nature decrees. They are not 'dispatchable' (on-demand) forms of power and any such source must be backed-up by an equivalent conventional capacity of natural gas. None are presently in planning as far as we know.

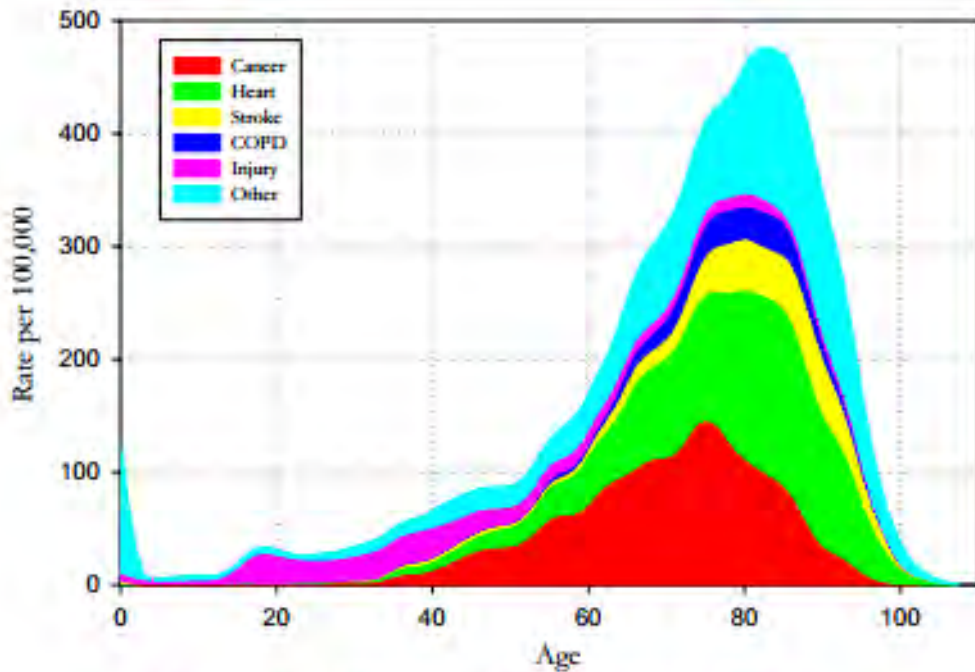
The Pembina Institute claims of lives to be saved and medical needs avoided are based on computer simulated models, not actual patient records. Alberta Health Services data does not support the claims of the Pembina Institute's report.

Let's examine the evidence.

²⁵ <https://friendsofsciencecalgary.wordpress.com/2015/09/29/power-generation-information-on-difficulties-of-instituting-the-proposed-wind-hydro-national-grid-network-in-acting-on-climate-change/>

²⁶ <https://friendsofsciencecalgary.wordpress.com/2016/05/03/alberta-government-subsidies-to-wind-and-solar-will-cost-you-billion/>

Figure 62: Distribution of Deaths in Alberta, 2005



Source: Alberta Vital Statistics, Death File, October 2006 release

The preceding graph from a 2006 Alberta Health Services study indicates that most people in Alberta pass on in their elder years. The blue COPD (Chronic Obstructive Pulmonary Disease) wedge is the only breathing related cause of death which the Lung Association (www.lung.ca/copd) states “is a lung disease that includes chronic bronchitis and emphysema. In 80-90% of cases, it is caused by smoking. Other causes of COPD can include:

- genetic reasons (alpha-1 antitrypsin deficiency)
- occupational dusts and chemicals
- second hand smoke
- frequent lung infections as a child
- wood smoke and other biomass (animal dung, crop residues) fuel used for cooking.”

Closing down coal fueled power plants will not reduce these COPD causes but will increase public financial burden and power prices, reducing available public health treatment funds.

The CIA Fact book confirms that Canada is in the top 20 countries for longevity, with little difference between the top nations.²⁷

THE WORLD FACTBOOK

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COUNTRY COMPARISON :: LIFE EXPECTANCY AT BIRTH

Life expectancy at birth compares the average number of years to be lived by a group of people born in the same year, if mortality at each age remains constant in the future. Life expectancy at birth is also a measure of overall quality of life in a country and summarizes the mortality at all ages.

DOWNLOAD DATA

| RANK | COUNTRY | (YEARS) | DATE OF INFORMATION |
|------|-------------------------------|---------|---------------------|
| 1 | MONACO | 89.52 | 2015 EST. |
| 2 | JAPAN | 84.74 | 2015 EST. |
| 3 | SINGAPORE | 84.68 | 2015 EST. |
| 4 | MACAU | 84.51 | 2015 EST. |
| 5 | SAN MARINO | 83.24 | 2015 EST. |
| 6 | ICELAND | 82.97 | 2015 EST. |
| 7 | HONG KONG | 82.86 | 2015 EST. |
| 8 | ANDORRA | 82.72 | 2015 EST. |
| 9 | SWITZERLAND | 82.50 | 2015 EST. |
| 10 | GUERNSEY | 82.47 | 2015 EST. |
| 11 | ISRAEL | 82.27 | 2015 EST. |
| 12 | LUXEMBOURG | 82.17 | 2015 EST. |
| 13 | AUSTRALIA | 82.15 | 2015 EST. |
| 14 | ITALY | 82.12 | 2015 EST. |
| 15 | SWEDEN | 81.98 | 2015 EST. |
| 16 | LIECHTENSTEIN | 81.77 | 2015 EST. |
| 17 | JERSEY | 81.76 | 2015 EST. |
| 18 | CANADA | 81.76 | 2015 EST. |
| 19 | FRANCE | 81.75 | 2015 EST. |
| 20 | NORWAY | 81.70 | 2015 EST. |

Pembina Institute and the anti-coal activists frequently refer to coal emissions of fine particulate matter of less than 2.5 microns (PM_{2.5}) as one of the main asthma triggers and health dangers. The following graph, based on Environment Canada 2011 statistics, shows that coal-fired power plants in Alberta have very low PM_{2.5} emissions compared to other ground level sources. **Residential fireplaces put out double that of coal**, while moving down

²⁷ <https://www.cia.gov/library/publications/the-world-factbook/rankorder/2102rank.html>

the graph you see that agriculture, construction and road dust emitted vast quantities of PM_{2.5}; and **wildfires emitted ~1,000 times the PM_{2.5} of coal in 2011.**

Comparative Chart of PM 2.5 Emissions in Alberta 2011

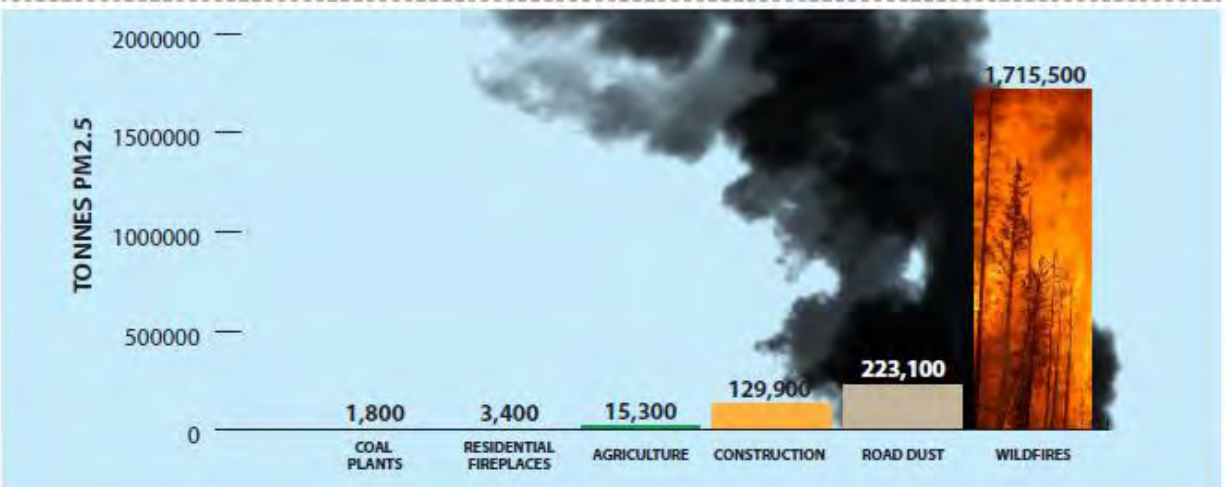
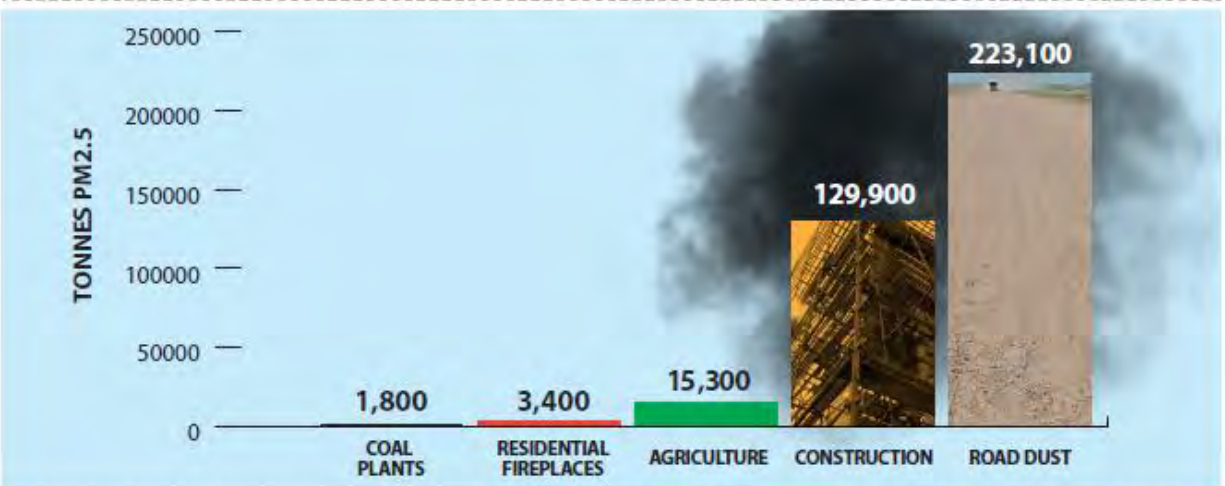
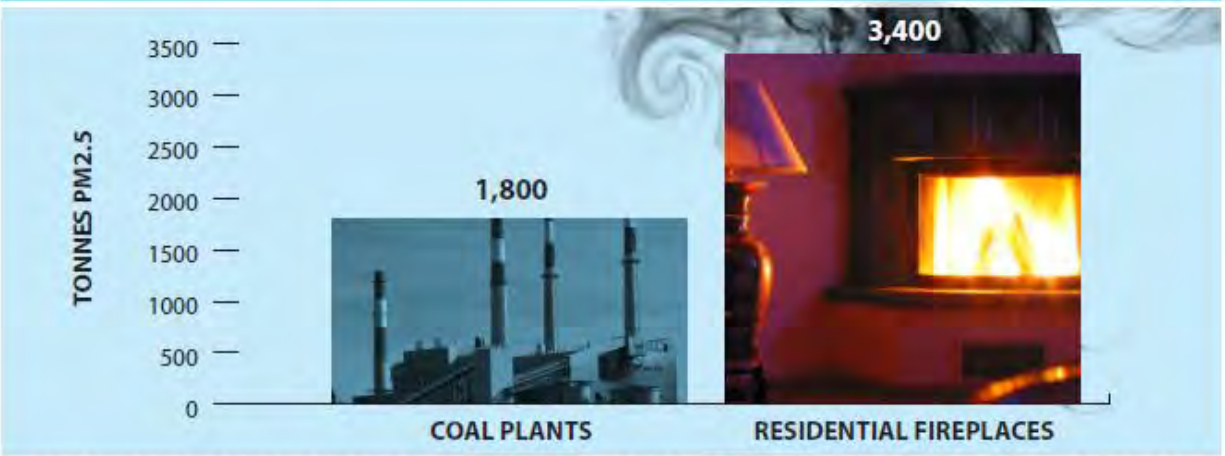


Image based on 2011 Environment Canada statistics

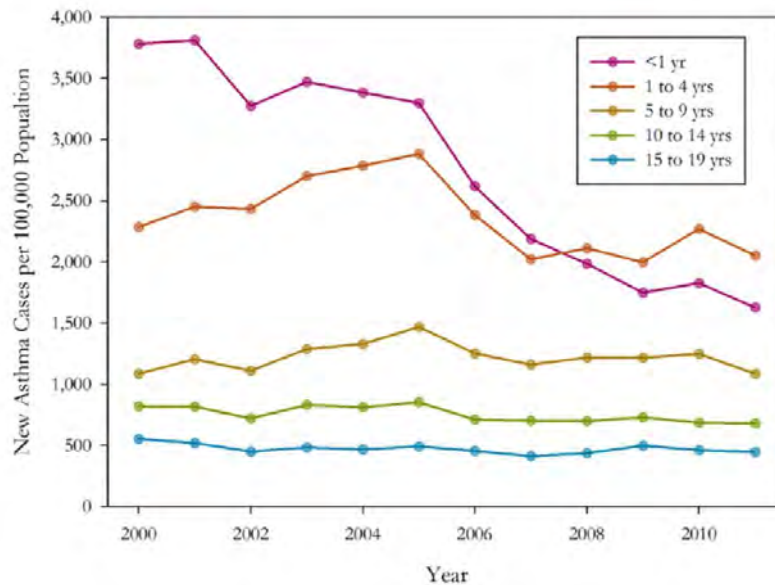
Stats Can notes that there has been an increase in the prevalence of asthma in Canada the past 20 years in youth, but the causes are said to be many.²⁸ And while prevalence has increased, they report that attacks per se have declined.

In Alberta in 2013, the deaths from asthma were primarily those in their elderly years. Of the 22 deaths reported due to asthma, 2 were ages 5-9, 1 age 15-19, 1 age 35-39, 3 age 50-54, 2 age 55-59, 1 age 60-64, and 11 in the age range from 75-90+, and 1 non-resident, according to Vital Statistics.²⁹

Table 20
(Continued)

| | | 0-4 | 5-9 | 10-14 | 15-19 | 20-24 | 25-29 | 30-34 | 35-39 | 40-44 | 45-49 | 50-54 | 55-59 | 60-64 | 65-69 | 70-74 | 75-79 | 80-84 | 85-89 | 90+ | Totals | Non Res Totals | Grand Totals | |
|-----|--------|-----|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----|--------|----------------|--------------|----|
| 206 | Asthma | M | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 11 | 1 | 12 |
| | | F | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 2 | 1 | 1 | 4 | 11 | 0 | 11 | |
| | | T | 0 | 2 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 3 | 2 | 1 | 0 | 2 | 1 | 2 | 6 | 22 | 1 | 23 | |

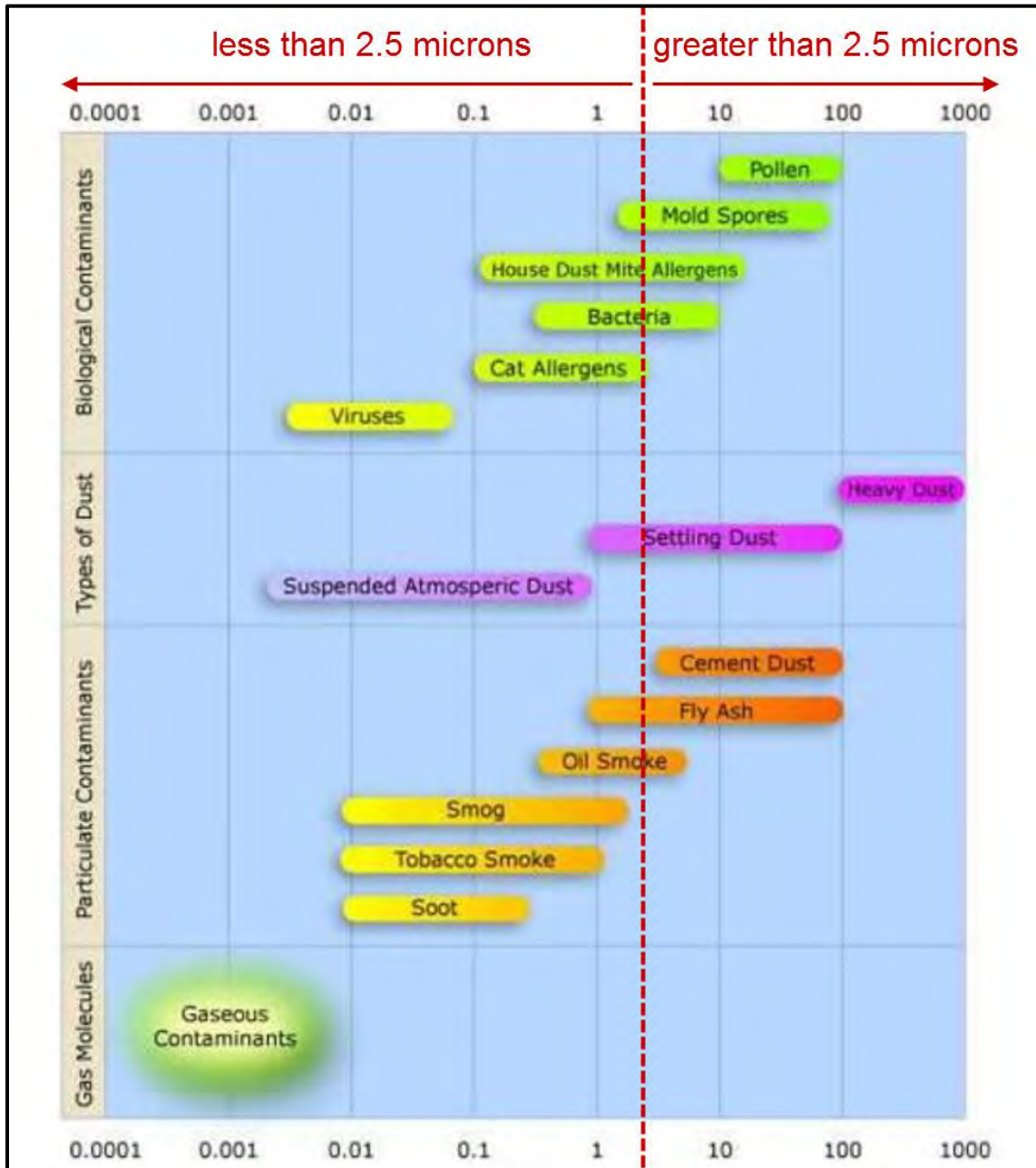
Furthermore, Alberta Health Services reports a significant decline in Infants Diagnosed with Asthma. (www.health.alberta.ca/documents/HTA-2014-08-12-Asthma-in-Alberta-Children.pdf)



²⁸ <http://www.statcan.gc.ca/pub/82-003-x/2008002/article/10551/5202470-eng.htm> "However, childhood asthma rates in Canada did differ by region. Children in British Columbia and the prairie provinces (Alberta, Saskatchewan and Manitoba) had the lowest rates in every NLSCY cycle."

²⁹ <http://open.alberta.ca/dataset/691ec9c3-35b6-4068-86b7-co4d85b073e2/resource/84128561-c3e4-4025-9bb7-8a035bf3a9f3/download/Annual-Review2013.pdf>

Indeed, there are many fine particulate <10 micron asthma triggers and airborne particulates.



Creative Commons GFDL, <https://en.wikipedia.org/w/index.php?curid=48987967>
Red dotted lines added for explanatory purposes.

One reported cause of asthma, particularly in children, is related to obesity.³⁰ Alberta obesity rates in children lead to long term chronic health costs.^{31 32 33} A May 2007 Calgary Herald article was headlined “There are 55,000 overweight or obese kids in Calgary.”

CHILDHOOD OBESITY- SOME OF THE FACTS

- ✓ The prevalence of overweight and obese children has been rapidly increasing all over the world over the past few decades. In 1978/79 among children aged 2 to 17 years in Canada, 15% were assessed as being overweight or obese. By 2004 this rate had almost doubled to 26%.
- ✓ Based on Alberta prevalence rates (2004), there are approximately 55,000 overweight/obese children residing in the Calgary health region catchment area.
- ✓ Childhood obesity has significant physical health, emotional, social and economic consequences.
- ✓ Obesity is strongly linked to the development of chronic diseases such as Diabetes Type 2, cardiovascular diseases, certain cancers, respiratory problems and musculoskeletal problems including osteoarthritis. A decade ago, Type 2 diabetes was only found in adults. Today, children as young as 6 years old are presenting with it. Of particular concern, the prevalence of Type 2 diabetes among Aboriginal people, including children, is two to six times greater than the general population.
- ✓ Evidence suggests that obese children may be discriminated against by their peers, affecting their emotional development. As children become adolescents, their self-esteem and body image may also become affected. Many overweight adolescents are socially marginalized.
- ✓ In 2000, researchers estimated that the total economic cost of obesity to Albertans was between \$620 and \$700 million (compared to \$804 million total costs due to tobacco). This figure includes direct costs and indirect costs associated with loss of productivity from disability and premature death due to obesity related illnesses.

An Environmental Scan Of Childhood Obesity In The Calgary Region

www.research4children.com/theme/common/document_launch.cfm?itemId=4542 (Removed since Aug 2016)

Other asthma factors relate to socio-economics, poor prescription management,³⁴ indoor pollution (smoking, dust mites, volatile organic chemicals, cooking), outdoor molds and pets,³⁵ seasonal factors and exposure to flu or other asthma/allergy triggers,³⁶ and individual health issues.

The air is never truly ‘clean’ – even if there is no industrial activity nearby – because nature produces significant fine particulate matter. Wind, volcanoes, and wildfires (near and far) deposit enormous volumes of particulate matter annually; wildfires dump some 44 tons of mercury on North America every year.³⁷ With or without harvest or gravel roads, there is always some dust and naturally formed secondary particulates suspended in the air in summer, and especially fall.

³⁰ [http://www.asthma.ncdhhs.gov/docs/presentations/obesityChildhoodAsthmaFINAL\(72x40\)-3.pdf](http://www.asthma.ncdhhs.gov/docs/presentations/obesityChildhoodAsthmaFINAL(72x40)-3.pdf)

³¹ <http://www.gpiatlantic.org/pdf/health/obesity/ab-obesity.pdf>

³² <http://www.gpiatlantic.org/pdf/health/obesity/ab-obesity.pdf>

³³ <http://www.albertahealthservices.ca/poph/hi-poph-surv-phids-childhood-overweight-obesity-2010.pdf>

³⁴ <http://www.albertahealthservices.ca/news/releases/2016/Page13003.aspx>

³⁵ <http://www.besthealthmag.ca/best-you/allergies/the-worst-canadian-cities-for-allergies/>

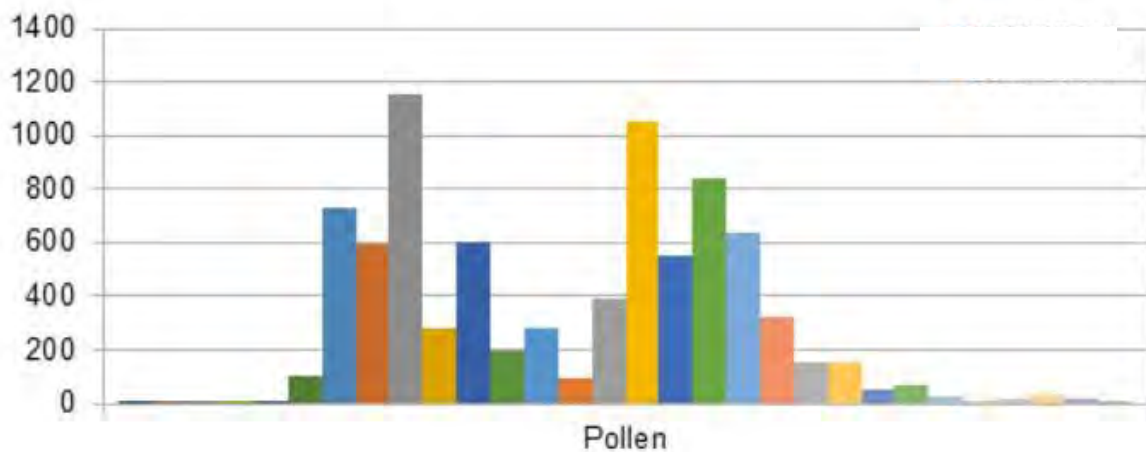
³⁶ <http://cochranenow.com/local/627-ahs-reminds-parents-of-september-asthma-spike>

³⁷ http://www.naturalnews.com/044065_mercury_pollution_forest_fires_North_America.html



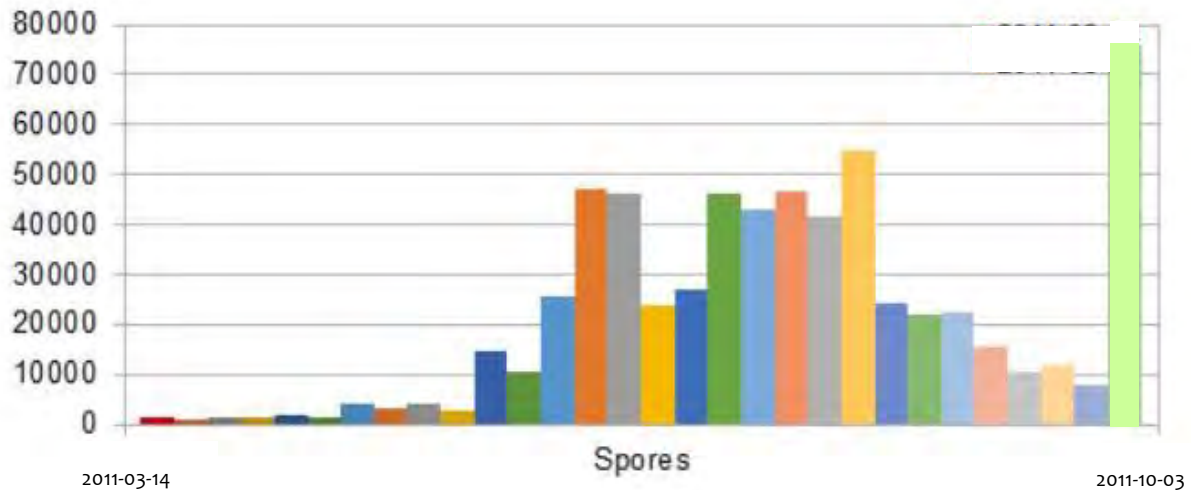
Dust suspended in autumn air at dusk in southern Alberta (2015). Photo credit: Clive Schaupmeyer ©2015

Nature also emits a profusion of various spores, molds and pollens through the year which can trigger asthma and respiratory events. The following graphs illustrate diverse natural spores and pollens by color and volume of particles per cubic meter of air per week in Edmonton in 2011.



2011-03-14

2011-10-03



Data Source: Aerobiology Research Labs Edmonton 2011-March-October by weeks+species.

See also: Friends of Science previous report “Burning Questions”

https://friendsofscience.org/assets/documents/FoS_BurningQuestions_Health_Coal_Wildfires_Jan2015.pdf

Note the significant spike in October 2011 to ~75,000 P/m³ (particles per cubic meter per week) indicated by the tall, pale green bar, of *Cladosporium sp* a well-known asthma trigger mold with human respiratory health implications in some species.³⁸ The sources and volumes of spores, pollens and molds vary significantly according to annual precipitation, growth, and weather patterns.

The Edmonton region is host to a number of Alberta’s largest coal-fired power plants. Based on Pembina's theoretical health claims against coal, one would expect there to be a more significant ratio of asthma reports in that region.

³⁸ <http://www.pollenplus.com/spores/db/cladosporium.php> “**Origin:** Found world wide. One of the most common fungal spores on air samples. Is often found in indoor air, damp walls, carpets, etc.. Certain species are food contaminants, others are found in woody rotting vegetation, soil, textiles, and cultivated and wild grasses.

Health effects: Some species are saprophytic and are not important in human or plant disease. Other species can cause systemic infections where initial inhalation leads to lung infections, which disseminates to other organs. The brain is sometimes involved. It is becoming more prevalent in patients with AIDS, organ transplants, leukaemia, autoimmune disease and Cushings Syndrome. Certain species can cause deep skin infections and can invade the central nervous system. They can cause sinusitis, respiratory diseases, and subcutaneous mycoses. May also cause keratomycosis and allergies. Lesions can occur anywhere in the body if a puncture occurs with contaminated vegetation. The species in air samples are impossible to differentiate microscopically. This makes it impossible to separate the non-pathogenic species from the potentially pathogenic ones. Cladosporium, however, can occur in such high numbers, that it probably should always be considered as a possible source of infection when fungi are suspected.”

However, in terms of actual patient records, we find in the peer-reviewed literature according to Rosychuk et al (2015)³⁹ in a study of pediatric emergency department presentations for asthma:

“During the 6-year study period, 93 146 patients made 199 991 ED visits for asthma. Crude rates in 2004/05 were 7.9/1000, 6.5/1000 and 15.4/1000 in the Edmonton, Calgary and [Non-Major Urban] NMU regions, respectively. The Edmonton and Calgary regions had consistently lower visit rates than the NMU regions.”

This suggests that the proximity to coal-fired power plants near Edmonton, a major urban center, is not a differentiating factor of significant scale, and that other environmental, socio-economic or individual health factors drive asthma response in youth.

Another long-term comprehensive 5-year study by Waters and Gabos (1996),⁴⁰ though from an earlier era, reviewed air pollution concerns in Strathcona County, Fort Saskatchewan, Edmonton, and Fort McMurray. This was prior to the use of asthma inhalers and during a time of far greater air pollutants (air quality legislation has become more stringent over time as have technical mitigations) but findings did not indicate higher mortality in these communities.

The point of mentioning these two studies based on actual patient records is to show that the **evidence does not support the coal-health computer modelled claims of the Pembina Institute, particularly as air quality standards have significantly improved.**

However, a more contemporary set of references is that of the Alberta primary care networks which show that asthma rates are more than ~300% higher in the rural areas, (including Pincher Creek are where there are some 200 wind turbines) than in Edmonton which has a number of coal-fired power plants about one hour west of the city.⁴¹

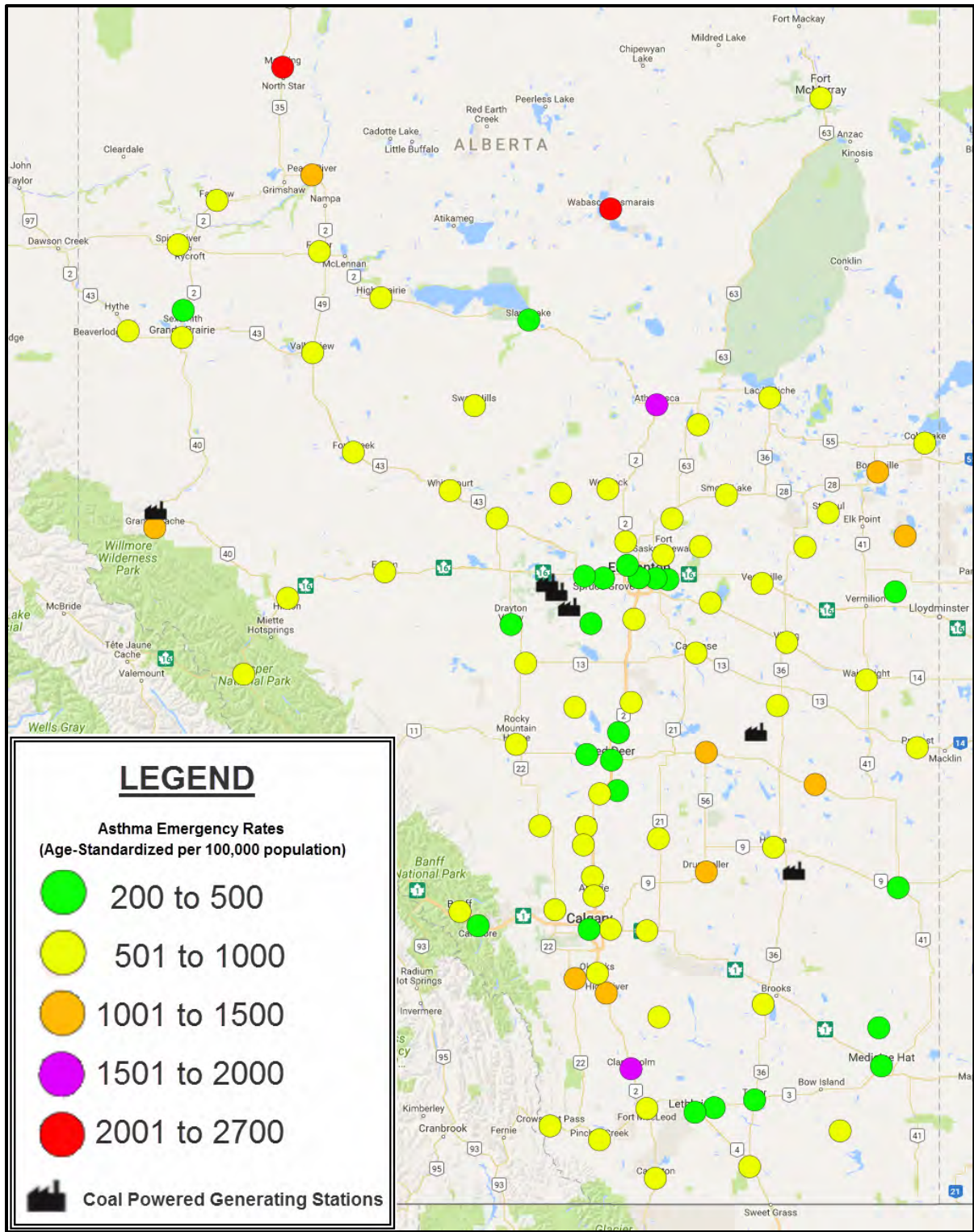
| Location | LGA Age-Standardized Inpatient Separation Rates (per 100,000 population) for asthma |
|----------------------|---|
| Edmonton Bonnie Doon | ~ 20 |
| Edmonton Duggan | ~ 25 |
| Edmonton Mill Woods | ~ 20 |
| Edmonton Northgate | ~ 25 |
| Pincher Creek | ~ 60 |

GA age-standardized inpatient separation rates (per 100,000 population) for asthma at four Edmonton Local Geographic Areas (LGA) and in Pincher Creek

³⁹ <https://www.cambridge.org/core/journals/canadian-journal-of-emergency-medicine/article/a-population-based-study-of-emergency-department-presentations-for-asthma-in-regions-of-alberta/6341F6AC630E92522BC778CAACE0AB5A>

⁴⁰ <http://www.health.alberta.ca/documents/Ft-Sask-Respiratory-Disease-1996.pdf>

⁴¹ http://www.health.alberta.ca/services/PHC-community_profiles.html

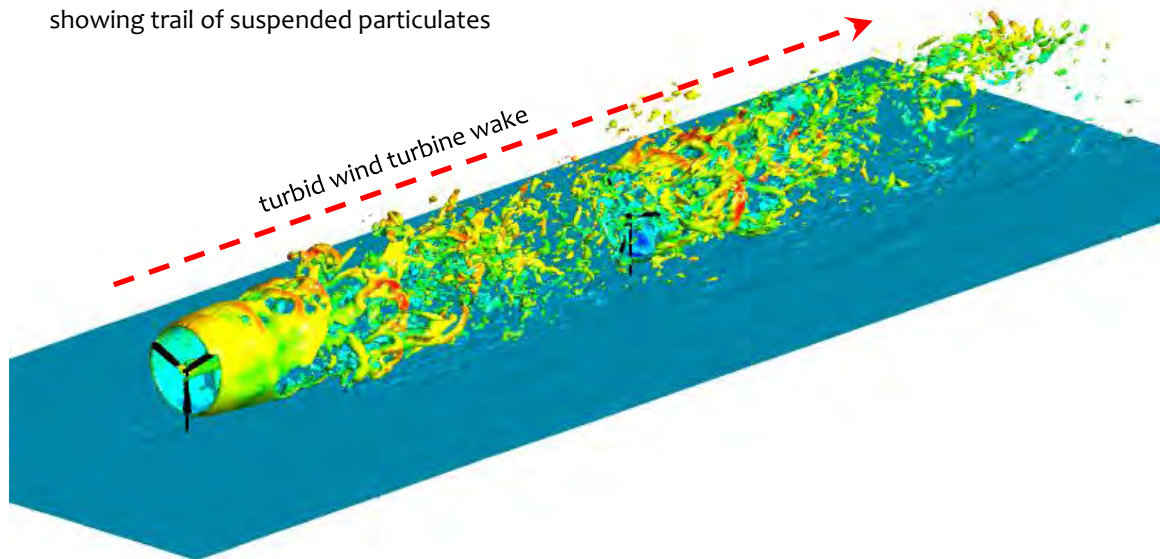


Map of asthma emergency rates, drawn from the data of the 2015 “Alberta Primary health care community profiles” reports on Alberta Health website <http://www.health.alberta.ca/services/PHC-community-profiles.html> , presents that **proximity to coal-fired power plants does not correlate to increased asthma rates.**

Edmonton asthma rates are significantly lower, despite being down wind of three coal-fired power plants.

If suspended particulate matter is a health concern, modelling of the turbid wakes of wind farms suggest that asthma-triggering suspended fine particulates might increase with additional wind farms.

Modelled turbid wake of wind turbines showing trail of suspended particulates

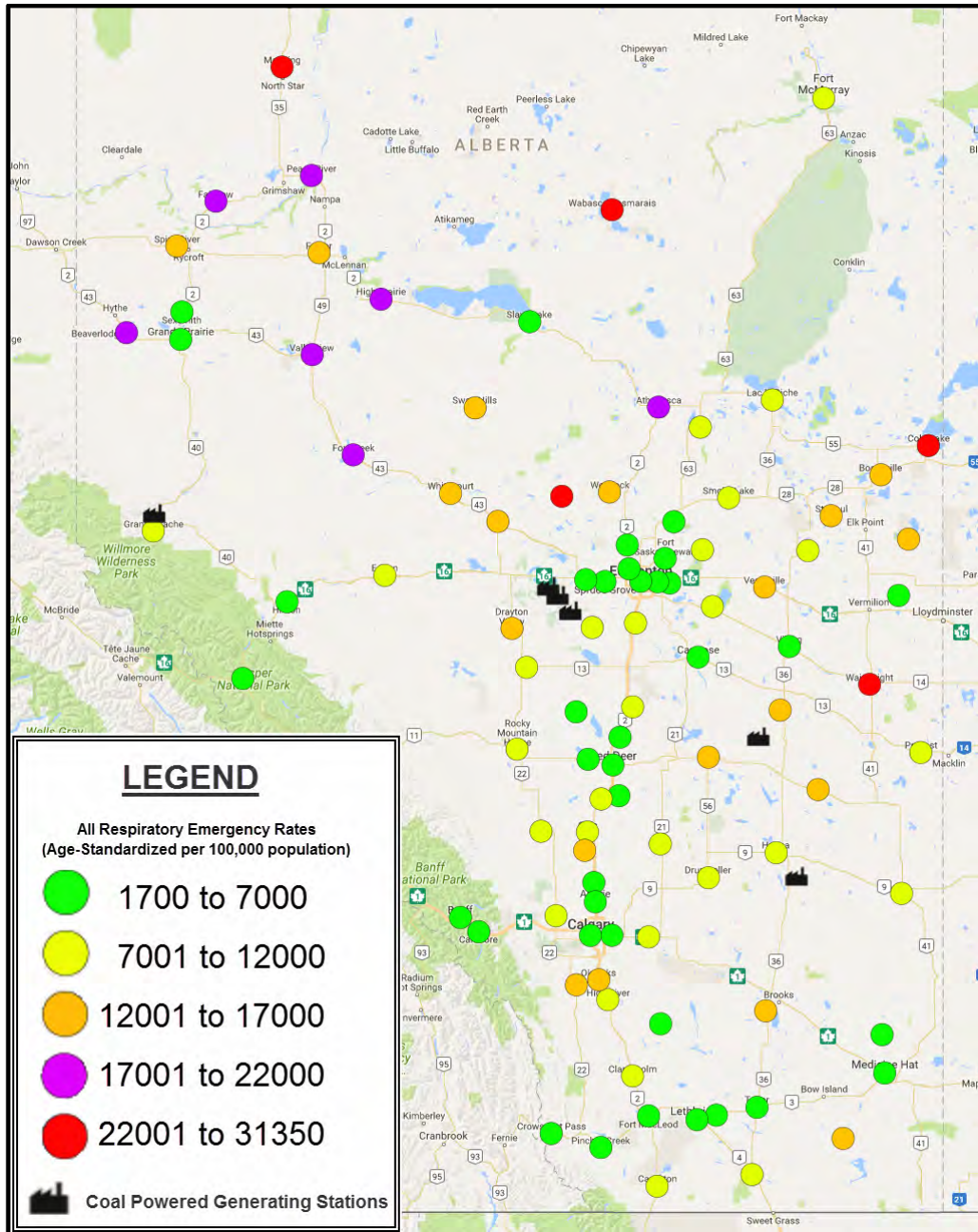


http://homepages.engineering.auckland.ac.nz/~snoroo7/films/2t_10ms_lines.gif



Image of foreign Danish wind farms with turbid wakes of fog and water vapor/ocean particulates
<http://www.nrel.gov/news/features/2012/1995>

Other health factors are affected by ambient air pollution. A review of the Alberta Health Services primacy care networks reports shows that **all respiratory emergency rates are also lower in the Edmonton area versus areas farther from coal-fired power plants**. Some of the areas in the northern boreal may be affected by various natural spores, or a **higher reliance on wood stoves for Residential Wood Combustion** as per Cooper (1980).⁴²



<http://www.health.alberta.ca/services/PHC-community-profiles.html>

⁴² <http://www.tandfonline.com/doi/pdf/10.1080/00022470.1980.10465119>

In the report “Breathing in the Benefits,” Pembina Institute makes many bold claims about saving lives, reducing premature deaths, asthma episodes, hospitalization costs, difficult breathing days, and claims a potential value of some \$3,093 million. **These claims are based largely on models,**



the many flaws in which have been noted by at least one expert, as reported by Friends of Science in 2013.

Dr. Ross McKitrick, professor of economics at the University of Guelph, and a scholar deeply involved in environmental economics, reviewed earlier modeling claims by Pembina Institute.

His comment on Pembina Institute’s report “A Costly Diagnosis” which relied on the Illness Cost of Air Pollution (ICAP) model was:

“These are modeling studies,” says Dr. McKitrick. “They don’t track actual individuals. Before using such model predictions, you need to ask if the numbers make sense, and here is where the problems start to arise.”

According to McKitrick, in Alberta, coal-fired power plants generated 1800 tonnes of fine particulate emissions in 2011.

“It appears the Pembina clean-energy activists are attributing 1 death for every 18 tonnes,” says McKitrick. “That same year in Alberta there were 3400 tonnes of fine particulate emissions from residential fireplaces, 7,000 tonnes from forest fires and 209,000 tonnes from driving on unpaved roads. So by their reasoning these sources caused about 12,200 deaths. Since there were only about 22,000 deaths from all causes in Alberta in 2011, the Pembina model attributes over half the annual deaths in the province to airborne fine particulates. **I find this implausible, to say the least,**” says McKitrick.

DR. ROSS MCKITRICK

Ross McKitrick is a Professor of Economics at the University of Guelph where he specializes in environmental economics. He has published many studies on the economic analysis of pollution policy, economic growth and air pollution trends, climate policy options, the measurement of global warming, and statistical methods in paleoclimatology. His book *Economic Analysis of Environmental Policy* was published by the University of Toronto Press in 2010. He has also published numerous invited book chapters, newspaper and magazine essays and think tank reports. In 2003 his (coauthored) book *Taken By Storm: The Troubled Science, Policy and Politics of Global Warming* won the \$10,000 Donner Prize for the best book on Canadian Public Policy. Professor McKitrick has made invited academic presentations around the world and has testified before the US Congress and the Canadian Parliamentary Finance and Environment Committees. In 2006 he was one of 12 experts from around the world asked to brief a panel of the US National Academy of Sciences on paleoclimate reconstruction methodology.

Dr. McKittrick had tested such models some years earlier during the Pembina-co-sponsored efforts to phase-out coal in Ontario. He found that when hindcasting (running the model in reverse against known data) the model predicted that more people died of air pollution than died in total.⁴³

In “*Breathing in the Benefits*” Pembina Institute relies on their own extrapolations of Environment Canada’s Regulatory Impact Analysis Statement (RIAS) model. However, they fail to include the essential economic benefit that Environment Canada foresaw from the institution of Carbon Capture and Storage – that being an expected economic benefit related to the use of captured carbon dioxide for pumping into depleted wells to recover oil.

*“The analysis also assumes that the Regulations will **spur investments in fossil fuel-fired power with carbon capture and storage (CCS) technology**. Where the captured CO₂ is used for enhanced oil recovery (EOR) an **additional net benefit of \$4.7 billion** is expected as a result of incremental oil production.”⁴⁴*

The opposite is the case. Investment has fled the province as the province has decided to cap oil sands production, phase-out coal (overturning the staged federal coal phase-out), and no carbon capture options are even being considered for coal plants in Alberta, consequently the Environment Canada assessment of costs and benefits is being misrepresented by Pembina Institute. Likewise, Pembina Institute’s recommendations that no compensation⁴⁵ should be paid to investors or the coal industry and the NDP government’s decision to sue itself over⁴⁶ the Power Purchase Agreement “Change” clause, have heightened investment market instability.

Thus, we caution that before accepting the claims of “*Breathing in the Benefits*” at face value, **Albertans should demand that the modelled health cost-benefit claims be tested by an independent authority and that the modelled impacts be tested against actual patient and air quality records.**

⁴³ <http://www.rossmckittrick.com/uploads/4/8/0/8/4808045/ampco.pdf>

⁴⁴ http://publications.gc.ca/collections/collection_2012/gazette/SP2-2-146-19.pdf (pg 2000)

⁴⁵ <http://www.pembina.org/reports/coal-compensation-brief.pdf>

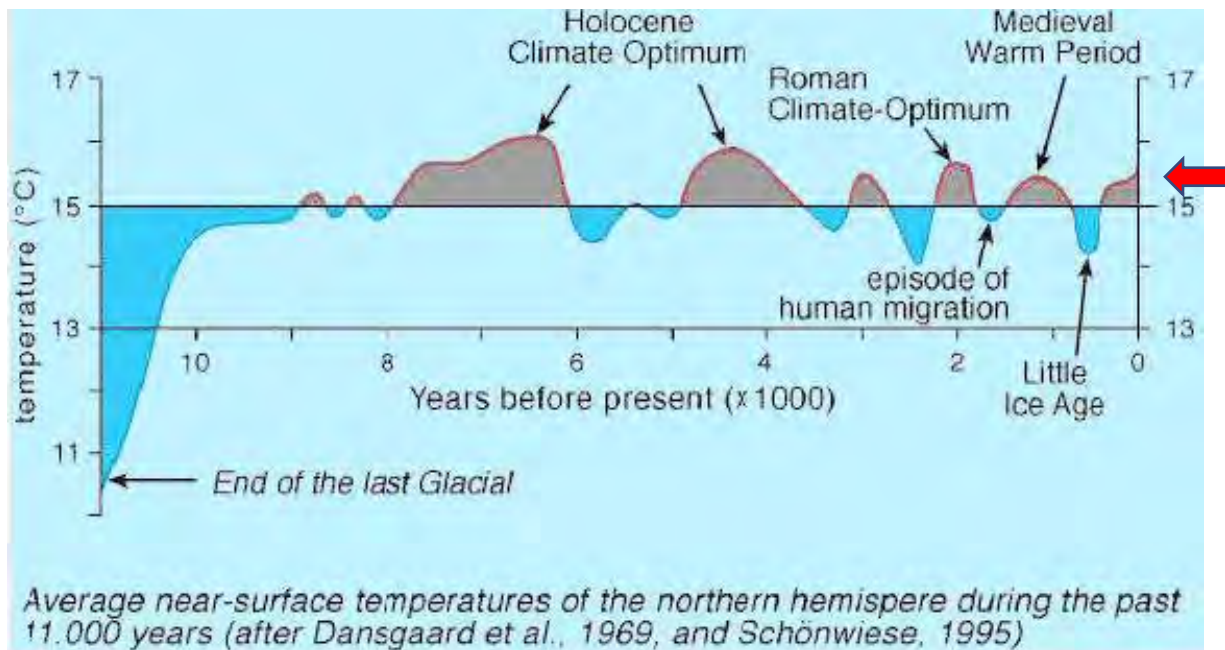
⁴⁶ http://www.huffingtonpost.ca/2016/08/05/enron-clause_n_11339468.html

4. CLIMATE ACTION OR CLIMATE RISK?

Much of Pembina Institute's report "Breathing in the Benefits" is premised on the notion that taking this 'climate change action' to reduce carbon dioxide emissions by closing coal-fired power plants would prevent climate change and thus save money and lives.

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This perspective ignores the billions of years of climate change, and the **recent disastrous climate change of the ~500 yearlong Little Ice Age (1300AD-1850AD)**, from which the earth emerged in about 1850 – the start of the Current Warm Period.



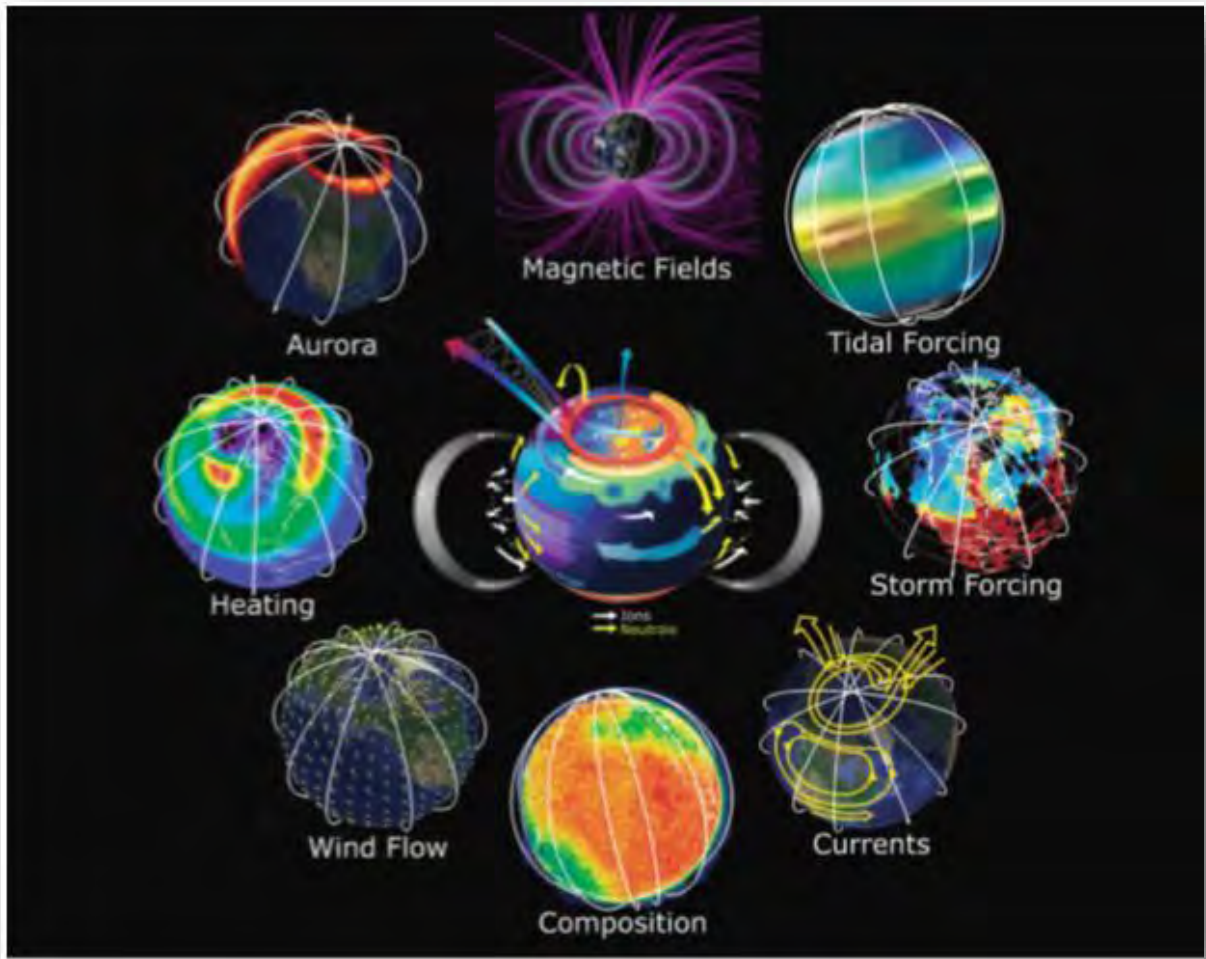
About 400 years of human records show that during cyclical variations of the sun, low sunspot activity has coincided with periods of extreme cold and very unpredictable weather patterns – to the point that in the 1600's, some 60,000 people were burned at the stake in Europe as witches for the alleged crime of "Weather Cooking" as the weather extremes were so terrifying it had to be 'unnatural' and human-caused.⁴⁷

As you can see by the foregoing graph, there are cyclical periods of warming and cooling. Based on the low solar activity of this Solar Cycle 24,⁴⁸ some scientists think warming may have reached the peak of its natural cycle and a decline in temperatures may be imminent.

⁴⁷ <https://youtu.be/wcAy4sOcS5M>

⁴⁸ <http://solarscience.msfc.nasa.gov/predict.shtml> "The current predicted and observed size makes this the smallest sunspot cycle since Cycle 14..."

Some observers note the recent signs of a ‘spotless sun’⁴⁹– or ‘solar hibernation’ (vernacular), a marked decline in Total Solar irradiance (TSI) and other solar activity factors as signaling a cooling trend.



Source: [Solar and Space Physics:](#)

A Science for a Technological Society: An Overview (2014) National Academies of Science Press

<http://www.nap.edu/catalog/18974/solar-and-space-physics-a-science-for-a-technological-society>

The sun⁵⁰ and various orbital factors of other planets, and other cosmic forces affects all of these climate systems on earth, directly and indirectly, which interact in a chaotic mix driving earth’s climate. However, human beings’ industrial and consumer emissions only affect the atmospheric concentration of gases, and then only nominally.

⁴⁹ <http://www.vencoreweather.com/blog/2016/6/4/300-pm-the-sun-has-gone-completely-blank>

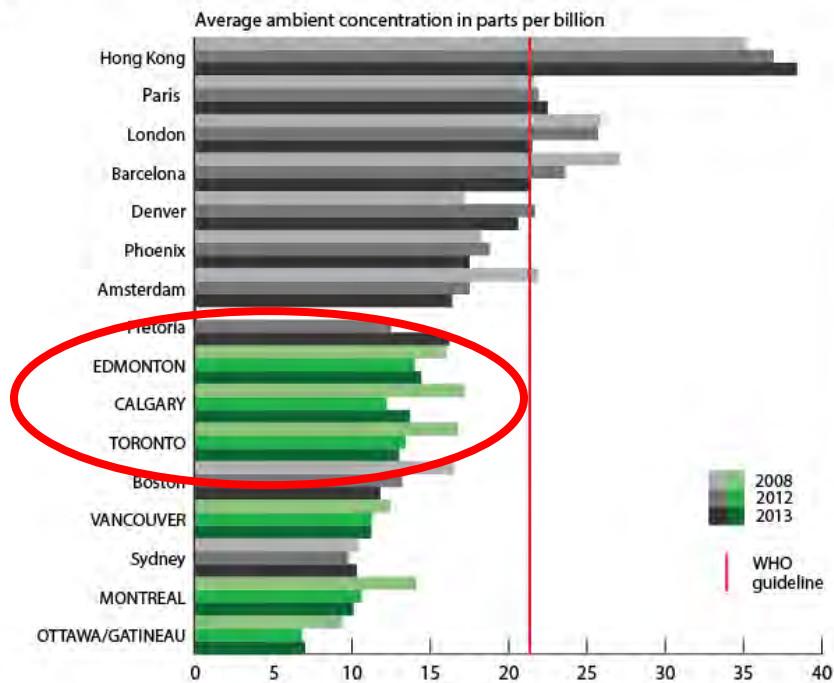
⁵⁰ <http://chrono.qub.ac.uk/blaauw/cds.html>

Our practical concern is that phasing out coal will put Albertans at risk of energy poverty - in the event of a cooling period like the Little Ice Age this could become a crisis (whether a shorter period of decades or longer one of centuries). As well, we see it is far more sensible to spend taxpayer's money on reducing noxious emissions everywhere in the world, than by taxing and trading carbon credits which does nothing practical for the people or the environment, and which has not been demonstrated to reduce emissions or the use of fossil fuels.⁵¹

5. DOES CANADA OR ALBERTA HAVE AN AIR POLLUTION PROBLEM?

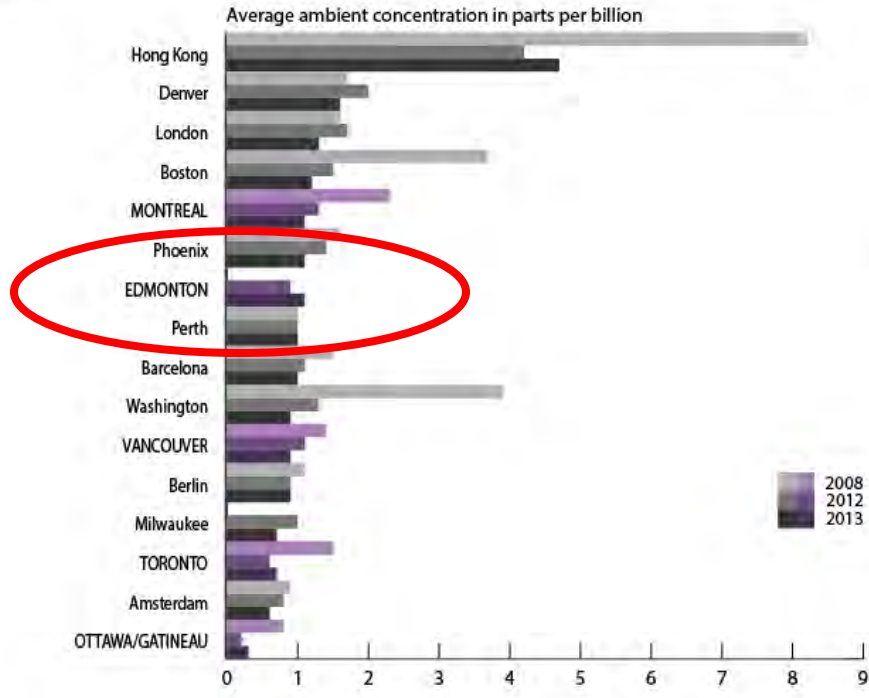
According to Environment Canada, our air quality is very good in terms of other world cities and the air pollution levels in our major centers are far below WHO air quality levels.

Annual average concentrations of nitrogen dioxide for selected Canadian and international urban areas, 2008, 2012 and 2013

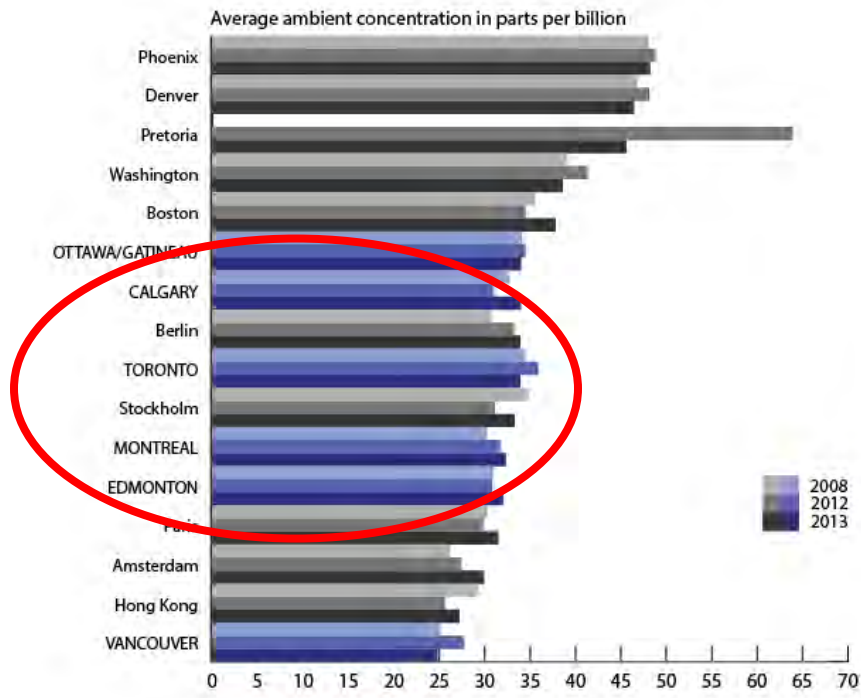


⁵¹ <http://www.taxpayer.com/blog/bc--carbon-tax-no-success-story>

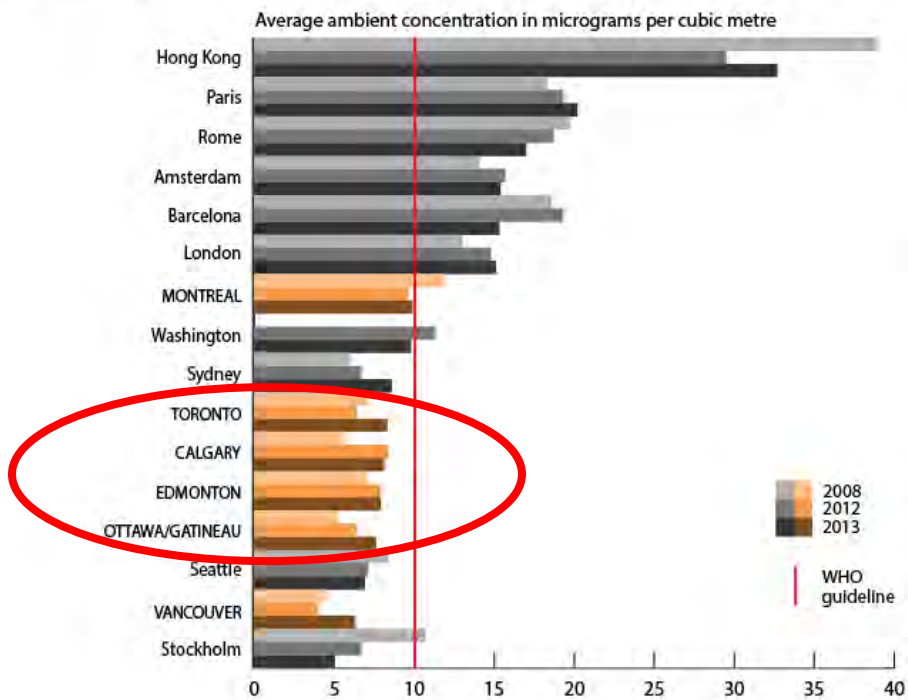
Annual average concentrations of sulphur dioxide for selected Canadian and international urban areas, 2008, 2012 and 2013



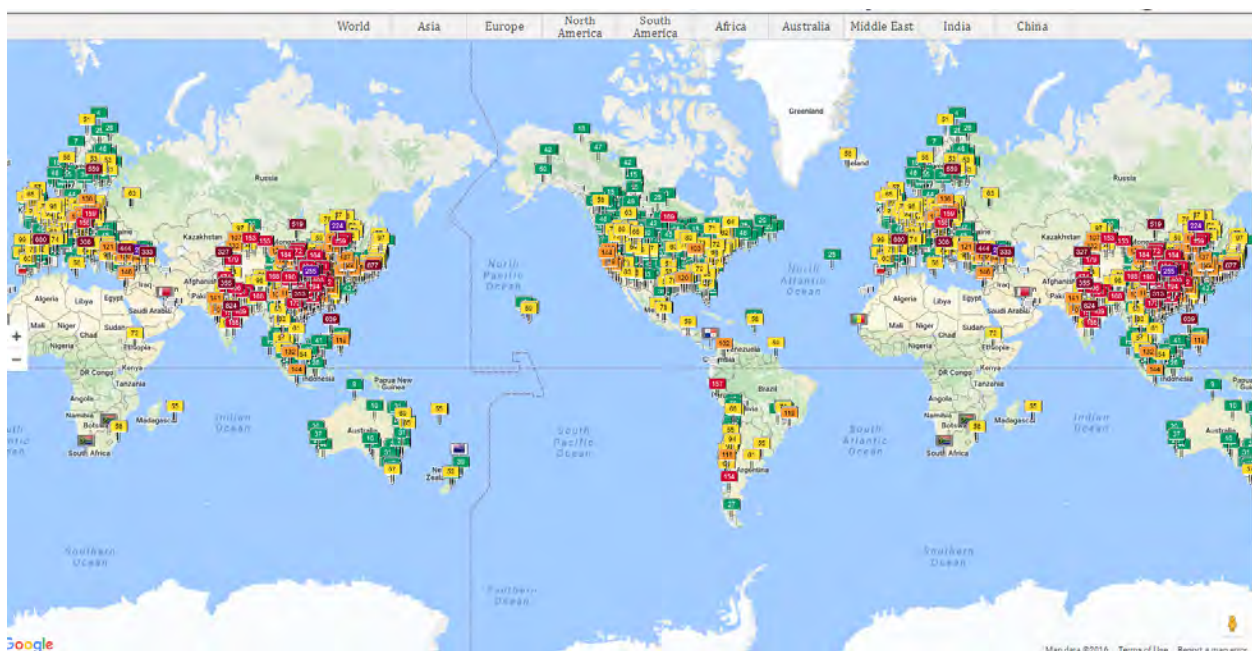
Annual average concentrations of ozone for selected Canadian and international urban areas, 2008, 2012 and 2013



Annual average concentrations of fine particulate matter for selected Canadian and international urban areas, 2008, 2012 and 2013

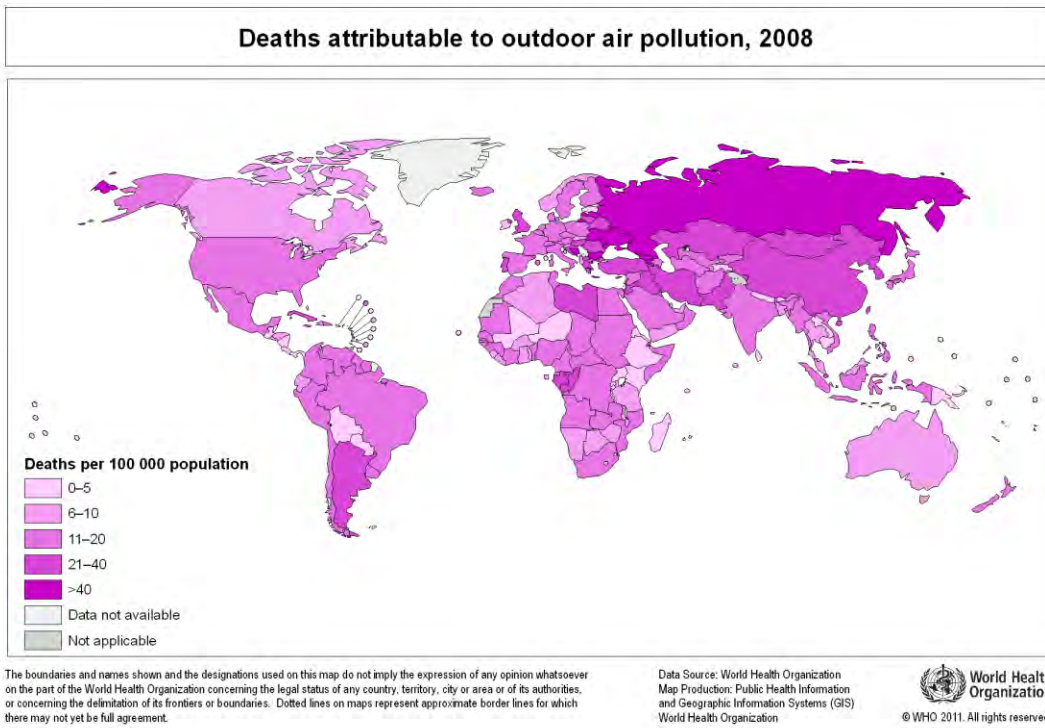
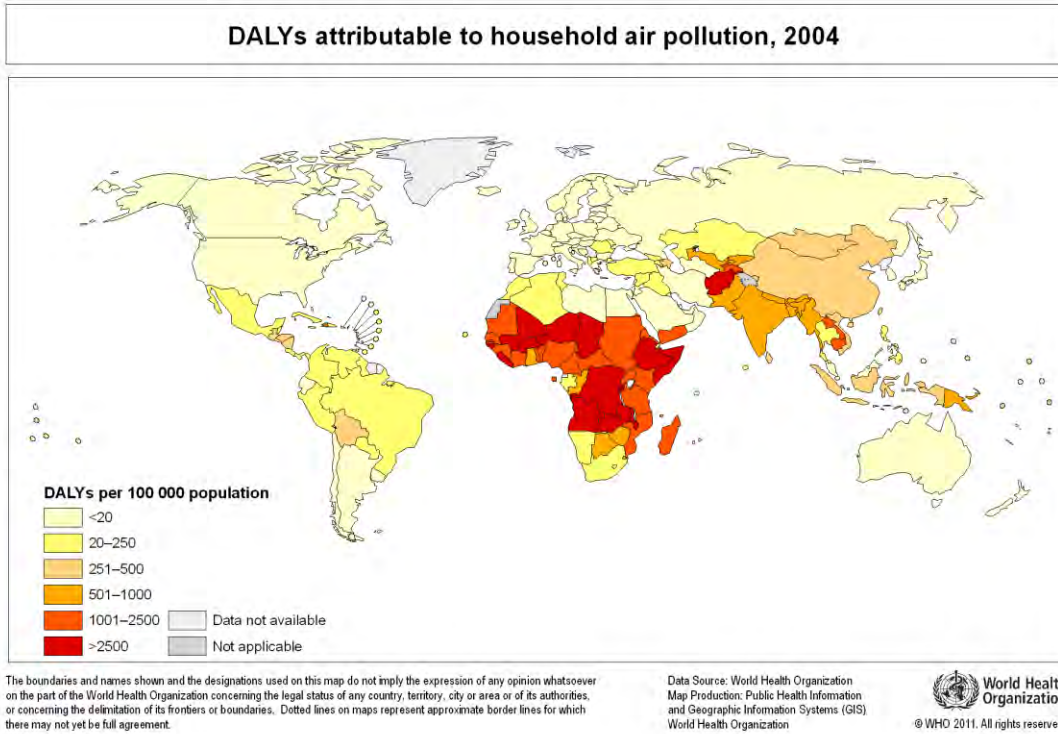


Though air quality is subject to change over time, depending on emissions, weather and natural events like wildfires and volcanoes, this WHO map gives some context for evaluating Alberta's and Canada's air quality.



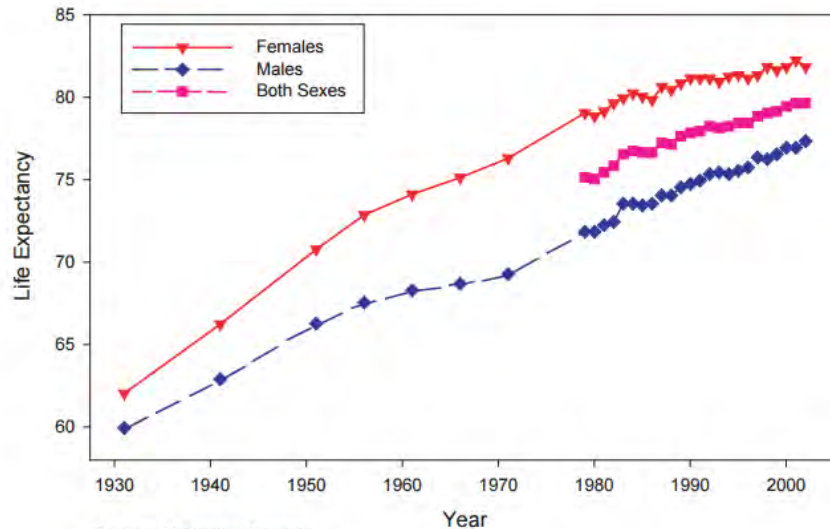
<http://aqicn.org/map/world/#@g/8.7531/-115.8846/2z>

Canada and Alberta barely register, both in ratios of “lost years of healthy life (DALY)” attributable to indoor air pollution (typically from cooking on open flame dung, wood or biomass in the developing world) and deaths from outdoor air pollution.



Since the advent and expansion of coal-fired power plants in Alberta in the early 1920's, Albertans' life expectancy has increased dramatically.⁵²

Figure 11 Life expectancy at birth in Alberta, 1931 to 2001



Even in Edmonton, which is “Gateway to the North,” a transportation hub with a higher load of ground level emissions, one can see that noxious emissions have steadily declined over the years. (Appendix A – Source: www.YourEnvironment.ca) Further, Environment Canada demonstrates that coal emissions per se have declined dramatically in recent years. See Section 8.)

Certainly there are many industrial facilities within Edmonton which contribute various loads of fine particulate matter, volatile organic chemicals, ozone, nitrogen oxides (NOx), sulfur dioxide (SO₂), carbon monoxide – not to mention the many truck fleets, transcontinental train traffic, the Edmonton International Airport and related diesel/jet fuel emissions particulates.

6. DOSE AND DURATION

Critical elements of evaluating the impact of any air pollution source are the dose and duration. While coal fired power plants in the Edmonton area do put out a large amount of nitrogen oxide, sulfur dioxide and fine particulate matter, there are numerous emitters right

⁵² <http://www.health.alberta.ca/documents/Health-of-Albertans-2006.pdf>

within the City of Edmonton boundaries, including fine particulates, mercury, ammonia, volatile organic chemicals etc. (Appendix B) In Appendix D we see that from August 2013 to September 2015 the Redwater Industrial region is the only place in Alberta with any recorded exceedances as per the CASA Data Warehouse readings of air monitoring stations in Alberta. The Redwater region is home to numerous large industrial operations and a farming industry that surrounds the town. These industries include refineries, an upgrader, a fertilizer plant, a chemical production plant, a petrochemical plant, a pipeline storage and shipping facility. Note that Redwater is on the northeast side of Edmonton, with the City itself lying between the coal power stations and Redwater. No coal-fired power plants are found in this area.

According to a 2013 article on the Edmonton Capital Region Airshed, there were 7 smog days that winter.⁵³

“We’re finding that half of it is from the urban contributions of us driving vehicles and heating homes. Then there’s a portion that comes (from outside the city limits) and a portion from industry,” said Lisa Avis, cumulative effects manager for Alberta Environment.

Urban sources are often worst for human health, Avis said.

“They are emitted at ground level. They’re not hot; hot air wants to rise and move away. This stays at the ground, right where we breathe, it so it has a bigger impact on us.”

⁵³ <http://capitalairshed.ca/news/new-efforts-aim-to-understand-poor-air-quality-in-edmonton>

Interactive Indicator Maps

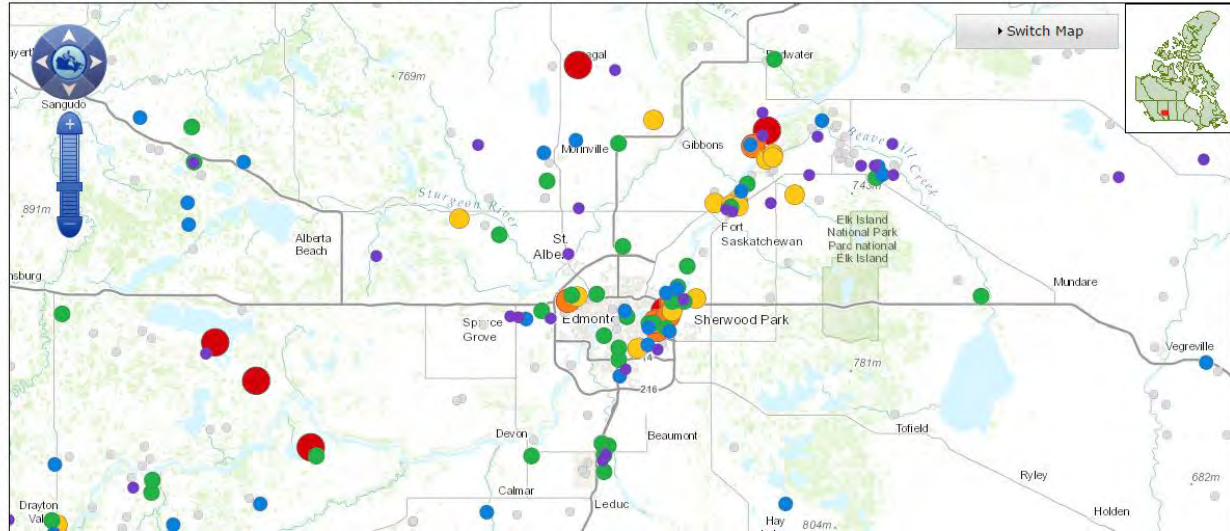
How to use this page

Map Preferences

Select theme: Air and indicator: Emissions – Fine particulate matter

Choose province: AB city: Edmonton or enter postal code (A1A): Find

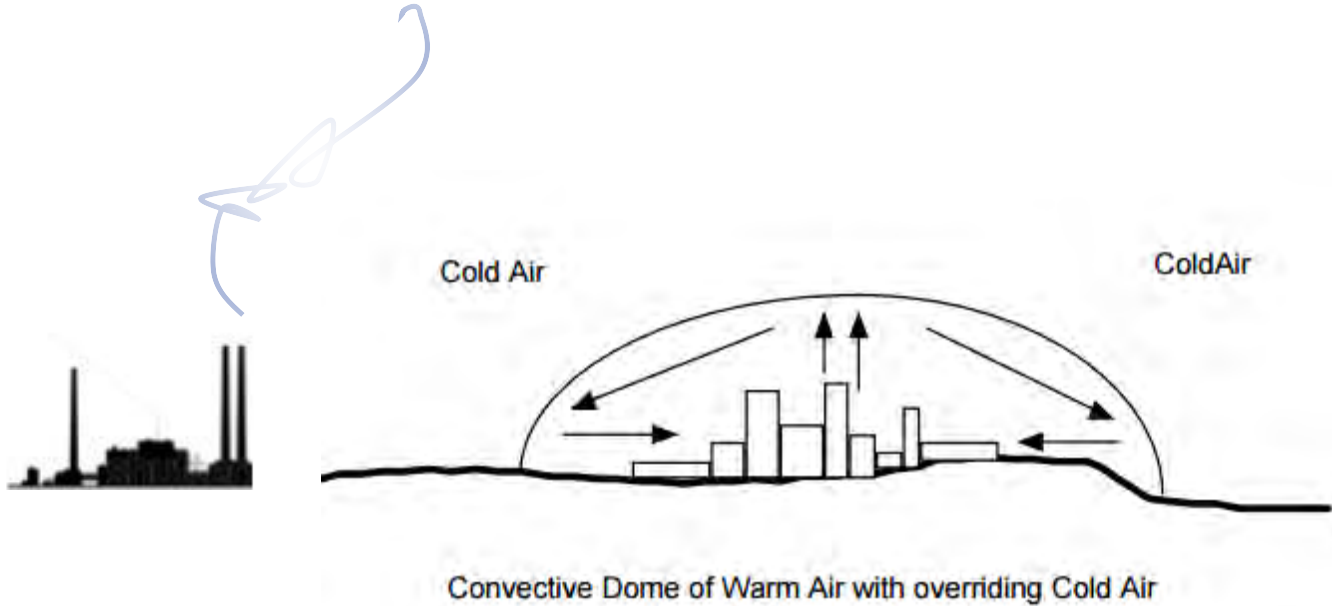
Fine particulate matter emissions by facility, Canada, 2014



Screenshot showing point sources of fine particulate matter emitters in the Edmonton area and city proper. Colors indicate relative size.⁵⁴

If closing coal-fired power plants is an air health quality issue when the plants are so far away from the city and when emissions are lofted high into the atmosphere and dissipated, it begs the question if all other emitters WITHIN the city of Edmonton should be shut down for the sake of the public's health. Certainly the likelihood of the formation of secondary particulate matter from ammonia, volatile organic chemicals, mercury, carbon monoxide, sulfur dioxide, nitrogen dioxide from plant emissions within Edmonton, combined with the 'soup' of transportation emissions, is far more likely within that urban heat island, than from airborne emissions dispersed an hour away and above the convective heat island of the city.

⁵⁴ <http://maps-cartes.ec.gc.ca/indicators-indicateurs/?lang=en>



Visualization of an Urban Heat Island, showing how heat from human activities concentrated in an urban center form a kind of bubble of convective currents.

If distant coal plants are a danger, are these urban emissions, within the ‘urban pressure cooker’ not? And if so, what compensation will be paid to those industries and where will the unemployed work?

However, **if all these operations are within deemed approved safe limits, are anti-coal activists making a case ‘out of thin air?’**

7. MERCURY

Mercury is a naturally occurring element that is found in many waterways (naturally) and that is also released from human industrial activities (coal burning, smelting), as well as natural events like forest fires and volcanoes.

Mercury exposure is a specific risk to those who eat fish or traditional wildlife in regions where there is a likelihood of bioaccumulation.

The Government of Canada recently issued a report⁵⁵ on mercury emissions in Canada and key findings included:

“During the period covered by the assessment, 1990 to 2010, Canadian mercury emissions to the air decreased by 85 percent.

⁵⁵ <http://ec.gc.ca/mercure-mercury/default.asp?lang=En&n=A2D7E54F-1>

- However, ambient air levels of mercury in Canada have only decreased by 18 percent on average from 1995-2010 because **over 95 percent of the mercury resulting from human activity that is deposited in Canada comes from foreign sources.**
- Mercury from foreign sources lands mostly in the Arctic where it adversely affects human health and the environment.
- Numerical modelling predictions suggest that over 95% of the anthropogenic mercury deposited in Canada comes from sources outside of the country (40% from East Asia, 17% from the United States, 8% from Europe, and 6% from South Asia). While Canadian emissions are predicted to decrease, global emissions are predicted to increase.”

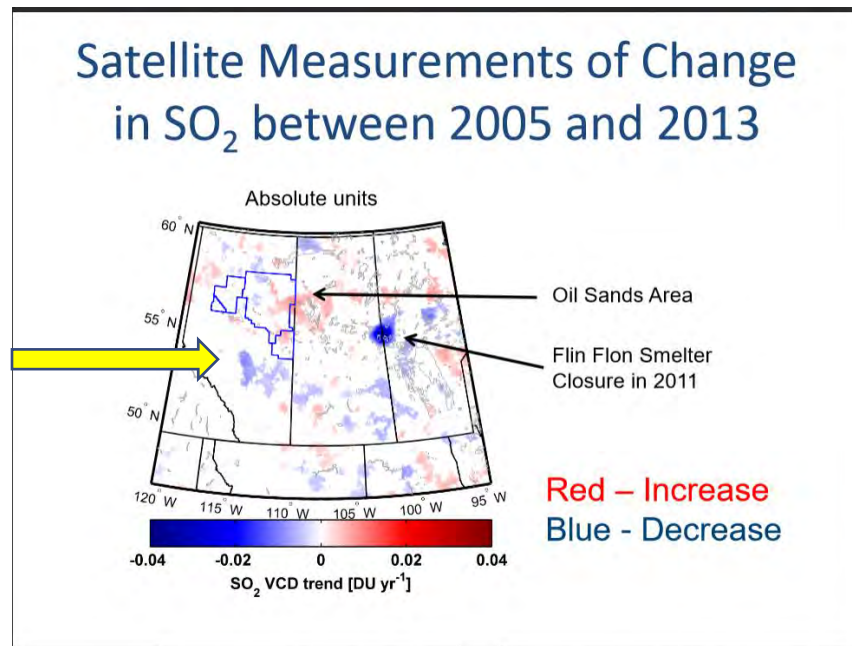
8. ALBERTA HAS GROWN – POLLUTING EMISSIONS HAVE DECLINED

In the fall of 2015, the Pembina Institute and anti-coal activists claimed in the press⁵⁶ that a recent Joint Oil Sands Monitoring exercise that modelled emissions of sulfur dioxide was some kind of ‘proof’ that such emissions posed a risk to human health due to the modelled distribution patterns. They reference this model again in their new report “Breathing in the Benefits” in footnote 42 on page 20.

Within the Joint Oil Sands Monitoring explanatory video by Heather Morrison of Environment Canada, she presents the following image.⁵⁷

⁵⁶ <http://www.cbc.ca/news/canada/edmonton/computer-generated-video-shows-pollution-spread-across-the-prairies-1.3261783>

⁵⁷ Power point page 3: http://aemera.org/wp-content/uploads/2015/09/83_Heather_Morrison.pdf Youtube: <https://youtu.be/oXugroqgNG8>



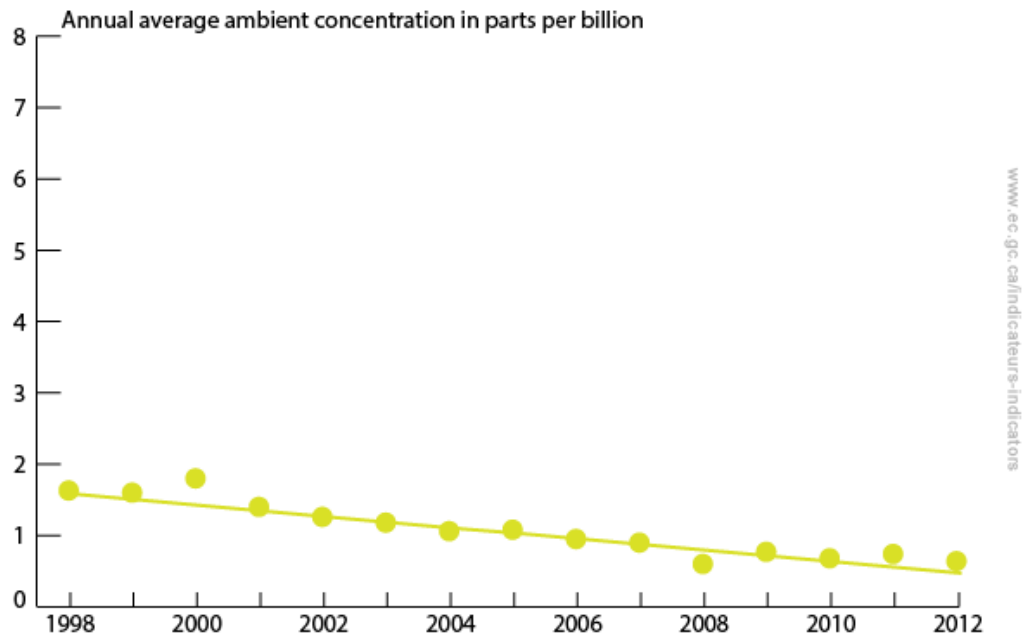
Coal-fired power plants are in a fairly dark blue. They have REDUCED SO₂ emissions over 8 years from 2005.

Ms. Morrison of Environment Canada states at 4:09 in the video that there has been a decrease in sulfur dioxide concentrations from the coal-fired power plants “which aligns very nicely with the mitigation that has happened over that time period...” and that this image shows in blue where there has been a decrease to 2013.

A computer simulation, or model, is not evidence. A critical review of these claims shows that the *model* appears to be parameterized on actual observations, but with no level of confidence / error margins disclosed.

The *model* shows a pattern of dispersion that is interesting, but meaningless without proper context such as empirical air quality and patient health data.

The *observed* numbers from Environment Canada validate that oil sands / electric generation industry in Alberta has been steadily decreasing emissions.



This Environment Canada graph (above) presents that the average sulfur dioxide concentration in the Prairies and northern Ontario has significantly declined from 1998 to 2012. In 2012, the annual average concentration of sulfur dioxide in outdoor air was 0.6 parts per billion, or 14 percent lower than in 2011. The trend from 1998 to 2012 represents a decrease of 68 percent or an average decrease of 4.8 percent per year over the period.

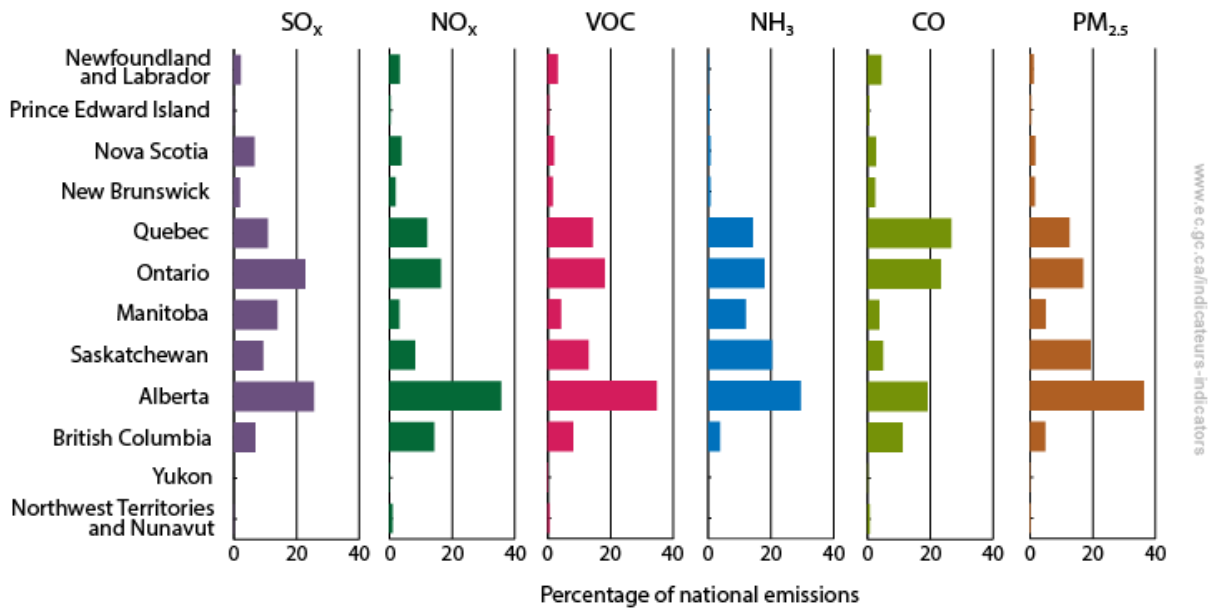
The *observed* data show air quality improving. (APPENDIX A – Edmonton and C)

Ozone is the only factor in Environment Canada information that shows a slight uptick. Otherwise, all parameters show reductions in *polluting* emissions (leaving CO₂ out) over time even as the population and industry has increased over the same period. The exception is ozone which is related to population and difficult to influence.

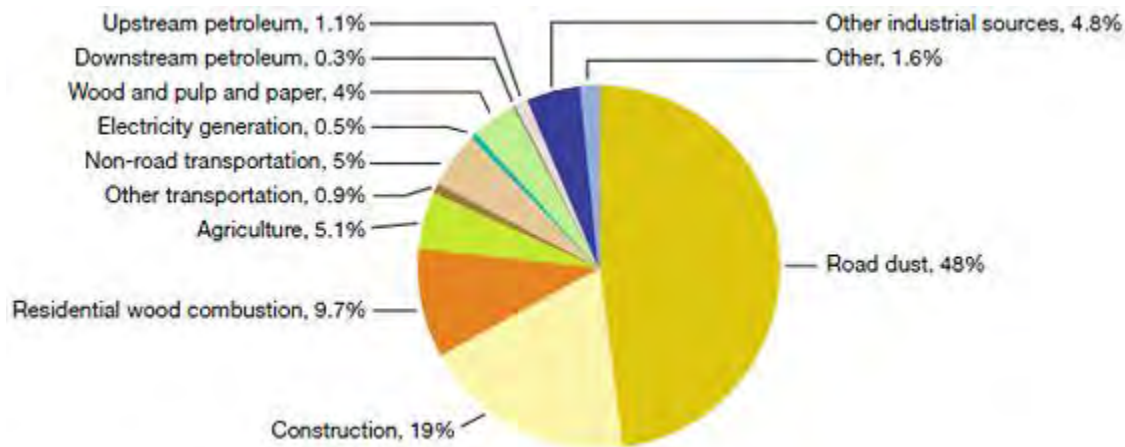
As per the EPA:

“Ground-level ozone (the primary constituent of smog) is the most complex, difficult to control, and pervasive of the six principal air pollutants. Unlike other pollutants, ozone is not emitted directly into the air by specific sources. Ozone is created by sunlight acting on NO_x and VOC in the air. There are thousands of types of sources of these gases. Some of the common sources include gasoline vapors, chemical solvents, combustion products of fuels, and consumer products.” <https://www.epa.gov/air-trends>

Coal is not identified as major source



According to Environment Canada “In 2014, Alberta had the highest emissions of all pollutants except CO. Emissions of SO_x, NO_x, and VOC in the province were high mainly due to the oil and gas industry, NH₃ as a result of agriculture and PM_{2.5} related to construction activities. Quebec had the highest CO emission levels, mainly because of high emissions from transportation and home fire wood burning.”⁵⁸



According to Environment Canada: “The largest sources of primary (directly emitted) fine particulate matter (PM_{2.5}) are road dust and construction/demolition activity, both characterized as open sources, amounting to approximately 67% of the national total. Other important anthropogenic sources are residential wood combustion, transportation and some industrial activities such as wood processing and pulp and paper plants (Figure 10). One area of

⁵⁸ <https://www.ec.gc.ca/indicateurs-indicators/default.asp?lang=en&n=E79F4C12-1>

high PM_{2.5} emissions density is the Windsor–Quebec City corridor resulting mainly from industrial activities and from the transportation, and residential wood combustion sectors (Figure 11). Major urban centres in western Canada and along the Edmonton–Calgary corridor are also shown as areas of high PM_{2.5} emissions density, again likely the result of emissions from the transportation sector. Figure 11 includes the emissions from open anthropogenic sources, illustrating the impact of these sectors such as in the interior of British Columbia. In this area, primary PM_{2.5} is a major issue of concern associated with residential woodstoves, agricultural and controlled burning, and road dust.”⁵⁹

Road dust, transportation and construction/demolition activity are the more significant emitters of PM_{2.5}.

It is important to recognize that sulfur and nitrogen deposition are natural and necessary for a healthy ecosystem. The question is to what extent the anthropogenic additions are harmful.

As can be seen below, in an estimate of Slave Lake 2011 wildfire emissions, Mother Nature puts out a huge amount of sulfur, nitrogen, and PM_{2.5}, compared to that of human industry.

The chart offers some equivalent quantifications to human industrial emissions for comparison.

| | Slave Lake | 2011 Alberta Total Wildfires | |
|---------------------------|------------|---------------------------------|--------------------------|
| Hectares burned | 4,700 | 946,688 | |
| CO ₂ emissions | 518,754 | 104,488,908 | tonnes CO ₂ e |
| CO | 180,209 | 36,298,199 | tonnes CO ₂ e |
| CH ₄ | 1,112,998 | 224,183,292 | tonnes CO ₂ e |
| NO _x | 84,007 | 16,920,965 | tonnes CO ₂ e |
| Total GHG | 1,895,967 | 381,891,364 | tonnes CO ₂ e |
| PM _{2.5} | 8,517 | 1,715,490 | tonnes |
| SO ₄ | 387 | 77,977 | tonnes |
| PM ₁₀ | 77,977 | 272,919 | tonnes |
| | | | |

Estimates based on material prepared by Pacific Phytometric Consultants using US First Order Fire Effects Model

To put things in perspective, the Slave Lake, Alberta fire of 2011 emitted an estimated annual average car emissions equivalent in GHGs of 379,193 cars or that of 43,090 diesel trucks.

⁵⁹ <http://www.ec.gc.ca/air/default.asp?lang=En&n=72F82C27-1&offset=7>

Slave Lake fire emitted the equivalent PM_{2.5} of 2,224,187 diesel truck annual averages, the SO₄ of 151,128 diesel trucks and the PM₁₀ of 326,542 diesel trucks.

In the course of 2011, all wildfires in Alberta emitted the annual average car emissions equivalent in GHGs of 76,387,273 cars or that of 8,679,349 diesel trucks. All 2011 wildfires in Alberta emitted the equivalent PM_{2.5} of 448,002,318 diesel truck annual averages, the SO₄ of 30,440,645 diesel trucks and the PM₁₀ of 65,773,104 diesel trucks.

Note also that the Slave Lake fire was human caused. Some 60-80% of wildfires are a result of human causation of some kind (though not necessarily arson – negligence, interaction with power lines, lack of FireSmart observance).

Clearly, Nature's volume of unconstrained noxious emissions is significant.

9. WHY IS COAL SO IMPORTANT TO THE POWER SYSTEM?

People take electrical power for granted in Canada. 99% of the time you flick on the lights and the power is there. This is thanks to an extremely complex system of interconnections that, in milliseconds, are weighing the demand and supply of power.

A very important part of the power calculation and supply is that of **Baseload**.

The power that you consume as an individual varies a lot throughout the day. Your peak personal consumption time is probably late afternoon and evening when you are at home and you or your family are cooking food, using the dishwasher or clothes washer/dryer, watching TV, using power tools, video gaming, surfing the internet, turning on yard lights and lighting up your house on short, cold winter days.

As well, the province overall has a **minimum power requirement** throughout a 24-hour period that is needed for office lighting, street lighting, powering of sanitation plants, hospitals, factories, businesses, and any other infrastructure needs.

This can make up the majority of the overall demand for power; consequently, the electrical system looks for the cheapest form of power generation to supply baseload. In general, that is coal. Coal-fired power plants are slow to start and difficult to rapidly power up or down in terms of supply/demand – but their slow, stable burn provides minimum cost and maximum power efficiency to the electrical system. Coal plants are very reliable and have a high capacity factor of 80-90%.

Sudden large surges in demand – or sudden drops - can make the entire grid go to blackout – so the demand and supply are closely tracked with advanced monitoring equipment to ensure a stable feed of power from baseload (coal), natural gas (simple cycle, combined

cycle, or ‘peaking’ plants), hydro, and then the co-generation, biomass, wind, and solar components.

Based on Table 2 of the Alberta Electric System Operator (AESO) 2015 report (pg. 6),⁶⁰ Alberta’s average demand was 9,162 MW, minimum demand was 7,203 so baseload equalled 78% of average load. The “load” is the average load divided by peak load in a period of time. “Baseload” refers to the portion of the slow, stable, least expensive form of power generation.

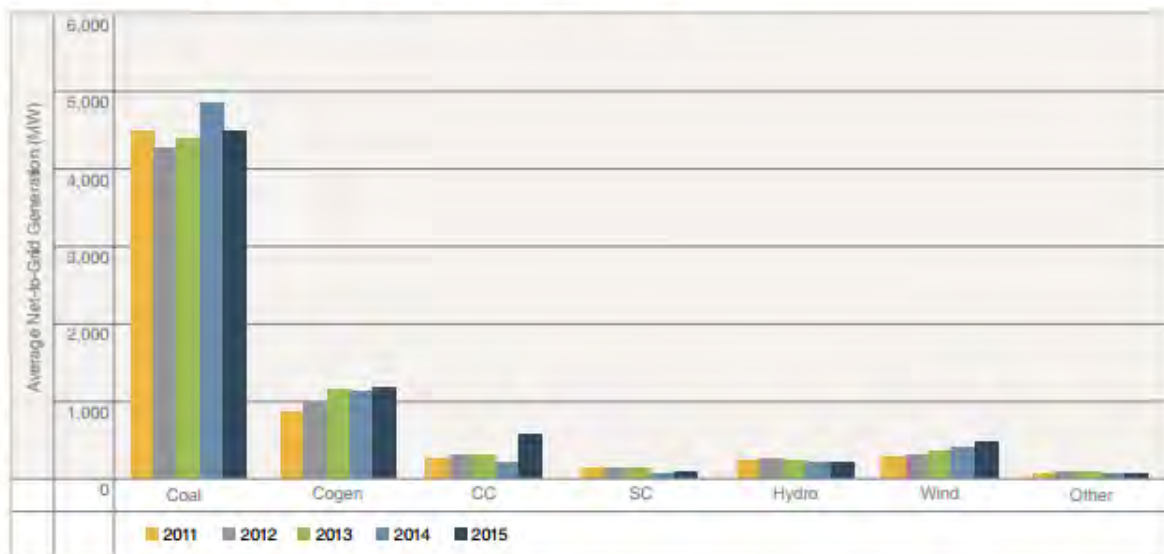
According to AESO: “In 2015, the capacity factor of coal [actual output] reached 72 per cent—on average, for every 100 MW of installed capacity, coal generation delivered 72 MWh to the AIES each hour. This result is consistent with the baseload operation of coal generation technology.” (pg. 12)

The following graph shows that in 2015, coal provided some 64 per cent of the Alberta system load, while natural gas only provided 26 per cent.

Coal Generation Served 64 Per Cent of System Load

Figure 11 illustrates the total net-to-grid generation from each generation technology over the last five years. In 2015, coal generation supplied almost two-thirds of energy used to serve system load. Gas generation technologies served 26 per cent of system load. Renewable generation served the remaining ten per cent of system load. Seven per cent of system load was served by wind power alone.

FIGURE 11: Annual Average Net-to-Grid Generation by Technology



Source: AESO Annual Report 2015 pg. 12

http://www.aeso.ca/downloads/2015_Annual_Market_Stats_WEB.pdf

⁶⁰ http://www.aeso.ca/downloads/2015_Annual_Market_Stats_WEB.pdf

The graph shows coal, co-generation (co-gen), combined cycle natural gas (CC), simple cycle natural gas (SC), hydro, wind and other (biomass). Clearly, Alberta is heavily reliant on coal.

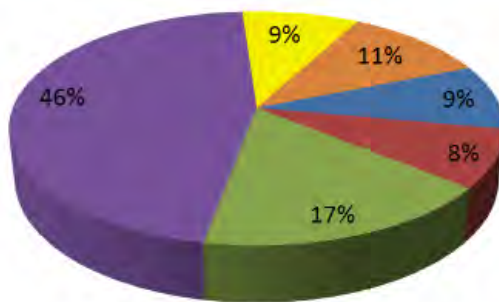
Drastically cutting coal from the mix will be a very expensive proposition because the current ratio of reliance on affordable, reliable coal power is so high.

All 'renewables' require **equivalent** thermal (coal or natural gas) capacity built to back them up. There is no 'free' power. It all costs money.

10. WILL "COAL PHASE-OUT" ACHIEVE INTENDED HEALTH RESULTS?

Let us look at the sectors that emit GHGs in Alberta. Shutting coal fired power plants requires a move to equivalent natural gas capacity, which also has similar emissions. In any case, all electricity generation accounts for only 17% of all Alberta's GHG emissions.

*“Over half the emissions in Alberta are the result of industrial, manufacturing and construction activity, as well as from producing the electricity we consume in our homes, communities and businesses.
The remainder comes from heating our homes and businesses, transportation and from agriculture, forestry and municipal waste.
Alberta’s emissions have increased 15% from 2005. Alberta’s greenhouse gas emissions from most sources are projected to continue to rise from now to 2030.”*



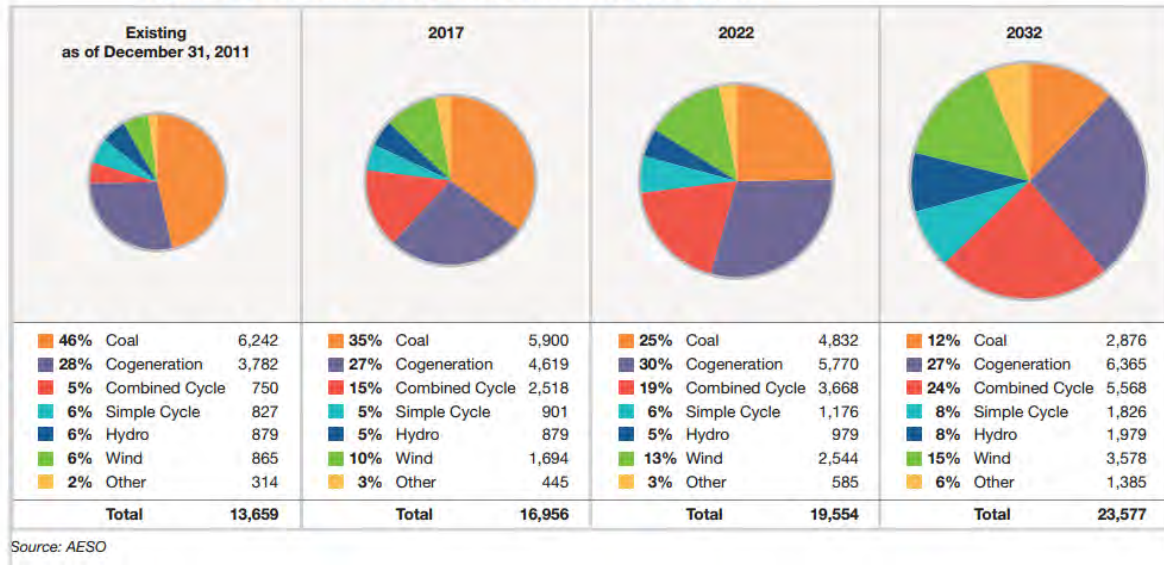
| Source | % |
|--|-----|
| Agriculture, Forestry and Waste | 9% |
| Buildings and Homes | 8% |
| Electricity Generation | 17% |
| Oil and Gas | 46% |
| Other Industry, Manufacturing and Construction | 9% |
| Transportation | 11% |

Source: <http://www.alberta.ca/climate-current-emissions.aspx>

One might as easily conclude that Albertans will have to stop living in buildings, thus reducing 8% of GHGs, or stop the transportation of goods and people to reduce another 11%. As shown in the pie graph above, while oil and gas emit the most GHGs, it is nonsensical to

completely eliminate a sector like coal-fired power generation which is interwoven in the fabric of industry and daily life, particularly when actual patient records do not support the claims regarding health impacts.

Figure 5.3.5-1: Generation Outlook – Installed Capacity (MW)



Source: AESO

If we look at the 2017 AESO forecast chart (above) for power generation in Alberta (set in 2013, prior to the Alberta Climate Plan and NDP government), we find that coal generation was forecast to make up only about 1/3 of power generation in the province – therefore, if 17% of GHGs come from power generation and coal fired power plants are closed, as anti-coal activists advocate, only about 5% of GHGs would be removed. **If we were to add in the carbon footprint of wind⁶¹ and solar, which are substantial, reductions would fall to perhaps 2 or 3%.**

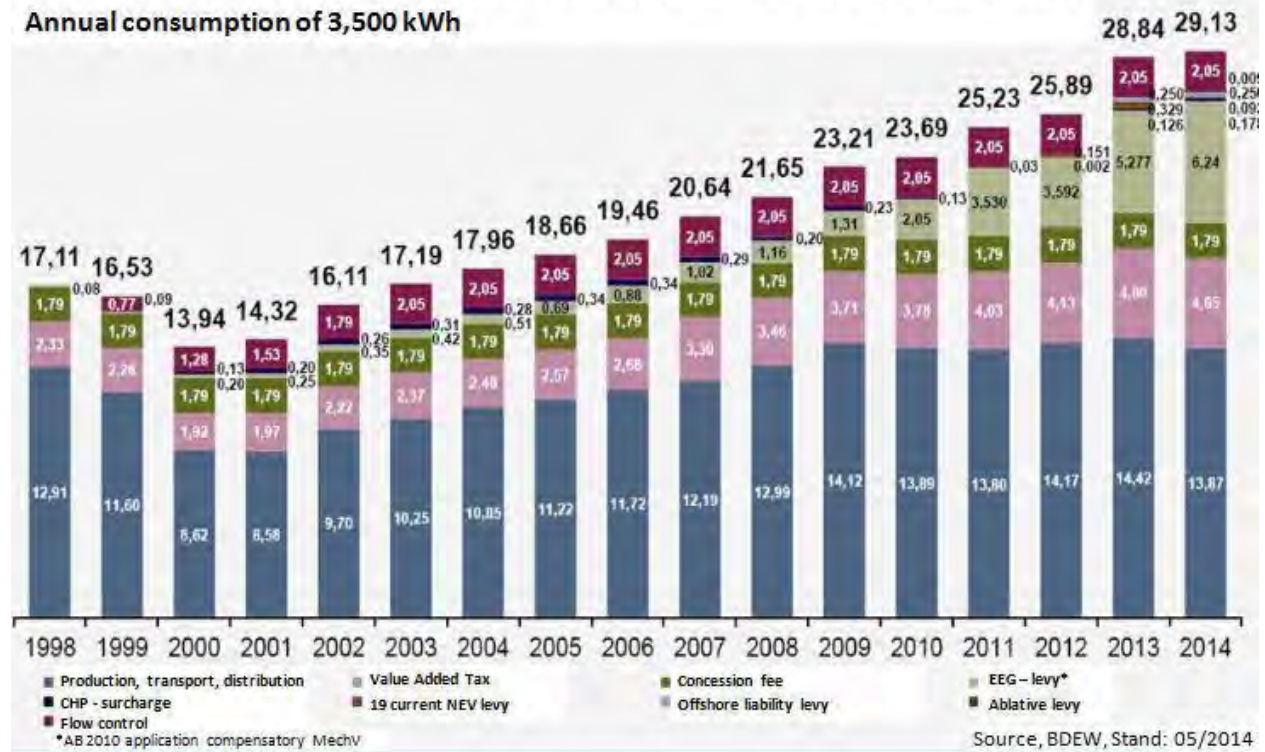
Thus removing coal-fired power capacity from the system will not substantially reduce emissions of concern to health, or carbon dioxide of concern to some environmentalists, but will decimate affordable power – Alberta’s affordable, reliable energy advantage – and lead to energy poverty and its health/mortality implications.

⁶¹ <https://stopthesethings.com/2014/08/16/how-much-co2-gets-emitted-to-build-a-wind-turbine/>

For example, due to the rising costs from the rapid transition to renewable energy in Germany, some 300,000 households (an estimated 800,000 people) have had their power cut off as they could not pay their bills.⁶²

Electricity Prices for German Households

Average electricity price of a three-person household in Euro cents/kWh
Annual consumption of 3,500 kWh



Germany went heavily into renewables. The electricity prices increased from 13.94 in 2000 to 29.13 €cents/kWh in 2014, which is a 109% increase in 14 years.

Ontario is experiencing a similar crisis of heat-or-eat poverty⁶³ where rural residents suffer disproportionately⁶⁴ where power bills include hundreds of dollars for wind/solar transmission lines.

⁶² <http://www.spiegel.de/international/germany/high-costs-and-errors-of-german-transition-to-renewable-energy-a-920288-2.html>

⁶³ <http://globalnews.ca/news/2796958/rural-ontarians-left-in-the-dark-as-electricity-bills-skyrocket/>

⁶⁴ <https://www.thestar.com/news/gta/2016/07/27/pensioner-left-in-dark-after-hydro-pulls-plug.html>

11. COSTS, CAPACITY AND CONSEQUENCES

An easy way to test the theory that wind and solar can replace two thirds of coal-fired power is to look at a screenshot of the electrical power generation statistics of Christmas Day 2015 at 3:46pm (below). Looking in the “Total Net Generation” column “TNG” we find that coal-fired power plants are generating 4875 MW (of 6289 MW capacity) and natural gas plants are generating 4092 MW (of 7214 MW capacity). There is wind power being generated, but at an 18% efficiency, just 266 MW of 1462 MW capacity. If you take away the coal generation, Alberta would not have had enough power for its needs on a cold, short, winter day, filled with festivities. Since wind and solar can never be relied upon and they are not ‘dispatchable’ (on-demand) power, thus it is a false premise to claim renewables can replace coal. Natural gas or hydro generation will have to be built in equivalent capacity to backstop any wind or solar plants installed into the Alberta electric system.

TNG - Total Net Generation

* Indicates that the value reported in MC column actually represents the asset's MCR

| GENERATION | | | |
|------------|-------|------|-----|
| GROUP | MC | TNG | DCR |
| COAL | 6289 | 4875 | 10 |
| GAS | 7214 | 4092 | 138 |
| HYDRO | 894 | 227 | 250 |
| OTHER | 428 | 276 | 0 |
| WIND | 1463 | 266 | 0 |
| TOTAL | 16288 | 9736 | 398 |

How was provincial air quality on Christmas Day 2015 with all that coal-fired power at work on a winter day? It was excellent in all locations – “Low Risk.”.

In jurisdictions where wind and solar have been added to the system in large numbers, there has been a substantial surge in power prices and many challenges to system reliability.

Note that it is not just "power prices" which are higher, but costs to consumers in other forms such as renewable subsidies and taxes, as well as higher costs for all goods and services as these incremental costs are passed on.

In order to maintain a reliable system with sufficient peak load capacity, as Alberta’s coal-fired power plants are phased out, the equivalent of some eight new 800 MW natural gas plants would have to be built at a cost of about \$1.4 billion each, using the new Shepard Energy Center as a reference point.

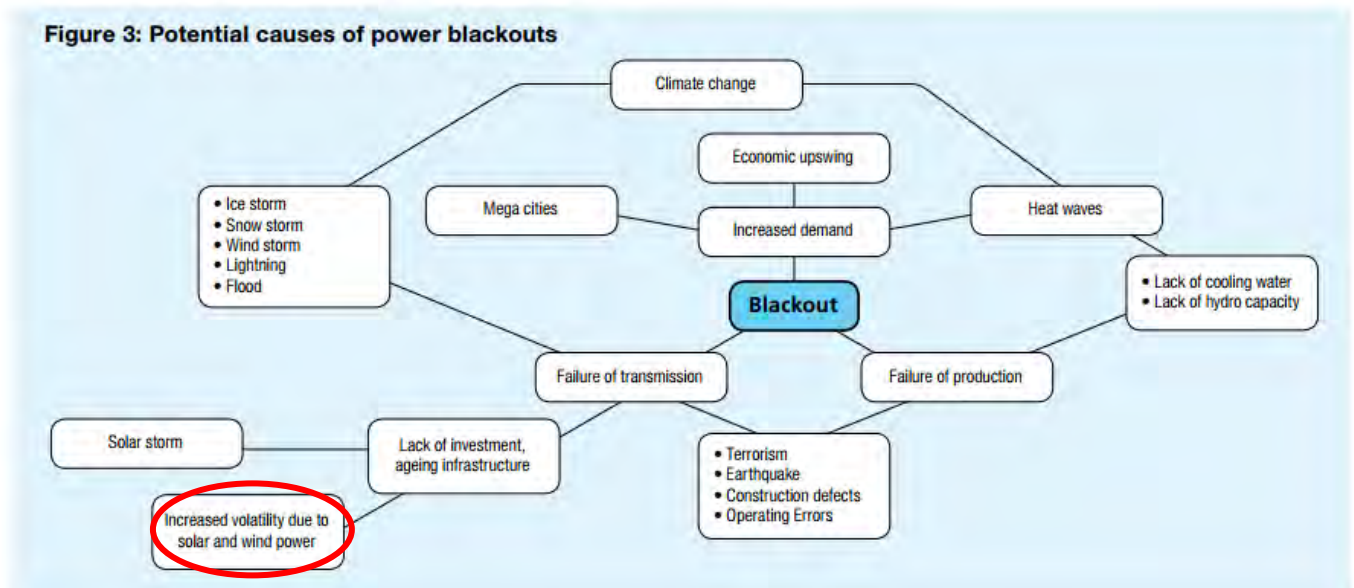
In 2007, Power Engineering magazine reported⁶⁵ that it was necessary to build a new gas plant in Alberta because the existing wind farms were destabilizing the system. The Shepard Energy Center became operational in March 2015 – so from initiation to completion a good seven years was required for application, approval, construction and commissioning.

At the present time, due to market uncertainty with the Alberta NDP government overturning federal coal phase-out legislation, the lack of agreement on coal industry compensation for stranded assets, and the Power Purchase Agreement lawsuit, investment capital has fled. Those investors left standing are interested in building subsidized wind and solar farms – all of which require equivalent thermal (natural gas) back-up.

Pembina Institute claims an accelerated coal phase-out would theoretically save “more” lives than maintaining the present 2030 phase-out target and they claim financial savings based on modelled medical costs, but in fact it is more likely to put the entire province at risk of blackouts which would have dire consequences to health and safety, as well as the economy, province-wide. Thus, these are dangerous, poorly conceived proposals from Pembina Institute et al, and as we have shown throughout this document, their coal-health claims are not supported by the evidence.

In fact, the addition of renewables to the system is judged to be an insurance blackout risk by Allianz.

3.2.2. WHAT ARE THE CAUSES OF BLACKOUTS?



Source: Allianz

https://www.allianz.com/v_1339677769000/media/responsibility/documents/position_paper_power_blackout_risks.pdf

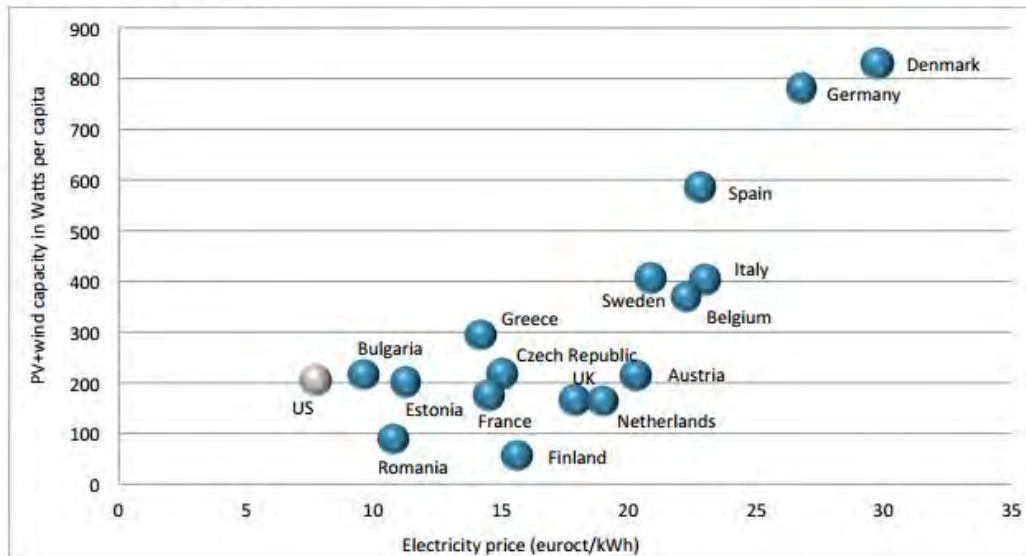
⁶⁵ <http://www.power-eng.com/articles/2007/04/enmax-plans-1200-mw-gas-plant-for-alberta.html>

And what of the costs of phasing out affordable, reliable coal?

The European Finadvice AG, an M&A advisory firm specializing in the utility industry issued a report in 2014 on the German experience with renewables entitled “Lessons Learned” shows how wind and solar capacity drove up power prices across Europe. Countries with the most wind and solar on the system also have the highest power prices. **It should be noted that both Germany and Denmark also use about 40-48% coal-fired power to this day, and supplement it with nuclear or hydro from surrounding countries, according to their interties with Sweden-nuclear, France-nuclear and Norway-hydro.**

The US EIA also reports independently that EU power prices are more than double that of the US.


Figure 16. Comparison of the amount of wind and solar capacity and electricity prices, selected countries, 2012⁴⁶



The rise in electricity prices has spurred a new debate in Europe about a new energy poverty. A recent front cover of the popular German magazine Der Spiegel titled “Luxury Electricity: Why energy will always be more expensive and what politicians have to do against it” and showing gold-plated and diamond-encrusted power cables, succinctly summarized the mood of the German public toward high energy prices. The article discussed “Germany’s aggressive and

Source: Finadvice “Lessons Learned”

http://www.finadvice.ch/files/germany_lessonslearned_final_071014.pdf


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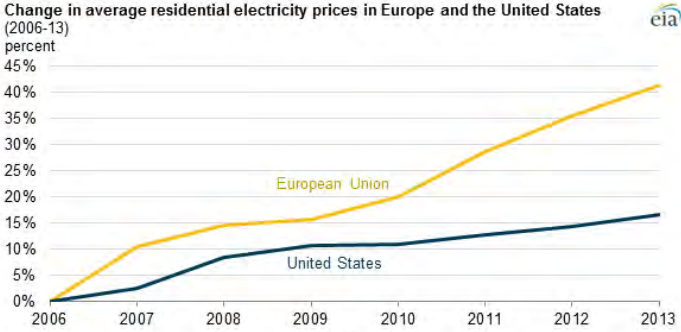
Archive

- 2016
- 2015

NOVEMBER 18, 2014

European residential electricity prices increasing faster than prices in United States

Change in average residential electricity prices in Europe and the United States (2006-13) percent



| Year | European Union (%) | United States (%) |
|------|--------------------|-------------------|
| 2006 | 0 | 0 |
| 2007 | 10 | 5 |
| 2008 | 15 | 10 |
| 2009 | 16 | 11 |
| 2010 | 20 | 12 |
| 2011 | 28 | 13 |
| 2012 | 35 | 14 |
| 2013 | 42 | 17 |

Source: U.S. Energy Information Administration and Eurostat
 Note: European Union average consists of 27 member countries in 2006, 28 member countries for all other years.

European residential electricity prices have historically exceeded U.S. prices, and the gap has widened in recent years. In 2013, average residential electricity rates in European Union (EU) countries were more than double rates in the United States. Regulatory structures—including taxes and other user fees, investment in renewable energy technologies, and the mix and cost of fuels—all influence electricity prices.

Source: US Energy Information Administration
<http://www.eia.gov/todayinenergy/detail.cfm?id=18851>

Ultimately, the electrical power generation system must offer reliability, affordability, and sustainability. Alberta has vast coal and natural gas reserves, and though these are non-renewable resources, Alberta has the special right of provincial ownership, offering unique financial advantage to consumers and local power producers. While considered "non-renewable" we have reserves to last hundreds of years, more than enough time to allow for truly sustainable and economic alternatives to be developed, rather than engaging in a 'rush-to-renewables' which has devastated the economies and grid stability of the UK and EU.

The Alberta Electric System Operator has methodically worked to ensure the power system is reliable, and in concert with power producers and AltaLink, has connected much of the province with appropriate transmission and distribution lines – though some of these are in need of upgrade due to aging or increase energy demands by industry and consumers.

In Alberta, some 75% of the electrical power is used by industry.

Thus, any price increase will substantially affect jobs or productivity. In the event that power prices were to rise too high, it is likely that manufacturers and industry would leave for places offering lower power prices, as has been the case in the UK and EU.

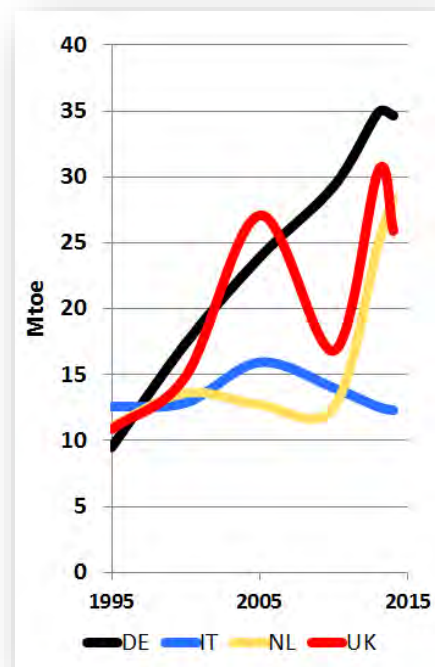
The outcome of such a scenario is that the burden of payment for the newly added renewables with the necessary natural gas plant capacity will fall more heavily on consumers.

In light of the foregoing evidence, consumers are right to be concerned about spiraling power prices – Minister Phillips must provide irrefutable evidence to support her claim that “renewables ... lower prices for consumers.”

And though we are constantly told that Germany and other EU countries have left coal-fired power behind, and renewables have reduced their emissions, recent statistics show CO₂ emissions rise; in some countries coal imports have increased dramatically. Hot on the heels of the Paris COP-21 Agreement, countries continued with business as usual, building and planning some 2,400 coal-fired power plants.⁶⁶



Coal reserves shown in light pink
Source: Coal Association



CO₂ emissions have increased in Germany (DE), Netherlands (NL) and dropped off in Italy (IT) and fluctuated in the United Kingdom (UK).

⁶⁶ <http://instituteeforenergyresearch.org/analysis/coal-will-remain-a-major-global-generating-fuel-particularly-in-china/>

Pembina Institute relies on various computer simulations (models) as a means to calculate the potential costs and benefits. While these include complex levels of mathematical assessments, filled with many assumptions, there are also many areas that are extremely subjective. Furthermore, a computer model can be made to produce any answer its designers/users want, which is why their output never constitutes scientific evidence. To be of any use for analysis or understanding of phenomena, as well as prediction, models must be validated against real world data.

An example from Pembina’s “Costly Diagnosis” report of 2013 is the Illness Cost of Air Pollution (ICAP) document, which, in “Phase II- Estimating Health and Economic Damages – Illness Cost of Air Pollution”⁶⁷ refers to a method of evaluating quality of life:

“For example, a common strategy is to use paired choices. For example, which would you prefer,

- i) *having breathing difficulties on average six times a year and receiving a \$200 income tax rebate or*
- ii) *having breathing difficulties on average eight times a year and receiving a \$300 rebate?” {Footnote 68, section I-3}*

This is an example of the muddled thinking and incorrect theoretical approach used to make poor policy recommendations. Far from basing the health claims on empirical evidence and physical benefits of improved health, this apples-to-oranges survey method conflates health concerns with tax rebates.

Commentators on the influence of foreign foundations on Canadian energy policies, such as Vivian Krause,⁶⁸ will be interested to note that the ICAP model was reportedly funded by the Walter and Gordon Duncan Foundation (page iv Acknowledgements). Ms. Krause has traced an inordinate volume of foreign funds streaming to Canadian environmental groups, apparently following the “Design to Win”⁶⁹ strategy of various climate-obsessed philanthropies, established in ca. 2007 to alter Canadian/global energy policies by funding local Environmental Non-Governmental Organizations (ENGOS) to advocate for policy change in line with the ideologies and investment strategies of these foreign bodies.



⁶⁷ Submitted to the Ontario Medical Association by DDS Management Consultants Inc. July 26, 2000

⁶⁸ http://fairquestions.typepad.com/rethink_campaigns/2011/05/foreign-funding-45-million.html

⁶⁹ http://www.climateworks.org/wp-content/uploads/2015/02/design_to_win_final_8_31_07.pdf

“Design to Win” Page 8:

“... to implement Design to Win’s strategies. We recommend, in the broadest of terms, a three-part menu of investments: 1. Support existing NGOs with deep knowledge of local conditions and needed strategies; cultivate new organizations where necessary.”

Indeed, one of the ClimateWorks philanthropies – the Oak Foundation - funded Pembina Institute to advocate for renewable energy (of which coal phase-out is essential, as renewables cannot meet the low price of coal) and Pembina thanks them for their generous support in “A Costly Diagnosis.” Oak Foundation has an article on its website which states “Oak Foundation has supported the work of many groups in North America and Europe to establish two cap and trade systems, which have seen varying degrees of success.”

The screenshot shows the Oak Foundation website's Grant Database. The header includes the Oak Foundation logo and navigation links: ABOUT US, PROGRAMMES, HOW TO APPLY, SEARCH, and GRANT DATABASE. The main heading is "GRANT DATABASE" with a sub-note: "This database includes all grants beginning in 2005." Below this is a search form with filters for PROGRAMME (set to "- Any -"), YEAR AWARDED (set to "- Any -"), and COUNTRY (empty). The KEYWORDS field contains "Pembina Institute" and a "Search" button. To the right of the search form are two icons: a magnifying glass labeled "Detailed view" and a download arrow labeled "Download result". A callout box highlights the following grant amounts:

- 2005 – USD \$269,971
- 2006- USD \$1,458
- 2007- USD\$479,678
- 2010-USD\$484,106
- 20012 – USD \$404,533

Below the search form is a table of search results:

| Organisation | Programme | Country | Year Awarded | Amount |
|-------------------|-------------|---------------|--------------|-------------|
| Pembina Institute | Environment | Canada | 2012 | USD 404,533 |
| Pembina Institute | Environment | Canada | 2010 | USD 484,106 |
| Pembina Institute | Environment | United States | 2007 | USD 479,678 |
| Pembina Institute | Environment | Canada | 2006 | USD 51,458 |
| Pembina Institute | Environment | Canada | 2005 | USD 269,971 |

http://oakfnd.org/grants?field_programme_value=All&field_year_awarded_value=All&field_country_value=&combine=Pembina+Institute

While it may be that the Oak Foundation,⁷⁰ the Walter and Gordon Duncan Foundation and other philanthropies would like to see Alberta phase out coal, (or be cornered into a cap-and-trade system in order to be able to do business or to incorporate wide-scale industrial wind and solar) they do not reside in Alberta and this interference appears to override the due process of an elected, democratic state and the wishes of the electorate itself.

It is concerning that some of these foundations/organizations have funded groups like the World Resources Institute,⁷¹ which claims on its website to have helped set the Intended Nationally Determined Contributions (INDC) for some **three-quarters** of the world's nations, and that Al Gore's Generation Investment Management offers investors in his projects "Global Collaborations" with **World Resources Institute, Natural Resource Defense Council, The Climate Reality Project, Mistra Institute, and Global Impact Investing Network**. One must question these apparent conflicts of interest. This is leading to a gross handoff of national sovereignty to private foundations and groups with ideological agendas that have no interest in the welfare of ordinary citizens.

This appears to be a rather large network of conflicted industrial interests and ENGOs, all hyping a climate catastrophe when there is an evidence split in the scientific community today over the role of carbon dioxide on climate change, and the ratio of influence of humans versus nature on climate change. One should remember that in parallel to the \$1.5 trillion US climate change "Big Climate" industry, there is an equally powerful multi-billion-dollar international industry of "Big Carbon" trading that has deeply engaged many banks, bond holders and various funds.

⁷⁰ <http://www.cleangroup.org/wp-content/uploads/Clean-Energy-Initiative-July-2003.pdf>

⁷¹ <http://www.climateworks.org/wp-content/uploads/2014/01/ClimateWorks-Annual-Report-2011.pdf>

Aside from this undue influence by foreign parties with apparent vested interests in renewables (wind / solar) there are concerning local conflicts of interests. The Alberta Climate Panel was made up of individuals who all had prior working relationships. Some of the parties were associated with NEI Investments, a group of some 120 institutional and benevolent pension funds, that is an activist investor that also has investments in the ‘big four’ oil sands operators⁷² who received preferential treatment in the climate plan. NEI’s own documents clearly state it found a willing partner in the Alberta government.⁷³ Does the electorate of Alberta find this interference appropriate?



Excerpt of power point explaining to investors how to benefit from the UN Clean Device Mechanism trading on polluting emissions. In this example, the World Bank and an unnamed private fund raised \$1.2 billion in 23 minutes trading Certified Emissions Reductions credits on pollution from a Chinese plant.

IN CONCLUSION

Pembina Institute and its anti-coal allies have made a case for an even more accelerated phase out of coal-fired power plants in Alberta, claiming there would be substantial benefits based on computer modelled results. They advocate for the installation of wind and solar to replace coal-fired power. Of course, wind and solar cannot replace coal-fired energy, and these policies and actions will lead to substantial harm to Albertans, with no discernable benefits.

⁷² <https://www.neiinvestments.com/documents/EngagementDialogues/Suncor%20Energy.pdf>

⁷³ <https://www.neiinvestments.com/documents/Marketing/Transitioning%20to%20a%20Low-carbon%20Energy%20System.pdf>

We have demonstrated the following:

- A rapid phase-out of coal-fired power plants would drop Alberta’s power system capacity to an extreme low, putting Albertans at risk of blackouts and the related economic and health consequences. This evidence is clear from the UK experience.
- Health impact models are not reliable as they must be validated against empirical evidence and actual patient data.
- Actual patient records do not reflect the Pembina Institute’s claims; ground level contaminants are a much greater contributor to poor air quality and to respiratory disease than coal-fired power plants.
- The highest rates of asthma do not correlate to a proximity to coal-fired power plants as evidenced by the rates in the Edmonton Region being some of the lowest in Alberta whilst being downwind of three large power plants. Some of the highest asthma rates are in the Pincher Creek area.
- Alberta and Canada enjoy some of the cleanest air on the planet according to the World Health Organization.⁷⁴
- Industrial emitters appear to be well within emissions standards with few, if any, short-term exceedances.
- The costs associated with coal phase-out are exorbitant and the outcome will not be a substantially ‘cleaner’ air, nor a more reliable or efficient power system.
- Within the urban heat island of Edmonton, where Pembina has pointed out there may be a higher risk to human health, emissions maps show that the same kinds of emissions from coal plants occur within the city itself, some in large quantities. These may be within approved levels, but they cannot be excluded from this conversation.
- Foreign financial forces are interfering in Alberta’s energy policies; at least one group has paid Pembina Institute for some of its work on anti-coal propaganda. These conflicts of interests should be investigated by the appropriate authorities.
- Phasing out coal will have dire consequences for Alberta including energy poverty, job loss and the potential for lack of capacity; and accelerated phase-out would heighten the risk of blackout.⁷⁵

Friends of Science Society holds the view that the sun is the main direct and indirect driver of climate change and that carbon dioxide from human activity is a nominal factor. It is our view that politicians can’t stop climate change.

The world runs on 3 cubic miles of oil equivalent energy every year⁷⁶ – one of those cubic miles (CMO) is oil, 0.8 CMO is coal, 0.6 is natural gas, 0.2 respectively for hydro, nuclear and biomass (wood), and finally wind and solar make up 0.01 CMO of the world’s energy mix. All wind and solar devices are made from oil, natural gas and coal.⁷⁷ Most have an oil

⁷⁴ <http://www.cbc.ca/news/health/canada-s-air-quality-3rd-best-in-world-1.980695>

⁷⁵ https://friendsofscience.org/assets/documents/AB_Climate%20Plan_Economic_Impact_Gregory.pdf

⁷⁶ <http://www.forbes.com/2010/08/09/energy-policy-coal-technology-oil.html>

⁷⁷ <http://spectrum.ieee.org/energy/renewables/to-get-wind-power-you-need-oil>

component (i.e. diesel generator back-up, turbine lubricant,⁷⁸ solar panel automated pivots for large arrays) and large fossil fuel/CO₂ footprints, often fraught with toxic materials that are environmentally damaging.^{79 80}

There is no feasible way to scale up to replace fossil fuels with wind or solar at this time. Alberta should learn from the hard lessons of Germany's costly experiment with wind and solar. In the end, Germany is building some 26 new coal-fired power plants while other industrial, competitive nations world-wide are building more than 1,000 coal-fired power plants,⁸¹ many of them **modern, supercritical coal-fired power-plants like Alberta's newest, which feature high-efficiency and low emissions. In this regard, we established ourselves as world leaders on climate and environment years ago.**

We would be pleased to respond to questions.

FRIENDS OF SCIENCE SOCIETY

⁷⁸ <https://www.mobil.com/industrial/Lubricant-Expertise/Sectors/power-generation-industry-lubricants/wind-energy>

⁷⁹ <https://stopthesethings.com/2014/08/16/how-much-co2-gets-emitted-to-build-a-wind-turbine/>

⁸⁰ <http://spectrum.ieee.org/green-tech/solar/solar-energy-isnt-always-as-green-as-you-think>

⁸¹ <http://instituteeforenergyresearch.org/analysis/coal-will-remain-a-major-global-generating-fuel-particularly-in-china/>

About

Friends of Science is a non-profit organization run by dedicated volunteers comprised mainly of active and retired earth and atmospheric scientists, engineers, and other professionals. We have assembled a Scientific Advisory Network of esteemed climate scientists, economists and policy reviewers from around the world to offer a critical mass of current science on global climate and climate change to policy makers, as well as any other interested parties. We also do extensive literature research on these scientific subjects.

It is our opinion that the sun is the main direct and indirect driver of climate change, not carbon dioxide (CO₂).

Friends of Science Society
P.O. Box 23167, Mission P.O.
Calgary, Alberta
Canada T2S 3B1
Toll-free Telephone: 1-888-789-9597
Web: friendsofscience.org
E-mail: [contact\(at\)friendsofscience\(dot\)org](mailto:contact(at)friendsofscience(dot)org)

