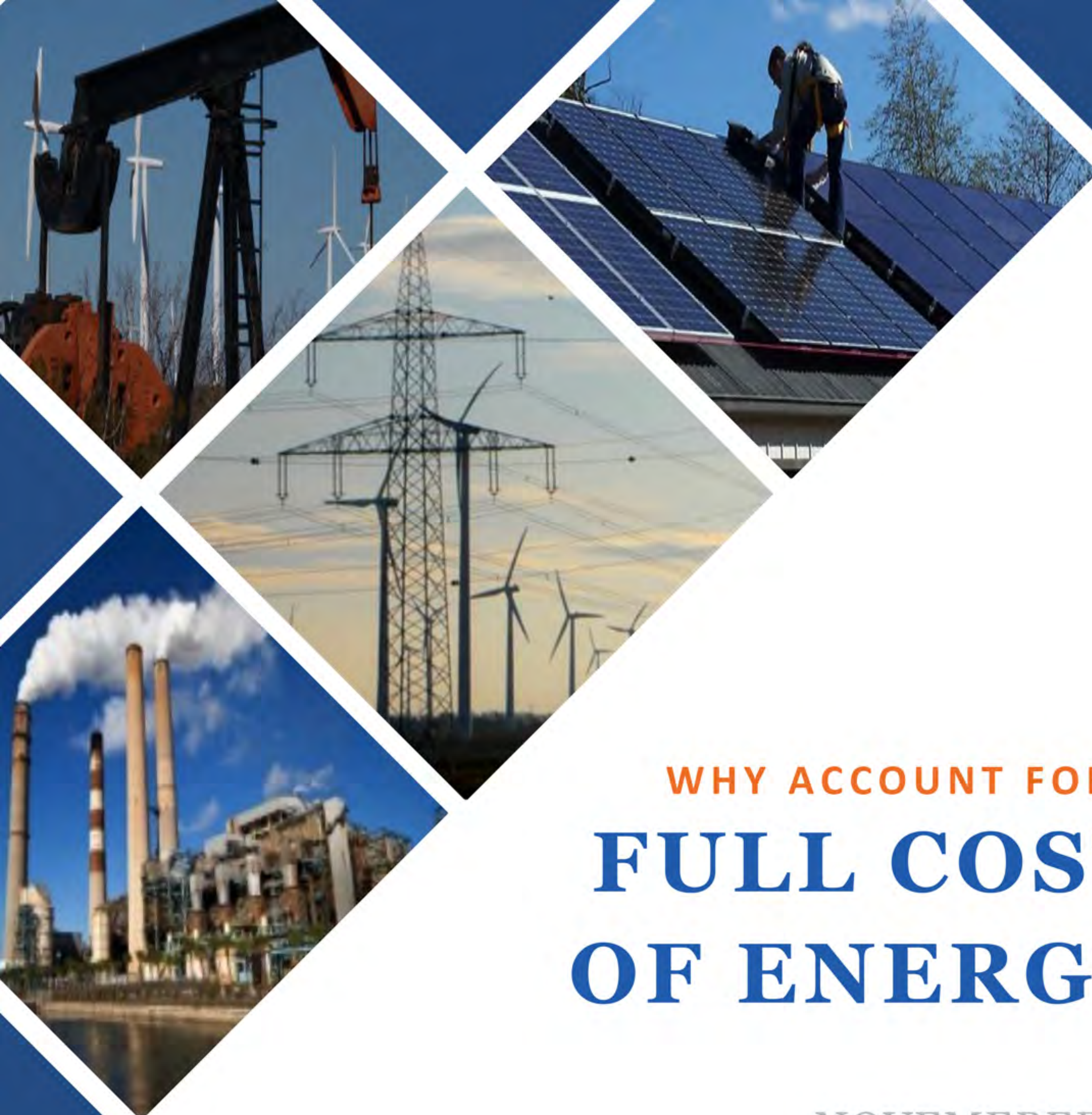


WHY ACCOUNT FOR THE

FULL COSTS OF ENERGY?

NOVEMEBER 2014

Clean Air Partnership

CLEAN AIR COUNCIL

ACKNOWLEDGMENTS

Clean Air Partnership (CAP) would like to thank the members of the Clean Air Council for their financial support, as well as their input, time and thoughtful reflections on this material. CAP would also like to acknowledge the ongoing financial and in-kind support provided by the City of Toronto.

ABOUT THE CLEAN AIR PARTNERSHIP

Clean Air Partnership (CAP) is a registered charity that works in partnership to promote and coordinate actions to improve local air quality and reduce greenhouse gases for healthy communities. Our applied research on municipal policies strives to broaden and improve access to public policy debate on air pollution and climate change issues. Our social marketing programs focus on energy conservation activities that motivate individuals, government, schools, utilities, businesses and communities to take action.

Clean Air Partnership's mission is to transform cities into more sustainable, resilient, and vibrant communities where resources are used efficiently, the air is clean to breathe and greenhouse gas emissions are minimized.

AUTHORS

Roma Malik
Kevin Behan
Gabriella Kalapos

IMAGES

Cover photos courtesy of sxc.hu

FOR MORE INFORMATION, CONTACT

Clean Air Partnership,
75 Elizabeth Street, Toronto, Ontario
M5G 1P4, Canada
416-392-6672
www.cleanairpartnership.org
cap@cleanairpartnership.org

TABLE OF CONTENTS

INTRODUCTION

Energy use is an integral part of our lives. Whether heating our homes in winter, cooling them in the summer, keeping our lights on so that we can read until the wee hours of the night, or powering our factories to manufacture goods; energy drives our economy and greatly supports our quality of life. Unfortunately, energy doesn't come without costs, and often calculating these costs isn't as insignificant or precise as we would like.

Despite the obvious benefits of the energy sources we currently rely on, it is increasingly clear that the costs associated with our current sources extend well beyond what we pay at the gas pump or to utility companies. The true cost of energy includes not only what shows up at the pump or on the utility bill (known as the "private costs"); but also includes the less obvious impacts of energy use on human and environmental well-being, as well as future national security. Economists refer to these additional costs as negative externalities, or "external costs". The challenge, of course, is determining the costs that are associated with these externalities.

In energy markets across the world, market prices for fossil fuels are often lower than prices of energy generated from renewable sources such as solar, wind, and bio-fuels. These market prices, however, do not account for negative externalities. Accounting for externalities can as much as double the cost of some fossil fuels and, in some cases, make them more expensive than renewable sources. Because renewable forms of energy have far lower external costs than energy generated from fossil fuels, the implementation of policies that incorporate externalities into the price of electricity help level the playing field and enhance the capacity of renewables to compete in a fairer market on an economically justified basis.

In addition to the described negative externalities, energy (fossil fuels, nuclear and renewables) has associated subsidies that are provided to energy companies or consumers via direct cash transfers, tax exemptions, rebates, price controls, or trade restrictions that also need to be factored into a more accurate analysis of the true costs of energy.

So how much does a litre of gasoline, a cubic metre of natural gas or a kilowatt of electricity truly cost? Some of the externality costs that are not currently accounted for in the market (private costs) for energy include:

- Environmental impacts of air pollutant emissions and the resulting health care costs and associated public health toll in illness and premature death;
- Carbon dioxide emissions causing climate change;
- Environmental and ecological impacts of fossil fuel spills;
- Nuclear radioactive risk, waste disposal and management;
- Recent water quality concerns about local damages associated with hydraulic fracturing ("fracking"); and
- Redistribution of water supply and ecosystems as a result of the construction of a hydro dam.

Efforts and actions aimed at addressing the environmental, health, and climate-related effects of our current energy sources are often derided as too costly. This is because current energy policy tips the balance in favor of energy sources that appear cheaper because their costs to human health, the environment, the climate, and national security are obscured or indirect. Smart energy policy must take into account the full social cost of energy production. An "apples to apples" comparison of actual costs means various energy sources can be compared, providing more-accurate information for public discourse around energy policy.

Hydroelectric power is the most abundant electricity source in Canada, forming over 63% of all generation. Fossil fuels form 19.3%, followed by nuclear at 15% (Statistics Canada, 2013). In Ontario, there is more reliance on nuclear when compared to the national picture. Ontario's energy sources (as of 2013) are nuclear (58%), hydro (23%), natural gas (11%), wind/solar/biomass (6%) and coal (2%). However the last Ontario coal fired power plant was phased out in 2014, making Ontario the first province or state in North America to successfully phase out burning coal to produce electricity. The inclusion of externality costs (particularly those related to public health care costs associated with air pollution from coal fired power plants) was a key factor in the drive to phase out the use of coal generated electricity.

This paper describes efforts to calculate externality costs and subsidies associated with various energy sources. Keep in mind that unless specifically noted, most costs described in this report do not include long term climate change impact related costs resulting from increased greenhouse gas emissions or necessary infrastructure upgrades due to the changing climate.

PART 1: CALCULATING EXTERNALITY COSTS

The true cost of energy includes not only what shows up at the pump or on the utility bill (known as the "private costs"); but also includes the less obvious impacts of energy use on human and environmental well-being, as well as future national security.

Research to calculate the external costs of energy has been conducted at varying geographic scales across many countries. In Canada, The National Illness Cost of Air Pollution Study (CMA, 2008) sought to quantify the national health and economic impacts of air pollution (almost all of which come from energy production and consumption). This study was commissioned to help policy makers make informed decisions based on both the health impact and the economic costs that air pollution has on Canadians.

The study found that nationally, in 2008, health care costs resulting from exposure to air pollution amounted to $438 million, with 92,000 emergency department visits (39,575 in Ontario alone) and almost 11,000 admissions (4,597 in Ontario alone). 21,000 premature deaths were estimated for 2008; and while most of these deaths were premature due to long-term exposure, over 2,500 were due to short term exposure. Based on emissions trends and demographic projections, by 2031, emergency department visits are expected to rise to 152,000, with a resultant 18,000 admissions. Premature deaths are also predicted to increase by 83% between 2008 and 2031. While the health care costs due to air pollution are high, the total economic costs are an order of greater magnitude.

Total economic costs which include; lost productivity, health care costs, quality of life, and loss of life, are calculated at $8 billion for 2008 and are expected to climb to $250 billion by 2031. The province of Ontario is particularly vulnerable to such costs on account of its ballooning urban centres, aging general population, high local pollution emissions and considerable transboundary pollution from the United States.

1.1 COAL

While the CMA study above looked at the national health and economic impacts of air pollution, a more sectorally and geographically focused study by DSS Management Consultants Inc. and RWDI Air Inc. (2005), examined the total cost of electricity generation over four scenarios in Ontario. It found that the financial costs of Scenario 1 (status quo on coal fired electricity) represented a levelized cost[1] of 3.7 ¢/kWh. However, this cost did not include external costs associated with health and environmental damages. When these costs were added in, the total cost of coal-fired generation rose to 16 ¢/kWh. In total, health and environmental costs accounted for 77% of the total cost of generation. The report found that pollution from coal-powered electricity generators caused damages of $3 billon/year, with 668 premature deaths, 928 hospital admissions, 1,100 emergency room visits and 333,600 minor illnesses. The cost of greenhouse gas control and carbon sequestration caused by these coal-powered plants was estimated at $371 million annually. The inclusion of external environmental and health care costs in the financial production cost benefit analysis helped make the business case for the phase out of coal-fired electricity in Ontario and provides a worthy example of the importance of accounting for externalities.

US National Research Council found that in 2005 the total annual external damages from air pollution created by burning coal at 406 US coal-fired power plants was about $62 billion (averaging an additional 3.2¢/kWh.

A relatively small number of plants (10%) accounted for 43% of the damages.

The US National Research Council (2010) also looked at the external costs of coal fired electricity generation. It found that in 2005 the total annual external damages from sulfur dioxide, nitrogen oxides, and particulate matter created by burning coal at 406 coal-fired power plants was about $62 billion; these non-climate damages average about 3.2 ¢/kWh of energy produced. A relatively small number of plants (10%) accounted for 43% of the damages. The report concludes that climate-related monetary damages can range all the way from 0.1 ¢/kWh to 10 ¢/kWh, depending on which factors are considered. This figure does not include damages from climate change, harm to ecosystems, and risks to national security, which the report examines but does not monetize. Machol and Rizk (2013) attempt to quantify the economic value of health impacts associated with Particulate Matter (PM)(2.5) and its precursors (NO(x) and SO(2)) on a kWh basis. Their research found considerable variance in the economic value of improved human health associated with avoiding emissions from fossil fuel electricity in the United States, ranging from a low of 0.5-1.3 ¢/kWh in California to a high of 41 ¢-$1.01/kWh in Maryland. Nationally, the average cost of health impacts associated with fossil fuel usage is 14 ¢ - 35 ¢/kWh. For coal, associated economic values of health impacts were 19 ¢ - 45 ¢/kWh - a cost that is higher than the typical retail price of electricity, demonstrating the magnitude of the externality.

Epstein et al. (2011) conducted comprehensive full cost life-cycle accounting for coal use, taking into account government coal subsidies;

[1] The levelized cost compares all sources over the same metric and currency, and includes initial capital, discount rate, and costs of continuous operation, fuel, and maintenance

In 2010, a U.S. government working group estimated the global damages associated with the release of a ton of CO2 into the atmosphere, calling their estimate the Social Cost of Carbon (SCC).

The group concluded that the current SCC is roughly $21 per ton of CO2 emissions. To put that number in context, at a cost of $21 per ton, carbon emissions in the United States last year resulted in roughly $120 billion in global damages.

increased illness and mortality due to mining pollution; climate change from greenhouse gas emissions; particulates causing air pollution; loss of biodiversity; cost to taxpayers as a result of environmental monitoring and cleanup; decreased property values; infrastructure damages from mudslides resulting from mountaintop removal; infrastructure damage from mine blasting; impacts of acid rain on account of coal combustion by-products; and water pollution.

The majority of the externality costs come from reductions in air quality, contributions to climate change, and impacts to public health. Most of these externality costs do not apply to renewable energy sources, but apply to fossil fuel use. Epstein et al. found that the total cost of these externalities range from approximately 9 to 27 ¢/kWh of electricity generated, with a median of approximately 18 ¢/kWh. The authors note that this is a conservative estimate, because they have not accounted for every associated impact.

Calculating Social Costs of Carbon

In 2010, a U.S. government working group estimated the global damages associated with the release of a ton of CO_2 into the atmosphere, calling their estimate the Social Cost of Carbon (SCC). The group concluded that the current SCC is roughly $21 per ton of CO_2 emissions. To put that number in context, at a cost of $21 per ton, carbon emissions in the United States last year resulted in roughly $120 billion in global damages. The damages within the United States itself are projected to be smaller, ranging from about 7 to 23 percent of total global damages. Of course, the global and domestic damages apply regardless of where on the planet the emissions occur.

With this SCC estimate, policy-makers now have a bright-line rule to identify effective policies, because they can quantify the benefits of regulations that would reduce carbon emissions. Indeed, the SCC has already become a standard tool in the evaluation of national policy choices. Since the release of the SCC values, the monetized benefits of CO_2 emission reductions have been included in at least seven major regulations (those with costs or benefits above $100 million) across three Unites States federal departments and agencies.

Based on this analysis, the social cost of existing coal plants is more than double the private cost (8.8¢ compared to 3.2¢); and the social cost of new conventional coal plants is roughly 83 percent higher than the private costs (11.5¢ compared to 6.2¢).

National Research Council found that a sample of 498 natural gas fueled plants, which accounted for 71 percent of gas-generated electricity, produced $740 million in total non-climate damages in 2005, an average of 0.16 ¢/kWh.

Estimated climate damages from natural gas were half that of coal, ranging from 0.5 to 5 ¢/kWh.

Potential damages from water pollution due to the fracking of natural gas were not included

The analysis also suggests that the cumulative domestic costs of a cap-and-trade bill would be between $600 billion to $1 trillion through 2050. However, the global cumulative benefits of the emissions reductions produced by enacting a cap-and-trade system would be approximately $1.5 trillion to $1.7 trillion over the same period, indicating that the benefits would have been much larger than the costs (Greenstone and Looney, 2012).

Ackerman and Stanton revisited the assumptions made by the Social Cost of Carbon Working Group in 2011. Their research found four major areas of uncertainty in the Report that affect the government commissioned SCC calculation: the sensitivity of the climate to greenhouse gases; the level of damages expected at low temperatures; the level of damages expected at high temperatures; and the discount rate. The recalculation of the SCC based on combinations of high and low alternatives for each of these factors, yields an array of 16 possible values, both for 2010 and for 2050.

In the worst case scenario, the SCC was found to be $900/ton in 2010, rising to $1,500/ton in 2050. In comparison, the most ambitious scenarios for eliminating carbon dioxide emissions as rapidly as technologically feasible (reaching zero or negative net global emissions by the end of this century) require spending up to $150 to $500 per ton of reductions in carbon dioxide emissions by 2050.

1.2 NATURAL GAS

The National Research Council (2010) notes that burning natural gas generated far less damage than coal, both overall and also per kilowatt-hour of electricity generated. A sample of 498 natural gas fueled plants, which accounted for 71 percent of gas-generated electricity, produced $740 million in total non-climate damages in 2005, an average of 0.16 ¢/kWh. As with coal, there was a vast difference among plants; half the plants account for only 4 percent of the total non-climate damages from air pollution, while 10 percent produce 65 percent of the damages. By 2030, non-climate damages are estimated to fall to 0.11 ¢/kWh. Estimated climate damages from natural gas were half that of coal, ranging from 0.5 to 5 ¢/kWh. However, it must be noted that harm to ecosystems was not evaluated in the report, so potential damages from water pollution due to the fracking of natural gas were not included. Machol and Risk estimate the associated economic values of health impacts of natural gas-powered generation at 1 - 2 ¢/kWh. Burtraw and Krupnick (2012) estimate the median externality cost of gas-powered generation at 3.5 ¢/kWh.

1.3 NUCLEAR

In Canada, the 1974 Nuclear Liability Act indemnifies nuclear vendors, suppliers and operators from paying for the full clean up costs and compensation in the event of an accident or terrorist incident, meaning costs of a nuclear accident would be ultimately borne by tax payers.

Nuclear power does not generate pollution and greenhouse gas emissions the way coal, oil or natural gas do. However, the byproduct of nuclear power generation is radioactive waste, for which there are no acceptable disposal methods. Nuclear waste has a half life of 25,000 years and remains hazardous for 250,000 years. Waste management is the primary environmental externality associated with nuclear power generation. In the event of a nuclear accident, environmental external costs grow rapidly. Following the 2011 Fukishima Daiichi nuclear disaster, the Japan Center for Economic Research estimated that the costs of the accident could range from nearly $71 to $250 billion dollars ($54 billion to buy land within 20 km of the plant, $8 billion for compensation payments to local residents, and $9 to $188 billion to scrap the plant's reactors). In Canada, the 1974 Nuclear Liability Act indemnifies nuclear vendors, suppliers and operators from paying for the full clean up costs and compensation in the event of an accident or terrorist incident, meaning costs of a nuclear accident would be ultimately borne by tax payers.

While uncommon in Canada, nuclear accidents are not unheard of. For example, Pickering reactor #4 had a heavy water leak in April 1996 that released radioactive tritium into Lake Ontario, contaminating drinking water supplies for local communities. An additional consideration when examining potential environmental and health consequences of nuclear power is that the energy required to mine uranium is considerable. This mining is in itself a significant greenhouse gas emissions source. In 2009, 20% of the planet's uranium mining took place in Canada, all within Saskatchewan, presenting a local problem that cannot be ignored. The mining and milling of uranium uses energy intensive machinery and excavating equipment, resulting in the release of carbon. Where approximately 75% of the CO_2 emissions in the nuclear fuel cycle happen at the point of enrichment, the other 25% is at the point of extraction. Additionally, methane emissions at mine sites are considerable (Taylor, 1997).

1.4 MOTOR VEHICLE FUELS

Transportation, which today relies almost exclusively on oil, accounts for nearly 30% of Canadian energy demand. 55% of this is for passenger movement, 41% for freight and 4% off-road. The figures for the US are identical. In the US in 2005, motor vehicles produced $56 billion in health and other non-climate related damages. In order to calculate the total costs associated with a variety of vehicle types and fuels, one would

Transport Canada (2008) estimated the total cost of transportation to be between $198 billion and $233 billion.

This range includes infrastructure costs ($43-55 billion), vehicle assets, operation ($145-153 billion) and social costs ($14.4 -39.5 billion).

need to consider their full life cycles; from extracting and transporting the fuel all the way to manufacturing and operating the vehicle. In most cases, operating the vehicle accounted for less than one-third of the quantifiable non-climate damages.

Damages per vehicle mile traveled were remarkably similar among various combinations of fuels and technologies (the range was 1.2 ¢ to about 1.7 ¢ per mile traveled), however the report notes that it is important to be cautious in interpreting small differences. Non-climate related damages for corn grain ethanol were similar to or slightly worse than gasoline because of the energy needed to produce the corn and convert it to fuel. In contrast, ethanol made from herbaceous plants or corn stover (which is not yet commercially available) had lower damages than most other options.

Electric vehicles and grid-dependent (plug-in) hybrid vehicles showed somewhat varied non-climate damages. Operating these vehicles on the battery produces few or no emissions, but producing the electricity to power them in many locations currently relies heavily on fossil fuels; also, energy used in creating the battery and electric motor adds up to 20 percent to the manufacturing part of life-cycle damages.

Both for 2005 and 2030, vehicles using gasoline made from oil extracted from tar sands and those using diesel derived from the Fischer-Tropsch process (which converts coal, methane, or biomass to liquid fuel) had the highest life-cycle greenhouse gas emissions. Vehicles using ethanol made from corn stover or herbaceous feedstock such as switchgrass had some of the lowest greenhouse gas emissions, as did those powered by compressed natural gas.

Providing more local context, Transport Canada (2008) conducted a full cost investigation of transportation in Canada. For the study year (2000), they estimated the total cost of transportation to be between $198 billion and $233 billion. This range includes infrastructure costs ($43-55 billion), vehicle assets, operation ($145-153 billion) and social costs ($14.4 -39.5 billion). In terms of relative importance, the five largest social costs were; accidents, air pollution, congestion, GHG emissions and noise.

1.5 COST COMPARISONS

The US Energy Information Administration provides a comparison of levelized costs for different power generation sources. The levelized cost represents the present value of the total cost of building and operating a generating plant over a period of time, and reflects overnight capital costs, fuel costs, operation and maintenance costs, financing costs, and an assumed utilization rate for each plant type (see Table 1).

TABLE 1: Levelized Cost & Externality of New Generation Resources, 2010

Generation type	Levalized average cost (2009 ¢/kwh)	Average externality costs (2009 ¢/kwh)	Total costs
Conventional coal	9.48	8.54	18.02
Natural gas (conventional combustion turbine)	12.45	3.51	15.96
Nuclear	11.39	1.08	12.47
Hydro	8.64	0.43	9.07
Solar	21.07	1.02	22.09
Wind (onshore)	9.7	0.43	10.13
Biomass	11.25	3.59	14.84

Source: Energy Information Administration, Annual Energy Outlook 2011, December 2010, DOE/EIA-0383(2010)

Burtraw and Krupnick's 2012 paper *The True Cost of Electrical Power* was created to assist decision-making and public policy by providing a more accurate assessment of the total costs associated with electricity generation methods. The report lists the estimates from four different cost studies listing externality costs of nine sources of electricity generation. The calculated median externality costs are assessed in Table 2 below.

Bringing levelized and externality costs together provides a more accurate reflection of the true costs of energy and show that there is less of a price differential between renewable and non renewable energy generation. It should also be highlighted that the above costs do not consider carbon costs, climate change impacts nor decommissioning and waste disposal costs. If those costs were also brought into consideration then the economic case for electricity from renewable sources would be even stronger.

In their Renewable is Doable report, The PEMBINA Institute and Greenpeace demonstrate that building a new nuclear plant will cost ratepayers 12-48% more than delivering that same amount of power using a mix of renewable and more efficient options. The report notes that beyond a short-term increase in jobs to build reactors, a green energy portfolio would create an additional 27,000 new, long-term jobs in Ontario.

Bringing levelized and externality costs together provides a more accurate reflection of the true costs of energy and shows that there is less of a price differential between renewable and non renewable energy generation.

A subsidy is usually defined as financial assistance granted by a government to an enterprise regarded as being in the public interest.

In 2009 G-20's members made a commitment to "rationalize and phase-out, over the medium term, inefficient fossil fuel subsidies that lead to wasteful consumption"

PART 2: CALCULATING SUBSIDY COSTS

A subsidy is usually defined as financial assistance granted by a government to an enterprise regarded as being in the public interest. Energy subsidies are provided by the government in order to lower the cost of energy production; raise the price received by energy producers; or lower the price paid by energy consumers.

Subsidies can be provided in the following way:

Direct Expenditures are often provided as direct payments or via programs to support activities that provide a financial benefit to producers or consumers of energy, for example; support for Research &Development in areas such as increasing energy supply, transmission, and energy efficiency.

Tax Expenditures are usually tax credits against a taxed amount due, or deductions against income prior to calculating the tax due. Tax expenditures result in lower taxes collected, so that they correspond to outlays from the government.

Loans and Loan Guarantees provide government support for loans taken out by energy companies to pursue furthering energy supply and other designated technologies and undertakings.

2.1 TO SUBSIDIZE, OR NOT TO SUBSIDIZE, THAT IS THE QUESTION!

Governments have long been investing in the energy sector in the form of subsidies. In the United States some form of federal subsidy for oil production has been in place since 1914 and most fossil fuel subsidies are permanent policy. Despite that, there is still debate regarding whether financing renewable energy is necessary or beneficial to society. On one hand there is the idea that the energy market should be allowed to operate freely, and the government should not pick winners and losers. It has also been noted that the market cannot accurately determine energy prices unless the externalities are accounted for. Others state that incentives are needed to bring renewable energy technologies to commercial scale, so they can compete with entrenched fossil fuel sources. Clean-energy advocates also point out that fossil fuel industries continue to enjoy high subsidies from governments.

Since 2009 there have been increasing calls from ever-wider sectors of society for the repealing of fossil fuel subsidies in order to level the playing field between fossil fuels and alternative sources. At a minimum, there has been a call for greater transparency regarding the subsidies that do exist.

The level of political and academic attention given to fossil-fuel subsidy reform – the removal or rationalization of subsidies – has increased dramatically since the G-20's members made their commitment to "rationalize and phase-out, over the medium term, inefficient fossil fuel subsidies that lead to wasteful consumption" at their Leader's Summit in Pittsburg, US in September of 2009. Since 2009 there have been increasing calls from ever-wider sectors of society for the repealing of fossil fuel subsidies in order to level the playing field between fossil fuels and alternative sources. At a minimum, there has been a call for greater transparency regarding the subsidies that do exist. Analytic work since the G-20 phase out commitment exposed a vast deficit in the information needed for an informed public debate on the scope, magnitude and impact of global fossil-fuel subsidies to take place. Despite these informational gaps, however, transparent information is essential for the costs and benefits of subsidy reform to be appropriately vetted and to more rigorously assess whether subsidies to fossil-fuel production represent an effective use of limited available public expenditure.

What is the purpose of a subsidy? The purpose of a subsidy is often justified as a mechanism that aims to stimulate action (usually towards the public good) that would not have otherwise been undertaken. Ideally a subsidy should be able to answer four questions:

1. What is the cost of this subsidy?
2. What is the purpose of this subsidy?
3. Is it working as intended?
4. What is the projected impact from eliminating it?

2.2 FOSSIL FUEL SUBSIDIES IN CANADA

Yves Cochet, Member of the European Parliament, and Elise Buckle, European Parliament produced a detailed report examining fossil fuel subsidies in 24 OECD nations, including Canada. They note that the federal and provincial governments (combined) could save over $2 billion annually by phasing out support mechanisms to the production and consumption of fossil fuels in Canada. Support for production and exploration was the most significant source of subsidy, including (2010 dollars):

- Energy Industry Drilling Stimulus for oil in Alberta ($386M) ;

- Energy Industry Drilling Stimulus for natural gas in Alberta ($346M) ;
- Accelerated Capital Cost Allowance for oil ($300M) ;
- Alberta Crown Royalty Reductions for oil in Alberta ($182M) ;
- Alberta Crown Royalty Reductions for natural gas in Alberta ($164M) ;
- Flow through Share Deductions for oil ($125 M) ;
- Flow through Share Deductions for natural gas ($112M).

EnviroEconomics Inc et al. (2010) estimates that Canadian federal and provincial governments are providing a combined $2.8 billion in subsidies to the oil sectors in Alberta, Saskatchewan, Newfoundland and Labrador.

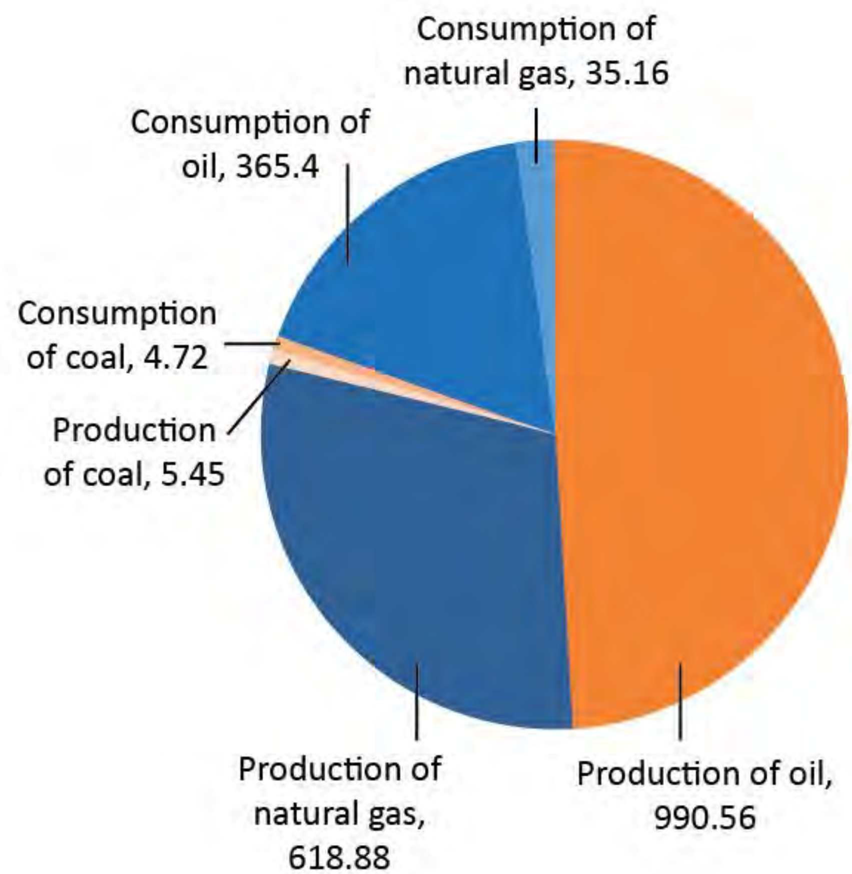


FIGURE 1: Displays both production and consumption subsidies to fossil fuels in Canada for the year 2010.

EnviroEconomics Inc et al. (2010) note that in Canada the most significant subsidies quantified are in Alberta, Saskatchewan, Newfoundland and Labrador. This study, which focuses on these three provinces, estimates that Canadian federal and provincial governments are providing a combined $2.8 billion in subsidies to the oil sectors in Alberta, Saskatchewan, Newfoundland and Labrador. These jurisdictions contribute approximately 97% of the oil production in Canada, and in this study 63 specific subsidies were identified for the oil industry in these three jurisdictions. Of the $2.8 billion, 49% is from federal subsidies ($1.38 billion) and Alberta specifically receives the majority of federal and provincial subsidies (73%).

Within Newfoundland and Labrador tax expenditures are favored; while in Saskatchewan royalty relief or reduction in other taxes are favored; and in Alberta royalty relief and tax breaks are the most common. The study stated that the "average subsidy level to produce new wells was found to be $139,000 per well or $143 per m^3 produced". This subsidy level represents approximately 27 per cent of the estimated future value of production from these wells, although the full tax implications of these subsidies were not estimated. Subsidies provided for production in Saskatchewan were found to be much smaller and estimated to be only $0.22 per m^3 produced. The study also calculated the economic activity and emissions implications of the subsidies at a national and regional level of oil production.

Credit: Edward McGowan

International Institute for Sustainable Development (2010) states that subsidies encourage "excessive energy consumption, artificially promoting capital-intensive industries, reducing incentives for investment in renewable energy, and accelerate the depletion of natural resources"; and that by removing these subsidies there could be up to a 13% decline in CO2 emissions, and a spillover effect on reducing energy demand globally.

Key findings from this research suggest that the current subsidies have only a slight positive impact on economic activity; that subsidies to the oil sector are increasing the level of production (especially for tar sands); and that the employment benefit of the subsidies is questionable.

The International Institute for Sustainable Development (2010) found that in Alberta, Saskatchewan, Newfoundland and Labrador, for the year 2008, an estimated $2.8 billion (in Canadian dollars) in subsidies were provided to the oil industry in the three provinces considered, approximately $2 billion of which were for exploration and development through a mix of tax breaks and royalty reductions. The remaining $800 million in annual subsidies are provided for operational activities ($424 million) and research and technology (approximately $377 million) including approximately $200 million provided in direct funding for carbon capture and storage projects. Of the total $2.8 billion in annual subsidies in the three provinces, the largest proportion is provided by the federal government ($1.38 billion in 2008) and the government of Alberta ($1.05 billion), while Saskatchewan provides $327 million and the government of Newfoundland and Labrador provides $83 million each year.

The report concludes that though subsidies are intended to protect consumers, they aggravate the fiscal imbalance, and depress private investment in the energy sector. Moreover, subsidies encourage "excessive energy consumption, artificially promoting capital-intensive industries, reducing incentives for investment in renewable energy, and accelerating the depletion of natural resources". The article states that by removing these subsidies there could be up to a 13% decline in CO2

Research comparing the amount of revenue collected from oil and gas developments in Canada with that collected in Alaska and Norway revealed that, relative to these international benchmarks, companies extracting Canada's oil and gas are receiving an implicit subsidy in the form of excessive profits that governments are failing to capture through taxes, royalties and other revenue generating policy options.

emissions, and could result in a spillover effect on reducing energy demand globally. "Energy subsidies have important distributive consequences" as the majority of energy subsidies benefit higher income households.

The Pembina Institute (2005) observed that in the late 1980s and early 1990s, the federal government was a significant supporter of energy megaprojects. This included, for example, the Hibernia Development Project and heavy oil upgraders. Since 1995, federal spending on non-renewable energy resources has been significantly reduced. While it is true, then, that current subsidies are lower than in the past, they are still substantial. Concurrently, government expenditure on the oil and gas sector including tax, program and direct expenditure totaled almost $1.1 billion (2000$) in 1996 and $1.4 billion (2000$) in 2002 (the increase in expenditure over this time period was 33%) and almost $1.2 billion from 1996 to 2002 to the oil sands alone.

Total expenditure from 1996 to 2002, inclusive, was equal to $8.3 billion (2000 CDN $). The vast majority of the expenditure is associated with tax initiatives and in particular, the Canadian Development Expense, the Canadian Exploration Expense, the Resource Allowance and the Accelerated Capital Cost Allowance for oil sands.

Other research has demonstrated relatively low taxation levels for the oil and gas sector, high tax concessions for oil sands and relatively high profits of oil and gas companies. In addition, previous research comparing the amount of revenue collected from oil and gas developments in Canada with that collected in Alaska and Norway revealed that, relative to these international benchmarks, companies extracting Canada's oil and gas are receiving an implicit subsidy in the form of excessive profits that governments are failing to capture through taxes, royalties and other revenue generating policy options.

2.3 NUCLEAR SUBSIDIES IN CANADA

The David Suzuki Foundation (2013) notes that while nuclear power is experiencing a revival due to growing concerns about climate change, nuclear power is neither an environmentally nor a financially viable option. Nuclear waste issues previously mentioned render it non-environmentally friendly. Moreover numerous financial issues often render it financially unviable.

Between 1956 and 2000, Atomic Energy of Canada Limited received $16.6 billion in subsidies. Although heavily subsidized, nuclear power is

still considerably more expensive than both fossil and renewable alternatives. The David Suzuki Foundation notes that the last reactors built in Canada cost $4,000 per kilowatt. Compared to current prices for large-scale wind power and natural gas plants, currently at $1,200 and $1,000 per kilowatt respectively, it is clear that nuclear is not a competitive financial option.

High as these figures for nuclear are, they are exclusive of societal and environmental costs; including costs of accidents, clean up, waste disposal or plant decommissioning.

And nuclear plants are not only expensive; they're also financially risky because of their long lead times, huge cost overruns and open-ended liabilities.

The average cost overrun on nuclear power plant construction is 2.5 times the budgeted amount. The last plant constructed in Ontario, Darlington, was budgeted at $3.4 billion but ended up costing $15 billion when it was finally completed in the mid-1980s.

The average cost overrun on nuclear power plant construction is 2.5 times the budgeted amount. The last plant constructed in Ontario, Darlington, was budgeted at $3.4 billion but ended up costing $15 billion when it was finally completed in the mid-1980s.

A Queen's University study found that the liability cap alone is worth $33 million per nuclear plant, per year to nuclear operators in the United States (where the cap is less generous than it is in Ontario).

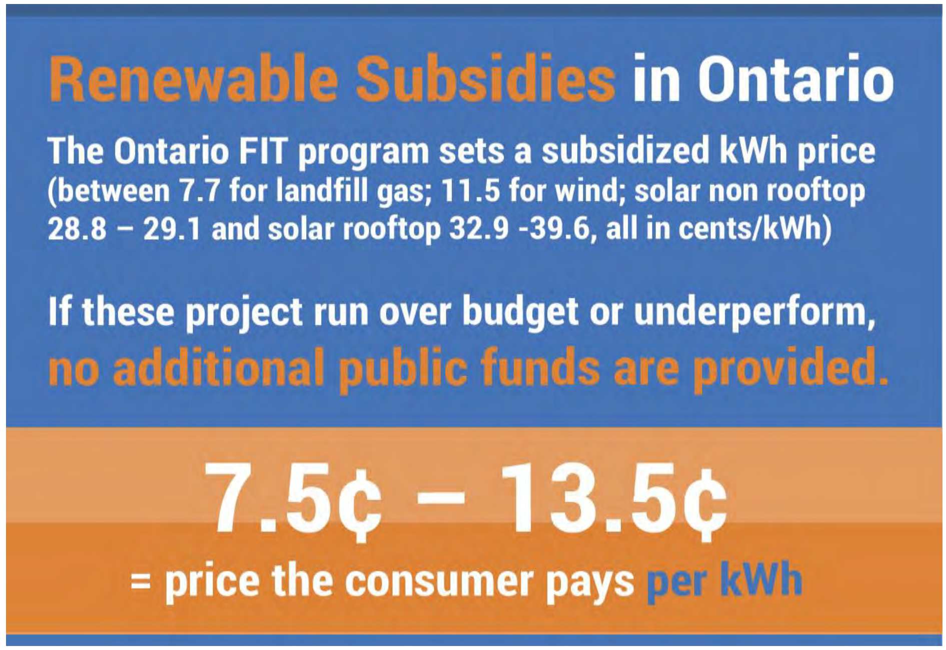
Nuclear subsidies and cost overruns are not unique to the Canadian nuclear industry. In the United Kingdom, the (now named) Department of Energy and Climate Change issued $14.07bn in grants to the UK Atomic Energy Authority over the period 1980-2005 to cover nuclear liabilities, decommissioning of facilities and for research funding (UK House of Commons Library, 2013).

Incorporating costs for nuclear waste disposal, the 2002 white paper 'Managing the Nuclear Legacy. A strategy for Action,' estimated the UK's civil nuclear liabilities at $77.65bn (47% for waste disposal, 43% for decommissioning, 10% for ongoing management and maintenance).

2.3 RENEWABLE SUBSIDIES IN CANADA

Like the fossil fuel and nuclear sectors, renewable energy providers are also subsidized in Canada. However, there is much hyperbole and confusion around the nature of the subsidies and what it means for taxpayers. Renewables are subsidized through the provision of enticing energy prices. Other generation types are subsidized through the provision of funds for capital infrastructure investments.

In Ontario, the FIT program does not use tax dollars to subsidize projects. Instead, the Ontario Power Authority set a kWh price designed to entice private investment to build renewable projects. If these projects run over budget, funds must be raised privately and there is no run on tax dollars, unlike the construction of nuclear plants for example, where cost overruns are ultimately borne by the tax payer.



As part of the 2010 Ontario Green Energy and Economy Act, Samsung will receive a $110 million subsidy over ten years. As part of this subsidy, factories will be built to manufacture solar panels, invertors, wind turbine towers and blades, creating 16,000 jobs. It is often reported that the Samsung deal will cost Ontario $7 billion, when in fact this is the amount to be privately invested by Samsung in the Province.

PART 3: CONCLUSION

By accounting for the full social and environmental costs of energy, and identifying the numerous subsidies available to different energy providers, we get a clearer picture of the true costs of energy. This allows for a more meaningful comparison of options. It also sets the stage for a discussion around energy subsidy reform.

For too long, the price paid to the utility company, or at the gas pump has been the sole comparator in the eyes of consumers. By providing the total cost of energy, suddenly the phase out of coal and the future phase out of nuclear power become less daunting, and more attainable. By demonstrating how exponentially more tax dollars are funneled to support nuclear and fossil fuel projects compared to renewable projects, again, we see how the scales have been manipulated to complicate direct comparisons of energy types.

By making renewable energy sources more attainable, we not only reduce potential social and environmental costs, we also invest in a more secure, robust, nimble, independent, decentralized energy sources for future generations. Nuclear megaprojects are the antithesis of such projects. There is limited space on the electricity grid. If large capacity nuclear power stations continue to be planned and built, there will be limited capacity for green energy to tap into the grid. As our long-term energy plans are currently being decided, the time to act is now. In doing so, we can ensure all the necessary information on total costs are factored into energy decision making and that the choices made by the public and governments are the most cost efficient and rational options available to present and future generations of Canadians.

APPENDIX: REFERENCES

Statistics Canada, Table 127-0002 - Electric power generation, by class of electricity producer, monthly (megawatt hour), Ottawa: Statistics Canada, retrieved 2013-01-04

Canadian Medical Association. No Breathing Room: National Illness Cost of Air Pollution. 2008
National Research Council. Hidden Costs of Energy. Unpriced Consequences of Energy Production, National Academy of Sciences. 2010. Pp.506

Cost Benefit Analysis: Replacing Ontario's Coal Fired Electricity Generation. DSS Management Consultants Inc. RWDI Air Inc. April 2005, pp. 93

Sarah Rizk and Ben Machol. Clean Energy and Climate Change Office, U.S. EPA Region 9, in San Francisco. December 2012
Michael Greenstone and Adam Looney, MIT Center for Energy and Environmental Policy Research. Paying Too Much for Energy? The True Costs of Our Energy Choices. February 2012. pp.34

Epstein, P.R, et al. Full Cost Accounting for the Life Cycle of Coal. Annals of the New York Academy of Sciences. 2011
Dallas Burtraw and Alan Krupnick. Center for Energy Economics and Policy, Resources for the Future. The True Cost of Electrical Power. June 2012. pp.48

Frank Ackerman and Elizabeth A. Stanton. Partnership between Stockholm Environment Institute; U.S. Center at Tufts University and Economics for Equity and Environment (E3). Climate Risks and Carbon Prices: Revising the Social Costs of Carbon. July 2011. pp20

Dave Sawyer and Seton Stiebert from EnviroEconomics Inc. Fossil Fuels- At What Cost? Government support for upstream oil activities in three Canadian provinces: Alberta, Saskatchewan, and Newfoundland and Labrador, Global Subsidies Initiative (GSI) of the International Institute for Sustainable Development (IISD). November 2010. Pp.142

International Institute for Sustainable Development – Global Subsidies Initiative. Tax and royalty-related subsidies to oil extraction from high-cost fields: A study of Brazil, Canada, Mexico, United Kingdom and the United States. November 2010

Elise Buckle. International Institute for Sustainable Development – Global Subsidies Initiative. Fossil fuel subsidies and government support in 24 OECD countries: Summary for Decision- Makers. May 2012.

NRDC and Oil Change International, Fuel Facts, Governments Should Phase Out Fossil Fuel Subsidies or Risk Lower Economic Growth, Delayed Investment in Clean Energy and Unnecessary Climate Change Pollution

International Monetary Fund, Energy Subsidy Reform: Lessons and Implications (Executive Summary). January 28th, 2013. pp 68
Michael Greenstone and Adam Looney, MIT Center for Energy and Environmental Policy Research Paying Too Much for Energy? The True Costs of Our Energy Choices, February 2012 pp.34

Amy Taylor, Matthew Bramley and Mark Winfield. The Pembina Institute. Government Spending on Canada's Oil and Gas Industry. January 2005 pp. 57

Taylor, Martin. Greenhouse gases and the nuclear fuel cycle: What emissions? IAEA Bulletin 19/2/1997, 1997.
UK Department of Trade and Industry, The Nuclear Legacy. A strategy for action, DTI 2002. Cm 5552