

Phasing-Out Coal-Fired Electricity in Ontario

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January 2021

Introduction

The phase-out of coal-fired electricity production in the Canadian Province of Ontario has been widely described as one of the most significant measures taken by any government in the world to reduce greenhouse gas (GHG) emissions (Petra van, 2017). The phase-out of coal, which in the early 2000s constituted a quarter of the province's electricity supply, was completed in 2014. The phase-out has been associated with dramatic improvements in air quality in southern part of province. As such, it is regarded as a core environmental legacy of the 2003-2018 Liberal governments of Premiers Dalton McGuinty and Kathleen Wynne.

As shown in **Table 1**, the phase out was an undeniable success in terms of emissions of GHGs, smog and acid rain precursors, and heavy metals, like mercury. These reductions in emissions translated into direct positive impacts on air quality in Ontario. In 2001, the province issued seven smog advisories covering 23 days, the most on record at that time. 2005 was the worst year, with 15 advisories covering 53 days. The number of advisories dropped to virtually zero from 2013 onwards (Ontario n.d.), coinciding with the closure of the coal plants.

Table 1: Electricity sector emissions reductions in Ontario (Ontario nd.)

POLLUTANTS	2005	DECREASE	2015 (EST.)
GHG (MT)	32.9	87%	4.25
NOX (KT)	48.1	86%	6.8
SOX (KT)	114.3	99.6%	0.4
HG (KG)	326	100%	0.0

The Ontario coal-phase-out had national impacts as well. In 2012 the Stephen Harper's Conservative federal government adopted a regulation establishing a national

phase-out of conventional coal-fired electricity generation, although with an effective date in the mid-2040s (Government of Canada 2012). The phase-out date, principally affecting Alberta, Nova Scotia and Saskatchewan, was subsequently advanced to 2030 by the Trudeau government (ECCC 2018). Coal phase-outs are central features of the 2016 Pan-Canadian Framework for Clean Growth and Climate Change (PCF), and provincial climate change plans.

At the same time, Ontario's approach to the phase-out did involve a series of significant environmental, economic and political trade-offs, the benefits of which continue to be debated, and whose consequences have affected the province's politics profoundly. With respect to the environment, although energy conservation and an expansion of renewable energy played significant roles in the phase-out, the process also involved a major recommitment to nuclear energy, and a significant expansion of natural gas-fired generation. Both technologies are associated with very substantial environmental impacts of their own. The economic costs of the phase-out, in the context of the overall reconstruction of the province's electricity system, and their impacts on electricity prices, remain a central controversy in Ontario politics. The phase-out was also embedded within a deepening explicit politization of decision-making around the province's electricity system. Within McConnell's (2010) framework for assessing policy outcomes around programmatic results, policy processes and politics, elements of the coal-phase out process range from a resilient and political success in terms of the phase-out itself, to a "Political Failure" with respect to the McGuinty and Wynne governments' overall handling of the electricity file.

The Ontario case is also a striking illustration of the potential impacts of "policy entrepreneurship" on the part of non-governmental organizations. It is doubtful whether the Ontario and subsequent national phase-outs would have occurred without the work of the Ontario Clean Air Alliance, and the coalition of health professions, municipal governments, unions and other NGOs assembled by the alliance.

The following chapter provides a brief history the Ontario coal phase-out, beginning with acid rain control efforts in the 1970s and 1980s, through to its completion in 2014. This is followed by a discussion of the landscape, institutional and policy factors that

contributed to the feasibility of a phase-out in the province. Finally, the chapter assesses the outcomes of the coal phase-out in terms of its programmatic environmental and economic impacts, policy resiliency and wider policy effects. The influence of the phase-out on the policy-making process and broader political dynamics within the province are evaluated as well.

The Coal Phase-Out: A History

The Role of Coal-Fired Electricity in Ontario

As shown in **Table 2**, Ontario constructed six coal-fired electricity plants between the early 1950s and mid-1980s. Up to the 1950s the province's electricity system had been almost entirely hydro-electric. However the dramatic post-war growth in electricity demand outstripped the province's the supply of readily developable hydro sites. The coal-fired plants were constructed to bridge supply until the province's planned nuclear energy program could be realized. That process that would stretch from the 1960s to the mid-1990s (Freeman,1996). Even then the coal-fired plants provided back-up supply for periods of high electricity demand.

Table 2: Ontario's Coal-Fired Electricity Plants

NAME AND LOCATION	COMMISSIONED	CAPACITY	FATE
HEARN (TORONTO)	1951	1200MW	Shutdown 1983, abandoned.
LAKEVIEW (MISSISSAUGA)	1962	2400MW	Shutdown 2005, demolished.
THUNDER BAY	1963	306MW	Converted to biomass 2015, shutdown 2018.
LAMBTON (SARNIA)	1969	1980MW	Shutdown 2013, demolished.
NANTICOKE	1972-78	3964MW	Shutdown 2013, demolished

ATIKOKAN	1985	211MW	Converted to biomass, 2014.
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The Beginnings: Acid Rain Control

While the Ontario coal phase-out is generally viewed as a response to issues related to climate change and air quality, environmental questions about role of coal-fired electricity in the province first arose around an earlier issue – acid rain. A complex process of domestic and international advocacy through the 1970s and early 1980s culminated with the imposition in 1986, by the newly elected Liberal minority government led by David Peterson, of special regulations on the four largest sources of acid rain-causing emissions in the province. Under the program, known as Countdown Acid Rain, Inco, Ontario Hydro, Falconbridge Ltd. and the Algoma Steel Co. Ltd., were required to reduce their total sulphur dioxide emissions from the 1980 level of 1,772,000 tonnes per year to 795,000 tonnes by 1995. Ontario Hydro, for its part, planned to meet its 1995 target of 175,000 tonnes per year largely by mothballing its coal-fired generating facilities as new nuclear plants, particularly the Darlington facility east of Toronto, came into service (Winfield, 2012). The coal-fired plants would, however, be held in reserve.

Coal and the “Common Sense Revolution.”

The arrival of a Progressive Conservative government lead by Mike Harris in 1995 would have major, if initially unexpected, implications for the fate of Ontario Hydro’s coal-fired plants.

The new government’s “Common Sense Revolution” (CSR) platform had said little about electricity issues, other than to promise a five year freeze on hydro rates. In practice, the government embarked on what would be the most extensive restructuring of the electricity sector in Ontario since the creation of the Ontario Hydro Electric Commission in 1906. Strongly influenced by developments in the United Kingdom and at the state and federal levels the United States, the government moved to abandon Ontario Hydro’s near monopoly on electricity system planning and control of major generating assets and to embrace a ‘market’ model for the system. Under that model

the role of utilities in long-term planning for electricity supply would be removed. Rather investors would make decisions about where and when electricity generating facilities should be built, on the basis of their assessments of the potential market for the power they would produce (Deweese 2005).

As part of the process Ontario Hydro was divided into five separate entities: Ontario Power Generation (OPG), which would own the utility's generating assets (including the coal-fired plants); Ontario Services Corporation (later named Hydro One) to operate the transmission infrastructure; an Independent Market Operator (IMO) to operate and administer a wholesale electricity market; the Ontario Hydro Financial Corporation, which assumed responsibility for the \$20 billion of Ontario Hydro's \$38 billion debt which was 'stranded' as a result of the utility's break-up; and the Electrical Safety Authority (ESA), which was to assume Ontario Hydro's regulatory functions with respect to electrical safety. All of the successor entities, except for the ESA, would continue, like Ontario Hydro, to be owned by the province. One of the major themes of the government's direction was to reduce Ontario Hydro's dominant position in the system, from ownership of 85 per cent of generating assets to 35 per cent of those assets by 2010 (Winfield 2012 102-103).

New problems emerged at Ontario Hydro even as the government was moving towards its dissolution. In July 1997 an external review raised major concerns regarding the maintenance and safety of Ontario's nuclear power plants (Ontario Hydro 1997). In response, Ontario Hydro adopted a Nuclear Asset Optimization Plan (NAOP). Under the plan, seven of the utility's nineteen operating power reactors¹ were taken out of service for repair and overhaul. Although not immediately apparent, the NAOP and its consequences would set in motion the chain of events that would lead to the phase out of coal-fired electricity generation in Ontario.

As part of the NAOP, Ontario Hydro relied on its five operational coal-fired generating facilities (Lakeview, Nanticoke, Lambton, Thunder Bay, and Atikokan) to replace the power supplies lost as a result of the taking out of service of the seven

¹ Pickering A Units 1-4 and Bruce A Units 1, 3 and 4. Bruce A Unit 2 had been shut down in October 1995.

nuclear units. This, inevitably, led to major increases in emissions of smog and acid rain precursors, heavy metals, and greenhouse gases from these facilities. In the result, as shown in **Table 3** between 1995 and 2001, as the plants' outputs rose, their greenhouse gas emissions increased by a factor of 2.3, and emissions of the smog and acid rain precursors sulphur dioxide (SO₂) and nitrogen oxide (NO_x) doubled and increased by a factor of 1.7, respectively.

Table 3 Ontario Power Generation's Coal Plants: Electricity Generation and Emissions 1995-2001 (Gibbons 2003).

PARAMATER	1995	1996	1997	1998	1999	2000	2001
ELECTRICITY GENERATION (Gwh)	16,699	18,915	24,523	33,275	34,068	41,446	37,185
GREENHOUSE GASES (megatons)	15.4	17.9	22.43	29.8	30.5	37.64	35.1
SULPHUR DIOXIDE (kilotons)	74.1	84.5	123.15	140.81	140.58	163.51	147.19
NITROGEN OXIDES (NO) (kilotones)	28.2	35.1	42.77	54.32	49.24	49.45	42.17

The emergence of the smog Issue

The large increases in emissions associated with the NAOP occurred as the issue of the health impacts of the smog episodes which were occurring with increasing regularity in southern Ontario became a major public concern. The situation led to a number of high profile interventions by health professionals. A major report released by the Ontario Medical Association (OMA) in May 1998 characterized the smog situation as posing a “serious health risk to the people of Ontario” (OMA 1998). The report, which represented the first major intervention by the OMA in an environmental issue since the late 1960s, was critical of the likely impacts of the NAOP on air quality and more generally of the province’s performance on air quality issues.

Three of OPG’s coal-fired plants, Lambton, Nanticoke and Lakeview, were located directly in the southern Ontario airshed most affected by smog. The province’s electricity consumption patterns, which were now moving towards peaking in the summer due to increased air conditioning loads, further reinforced the problem. Summer peaks meant that the coal plants were being run at maximum capacity at the time when the conditions for smog formation were at their worst (Cundiff 2015).

The combination of the emergence of the smog issue and implementation of the NAOP led to the establishment of what would become the key policy entrepreneur in the coal-phase out story – the Ontario Clean Air Alliance. The alliance was founded in 1997 as a project of the Canadian Institute for Environmental Law and Policy.² The alliance rapidly assembled a diverse coalition of supporters including municipalities, private sector companies, unions, health professions and associations and other environmental organizations. The presence, and active engagement and advocacy by the health professions through the Ontario Medical Association, Registered Nurses Association of Ontario, and Ontario Public Health Association was particularly important in overcoming opposition from the major institutional actors in the system (e.g. OPG and OPA/IESO), industrial power consumers, represented by the Association of Major Power Consumers

² The Alliance later moved its institutional home to Pollution Probe.

of Ontario (AMPCO) and the Power Workers' Union, which represented OPG's workers (Cundiff 2015; Harris, Beck and Gerasimchuk 2015).

The alliance initially focused on the establishment of emission caps for greenhouse gases, nitrogen oxides and sulphur dioxide for the electricity sector (Gibbons and Bjorkquist 1998). OCAA was specifically concerned over the government's direction to Ontario Hydro to sell generating assets to reduce its dominant position in the emerging market. The utility was under pressure to sell those assets, including the coal-fired plants, as going concerns, to maximize the revenues their sale would generate. Those revenues could then contribute to paying down Ontario Hydro's debt.

The federal government added to the pressures on the province over air quality issues by initiating discussions with the US federal government to develop an Ozone Annex to the 1991 Canada-US Air Quality Agreement.³ The Annex was eventually signed in October 2000. Its provisions included a cap on nitrogen oxide emissions from coal-fired power stations in central and southern Ontario, opening the possibility of federal regulation of these facilities if the province did not take steps to reduce their emissions on its own. That possibility was reinforced with the addition, in May 2001, of particulate matter 10 microns in diameter (PM₁₀) and then, in July 2002, sulphur dioxide and nitrogen oxides, volatile organic compounds, nitric oxide, ozone and gaseous ammonia - all smog components or precursors - to the list of toxic substances under the *Canadian Environmental Protection Act* (CEPA). The listing of these substances under CEPA would permit the federal government to regulate their emissions directly.

In response to these pressures the province announced, in January 2000, its intention to impose new sulphur dioxide and nitrogen oxide emission caps on OPG's coal and oil fired plants as of January 2001 as part of its "strategic attack" on air pollution (Ontario Ministry of the Environment 2000). Under continuing pressure from the OCAA's campaign, reinforced by the anticipation of reports from the Ontario Medical Association (OMA 2000) and the City of Toronto's Medical Officer of Health (Toronto

³ The 1991 agreement had been principally concerned with the acid rain.

Public Health 2000) highlighting the role of the coal-fired plants in southern Ontario's air quality problems, the province announced in May 2000 an "environmental" moratorium on the sale of OPG's coal-fired plants (Clark and Yacoumidis 2000).

A phase-out of the Lakeview coal-fired plant by April 2005 was announced by Environment Minister Elizabeth Witmer. Any replacement facility would be required meet same emission standards as "efficient natural gas technology" (Elwell, Castrilli and Chau 2001 72). That requirement was incorporated into a regulation in October 2001. The government subsequently refused to approve proposed sales of the Thunder Bay and Atikokan Plants for "environmental reasons," and made any future sales conditional on the conversion of the coal-fired plants to natural gas (Smith and Stewart 2004 173). These steps, sometimes referred to as the "Witmer standard," represented the beginning of the end for the province's coal-fired plants.

The 2003 Election: A coal phase-out moves to centre stage.

All three major political parties in Ontario entered the October 2003 election with platform commitments to the phase-out of coal-fired electricity. The governing Progressive Conservatives, now led by Ernie Eves, committed to closing all of Ontario's coal-fired power plants by 2015 (PC Ontario 2003 paper 6). The NDP's *Publicpower* platform was more ambitious, proposing a 2007 closure date (NDP 2003). The Liberals, led by Dalton McGuinty, who would emerge from the election with a strong majority government, also committed to "shut down" Ontario's coal burning power plants by 2007 (Ontario Liberal Party 2003 3-5).

The new government began to move away from the market model for the electricity system, towards what it described as a "hybrid" system of markets and planning, symbolized by the redubbing of the Independent Market Operator as the Independent Electricity System Operator (IESO). *The Electricity Restructuring Act*, adopted in 2004, created a new entity, the Ontario Power Authority (OPA). The OPA was mandated to develop a 20-year Integrated Power System Plan (IPSP) for the province's electricity system. The legislation provided for the issuance of directives to the OPA by the Minister of Energy with respect to the content of the IPSP.

In response to a request for advice from the Minister of Energy on the appropriate mix of supply options for Ontario's future electricity system over the next 20 years, the OPA recommended that coal be phased out between 2005 and 2015. The coal plants would be replaced by a combination of natural gas fired generation and new renewables – principally a combination of refurbished hydro facilities and new wind power projects (OPA 2005).

A Supply Mix Directive was issued to the OPA regarding the IPSP that it was to develop on the June 13, 2006. Consistent with the OPA's advice, the directive signalled a backing away from the government's commitment to phase-out coal-fired electricity by 2007, simply requiring that the plan provide for the replacement of coal-fired generation "in the earliest practical time frame that ensures adequate generating capacity and electricity system reliability in Ontario (Duncan 2006)." The directive was widely criticized by environmental advocates for its focus on nuclear energy, abandonment of the 2007 coal-phase-out target date, and exemption of the overall planning process from the *Environmental Assessment Act* (Ontario Clean Air Alliance 2006).

The IPSP, proposing \$60 billion in investments in energy supply and conservation (including \$27 billion on nuclear energy) was filed with the Ontario Energy Board in August 29, 2007, just prior to the start of the 2007 election campaign. A regulation (Ontario Regulation 496/07) requiring the cessation of the use of coal at the province's four remaining coal-fired power plants by 2014 was adopted at the same time. From the government's perspective the electoral advantage of a renewed commitment to a coal phase-out and modest support for renewable energy and conservation, which helped divide some of the environmental opposition to the plan, was seen to override the political risk of parts of the ENGO community actively campaigning against the IPSP (Toronto Star 2007).

The move in the direction of a coal phase-out was further reinforced by the emerging issue of climate change. Ontario announced its Go Green climate change plan in June 2007. The plan committed to reducing the province's GHG emissions to 6 per cent below 1990 levels by 2014, 15 per cent by 2020, and 80 per cent by 2050. The commitment to phase out coal-fired electricity generation was the centrepiece of the

plan. The plan included by major investments in public transit and a cap-and-trade system for other large industrial sources as well (ECO 2009).

The Liberal platform going into the October 2007 election committed to carrying through on the climate change plan, including a coal phase-out by 2014. However, the government's wider plans were profoundly disrupted by the fall 2008 global financial crisis. Among other things, the financial collapse triggered a further crisis in the North American automobile manufacturing industry. As a result, the province's economy lost nearly 250,000 jobs between the fall of 2008 and the spring of 2009.

Picking up on signals from the incoming Obama administration in the United States, the province made strong moves to link its economic recovery strategy to environmental sustainability, particularly in the form of the 2009 *Green Energy and Green Economy Act* (GEGEA). The act provided, among other things, the authority for a feed-in tariff (FIT) mechanism similar to those employed in Germany, Spain, and Denmark, for low-impact renewable energy sources. FIT mechanisms pay the owners and operators of renewable energy projects a guaranteed fixed price for the electricity produced by their facilities (Winfield 2015).

Along with a number of competitive request-for-proposal processes, the FIT did facilitate a large increase in renewable energy capacity in the province. From a starting point of virtually zero in 2005, approximately 4500MW of wind and 450MW of solar PV capacity had been installed by the end of 2018 (IESO 2020a). At the same time, the program became the target of growing criticism over rising electricity costs and the need for additional power supplies in the face of declining electricity demand (Winfield and Dolter 2014). It would be effectively terminated by McGuinty's successor, Kathleen Wynne, for larger projects in 2013, and for smaller ones in 2017 (Winfield 2016).

Completing the phase-out 2011-14.

The 2011 Liberal platform again committed to the completion the phase-out of coal-fired electricity. The Liberals emerged from the election just short of a majority government (a "major minority" in Premier McGuinty's words). The electricity question plagued McGuinty's final term in office. Serious complications arose around the

government's cancellation of proposed gas-fired electricity plants in Oakville and Mississauga, both part of the coal-phase-out process, in the run-up to the election. The plants had faced very strong local opposition in both communities. It would emerge in the aftermath of the election that the cost of cancellation of the plants, for which contracts had been signed between the OPA and the proponents, would approach \$600 million (Artuso 2013).

The legislative opposition's pursuit of the issue, in the context of the minority legislature produced by the October 2011 election, would be central to McGuinty's October 2012 decision to prorogue the legislature and announce his intention to resign. McGuinty was succeeded as premier by Kathleen Wynne in February 2013. Wynne's leadership platform was silent on electricity issues, beyond a specific commitment to continue the coal phase-out (Wynne 2013). The phase-out would ultimately be completed at the end of 2014 with the closure of the Nanticoke and Lambton facilities, and the conversion of the Thunder Bay and Atikokan facilities to burn biomass (i.e. wood pellets). The phase-out continued to be referenced as a major component of the government's comprehensive 2016 Climate Change Action Plan (CCAP). At the same time, the fallout from the Liberal government's handling of the electricity file would continue play a defining role in the province's politics.

The Aftermath: The Fair Hydro Plan and Doug Ford

In June 2016, the government adopted legislation merging the IESO and OPA.⁴ Perhaps more significantly, the legislation eliminated the requirement for the development and publication of IPSPs by the merged entity or for their review by the OEB before implementation. Instead, system plans would be developed by the minister of energy and approved by the cabinet. The OEB and IESO would then be required to implement those plans. In effect, the legislation dropped the pretense of rational planning, subject to meaningful independent public review, for the province's electricity

⁴ Bill 135 – *The Energy Statute Law Amendment Act, 2016*, S.O. 2016, c. 10.

system. Instead it formalized a paradigm of political management in electricity system planning (Winfield and MacWhirter 2019).

A major expression of the politization of decision-making around electricity came at the beginning of March 2017. With high hydro costs being consistently identified as the leading public concern facing the province (Nanos 2016) the government announced a “Fair Hydro Plan.” The plan was to reduce electricity rates by 25 per cent for the following five years, beginning 1 July 2017, (Office of the Premier 2017) with the intention of removing the issue of hydro rates from the political agenda before the provincial election in 2018. The plan relied principally on extending the financing period for debt associated with new electricity infrastructure, typically from twenty to thirty years. The potential additional financing costs of this approach, along with the elimination of the HST on hydro bills, were estimated at \$45 billion, with the costs largely falling on future consumers (Auditor General of Ontario 2017).

In the end, the plan had no impact on the election outcome in 2018, which resulted in a major defeat for the Liberals, and the election of a populist PC Premier, Doug Ford. Relief from energy costs, particularly electricity costs, was a major theme in the PC platform. Blame for those costs was laid squarely at the feet of the GEGEA FIT program and the greenhouse gas emission cap and trade system that was at the heart of the 2016 CCAP (PC Ontario 2018). Although the Ford government moved quickly to dismantle the cap and trade program and the CCAP programs financed through it, and to repeal the GEGEA, there was no effort to reverse the coal phase-out (Winfield and Kaiser 2020). Indeed, it was referenced as an important success in the Ford government’s own “made-in-Ontario” environment plan, released in December 2018 (Ontario 2018).

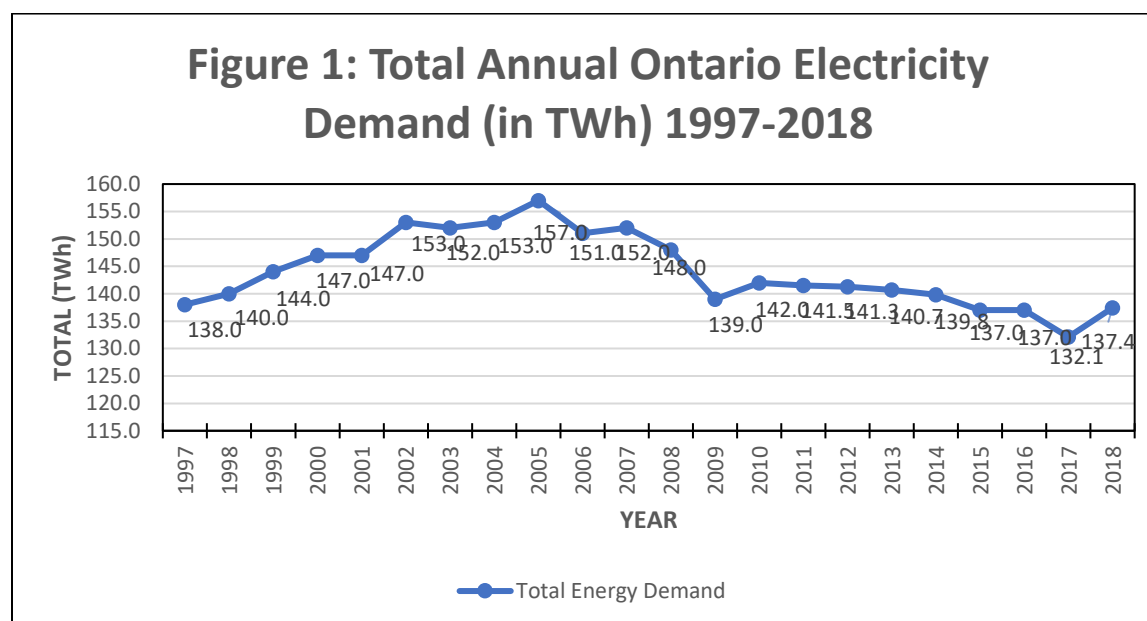
External, Policy and Institutional Factors Facilitating a coal phase-out in Ontario

The Ontario Clear Air Alliance’s policy entrepreneurship, and the consistent political commitment of the McGuinty and Wynne governments to a phase-out were the central factors in its completion. A number of other external and institutional factors and complementary policy decisions converged to facilitate a coal phase-out in Ontario as well. These included a decline in electricity demand, the construction of new gas-fired

and renewable energy sources, and the return to service of some of the NAOP “laid-up” nuclear facilities. The fact that OPG was owned by the province, as opposed to being an investor-owned utility, also helped to facilitate the phase-out. Each of these elements is discussed in detail in the following section.

Declining electricity demand and conservation

The phase-out of coal-fired generation was assisted by a significant decline in electricity demand in the province from the mid-2000s onwards, as shown in **Figure 1**. The decline was despite continuing growth in the province’s population and economy. The shift has been attributed in large part to economic restructuring away from energy-intensive manufacturing and resource extraction and processing activities, towards less energy-intensive service, knowledge and information-based sectors. The impact of the conservation programs put in place from 2003 onwards was also a factor (Winfield and Gelfant 2020).



Declining natural gas prices and new gas-fired generating capacity

Between 2004 and 2012 the province added 5500 MW of natural gas fired generating capacity, in the form of new combined cycle facilities, single cycle peaking plants and combined heat and power facilities (Ontario n.d.). The contracts for these facilities were structured around capacity payments ensuring that the capital costs of

facility construction would be retired at the end of these contracts, regardless of facility utilization rates. The development of new natural gas-fired generating facilities in Ontario coincided with historically low natural gas prices in North America, a product of the increasing availability of “fracked” natural gas. The situation has prompted a widespread displacement of coal-fired generation by natural gas throughout the United States (Saha 2019).

Return to service of refurbished nuclear facilities.

Four of the seven nuclear reactors “laid-up” through the NAOP were eventually refurbished and returned to service. These included two units each at the Pickering⁵ and Bruce⁶ facilities. Two unrefurbished units at Bruce were also returned to service.⁷ Although making significant contributions to the province’s electricity supply, all of the refurbishment and repair projects ran substantially over budget and behind schedule (Winfield, Jamison, Wong, and Czajkowski 2006 Table 6.4).

New non-hydro renewables

Along with a number of competitive request-for-proposal processes, the GEGEA did facilitate a large increase in renewable energy capacity in the province. As noted earlier, from a starting point of virtually zero in 2005, approximately 4500MW of wind and 450MW of solar PV capacity was installed by the end of 2018 (IESO 2020a). A number of upgrades and refurbishments were also undertaken on OPG’s existing hydro-electric facilities.

Public ownership of Ontario Power Generation

A final factor contributing to the feasibility of a coal phase-out in Ontario was the consideration that the owner of the five coal plants was OPG, which itself remained in provincial ownership throughout the restructuring of the electricity sector. As the ultimate owner of OPG, the province could give directives directly to the utility, and choose to write-off the whatever residual capital value might have remained in the coal-

⁵ Unit A1 (515MW) returned to service 2003. Unit A4 (515MW) returned to service 2005. Refurbishment of units A2 and A3 was abandoned as uneconomic

⁶ Units A1 and A2 (both 830MW) returned to service 2012.

⁷ Unit A3 2004; Unit A4 2003.

fired plants at their time of closure. This was a very different approach from that taken by the NDP Notley government in Alberta to its phase-out of coal-fired electricity. Alberta's coal-fired plants were owned by private utilities, and rather than risking legal battles with those utilities, the province used the revenues from its carbon pricing systems to compensate the owners for the lost value of their facilities due to the phase-out (Vriens 2018).

Evaluation: Program, Policy Process and Politics

An overall assessment of the Ontario coal phase-out has to recognize that while the coal phase-out can be seen as a stand-alone initiative in programmatic, policy process, and political terms, it was intimately connected to the province's overall handling of the electricity file. Any final evaluation has to account for both of these dimensions of the process.

The Coal-Phase Out as a Program.

Environmental Outcomes

As shown in **Table 1**, the phase out of coal-fired electricity in Ontario resulted in major reductions in emissions of GHGs, smog and acid rain precursors, and hazardous air pollutants, particularly heavy metals, leading to substantial, measurable improvements in air quality in southern Ontario.

At the same time, the phase-out did involve some important environmental trade-offs. The province's approach to the phase-out involved a significant re-expansion of role of nuclear generation, which grew from 43 per cent of electricity output in 2003 to more than 60 per cent from 2014 onwards (Ontario n.d.). The growth in nuclear generation resulted in increases in the production of extremely hazardous and long-lived up and downstream waste streams. Nuclear is also associated with unique and uniquely severe accident and security risks and carries with it significant losses in system flexibility at the operational and planning levels (Sovacool, Schmid, Stirling, Walter and MacKerron 2020; Winfield et.al. 2006).

A sustainability assessment of the 2007 IPSP concluded that the coal vs nuclear refurbishment and expansion trade-off that underlay the plan was unacceptable from a sustainability perspective. Both options presented severe, although different, immediate and long-term negative consequences, while better options were available (Winfield, Gibson, Markvart, Gaudreau, and Taylor 2010). As noted earlier, the phase-out was also associated with the construction of a large fleet of new natural gas-fired generating facilities, which can have significant air quality impacts, particularly in terms of emissions of GHGs, nitrogen oxides and particulate matter, when operating. Unconventional or “fracked” natural gas production, which constitutes a growing portion of North American natural gas supplies, is also associated with significant environmental effects, including methane leakage, and groundwater and landscape impacts (Barcelo and Bennett 2016).

Costs and Benefits

In purely economic terms, coal-fired generation offered a relatively cheap and reliable electricity source. Viewed in wider terms, the cost of coal-fired generation was much higher. A 2005 study completed for the province estimated that the total annual cost of coal-fired electricity, including health, financial and environmental costs, was \$4.4 billion (2004\$). At the same time, the period over which the phase-out occurred was associated with major increases in electricity prices, particularly for residential consumers. What consumers paid per kwh of electricity more than doubled from the early 2000s to 2018 (IESO 2020b). The situation with respect to electricity costs became a point of major political controversy, leading to the 2017 Fair Hydro Plan. Even then it was widely seen as a contributing factor in the Wynne government’s defeat in the 2018 election (Gurney 2018).

As of 2003, the Electricity Conservation and Supply Task Force had estimated that two-thirds of the system’s generating assets (including the coal plants) would need to be refurbished or replaced over the following twenty years (ECSTF 2004 Figure 1A). The capital costs of these investments were embedded in what is referred to as the “Global Adjustment” (GA) component of electricity bills. As shown in **Figure 2**, in recent

years the GA has risen to account for approximately 80 per cent of the electricity portion of consumers' bills (IESO 2020b).

Figure 2 – Average Global Adjustment vs. Average Market Electricity Price (2009-2019)



Although the 2009 *Green Economy and Green Energy Act (GEGEA)* Feed-in Tariff (FIT) program has been widely blamed for the increases in the GA (McKittrick 2013), the breakdown of the contributors to the charge tells a more complex story. As of March 2020, renewables, principally wind and solar, accounted for approximately 25 per cent of the GA. Nuclear, mainly the costs of the first Pickering and Bruce refurbishments accounted for over 50 per cent, and is expected to account for an ever higher portion as the refurbishments of the Bruce and Darlington facilities proceed. Natural gas fired generation accounted for 10 per cent, largely driven by capacity payments for the natural gas-fired plants constructed between 2004 and 2012 (IESO 2020b). The upgrading and refurbishment of transmission and distribution infrastructure, reflected in the “delivery” portion of bills, usually accounting for about one third of the total bills, added further costs (Environmental Defense 2017). Industrial consumers were able to avoid the GA part of their electricity bills through a variety of mechanisms (Winfield and Gelfant 2020), meaning that the bulk of the capital costs of rebuilding the system fell on residential consumers.

Although the Ford government took steps to clarify the costs of the 2017 Fair Hydro Plan (Bill 87), its core elements have been left in place. The result has been a situation where hydro rates are being kept artificially low through subsidies out of

general revenues of \$5.6 billion/yr (CBC 2020). There are ongoing debates whether the reconstruction of the system could have been achieved at lower costs. Particularly strong arguments occur over the necessity and costs of new renewable energy sources, new gas-fired generation and nuclear refurbishments, as well as the availability of lower cost alternatives through conservation and hydro imports from Quebec (Winfield and MacWhirter 2019).

Given the scale of the overall system reconstruction that took place between 2004 and the present, the range of elements that contributed to the phase-out (conservation, declining demand, new renewable and natural gas fired generation and nuclear refurbishments) and scope of possible scenarios for the retention of coal, such as major pollution control retrofits, it is virtually impossible to define a specific marginal cost for the coal phase-out. Any assessment is further complicated by the consideration that with the possible exceptions of Nanticoke and Atikokan, the province's coal-fired power plants were at or approaching technical end-of-life in the early 2000s, requiring major reconstructions or replacements regardless of any policy decisions made by the province (Cui 2019).⁸ At the same time, the coal phase-out *per se*, is rarely blamed for the electricity cost increases seen over the period.

Policy resiliency

The demolition of the southern Ontario coal plants (Lakeview (2006-07), Nanticoke (2018-19), and Lambton (2019-20)) make a large-scale return to coal virtually impossible. The Thunder Bay plant was converted to burn biomass (wood pellets) but is now retired. Only the Atikokan plant remains in service, running on wood pellet biomass. There seems no serious consideration of restoring the role of coal in the province's electricity system. Indeed, the phase-out is referenced as a major achievement in the Ford government's December 2018 Environment Plan.

⁸ The anticipated life for coal-fired power plants is in the range of 40-50 years. R.Y.Cui et.al., "Quantifying operational lifetimes for coal power plants under the Paris goals" *Nature Communications* **10**, 4759 (2019). <https://www.nature.com/articles/s41467-019-12618-3>. This would suggest non-policy driven closure dates as follows: Nanticoke 2012-2028; Atikokan 2025-2035; Thunder Bay 2003-2013; Lambton 2009-2019; and Lakeview 2002-2012.

In the longer term, however, some of the environmental gains from the coal phase-out may be significantly eroded. The province currently plans to run the fleet of gas-fired plants commissioned between 2004 and 2012 to make up for potential power shortfalls from the retirement of the Pickering nuclear facility in 2024, and refurbishments at the Bruce (6 units) and Darlington (4 units) nuclear plants between 2020 and 2033. Thirty to 40 per cent of the reductions in emissions of greenhouse gases and smog precursors obtained through the coal phaseout could be lost through such a strategy (IESO 2020c).

A national phase-out of conventional coal-fired electricity generation was announced by Stephen Harper's Conservative federal government in 2012, although full implementation would not have occurred until the 2040s. In 2018 the Trudeau government advanced the phase-out date to 2030, principally affecting facilities in Alberta, Saskatchewan and Nova Scotia (Canada 2018).

On the whole, in programmatic terms, the Ontario coal phase-out itself can be rated as a "Resilient Success" in McConnell's (2010) terms, delivering significant, measurable improvements in environmental quality. Although some of the environmental gains from the phase-out are at risk of partial erosion, there little or no risk of full-scale reversal. While there is broad consensus around the positive environmental and health impacts of the coal-phase-out, the overall costs and directions for the restructuring of the province's electricity sector remain a point of high levels of political conflict, and might be considered a "conflicted" or even "precarious" success at best.

The Coal Phase-Out as a Policy Process

One of the central critiques around the province's post-2003 approach to decision-making around the electricity system has been that it has become increasingly, explicitly politicized (Vegh 2018). That process culminated in the adoption of Bill 135 in 2016. The bill effectively eliminated the requirement for a formal evidence-based planning process around the electricity system, and instead established a system based on directives from the political level to the province's energy agencies.

The coal phase-out highlighted several trade-offs associated with this politicized decision-making model. On the one hand, the phase-out was strongly resisted by key institutional actors in Ontario electricity system (e.g. OPG/OPA/IESO) and the major industrial consumers represented by the Association of Major Power Consumers of Ontario (AMPCO). In that context, it is highly unlikely that the phase-out would have occurred without the consistent political direction and formal directives provided by the McGuinty and Wynne governments to the OPA and IESO. The same could be said regarding the province's progress on energy conservation and renewable energy development. At the same time, the province has been left with no real electricity system planning process, and an apparent acceptance of political direction as opposed to open, evidence-based decision-making around major infrastructure decisions, as the norm (MacWhirter and Winfield 2019).

The overall result, in policy process terms might be consider a "Conflicted Success" in McConnell's (2010) framework, in the sense of that the coal phase-out was successfully implemented. At the same time, the overall state of energy and electricity policy making remains precarious, if not a "Process Failure," and highly controversial in political terms.

Politics

The conflicting outcomes are even deeper in a political sense. The coal phase-out itself can be seen as a politically successful policy for which, by 2003, there was support among all of the province's major political parties. At the same time, the overall state of the province's electricity system planning efforts must be seen as a "Political Failure." This is particularly evident in the role of the issue of electricity costs in the outcome of the province's 2018 election. The election saw the defeat of the Liberal government and its replacement by a populist Progressive Conservative administration, whose promises to "clean up the Hydro mess," and "cut hydro rates" (PC Ontario 2018) were central to the outcome of the campaign.

The overall assessment of the province's handling of the coal phase-out, in McConnell's (2010) terms, is summarized in **Table 4**. The conclusions highlight the relative successes around the coal phase-out *per se*, but failures around the handling of the electricity question more generally.

Table 4: Assessing the Ontario Coal Phase-out

PROGRAM ELEMENT	POLICY AS PROGRAM	POLICY AS PROCESS	POLICY AS POLITICS
COAL PHASE-OUT	Resilient Success	Conflicted Success	Political Success
ELECTRICITY POLICY OVERALL	Conflicted/Precarious Success	Precarious Success/Process Failure	Political Failure

Conclusions

The phase-out of coal-fired electricity generation in Ontario, completed in 2014, has had significant, measurable, positive effects on environmental quality, particularly with respect to acid rain, smog and greenhouse gas emissions. The Ontario phase-out ultimately prompted the federal government to pursue a national phase-out of conventional coal-fired electricity, initially by the 2040s, and later by 2030.

At the same time, the Ontario phase-out involved significant trade-offs in terms of the environmental sustainability of the province's electricity system. Assessments of the economic costs of the phase-out are difficult, given its complex relationship with the overall reconstruction of the province's electricity system.

The phase-out was also a product of a wider explicit politicization of decision-making around the system. The phase-out demonstrated both the advantages of that trend in terms of the implementation significant structural changes to a system with deeply embedded institutional interests, and also the risks around the erosion of transparent, evidence-based decision-making regarding major infrastructure projects.

The coal phase-out itself was politically successful, gaining support from all of the major political parties in Ontario politics, and even featuring in the populist Ford government's 2018 environmental plan. However, the arrival of that government was in

no small part due to the failures, in political terms, in the McGuinty and Wynne governments' overall handling of the electricity file.

On a final note, the importance of the role of the Ontario Clean Air Alliance as the key policy entrepreneur in the Ontario coal-phase-out must be recognized. Without the alliance's work it is unlikely the phase-out would have occurred. The engagement of the province's health professions around air quality issues was also a critical factor in overcoming the objections of key institutional actors and economic interests to a phase-out. The federal interventions in the early 2000s around the Ozone Annex agreement with the United States also contributed to the all-party consensus around a phase-out going into the crucial 2003 provincial election.

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