David I. Poch Barrister tel. (613) 264-0055 fax (613) 264-2878

14 August 2008

Ms. Kirsten Walli,
Board Secretary
Ontario Energy Board

By e-mail and RESS

Dear Ms. Walli: Re: EB-2007-0707 Exhibit L-8-2, ICF report on load forecast issues

Further to my letter of August 1st, the principal author of the ICF report, Mr. Ralph Torrie, has experienced a severe confluence of deadlines and travel commitments (notably work urgently needed by the Ontario Ministry of Environment for upcoming cabinet deliberations on climate change policy). This has delayed the availability of the attached report until today. Unfortunately, an effort to rely upon other ICF staff to meet the earlier filing date proved to be unworkable given the extensive background to this case. As is apparent from the document, the work was data intensive and relied to a considerable degree on knowledge of the Ontario electricity planning history, economic context and the details of OPA's filings and responses to interrogatories.

GEC-Pembina-OSEA has previously expressed its desire to see the hearing proceed expeditiously. Eight of the nine reports the groups commissioned were filed on August 1st. Unfortunately, the GEC-Pembina-OSEA intervention team had no advance notice of the difficulty facing ICF and accordingly, we had not applied for permission to file late. Given the repeated delays we have experienced in obtaining this report over the last two weeks, we were not in a position to reliably predict when the report would be available to enable us to seek an alternative deadline from the Board.

We apologize for the delay and ask that the document be received by the Board on the basis that we will accept interrogatories on it until August 22nd and we will respond by the original response deadline of September 2nd. In this manner we hope that any inconvenience to the Board and parties will be minimized and no prejudice or delay in the hearing progress will result.

Please note that I am out of the country during the week of August 11th.

Sincerely,

David Poch

Cc: all parties

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Green Energy Coalition

Filed: August 14, 2008
EB-2007-0707
Exhibit L
Tab 8
Schedule 2

BEFORE THE ONTARIO ENERGY BOARD

IN THE MATTER OF sections 25.30 and 25.31 of the Electricity Act, 1998;

AND IN THE MATTER OF an application by the Ontario Power Authority for review and approval of the Integrated Power System Plan and proposed procurement processes.

Review of the Ontario Load Forecast in the Integrated Power System Plan (IPSP)

by Ralph Torrie & Doug Morrow
ICF International

Filed August 14, 2008

prepared for:
Green Energy Coalition
(David Suzuki Foundation, Eneract, Greenpeace Canada, Sierra Club of Canada, World Wildlife Fund Canada)
Pembina Institute
Ontario Sustainable Energy Association

Review of the Ontario Load Forecast in the Integrated Power System Plan (IPSP)

Prepared by:

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August 14, 2008

1 Some Historical Context

Long range forecasting of electricity demand has been the central reason that previous attempts at electric power investment planning in Ontario have failed. The great power system expansion plans put forward by Ontario Hydro in the mid-1970's and then again in the late 1980's never materialized because they were based on forecasts that turned out to be so far off the mark that none of the dozens of power plants proposed in those earlier efforts was ever built. In fact, the forecasts that underpinned those planning efforts proved to be so wrong so quickly after they were done that the reviews and associated public hearings associated with those earlier planning efforts (the Royal Commission on Electric Power Planning, the Environmental Assessment of the Demand Supply Plan) did not even run their course before the proposals were withdrawn or shelved for the indefinite future.[1]

In the mid-1970's, Ontario Hydro put forward a long range investment plan for Ontario's electricity system that was based on a forecast of electricity that saw the demand doubling roughly every ten years, with the capacity of the system passing through the 70,000 MW mark around 1997, and then nearly doubling again by 2008. The generation supply plan (LRF48A) included the addition of 120,000 MW of new capacity by the summer of 2008, provided by nuclear and coal in about a 2:1 ratio. The nuclear units increased in size from 850 MW to 1200 MW to 2000 MW over the course of the supply plan; the coal units were standardized at 750 MW each. By 2008, the plan included 56 nuclear reactors, *post-Darlington*, and 50 coal-fired units, none of which were ever built.

In the 1977 forecast, the system peak in 1997 was projected to be 57,000 MW, with low and high variations of 36,000 MW and 67,000 MW, respectively. The plan asserted that "it is unlikely the actual load will be outside the range of these scenarios"[2] – the actual peak demand in 1997 was 22,200 MW. The 1977 forecast was so egregiously wrong that thirty years later the system peak has not reached the mark that the 1977 forecast predicted it would pass through 25 years ago, in 1983.

In the late 1980's Ontario Hydro came forward with another power system plan -- *Providing the Balance of Power*.[3] By this time, the traditional "top down" macroeconomic correlation methods for forecasting electricity demand (that had proven so inadequate in the 1970's) were being supplemented at Ontario Hydro with a set of end use models that allowed the forecast to be developed with more detail than had been the case in the past. Notwithstanding the end use

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[1] Given that it has been wrong-headed load forecasting that has been the central weakness in previous attempts at long range electric power investment planning in Ontario, it is ironic that reviews and assessments of those plans often take the load forecast "as a given", even to the point of ruling it out of bounds as a suitable topic for inclusion in the review of the investment plan.

[2] Ontario Hydro, "Planning of the Ontario Hydro East System", Report No. 573 SP, November 15, 1977.Part 2, page 3-1 ff.

[3] Ontario Hydro, "Providing the Balance of Power: Ontario Hydro's Plan to Serve Customers Electricity Needs", Ontario Hydro, Toronto, 1989.

disaggregation and the fact that the projected electricity growth rate was much lower than had been the case with the earlier generation of forecasts, the forecast that underpinned the *Balance of Power Plan* completely misread the dynamics of the commodity market. It had peak demand reaching 34,900 MW by 2005 and 39,800 MW by 2014 and asserted that there was only a 10% probability the actual load would fall below a lower bound forecast that reached 28,700 MW by 2004 and 33,500 MW by 2014. Actual demand peaked at 25,000 MW in 2004, 10,000 MW below the median forecast in *Providing the Balance of Power* and 3,700 MW below even the lower boundary (less than 10% probability) of the forecast bandwidth.

These and most other historical forecasts of electricity demand that have been done to support long range electric power planning in Ontario over the past 30 years were not too high because they underestimated the amount of conservation and electricity efficiency improvement that would take place over the forecast period. They were too high because they failed to capture (or even attempt to capture) the underlying dynamics of the electricity commodity market. While there have no doubt been and continue to be improvements in the efficiency of electricity use, until now at least such improvements comprise a relatively small contribution to the reason why the aggregate demand for electricity has turned out to be so much lower than predicted.

For example, in the mid-1970's when the total consumption of electricity was in the range of 85 TW.hours, Ontario Hydro's load forecast projected it would grow to more than 325 TW.hours by 1997. Electricity demand in 1997 was 140 TW.hours. Only a fraction of the 185 TW.hour shortfall from the forecast could possibly be attributed to conservation and efficiency – most of it was due to the evolving structure of electricity demand which rendered moot the assumptions in the 1977 load forecast.

In 1988, when the P*roviding the Balance of Power* supply plan was put forward by Ontario Hydro, annual electricity consumption in the province was 140 TW.hours and forecast to grow by some 85 TW.hours by 2005, to 225 TW.hours. By 2005 the actual demand was 155 TW.hours. As it turned out, the misreading of the future demand for electricity represented by the load forecast that underpinned the rationale for the Demand Supply Plan was a much larger "problem" with the Demand Supply Plan than the aggressiveness of the demand and conservation component of that plan. While the environmentalists and Ontario Hydro were debating before the Environment Assessment Board whether it might be possible to get 10 or 20 or even 35 TW.hours of electricity conservation out of the forecast load by 2010, the real issue would turn out to be that the demand itself would be lower than the forecast by more than twice the most aggressive estimate of DSM potential.

As had been the case in the earlier round of planning, the large gap between the forecast and what actually transpired was well above even the most aggressive analyses of the realizable potential for conservation and efficiency. As had also been the case in the earlier round of power system planning, the forecast was high primarily because it failed to capture the market dynamics of electricity demand, dynamics in which role of kilowatt-hours in providing underlying energy service demands was undergoing major changes for reasons that had very little to do with the price of fuels and electricity or the technological efficiency of electricity using devices.

The demand for kilowatt-hours of electricity is derived from and part of more fundamental demands for amenities, including for example energy end use services such as lighting; information processing and telecommunications; convenient and quick access to recreation, culture and the performing arts; and interior working and living spaces that are warm in winter and cool in the summer. These amenities are provided with an array of techniques and technologies, and electricity varies from one energy end use vector to the next and over time with regard to its importance and relative contribution to the overall cost of providing the amenity. Electricity's competition over the past thirty years has not been primarily other energy commodities, or even the greater efficiency of electricity use itself; rather, electricity's competition has come from an underlying improvement in the electricity productivity of the Ontario economy that is much deeper and much broader than the mere technological efficiency improvement of electricity use.

2 The Current Forecast – An Overview

By the time the Ontario Power Authority was formed, there had been a lengthy hiatus in long range electric power planning in Ontario. The last long range forecast had been done in the early 1990's at Ontario Hydro. The power industry in Ontario had been restructured, with no single player having responsibility for long range planning. The Independent Electricity System Operator (IESO) maintained a forecast, but it was focused on the short term and was generated using top down correlations with labour force and household formation, was not intended for and did not have the internal structure to support long range planning or DSM potential analysis.

The OPA has recently expressed interest in taking an integrated approach to the modeling and analysis of DSM and the future demand for electricity, an approach that would at least provide the possibility of the type of scenario and portfolio risk analysis that is needed to better prepare for a range of plausible long term directions of Ontario's electric power system.[4] While the OPA has indicated it expects such an approach can be put in place in less than a year, they are just getting underway in this direction. Meanwhile, the IPSP is based on the traditional approach -- a single line forecast against which a separate analysis of DSM potential is conducted.

The load forecast underpinning the IPSP is depicted in Figure 1, and a close examination reveals a significant departure from recent trends. For one thing, the forecast predicts that the

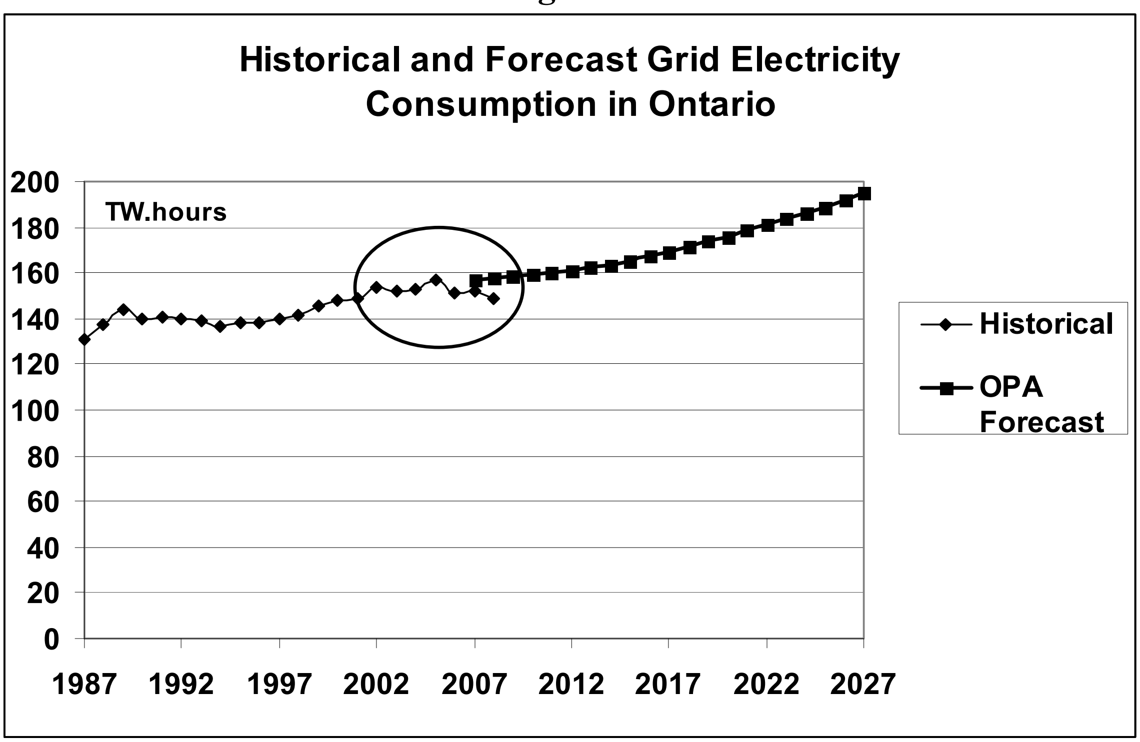
[4] Ontario Power Authority, "REQUEST FOR PROPOSALS FOR CONSULTING SERVICES TO DEVELOP A 20-YEAR ENERGY AND DEMAND FORECAST AND A CONSISTENT CONSERVATION POTENTIAL ASSESSMENT OR TO DEVELOP A MODEL TO PRODUCE SUCH FORECASTS AND ASSESSMENT, Issued June 30, 2008, Toronto, Canada.

rate of demand growth, which has been falling for decades, will turn around and begin increasing, with electricity demand growth actually accelerating over the forecast period.

It is also evident that the forecast has already diverged significantly from actual demand trends. The last year for which historical data was available when the forecast was produced was 2005, when the demand hit an all time high of 157 TW.hours. In the IPSP forecast, demand growth rates stop falling and turn around, with forecast demand in 2007 returning to 157 TW.hours in 2007 and climbing slowly to 159 TW.hours in 2010 before beginning to accelerate to 195 TW.hours in 2027.

But by the end of June 2008, electricity consumption in Ontario was down 2.75% compared to the first six months of 2007. Total annual electricity use in Ontario in 2008 is on track to be lower than it has been since 1999, and this year will be the third year in a row electricity consumption has been lower than the all-time high reached in 2005 of 157 TW.hours. It is likely that 2008 electricity use will be in the range of 148 TW.hours, nearly 10 TW.hours below the IPSP load forecast issued in 2007, *just one year earlier*.

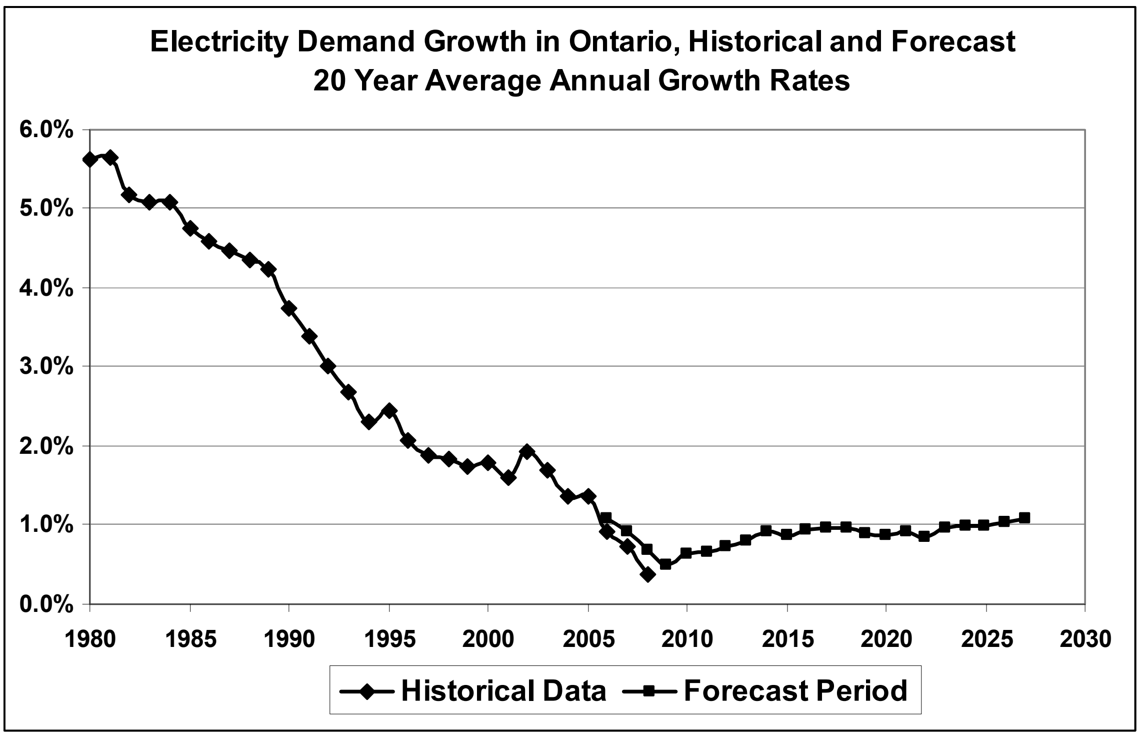
Figure 1



The extent to which the forecast diverges from past trends can be seen more clearly by comparing the twenty-year average growth rates for the historical years with the twenty year averages for the forecast years. The average growth rate of electricity demand in Ontario for the past ten years has been about 0.5% per year[5] and in the twenty years prior to 2007 the average annual growth rate was 0.7% per year.

This twenty year average growth rate has been declining steadily for over 25 years, as shown in Figure 2. (In this figure, the growth rate shown for each year is the average annual growth rate for the twenty year period leading up to that year; for example, the growth rate shown for 1996 is 2.0%, the average annual growth rate of the 1976-1996 period.) In the Integrated Power System Plan, this longstanding historical trend is assumed to be reversed, and electricity demand rates begin to grow and even accelerate over the 2007-2027 forecast.

Figure 2



In the OPA forecast, electricity demand growth averages 1.1% per year over the next twenty years, as compared with 0.7% over the 1987-2007 period and with what will likely be about 0.5% over the 1988-2008 period. Between 1987 and 2007, electricity consumption in Ontario grew by 26 TW.hours; in the OPA forecast it grows by 38 TW.hours over the 2007-2027 period.

[5] The OPA load forecast notes that the annual growth rate from 1995 to 2005 (a high demand year) was 1.3%, but it has been declining every year since and is on track to drop below 0.5% by the end of this year.

In this sense, the load forecast underpinning the IPSP follows in the tradition of the previous load forecasts we have referred to above, which have acknowledged the historical decline in electricity demand growth rates but then go on to assume (or to adopt assumptions that lead to the conclusion) that the decline will stop more-or-less immediately in the forecast year and even reverse and begin climbing again over the forecast period.[6]

Perhaps this time will be different, and the decline in the long range average growth rate of electricity demand that has been going on in Ontario for over 40 years since it peaked in 1965 will turn around and begin to grow again in the next year or two as the IPSP forecast predicts. To explore this possibility further we need to look more closely at the sector and end-use makeup of the IPSP forecast.

3 The IPSP Load Forecast – A Closer Look

The IPSP forecast is a somewhat cobbled together effort. The economic growth rates and associated end use breakdowns are based largely on the outdated NRCan 2006 Energy Outlook. Additional detail has been filled in by MKJ Associates and Marbek who were commissioned by the OPA to take a national study of conservation and demand management potential for all fuels for all of Canada[7] (which had also relied on the NRCan 2006 Outlook as a reference point) and adapt it for the case of Ontario electricity.[8]

When ICF did an preliminary assessment of the DSM potential for the OPA in 2005,[9] the only long range forecast available was based on the IESO ten-year forecast of the day, as extended to 2025 by Navigant[10]. That forecast used the historical correlation between electricity demand, housing starts and labour force growth to project electricity demand into the future and it projected a long range growth of electricity demand of 0.9%, reaching 186 TW.hours in 2025, very close to the 189 TW.hours in 2025 in the IPSP forecast. In fact, the OPA forecast that

[6] As the electricity demand growth in Ontario hovers around zero it is important to realize that a zero growth rate for electricity demand does not represent a floor below which demand growth rates cannot fall for a sustained period. Indeed, the ICF sectoral calibration concluded that residential electricity demand in Ontario will likely trend downward over the forecast period, even as population, households and incomes continue to grow. As a consideration of the derived nature of electricity demand suggests, there are clearly conditions under which there can be negative growth in the contribution of kilowatt-hours to meeting underlying human amenities and energy end use services, even as the supply of those amenities and services continues to grow.

[7] Marbek Resource Consultants Ltd. and MK Jaccard and Associates (MKJA). “Demand Side Management Potential in Canada: Energy Efficiency Study.” Submitted to: Canada Gas Association, May 2006.

[8] MK Jaccard and Associates (MKJA). “Modelling and Scenario Documentation.” Prepared for: Ontario Power Authority Power System Planning (Ex. D, Tab 4, Attach. 6), September 2006.

[9] ICF Consulting. “Electricity Demand in Ontario – Assessing the Conservation and Demand Management (CDM) Potential.” Prepared for: Ontario Power Authority (OPA), November 2005.

[10] Navigant Consulting Ltd., “Avoided Cost Analysis for the Evaluation of CDM Measures Presented to Hydro One Networks Inc.”, June 14, 2005. The Navigant forecast is an extrapolation the “Median Growth Scenario” in the IESO 10-Year Outlook: Ontario Demand Forecast from January 2005 to December 2014 (March 31, 2004).

underpins the rationale for the IPSP is essentially the same as the forecast we analyzed in 2005, albeit with a higher long range growth rate (1.1% vs. 0.9%).

To estimate DSM potential, however, it is necessary to have a forecast that contains a high level of sector and end-use disaggregation. To estimate how much electricity could be saved by a particular technology in a particular sector/end use application (for example, office building lighting) one first needs to know or have an assumption about how much electricity will be used by office building lighting, and what the saturations and market shares of current technologies are for providing office building lighting.

These issues were addressed in more detail in the report produced at the time, but the point is that in order to do a DSM potential assessment it is first necessary to have a disaggregated breakdown of electricity, at least for the end uses being targeted by the proposed DSM programs. That is what ICF had to do in 2005 in order to estimate the DSM potential relative to the forecast, and that is why MKJ and Marbek also had to develop a disaggregated forecast before they could proceed with their DSM potential estimates.

Both the ICF and the MKJ/Marbek analyses were done against the backdrop of the NRCan Outlook (which we know is in good agreement with the forecasts for the Ontario economy on which the OPA forecast is based). The MKJ/Marbek end use forecast reflects the OPA forecast of 1.1% long term growth in electricity demand. The ICF analysis calibrated to the 0.9% growth rate in the IESO/Navigant forecast, but only by making assumptions about activity growth rates and natural rates of efficiency and productivity improvement that biased the demand upward so as to "hit" the IESO/Navigant forecast. The ICF study concluded that electricity demand growth in Ontario would stay well below 0.9% per year unless there was a reversal of historical trends, for example the assumption of unmoderated commercial building floor area growth while at the same time assuming no improvement in building electricity intensities over the entire forecast period. The study concluded:

> While the IESO forecast growth rate of 0.9 percent per year is low by the standards of the 1970's and 1980's, it is significantly higher than the 0.5 percent year average of the period since 1990. The forecast demand could prove low if the electricity-intensive industries grow faster than the rest of the economy, or if electricity's market share of space and water heating increases, or if the rate of new commercial building construction accelerates relative to the trend of the past fifteen years, but these circumstances represent reversals of recent trends. If recent trends continue, then the risk of the forecast being too high is more likely.[11]

[11] ICF Consulting. "Electricity Demand in Ontario – Assessing the Conservation and Demand Management (CDM) Potential." Prepared for: Ontario Power Authority (OPA), November 2005.

To further understand the reasons why the OPA forecast is projecting a reversal of the longstanding historical trend, we looked at each of the sectors separately in some detail; we present here some of the key observations from that analysis.

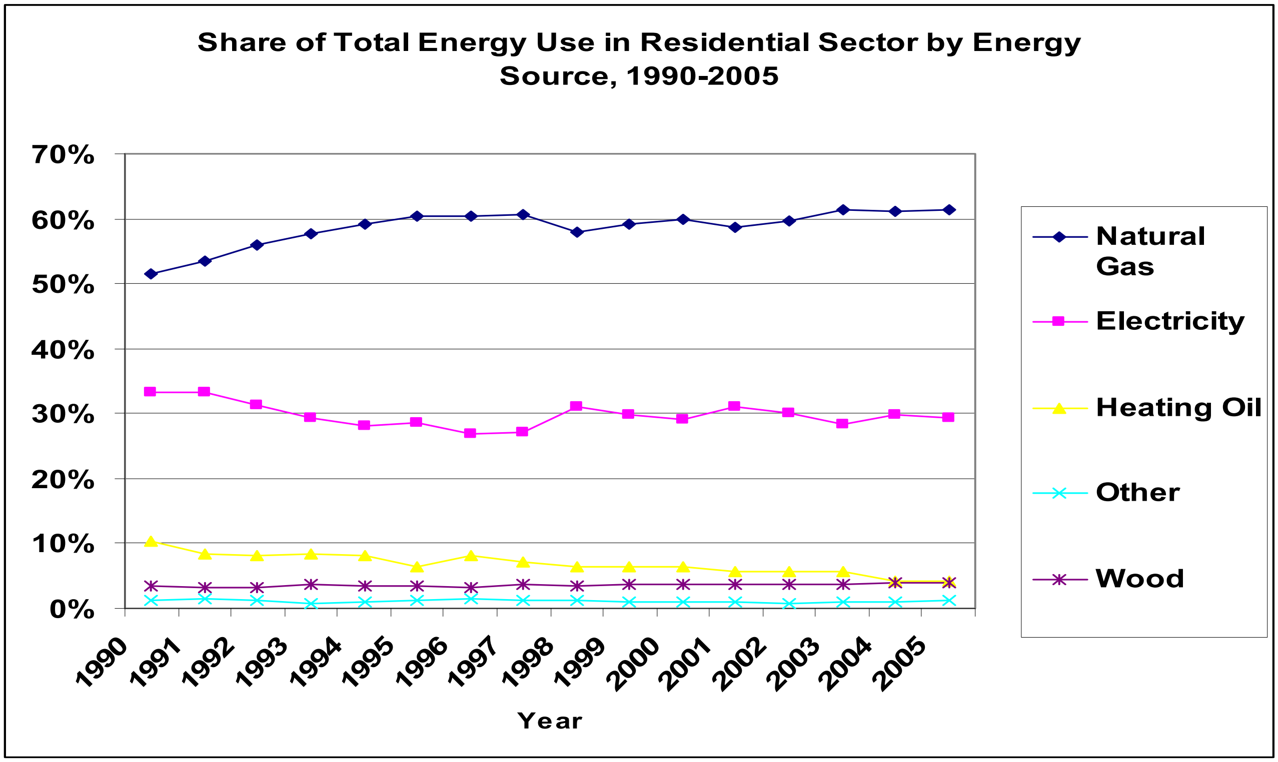
Residential Sector

Structure of Electricity Demand

Electricity use in the residential sector depends on a number of factors, including population growth rates, the number of households, the proportion of households that use electricity for space and water heating and the energy efficiency of electricity-specific end uses[12], such as lighting. Since electricity is a subset of energy, it is instructive to examine to relative contribution of electricity to the total energy needs of the residential sector. As shown in Figure 3, the contribution of electricity to total energy use remained relatively flat over the 1990-2005 period, ranging from approximately 33% in 1990 to 30% in 2005. The most significant development to take place over the historical period was the increasing share of natural gas at the expense of both electricity and heating oil. In 2005, fully 61% of total residential energy use was derived from natural gas, up from 52% only 15 years earlier.

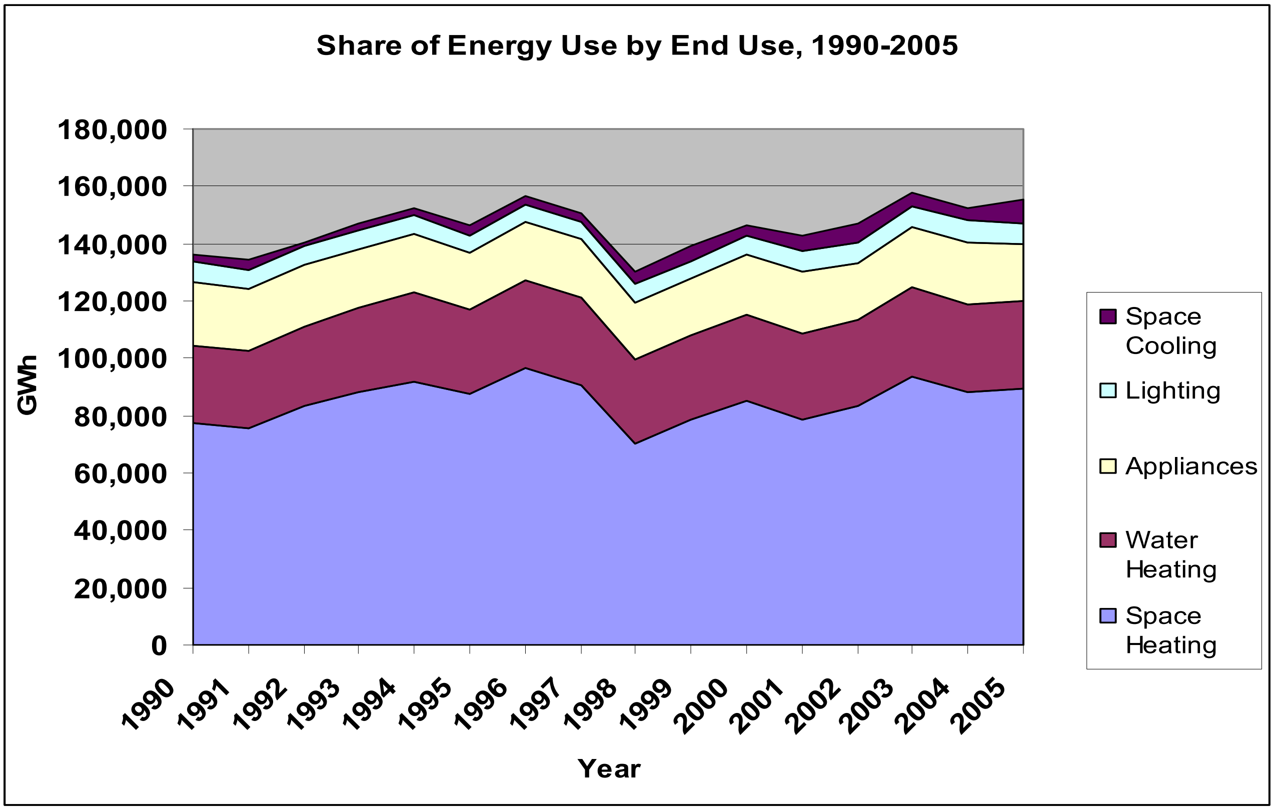
[12] This refers to end uses whose only energy source is electricity.

Figure 3



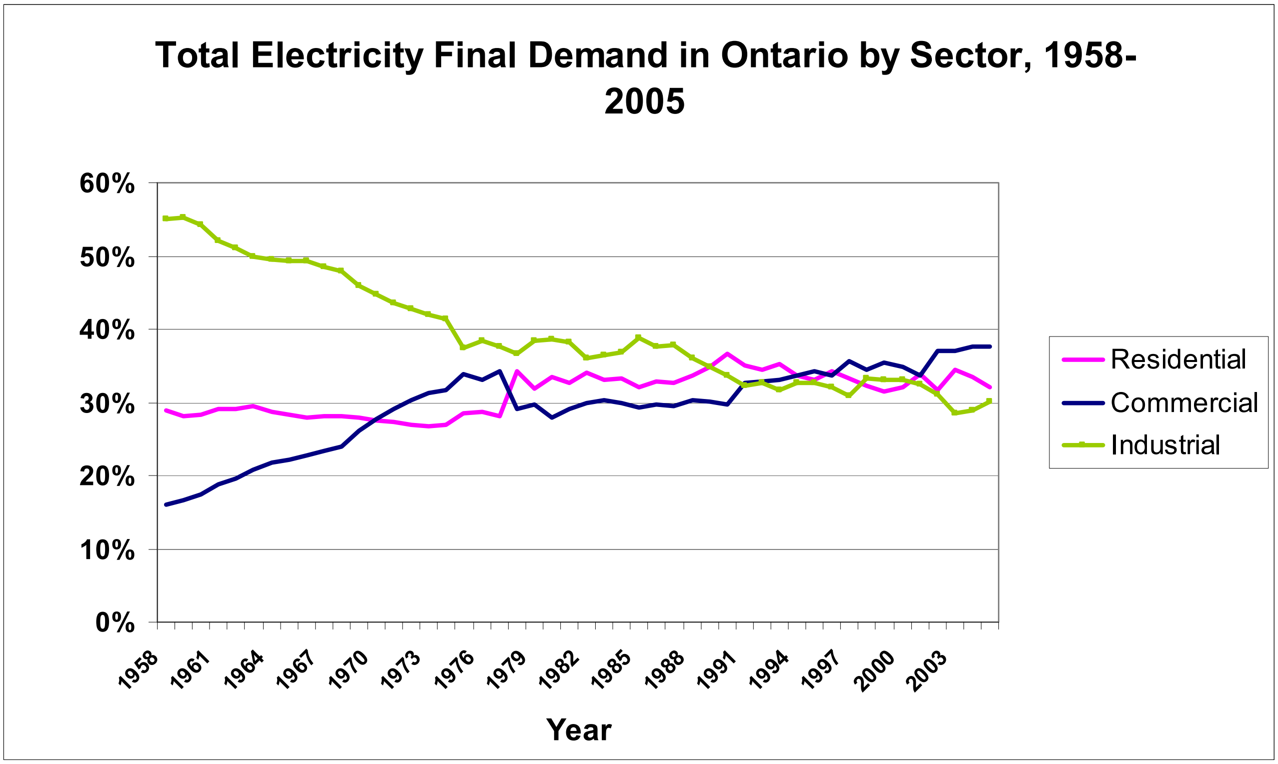
As in the commercial and industrial sectors, the largest end use for energy consumption in the residential sector is space heating. As shown in Figure 4, energy demand for space heating in 2005 totaled 89,400 GW.h, or approximately 58% of total energy use in the sector. Space heating thus commands a larger share of total energy demand than all other end uses combined. When interpreting the energy demand of different end uses, it is important to keep in mind that energy demand for lighting and space cooling can only be met by electricity. As a result, these end uses can be thought of as captive markets for electricity. By contrast, electricity must compete with other energy sources (principally natural gas) for use in space heating, water heating and, to a far lesser extent, in ranges and clothes dryers. Any transition away from the use of electricity in space heating will have disproportionately large effects on total electricity demand.

Figure 4



The relative contribution of residential electricity use to total electricity use in Ontario has remained roughly constant over the past half-century. As shown in Figure 5, the relative share of residential sector electricity use shifted by only 10% over the 1958-2005 period, ranging from a low of 27% in the early 1970s to a high of 37% in 1990. The residential sector is the only sector not to have undergone a significant proportional change since the 1950s.

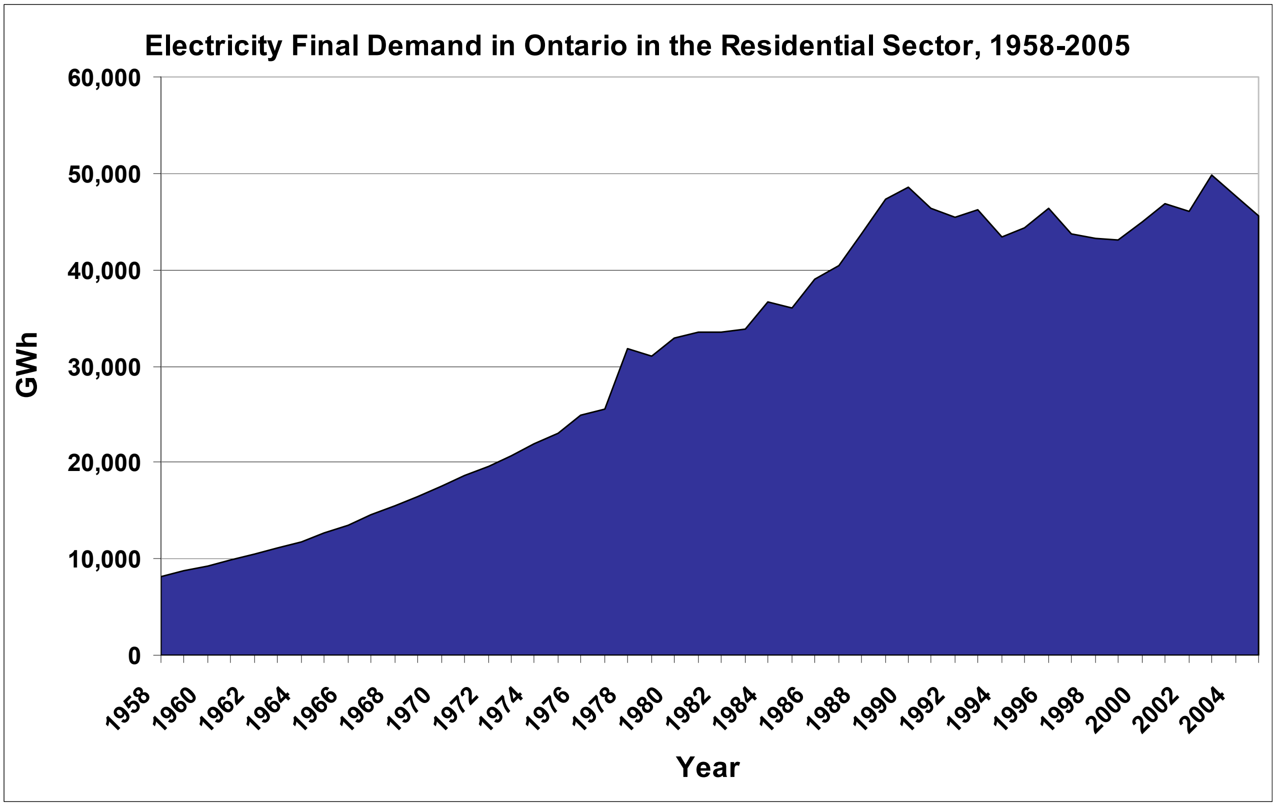
Figure 5



Historical trends

As shown in Figure 6, final electricity demand in the residential sector increased dramatically over the past half-century, growing from approximately 8,000 GW.h in 1958 to 46,000 GW.h in 2005. While the broad historical pattern can therefore be characterized as one of increasing demand, Figure 6 also illustrates how growth in electricity use experienced a marked slowdown beginning around 1990. Notable year-on-year decreases in total residential electricity demand occurred in the early 1990s, 1996 and, most recently, in the early 2000s, where electricity demand declined from an all time high of approximately 50,000 GW.h in 2003 to 46,000 in 2005.

Figure 6



The observed leveling of electricity demand growth in the Ontario residential sector is noteworthy in that many of the aforementioned drivers of residential electricity demand– including household, floor space and population growth—grew much more quickly than electricity use over the same period. This trend, which is explored in greater detail in Figure 7, is a central feature of residential sector electricity use since 1990.

Figure 7

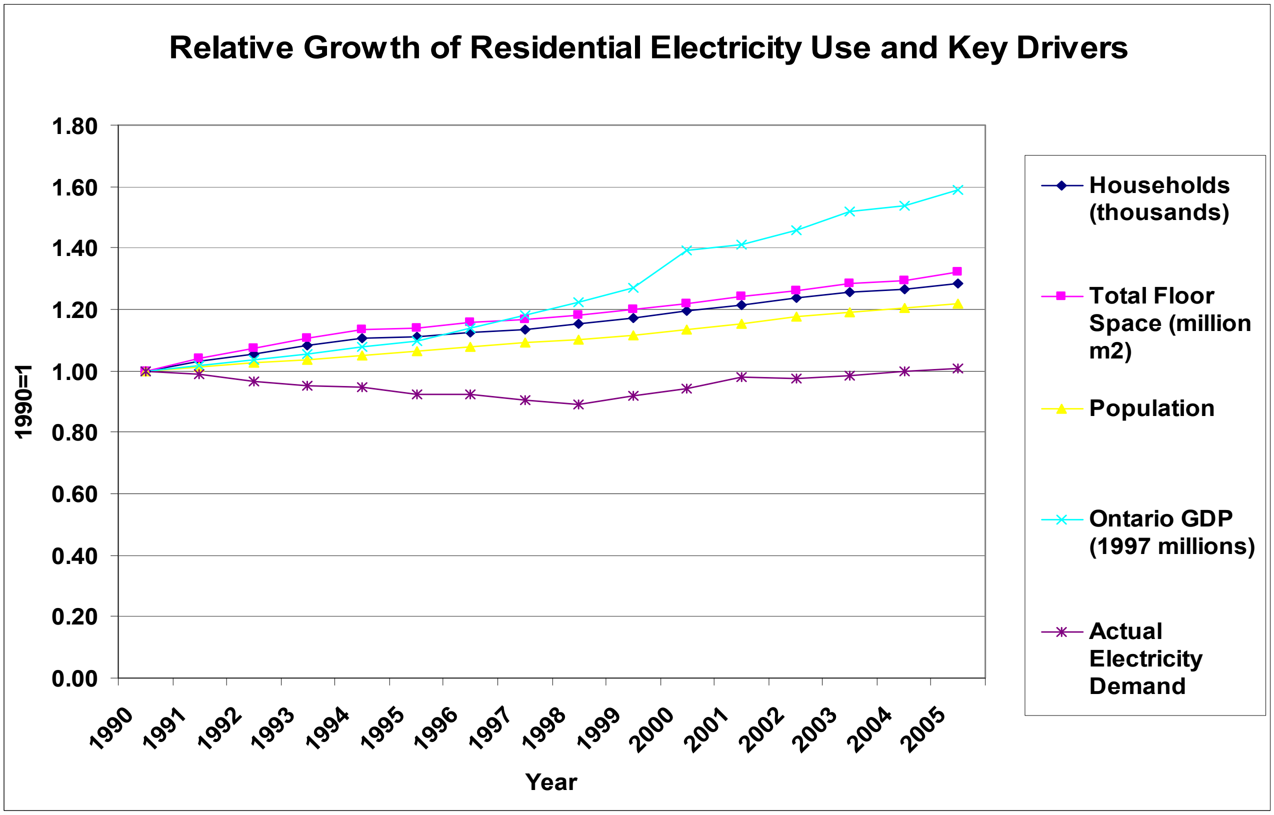
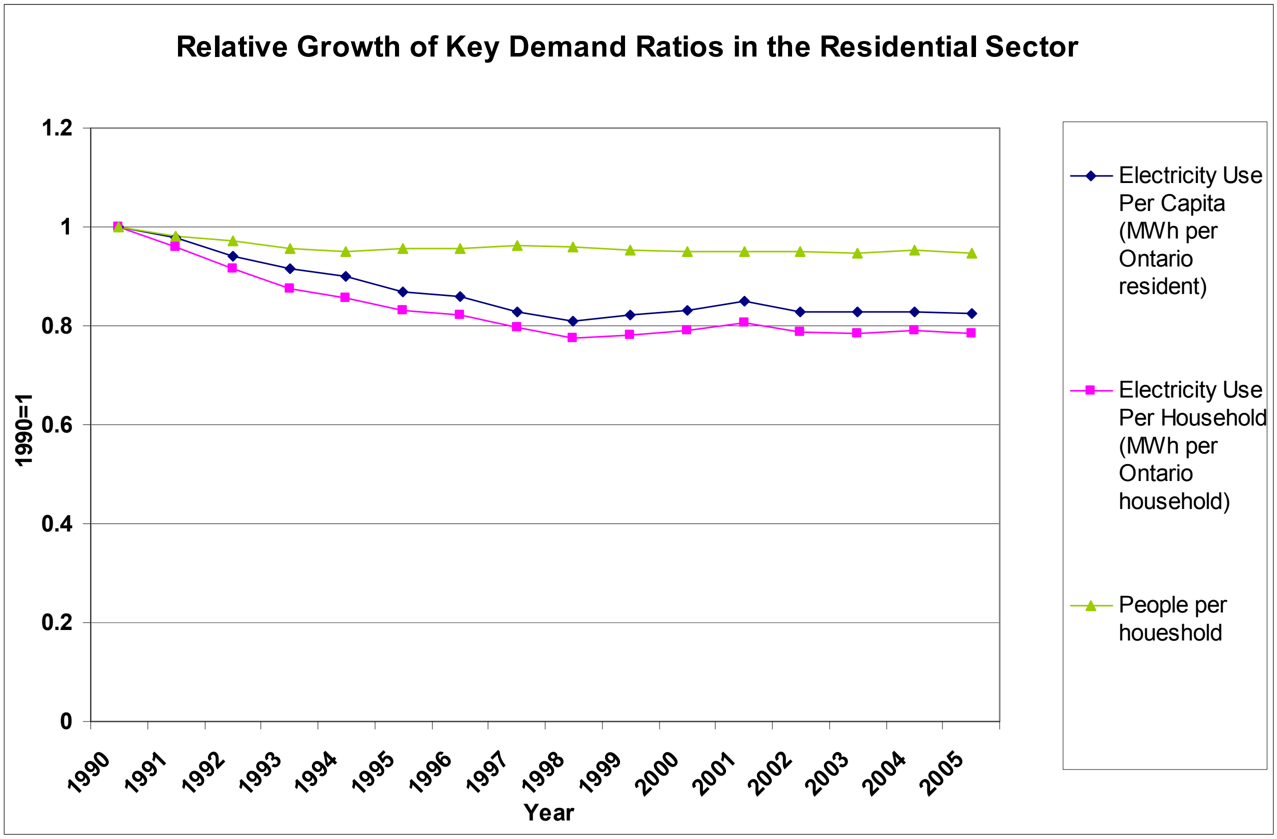


Figure 7 shows the relative growth in actual electricity use and a number of key demand drivers over the historical period (normalized to 1990). The graph illustrates that electricity use did not keep pace with growth in households, total floor space or population. This reflects the growing ‘electrical productivity’ of the Ontario residential sector. Despite near flat growth in electricity use from 1990 to 2005 (electricity use increased by less than 1% from 1990-2005, with average annual growth of 0.05%), the number of households in Ontario increased by 29% over the same period, growing from 3.6 million in 1990 to 4.7 million in 2005. A similar pattern is found with population (which increased by 22%) and total floor space (which increased by 32%). While GDP would not be expected to be correlated with residential sector electricity use, it is included in Figure 7 as a point of reference to show the decoupling of electricity demand and economic growth in the province (a trend that is also borne out in the commercial and industrial sectors).

Expressing these variables as ratios shows that electricity use per household and per capita declined substantially during the historical period (see Figure 8). In 1990, the average Ontario household used 12.5 MW.h of electricity. By 2005, that figure had dropped to 9.8 MW.h, a decrease of 22%. In terms of a per capita comparison, the average Ontario resident used 4.4 MW.h of electricity in 1990 and 3.6 MW.h in 2005, a decrease of 18%. Figure 8 also shows how the number of Ontario residents per household remained essentially flat during the 1990-2005 period, during which time the relative composition of Ontario's housing stock (i.e., single detached, single attached, apartments and mobile homes) did not change significantly.[13]

Figure 8

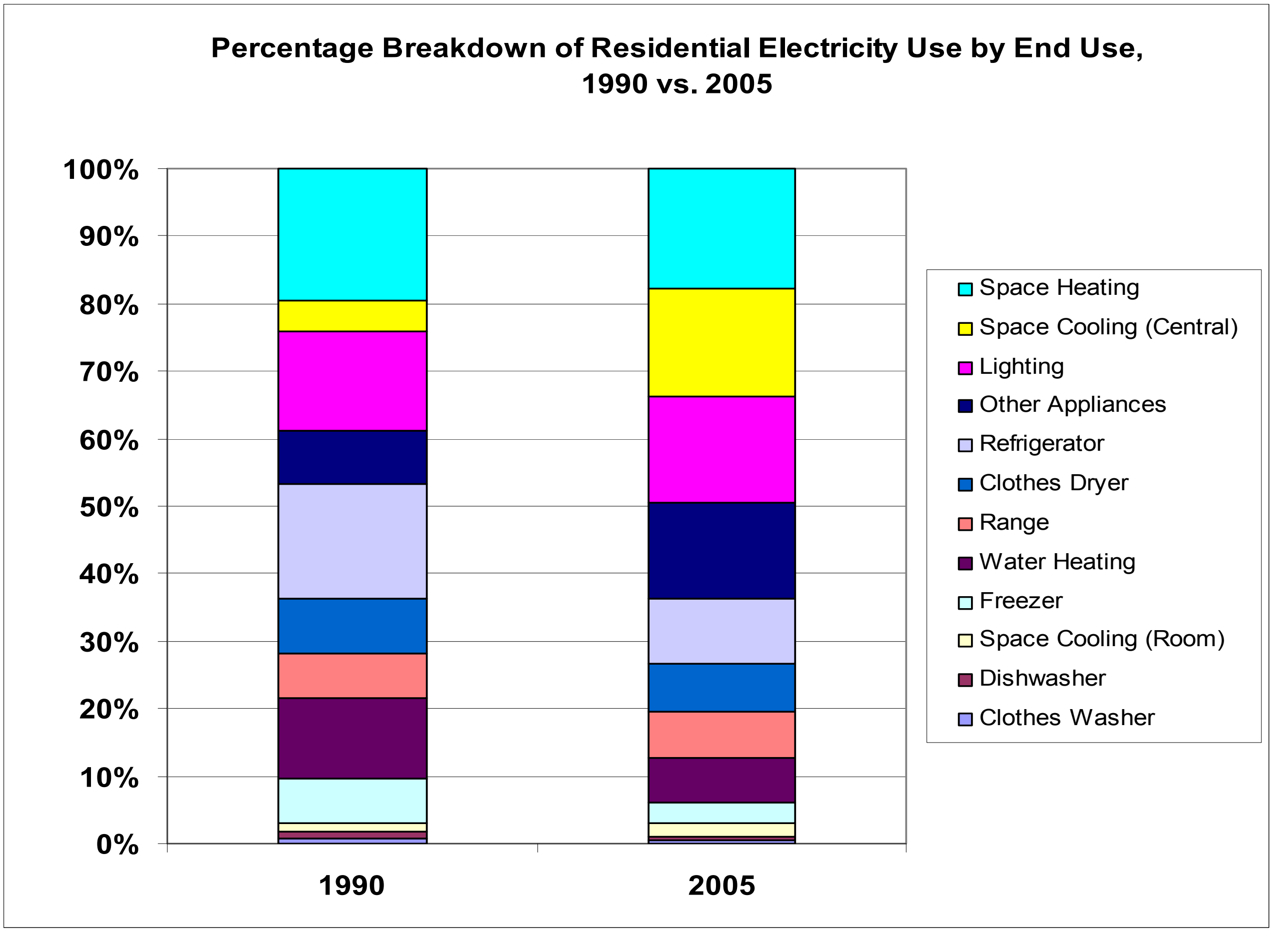


While total residential electricity demand remained essentially flat between 1990 and 2005 (45,274 GW.h in 1990 vs. 45,630 in 2005), the end use composition of electricity demand underwent a number of profound changes.

The first change was that seven end uses experienced negative growth in terms of absolute electricity demand. From 1990-2005, end use demand declined for freezers (-56%), water heating (-45%), refrigerators (-44%), dishwashers (-39%), clothes washer (-23%), clothes dryer (-9%) and space heating (-8%). Given that the stock in the Ontario economy of each of these end uses increased (often dramatically, such as the case with dishwashers) during the period, the decreases point to rapid and systematic energy efficiency improvements that occurred across these product categories beginning in the mid 1990s.

[13]According to the OEE, the percentage breakdown of Ontario's housing stock in 1990 was as follows: single detached (56%), single attached (13%), apartments (30%), and mobile homes (1%). In 2005, the breakdown was as follows: single detached (57%), single attached (14%), apartments (29%), and mobile homes (1%).

Figure 9



Expressed in terms of the change in their relative contribution to total residential sector electricity demand, four of these seven end uses underwent significant declines, with the others remaining relatively constant (i.e. <1%). In 1990, refrigerators and water heating accounted for 17% and 12%, respectively, of residential sector electricity use. By 2005, these figures had dropped to 9% and 6%. Less dramatic declines occurred for freezers (7% of total sector demand in 1990 vs. 3% of total sector demand in 2005) and space heating (20% of total sector demand in 1990 vs. 18% of total sector demand in 2005).

Figure 10

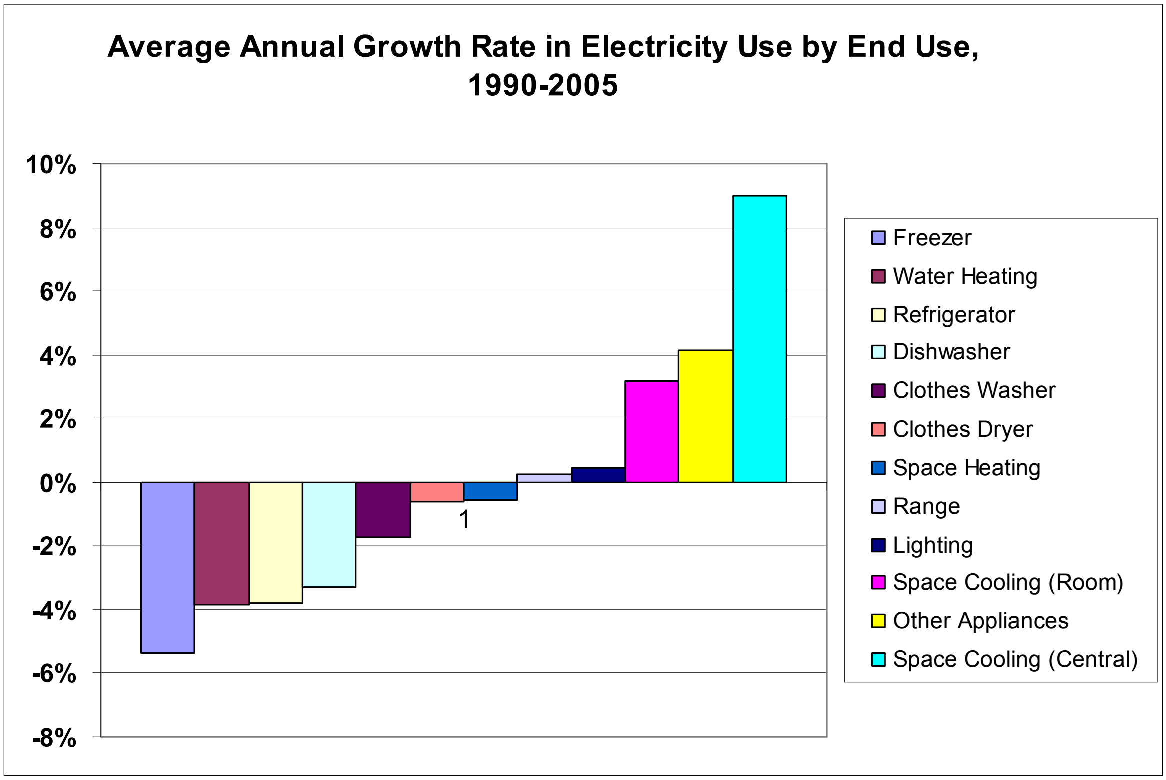
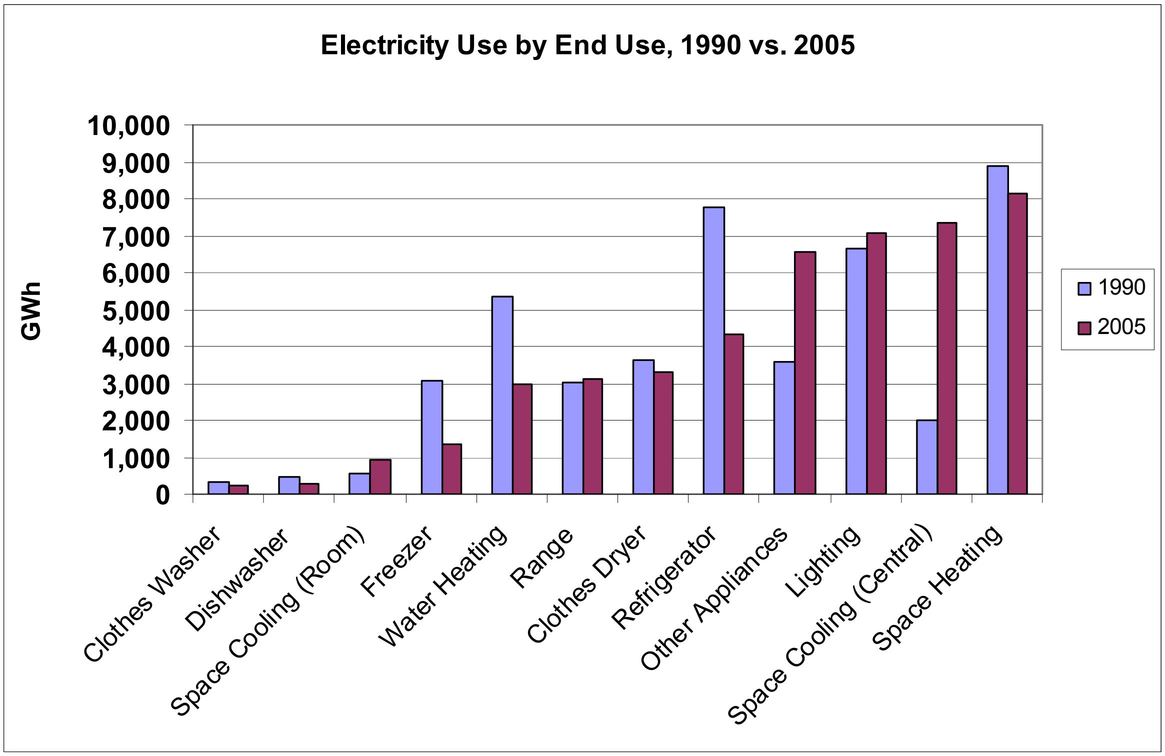

Average Annual Growth Rate in Electricity Use by End Use, 1990-2005
10%
8%
6%
4%
2%
0%
-2%
-4%
-6%
-8%
1
Freezer
Water Heating
Refrigerator
Dishwasher
Clothes Washer
Clothes Dryer
Space Heating
Range
Lighting
Space Cooling (Room)
Other Appliances
Space Cooling (Central)

Figure 11

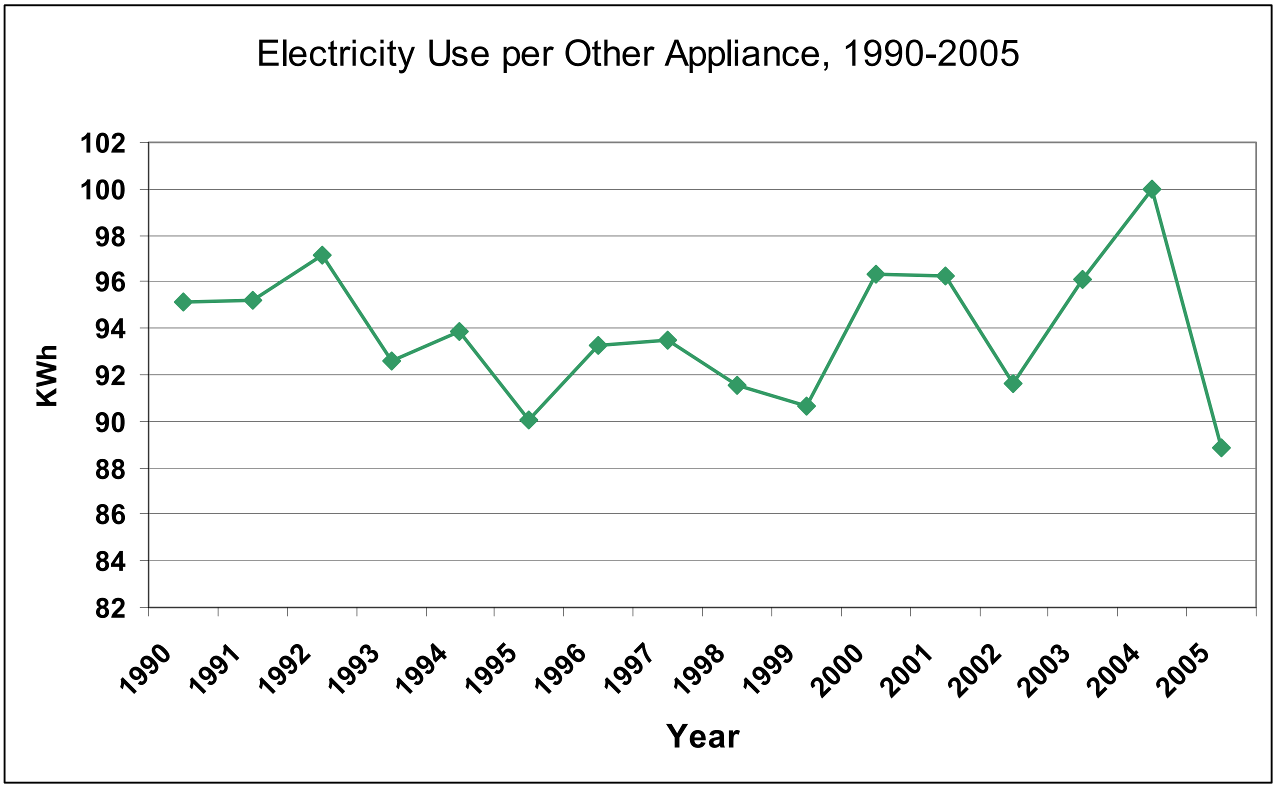


The second major change was that absolute electricity use increased significantly for five end uses, including ranges (4%), lighting (7%), room space cooling (60%), other appliances[14] (84%) and central space cooling, which increased from 2,000 GW.h in 1990 to 7,300 in 2005, a gain of 263%. While the relative contribution to total residential sector electricity use remained constant for lighting, ranges and room space cooling, it increased markedly for other appliances (8% in 1990 compared to 14% in 2005) and central space cooling (4% in 1990 compared to 16% in 2005).

The increase in end use demand for other appliances and central space cooling is clearly a function of shifting consumer preferences for these devices. The number of other appliances in Ontario grew from approximately 38 million in 1990 (roughly 10 per household) to 74 million by 2005 (roughly 16 per household). At the same time, electricity use per other appliance dropped from approximately 95 KWh in 1990 to 88 in 2005 (see Figure 12).[15]

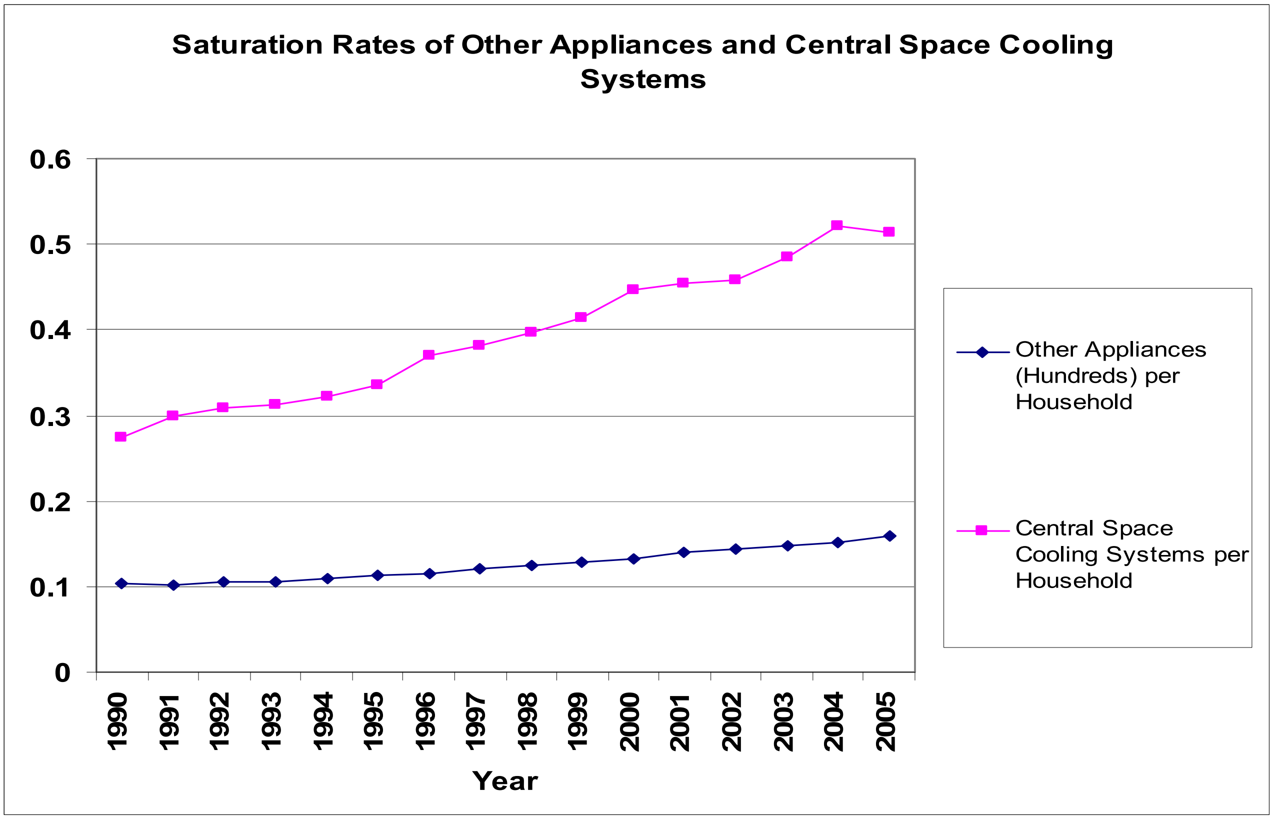
[14] The OEE defines 'other appliances' as "small appliances such as microwaves, televisions, cable boxes, video cassette recorders, stereo systems and computers."
[15] The sudden decline in electricity use per other appliance from 2004 to 2005 could be a result of an error in the OEE Comprehensive Energy Use database. The decline (from roughly 100 KWh in 2004 to 89 KWh in 2005) is a function of both a significant decrease in the amount of total electricity use from other appliances reported over 2004-2005 and a sizeable increase over 2004-2005 in the number of other appliances in the economy.

Figure 12



Looking at space cooling, in 1990, there were 997,000 central space cooling systems in Ontario, or 0.3 per household. By 2005, there were 2.4 million systems in Ontario, or 0.5 per household. Figure 13, which compares the saturation rate for these two end uses, shows that growth in central space cooling systems per household appears to be tapering off, which could put downward pressure on residential sector electricity growth going forward.

Figure 13

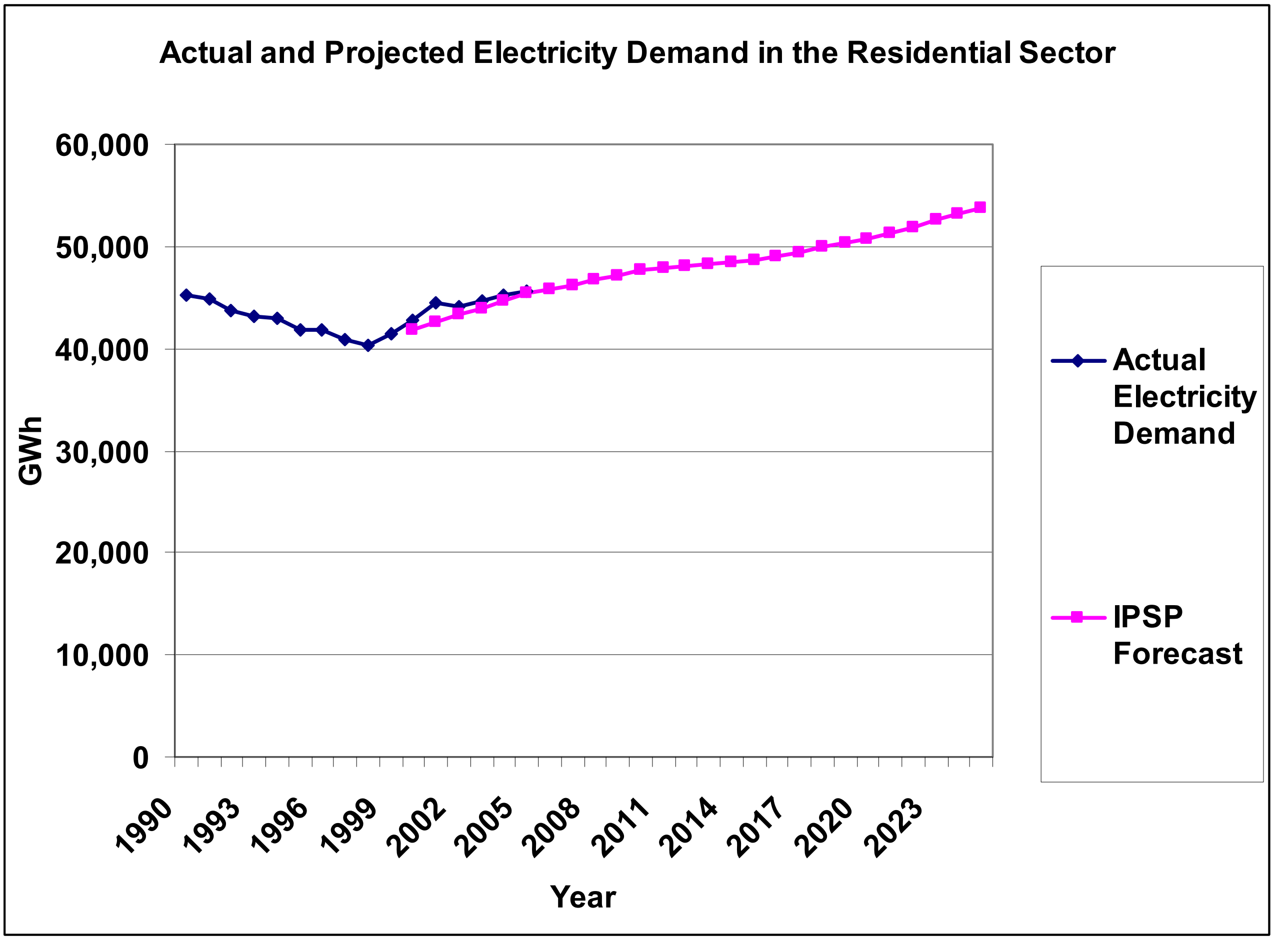


Analysis of the IPSP Forecast

Figure 14 shows actual electricity use in the residential sector from 1990 to 2005 and projected use from 2000–2025 under the IPSP forecast. The IPSP reference case anticipates an increase in residential electricity demand from 41,900 GW.h in 2000 to 53,830 GW.h in 2025, an increase of 11,930 GW.h or 28%.[16] Analyzing the 5 year overlap (2000-2005) between actual electricity demand data from the OEE and forecasted electricity demand from the IPSP shows that the latter is tracking relatively closely to historical trends. The IPSP forecast for 2000 was 41,900 GW.h, while actual demand was 42,730 GW.h. A gap of approximately 2,000 GW.h between actual and forecasted data emerged in 2002, but it narrowed to a negligible amount by 2005. Indeed, the difference between actual electricity use in 2005 and the IPSP forecast was only 307 GW.h.

[16] Since data in the IPSP reference case are provided in six, five-year increments (e.g. 2000,2005,2010,2015,2020 and 2025), data points for the intervening years were interpolated. The same method is followed in the commercial and industrial sectors.

Figure 14

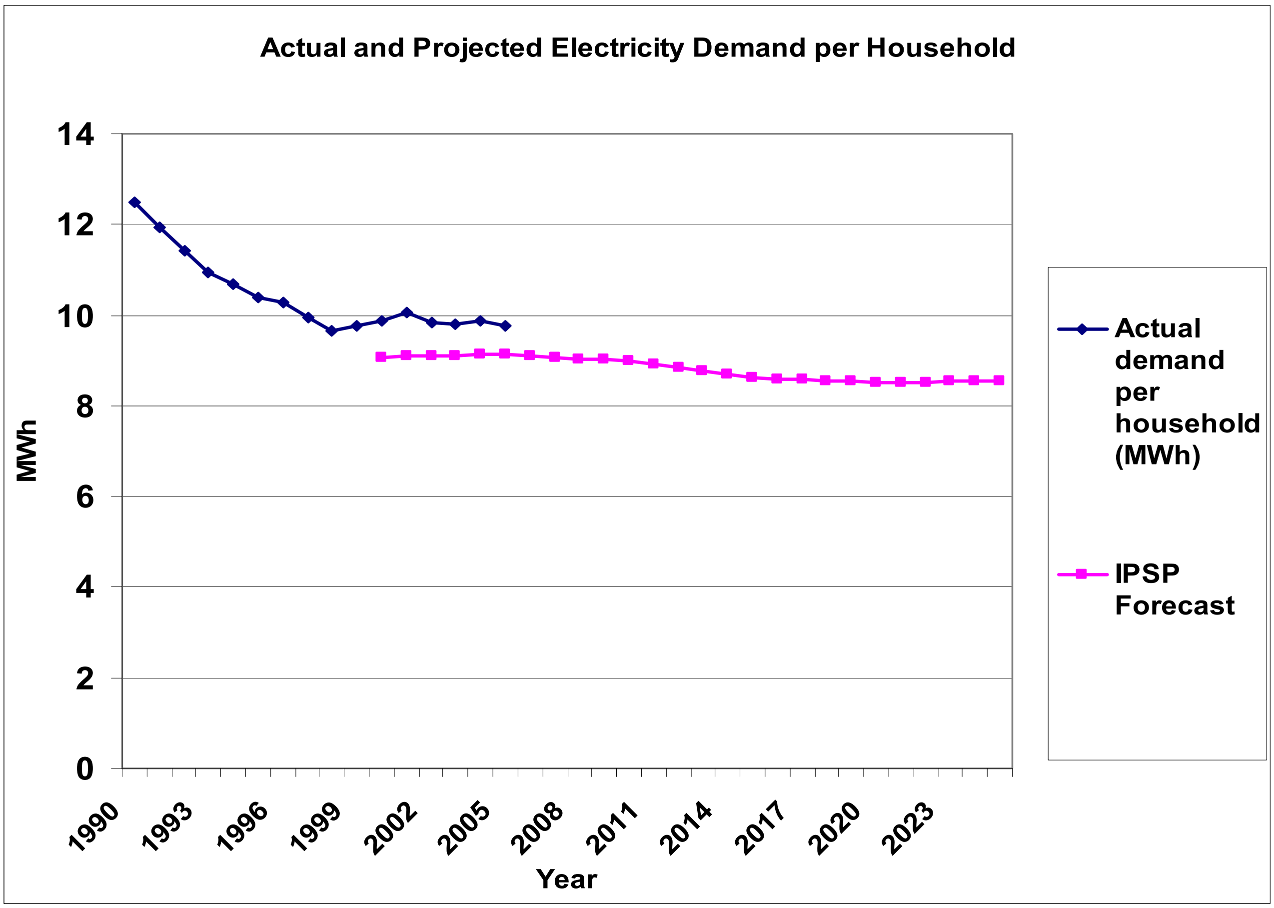


Looking at electricity demand per household (Figure 15), the IPSP anticipates a modest decline over the forecast period, reaching 8.5 MW.h per household by 2025. Demand per household in the IPSP forecast for the overlap period of 2000-2005 is slightly lower than actual demand per household not because of differentials in electricity demand but rather because the number of households in the IPSP forecast is larger than the number of households in the OEE database.[17] Despite this discrepancy, the IPSP forecast anticipates a slowing down and ultimately a reversal of the pronounced trend towards declining energy use per household observed from 1990-2005. From 1990-2005, electricity use per household declined on average by 1.61% per year. Demand

[17] The IPSP states that its economic growth projections (including forecasts for households) are based on growth rates found in the NRCan Energy Outlook 2006 (see D-4-1, Attachment 6, pg. 20). However, investigation revealed that the IPSP household forecast does not appear to correspond to data in the source document. For example, the IPSP forecasts 4.96 million households in 2005, while the NRCan Energy Outlook 2006 forecasts 4.73 million. See "Canada's Energy Outlook: The Reference Case, 2006," NRCan, Analysis and Modelling Division, pg. 183. The origin of the household data in the IPSP is therefore unclear.

per household under the IPSP forecast is expected to decline on average by 0.24% per year. Moreover, demand per household under the IPSP forecast is expected to begin *increasing* in 2020, albeit very marginally.

Figure 15



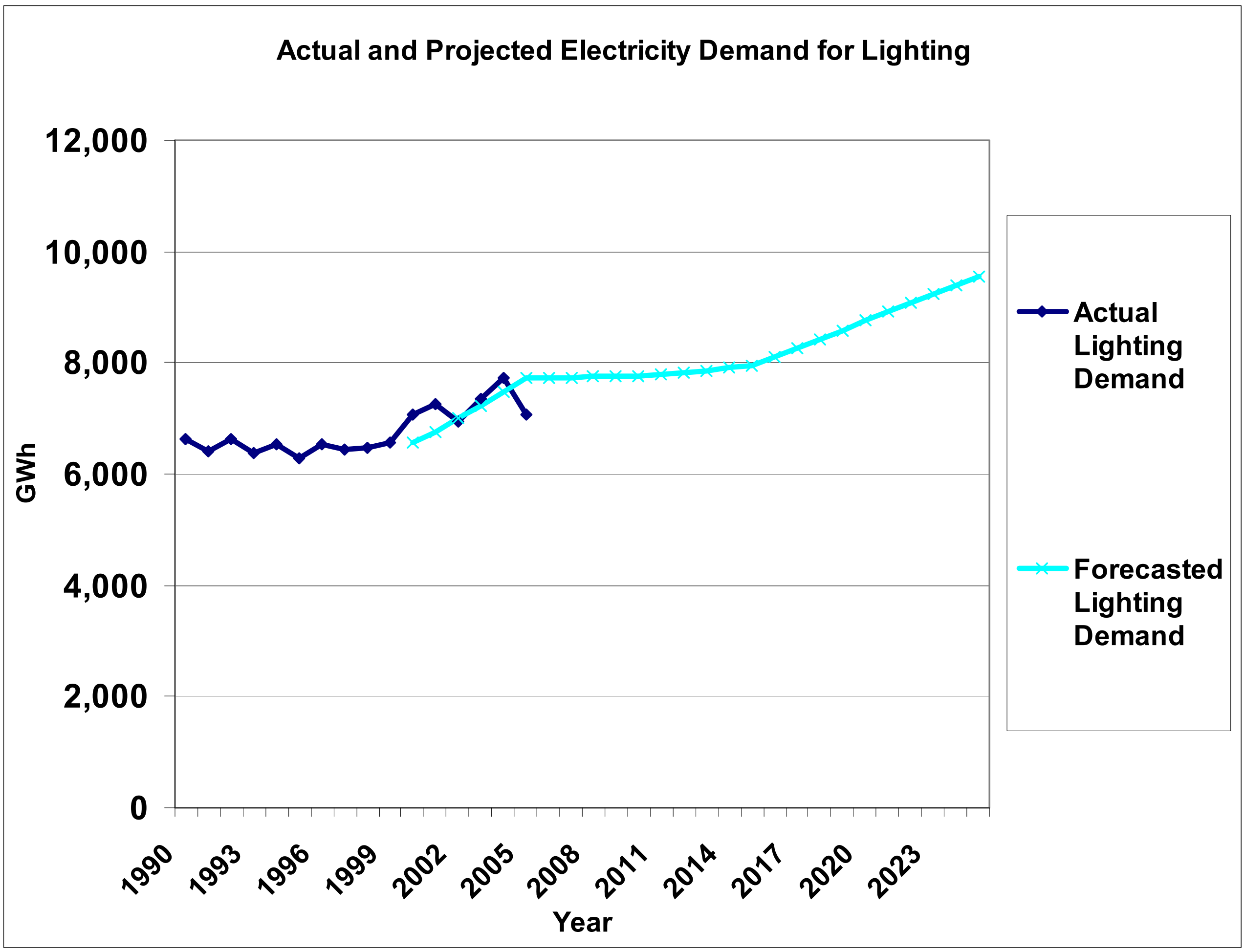
In terms of the end use distribution of residential electricity use in the OPA forecast, it identifies thirteen end use categories, which generally correspond with the twelve end use categories used by the OEE.[18] This relatively seamless overlay facilitates between historical end use demand and projected end use demand under the IPSP forecast.

As mentioned above, the IPSP projects that residential sector electricity use will increase by approximately 11,900 GW.h from 2000-2025. *Over 99% of this increase is expected to come*

[18] The 12 overlapping end use categories are: central space cooling, clothes dryer, clothes washer, dishwasher, freezer, lighting, other/minor appliances, range, refrigerator, room space cooling, space heating and water heating. The 13th standalone category identified in the IPSP but not in the OEE database is for electric furnace fans.

from just two end uses: lighting and other appliances. Figure 16compares actual and projected electricity use from lighting, while Figure 17 looks at demand from other appliances.

Figure 16



Insofar as lighting is concerned, the IPSP assumes "a slight increase in the penetration of compact fluorescent lighting." This assumption has been overtaken by the federal policy to phase out incandescent lighting by 2012. The IPSP reference case does not address the effects of this policy shift because it does not take into account any conservation and demand management (CDM) programs implemented after 2000.

While the government plan does not make it illegal to use incandescent bulbs, the IPSP reference forecast is inconsistent with expected technological trends in that it uses a constant figure of 0.055 MW.h per incandescent bulb across the entire forecast period. Since this figure is higher than the new standard for incandescent bulbs that will take effect in 2012, the IPSP reference case almost certainly overstates electricity demand for lighting.

The specific impact on electricity demand of a wholesale transition from incandescent bulbs to more energy efficient alternatives such as compact fluorescents is far from trivial. Shifting 50% of the number of forecasted incandescent bulbs in 2025 to compact fluorescent bulbs would trim a full 3,500 GW.h from the IPSP reference case forecast for residential sector electricity demand in 2025 (6.5% of total forecasted 2025 demand for residential sector). This conforms with the success of similar government programs in other jurisdictions and may understate the case. According to internal ICF models, compact fluorescent bulbs could overtake incandescent bulbs in the Canada-wide residential lighting market as early as 2014. In the IPSP reference case, incandescent bulbs command a 94% share of the total 2025 light bulb stock with compact fluorescents capturing 5.8%.[19]

[19] The remaining 0.2% is captured by light emitting diodes.

Figure 17

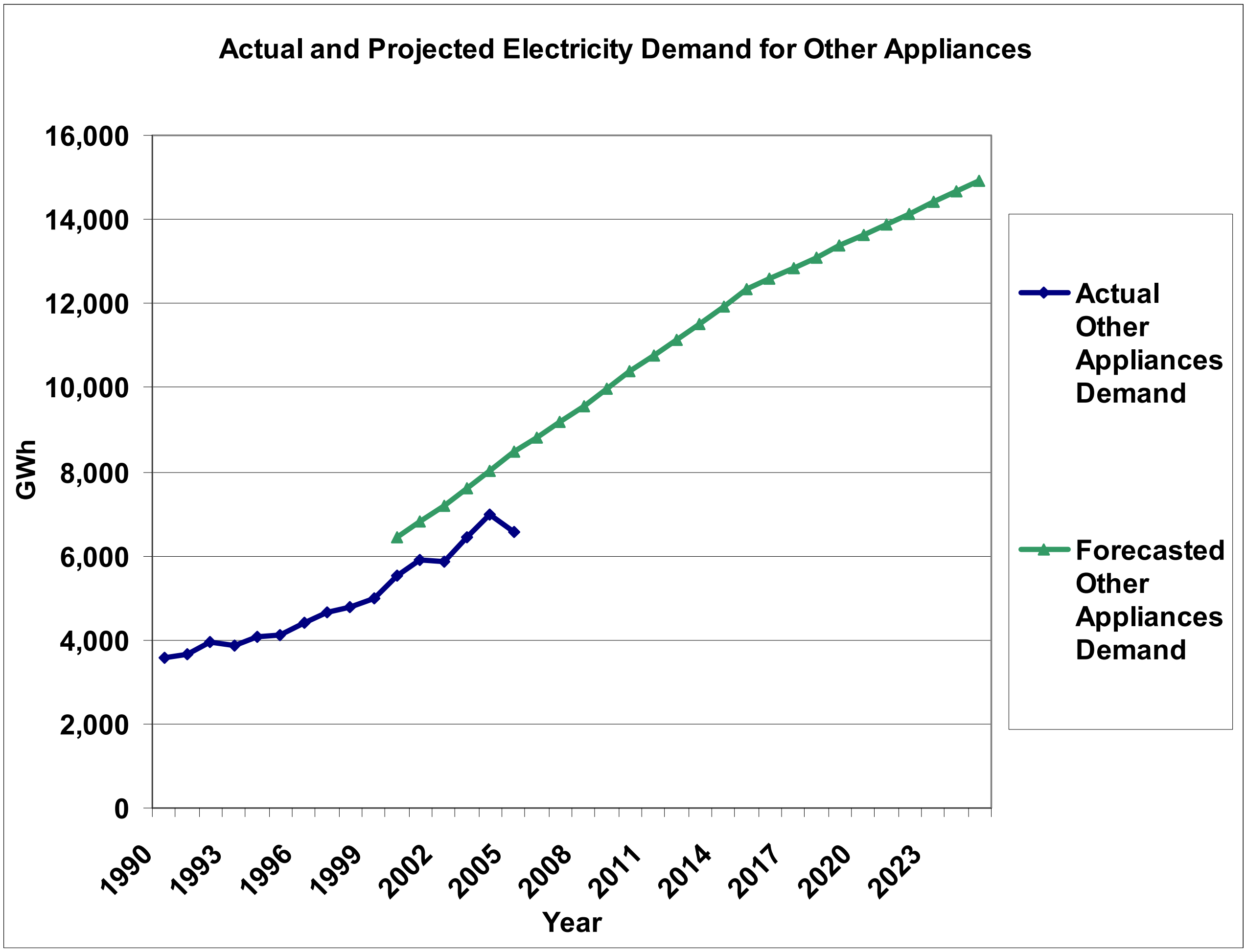
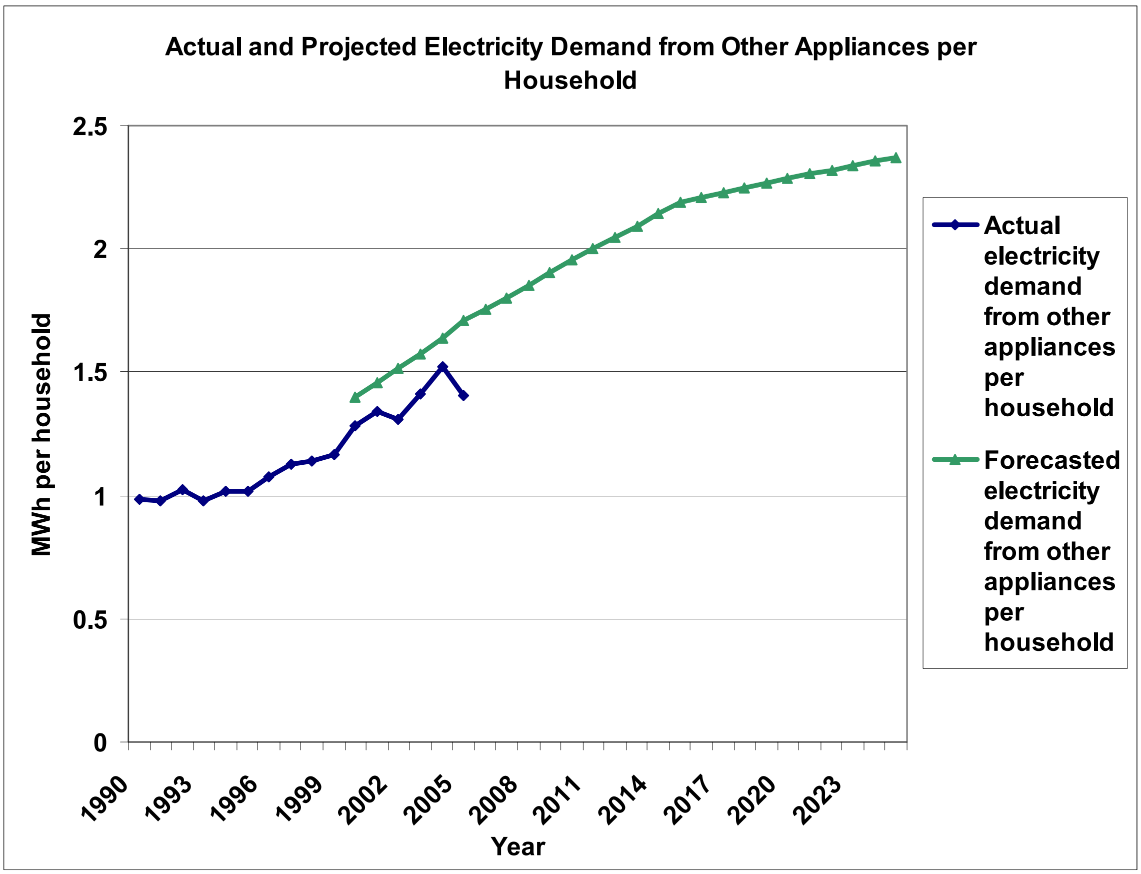


Figure 17 illustrates the steep growth trajectory anticipated in the IPSP reference case for electricity use from other appliances. "Other appliances" are by far the largest contributor to the increase in residential sector electricity demand forecast in the IPSP. Of the 11,900 GW.h increase forecast over 2000 to 2025, fully 8,470 (71%) comes from "other appliances". Thus the forecast for the residential sector as a whole depends greatly on anticipated demand for these appliances.

While the basis for residential electricity growth in the OPA forecast rests almost totally on the growth of electricity consumption of "other appliances", the supporting analysis in the MKJ/Marbek calibration is particularly weak. Per household electricity use in this category grows from 1,500 kW.hours to 2,400 kW.hours over the forecast period, as shown in Figure 18, but the basis for this projection is unclear. We know that the stock of "miscellaneous" electricity using devices will grow during this period, but how much the related electricity will grow, if at all, depends on how much they are used and per device use will tend to decline as the number of devices per household increases, even as household size itself continues to decline. To the extent standby losses are an important contributor to this end use category, it is also worth noting that there is an intense international research and technological development effort underway to address this issue, an effort that will likely have a significant impact on the time scale of this forecast.

Figure 18



Another issue with respect to the MKJ/Marbek calibration of the forecast has to do with the importance of the end use calibration of historical electricity use both in providing a sound basis for projecting future electricity use and as a reliable basis for DSM potential analysis. In and end use forecast such as the OPA forecast, in which different end uses are forecast at different rates, if the initial allocation of electricity use to end use categories is wrong, then the forecast will be growing electricity demand at the wrong rate. For example, if the initial calibration assigns too little electricity to an end use that has a relatively slow growth rate, and assigns it instead to an end use that has a relatively high growth rate, then the forecast will be high.

There is a compounding problem with end use misallocation, and that is the effect it has on any subsequent estimate of DSM potential. For example, if too electricity use is allocated to an end use that has a relatively high DSM potential, and instead is allocated to an end use with relatively low DSM potential, then when the DSM potential analysis is done, it will tend to underestimate the overall potential for DSM to moderate the forecast.

In the MKJ/Marbek residential electricity forecast, an example of this type of compounding error occurs with respect to electricity use in furnace fans. The MKJ/Marbek calibration assumes only about a million Ontario households have furnace fans, with total base year electricity use of 1,200 GW.hours, averaging about 1,200 kW.hours per fan. However, there are some 3,000,000 houses in Ontario with furnace fans, three times more than the MKJ/Marbek estimate, so a figure of 3,600 GW.hours seems a more reasonable base year number for this end use. (With the increasing use of these fans for air circulation and as part of central cooling systems, the 1,200 kW.hour average figure may also bee too low, further exacerbating the calibration error for this end use.)

Because the base year is calibrated to actual electricity use, the "missing" furnace fan electricity use (the difference between 3,600 GW.hours or more and the MKJ/Marbek estimate of 1,200 GW.hours) must be misallocated to other end uses. The total number of furnace fans in Ontario grows at the rate of new houses that install forced air heating systems; if the base year electricity use that should have been assigned to furnace fans has been misallocated to end uses that grow faster than this (e.g. "other appliances") the resulting forecast will be high. When the error is as large as it appears to be in the case of the residential furnace fans, the effect on the overall forecast can be significant.

The furnace fan case also illustrates the problem that end use misallocation can have on subsequent analysis of DSM potential. The new ECM motors reduce furnace fan electricity use by 75%;[20] although evidently not captured in the MKJ/Marbek DSM technology database, the residential furnace fan has a very high potential for electricity improvement. Because it is also one of the largest residential electricity end uses (probably the largest in homes that do not have electric space or water heating), the large under-allocation of furnace fan electricity use in the OPA forecast means that the DSM potential for this end use will also be underestimated. In a case like this, where the end use is large and has above average efficiency improvement potential, the resulting underestimation of DSM potential can be significant.

[20] Gusdorf, J., Hayden, S., Entchev, E., Swinton, M., Simpson, C., and Castelian, B. "Final Report on the Effects of ECM Furnace Motors on Electricity and Gas Use: Results from the CCHT Research Facility and Projections." Canadian Centre for Housing Technology, NRCC-38500, 2003.

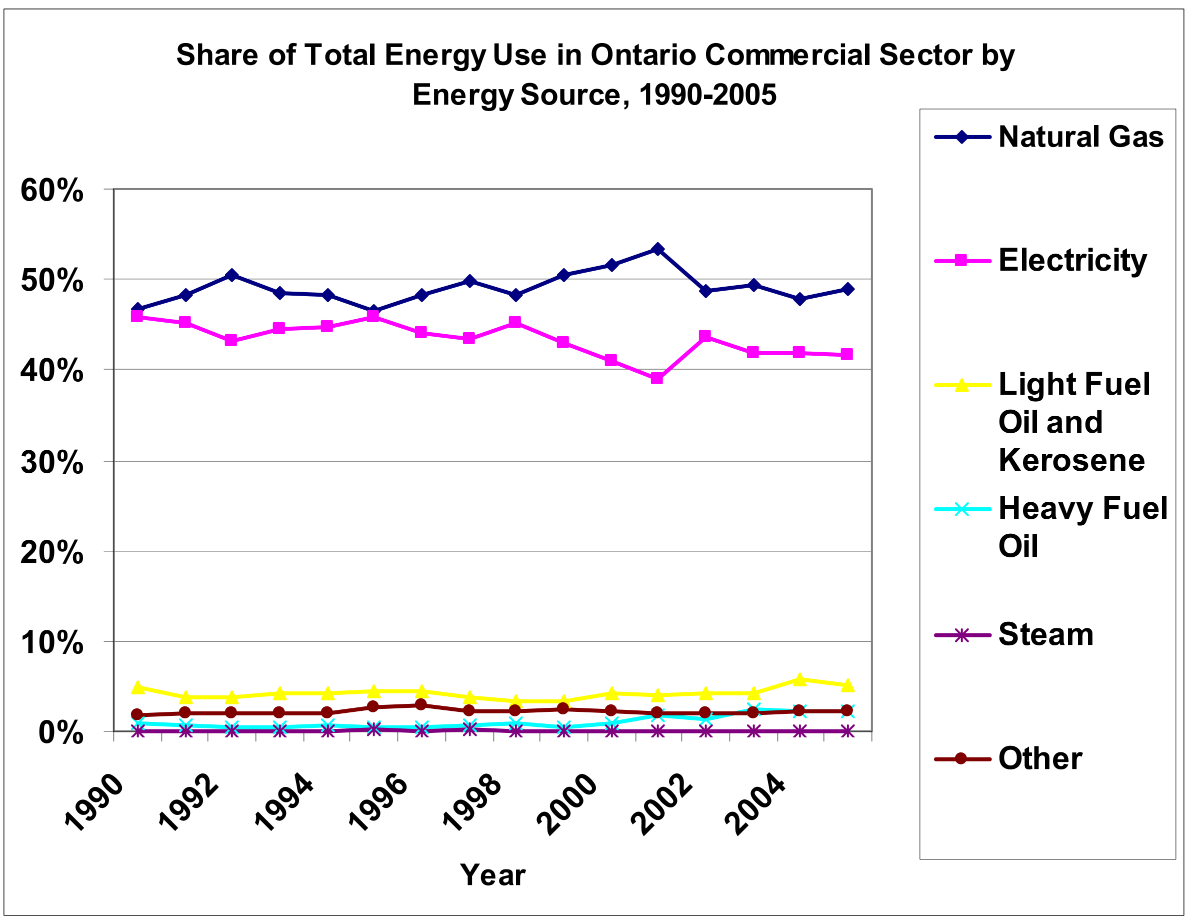
Commercial Sector

Structure of Electricity Demand

Electricity demand in the commercial sector is driven by a number of different factors. The variable with the tightest historical correlation to actual electricity demand has been commercial sector floor space, however other important determinants of electricity use include commercial sector GDP and the proportion of commercial institutions using electricity for space heating.

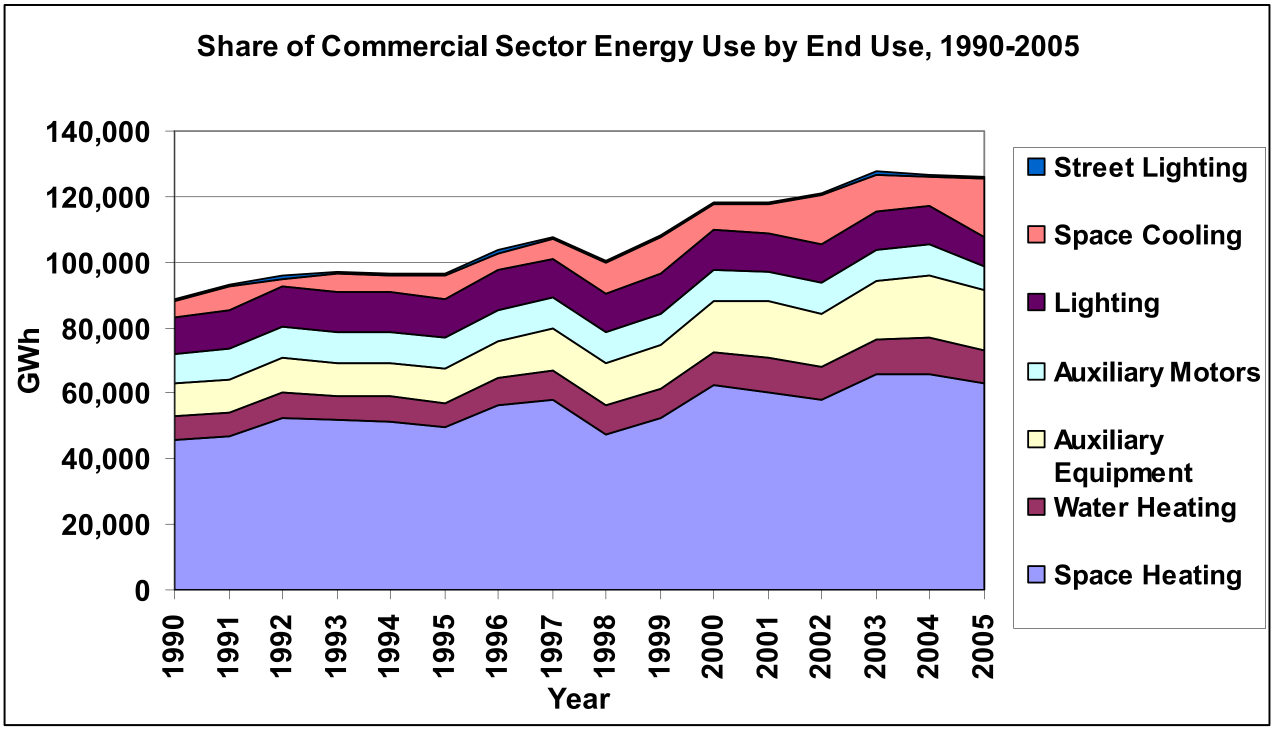
Like energy use in the residential sector, energy use in the commercial sector is dominated by natural gas and electricity (see Figure 19). In 2005, 49% of total energy use came from natural gas, while 42% came from electricity.

Figure 19



Segmenting energy by end use (Figure 20), we see that space heating accounts for the largest proportion of energy use, representing 52% of total energy demand in 2005. Figure 20 provides little evidence of any expected changes in the composition of end use demand going forward, although the increased share of space cooling over 2004-2005 could be an indication of growing future demand for this end use.

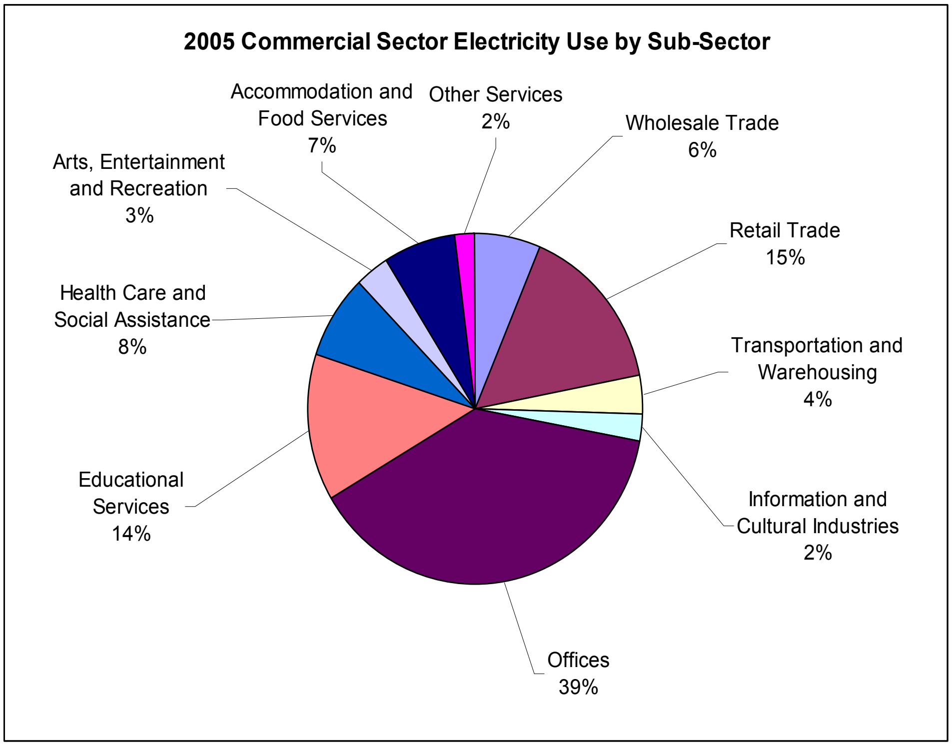
Figure 20



The largest user of electricity in the commercial sector at the sub-sector level is offices[21], which, in 2005, accounted for nearly 40% of total electricity consumption in the sector (see Figure 21).

[21] Offices includes activities related to finance and insurance; real estate and rental and leasing; professional, scientific and technical services; and public administration.

Figure 21



Historical trends

Electricity demand in the commercial sector increased from approximately 5,000 GW.h in 1958 to 53,000 GW.h in 2005 (see Figure 22) . In 2005, the sector accounted for 37% of total residential electricity use (compared to 31% for residential and 32% for industrial). This represents an increase in share from 1990 when the commercial sector accounted for 30% (compared to 35% for both residential and industrial). The commercial sector is thus the only sector whose electricity demand consistently grew during the 1990-2005 period, both in absolute terms and in terms of relative contribution to overall electricity demand in the province.

Figure 22

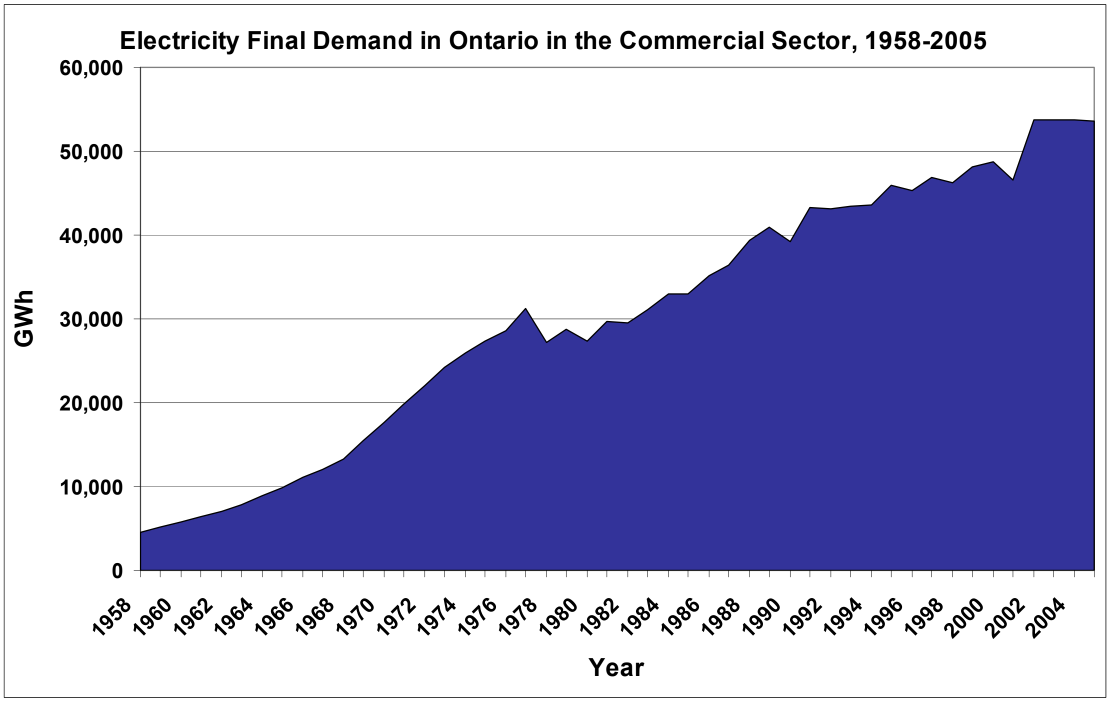


Figure 23 examines the historical relationship among the main drivers of commercial sector electricity demand, including total commercial floor space, Ontario GDP, commercial sector GDP, and actual electricity use. This analysis shows that electricity demand has traditionally tracked very closely to commercial sector floor space. From 1990-2005, commercial sector electricity demand grew on average by 1.72% per year, while floor space grew at 1.75% per year. The graph also shows how electricity demand diverged from economic output (measured in terms of Ontario GDP and commercial sector GDP) during the historical period.

Figure 23

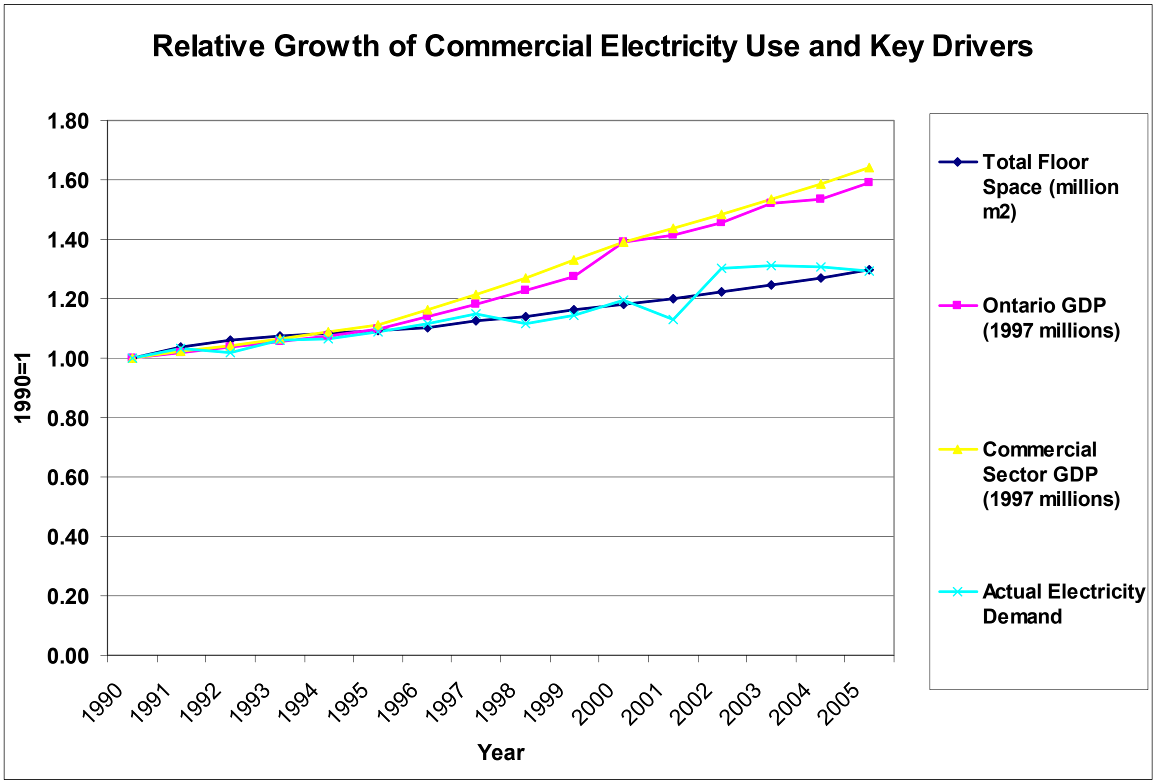

Relative Growth of Commercial Electricity Use and Key Drivers
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
1990=1
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
Year
Total Floor Space (million m2)
Ontario GDP (1997 millions)
Commercial Sector GDP (1997 millions)
Actual Electricity Demand

Figure 24

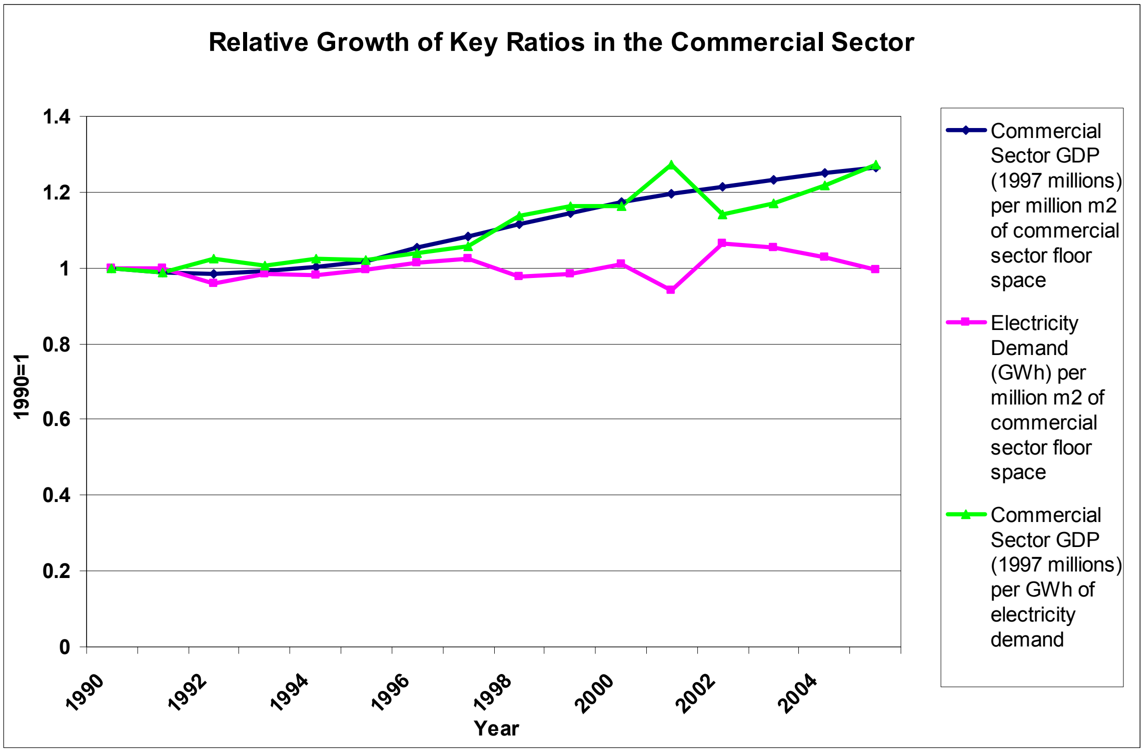


Figure 24 shows that the electrical productivity of the commercial sector (measured in terms of commercial sector GDP produced per unit of electricity) increased significantly during the 1990-2005 period. In 1990, 1 GW.h of electricity use generated $4.8 million in commercial sector GDP (in constant 1997 dollars). In 2005, the same amount of electricity produced $6.1 million in commercial sector GDP (in constant 1997 dollars), a 27% increase. Counterevidence to this trend occurred during the bear market of 2001-2002, where electrical productivity declined sharply. Since that time, however, the decoupling of electricity demand and economic growth has continued.

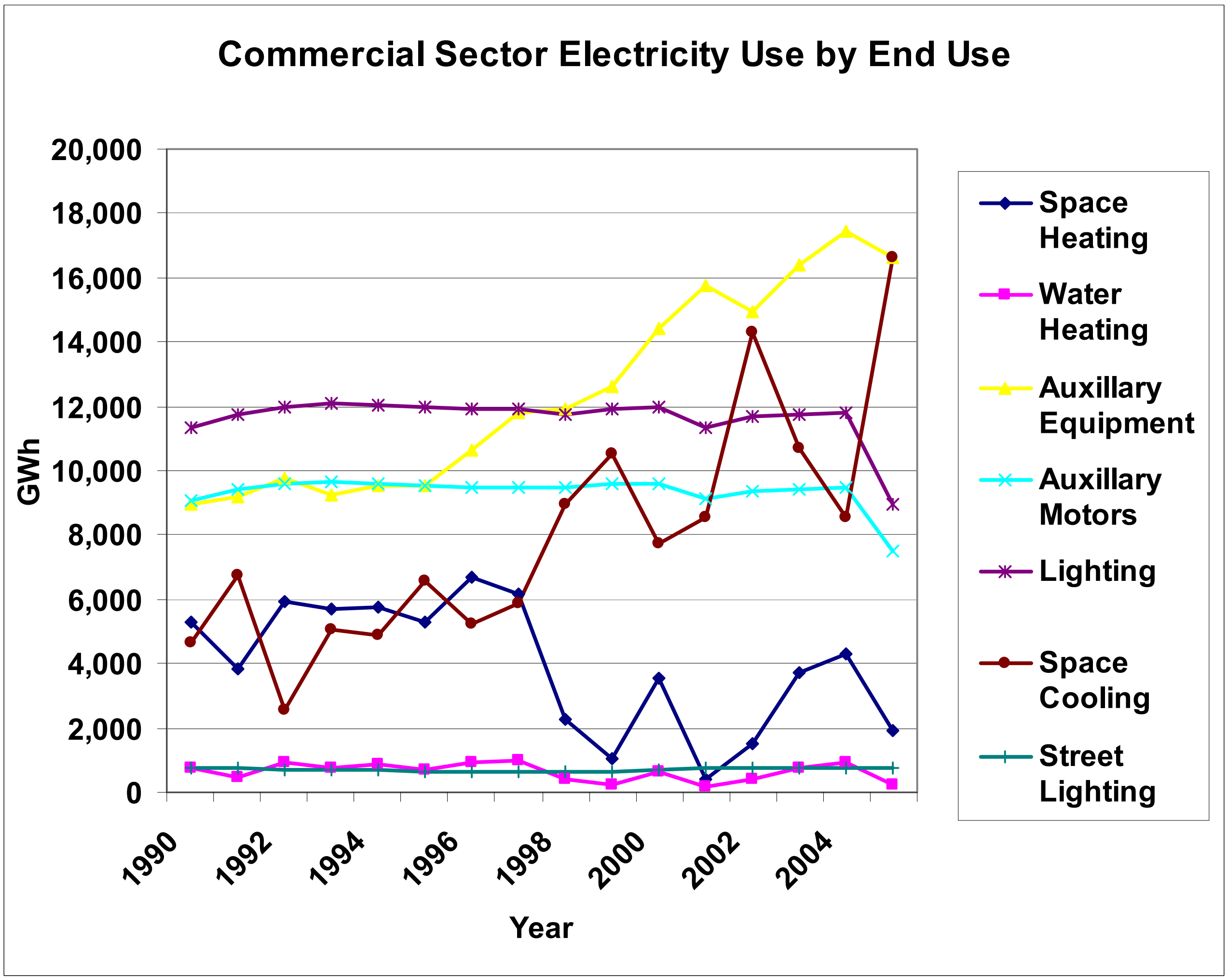
Figure 24 also illustrates how electricity demand per unit of commercial sector floor space remained essentially flat from 1990-2005, with the exception of a notable dip during the economic slump of the early 2000s.

Segmenting total electricity use in the commercial sector over the 1990-2005 period by end use yields a number of insights into how consumer demands for electricity are changing (Figure 25). The most notable trend has been the growth in electricity demand for space cooling, which grew by 260% during the period, increasing from 4,900 GW.h in 1990 to over 16,000 GW.h by 2005.

An equally compelling trend has been the steady growth in electricity use for auxiliary equipment[22], which increased by 86% from 1990-2005 (average annual growth of over 4%).

The most dramatic decreases over the period occurred for water heating (-8% average annual growth), space heating (-7% average annual growth) and lighting (-2% average annual growth), while growth was flat for auxiliary motors (-1% average annual growth) and street lighting (-0.2% average annual growth). In the case of water heating and space heating, the decreases were largely a function of electricity's eroding market share at the expense of natural gas (natural gas increased its share of the water heating market from 77% in 1990 to 83% in 2005 and the space heating market from 77% in 1990 to 82% in 2005).

Figure 25



[22] Auxillary equipment includes stand-alone equipment powered directly from an electrical outlet, including computers, photocopiers, refrigerators and desktop lamps.

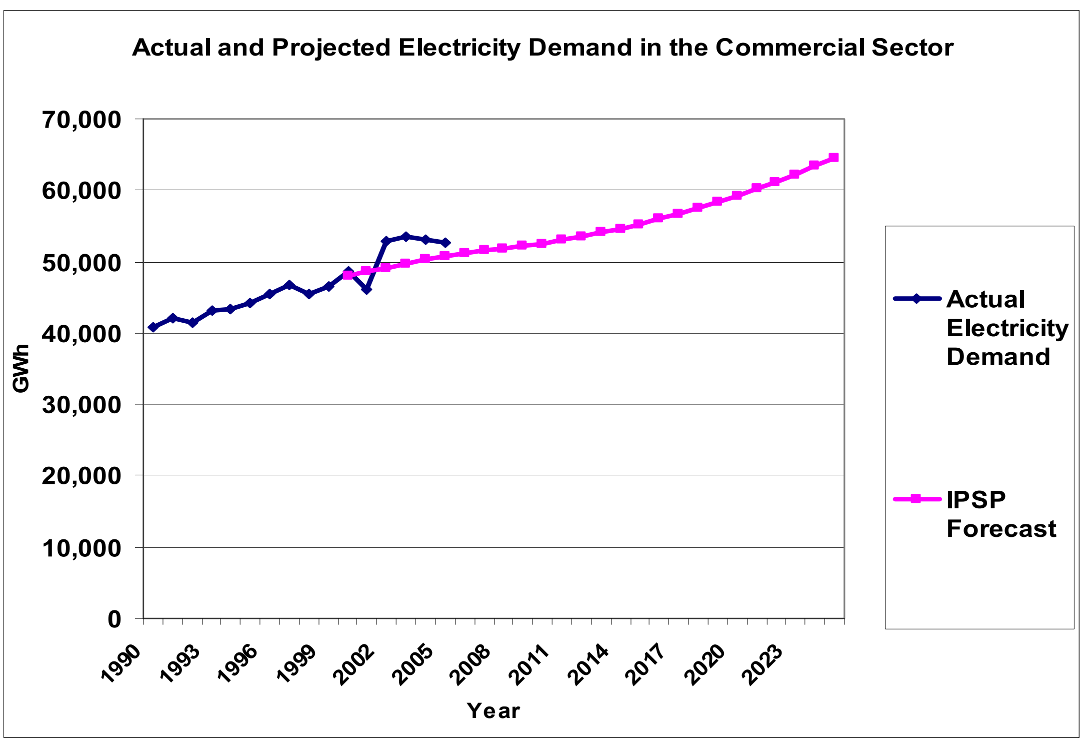
When interpreting trends in end use electricity demand in this sector, it is important to understand that in most (but not all) cases, data for 2005 diverged sharply from the historical pattern that had been established up until that point. Nowhere is this more evident than for water heating. Looking at 1990 to 2005 data, electricity demand for water heating dropped 71%, from 760 GW.h to 225 GWH, for an average annual decline of approximately 8%. However, based on 1990 to 2004 data, electricity use for water heating *increased* by 19% and grew, on average, by over 1% per year.

Similar interpretation issues are at play when assessing trends in end use demand for lighting, which, depending on the termination year, either decreased by 2% (on average) per year, or increased by 0.3% (on average) per year.

Analysis of the IPSP Forecast

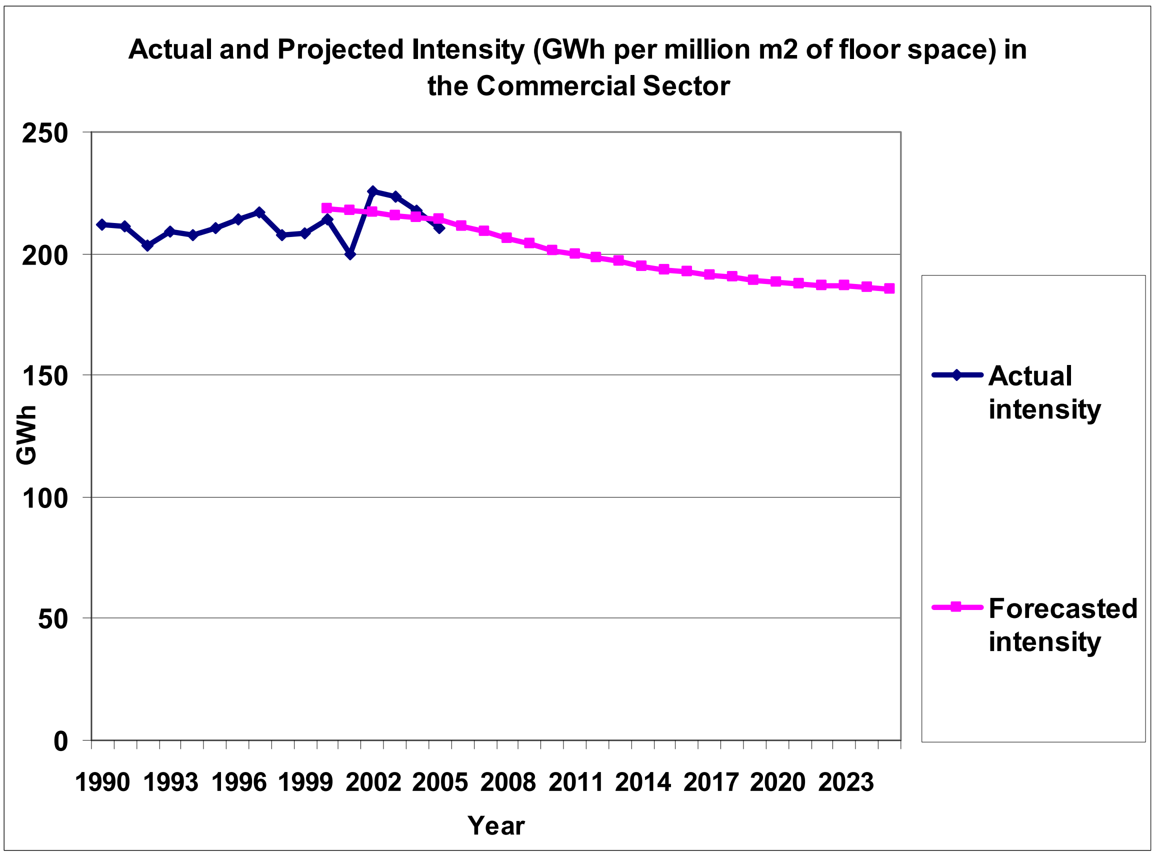
Under the IPSP reference case forecast, commercial sector electricity demand is expected to grow from 47,980 GW.h in 2000 to 64,430 GW.h in 2025, an increase of 16,450 GW.h or 34%. Figure 26 shows actual electricity use in the commercial sector from 1990 to 2005 and projected use from 2000–2025 in the IPSP forecast. The average annual growth rate during the 1990-2005 period was 1.72%, while the average annual growth rate across the IPSP forecast is 1.19%.

Figure 26



As demonstrated in Figure 27, the IPSP forecast anticipates a steady decline in the electrical intensity of the commercial sector, measured as electricity use per million m2 of commercial floor space.

Figure 27



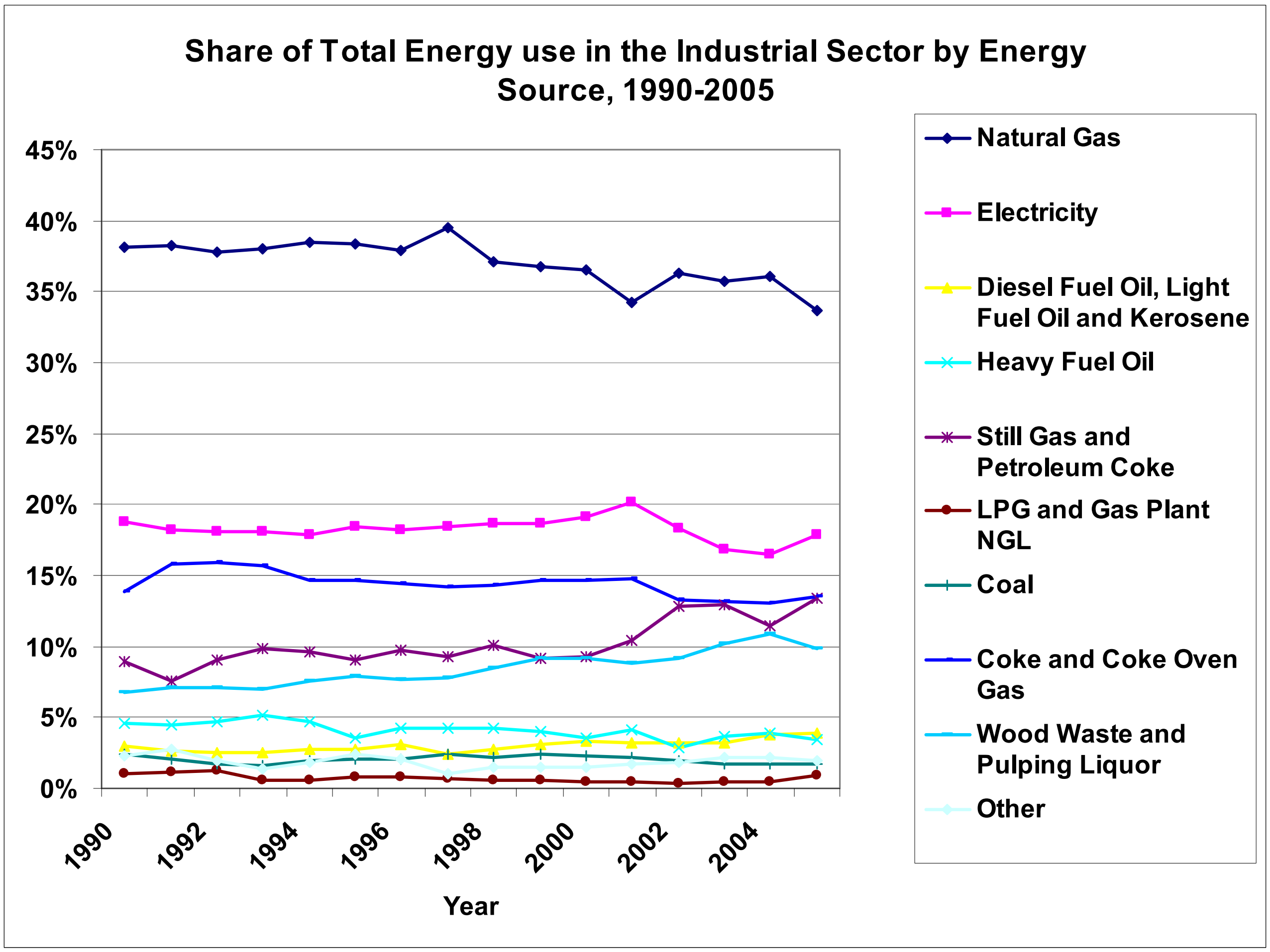
Industrial Sector

Structure of Electricity Demand

The structure of electricity demand in the industrial sector is distinct from that in the residential and commercial sectors. The industrial sector can be further divided into various sub-sectors, and electricity demand in each of these sub-sectors is driven by a unique set of drivers. In general, electricity use in the industrial sector can be said to track physical output measures, such as Mt of pulp and paper or Mt of mineral ores.

The largest single contributor to energy use in the industrial sector is natural gas (see Figure 28). Electricity commands a lower proportional share of the energy market in the industrial sector than in either the residential or commercial sectors.

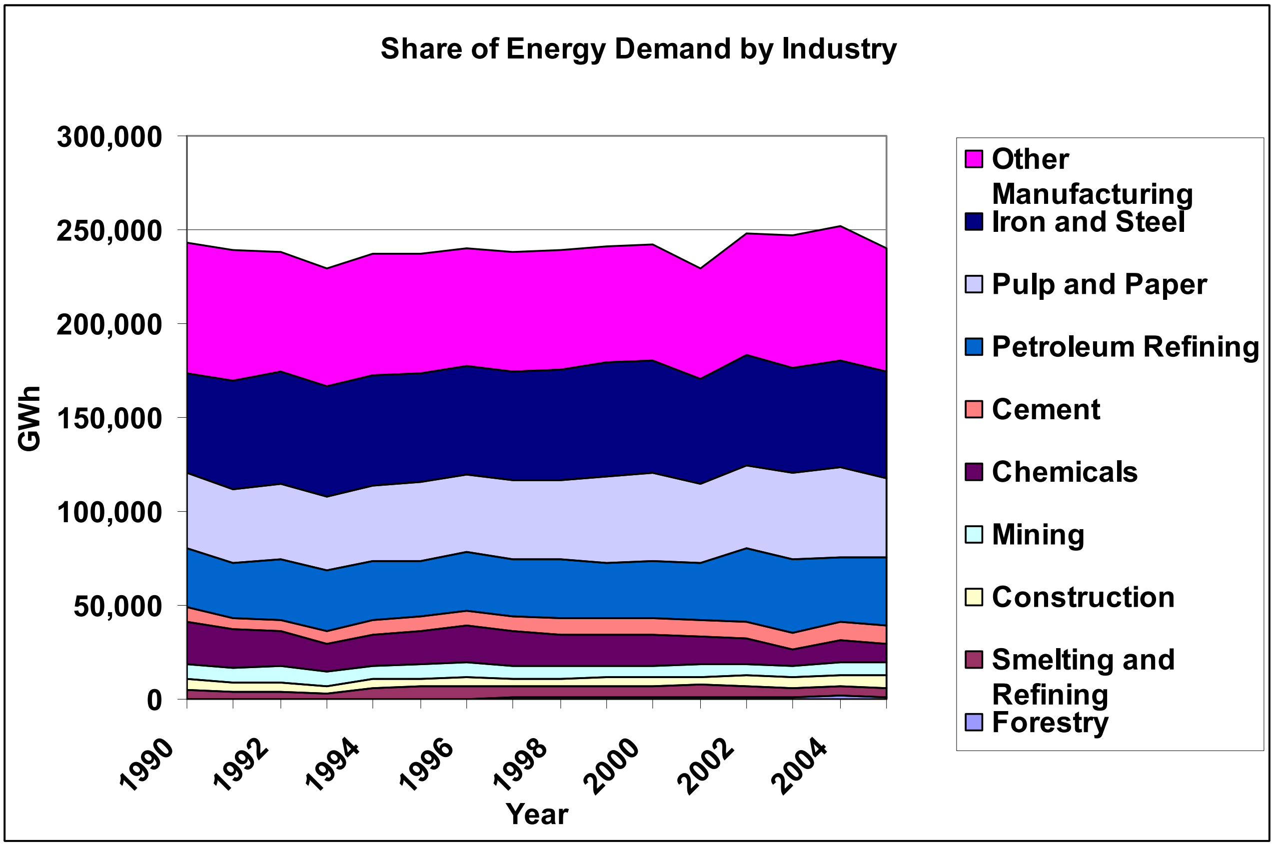
Figure 28



Unlike the share of natural gas in the residential and commercial sectors, the share of natural gas use in the industrial sector declined over the historical period. In 1997, natural gas accounted for nearly 40% of energy use in the sector, while its share by 2005 had dropped to 34%. This decrease was offset by an increase in the share of still gas and petroleum coke and, to a lesser extent, wood waste and pulping liquor.

In terms of energy consumption by individual industries, Figure 29 shows that the composition of energy demand did not change substantively from 1990-2005, with the Other Manufacturing, Iron and Steel and Pulp and Paper industries accounting for over 60% of total energy use.

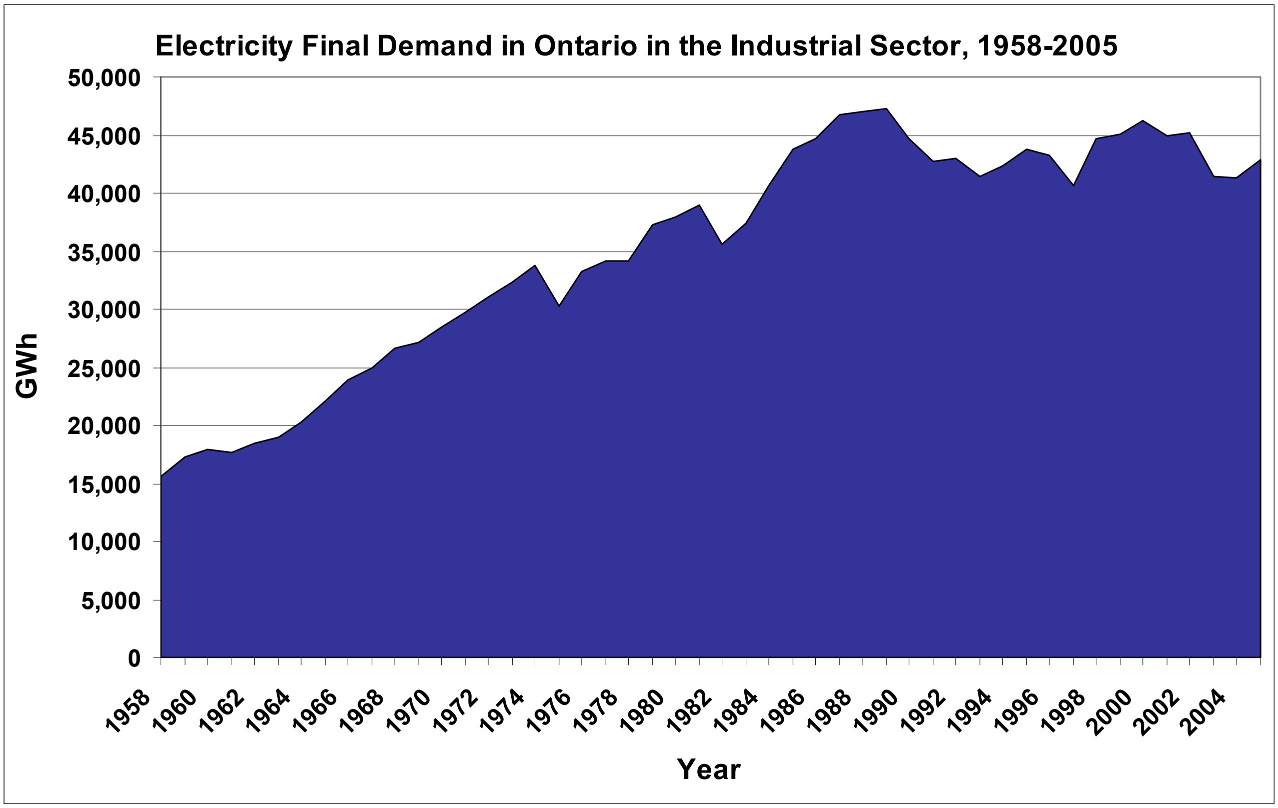
Figure 29



Historical trends

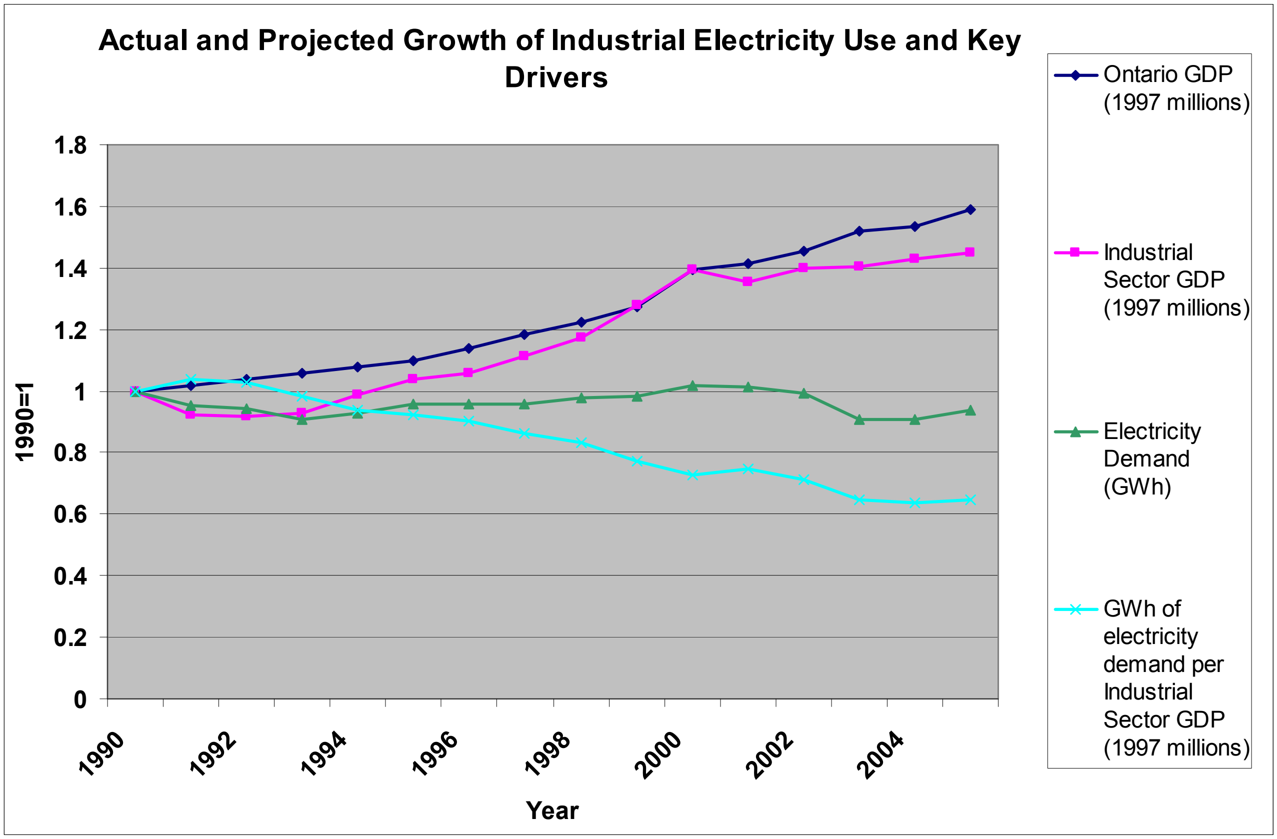
Electricity demand in the industrial sector increased from approximately 15,500 GW.h in 1958 to 43,000 GW.h in 2005. In 2005, the sector accounted for slightly over 30% of total electricity use in Ontario, the smallest share of all three sectors. The share of industrial sector electricity use in Ontario's total electricity demand has declined unabatedly since the late 1950s. Reflecting the economic challenges facing Ontario's heavy industry sector, electricity use in the industrial sector in 1990 was approximately 3,000 GW.h higher than in 2005. The industrial sector is the only sector whose electricity demand declined substantially during the 1990-2005 period.

Figure 30



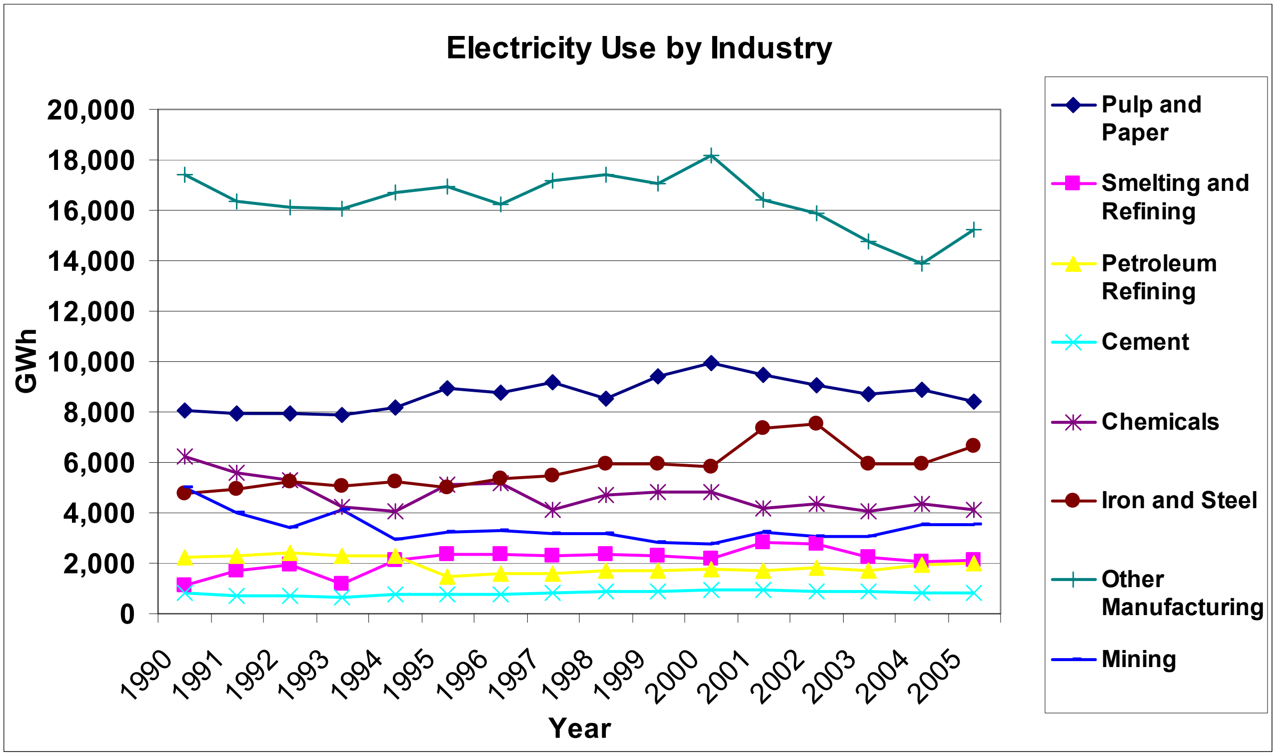
Industrial electricity use and some its key drivers are illustrated in Figure 31. Industrial sector GDP began to diverge from total GDP during the economic slump of the early 2000s and is expected to contribute an increasingly small share of total GDP going forward (as commercial sector activity takes its place as the main economic growth driver in the province).

Figure 31



As in the commercial sector, electricity demand in the industrial sector did not track economic output (whether measured as total GDP or industrial sector GDP) during the historical period, with the divergence between the two sets of activities beginning in 1990. This relationship speaks to the growing electrical productivity of the Ontario economy identified earlier. This relationship is also borne out by the downward trajectory of electricity demand per unit of industrial sector GDP shown in Figure 31.

Figure 32

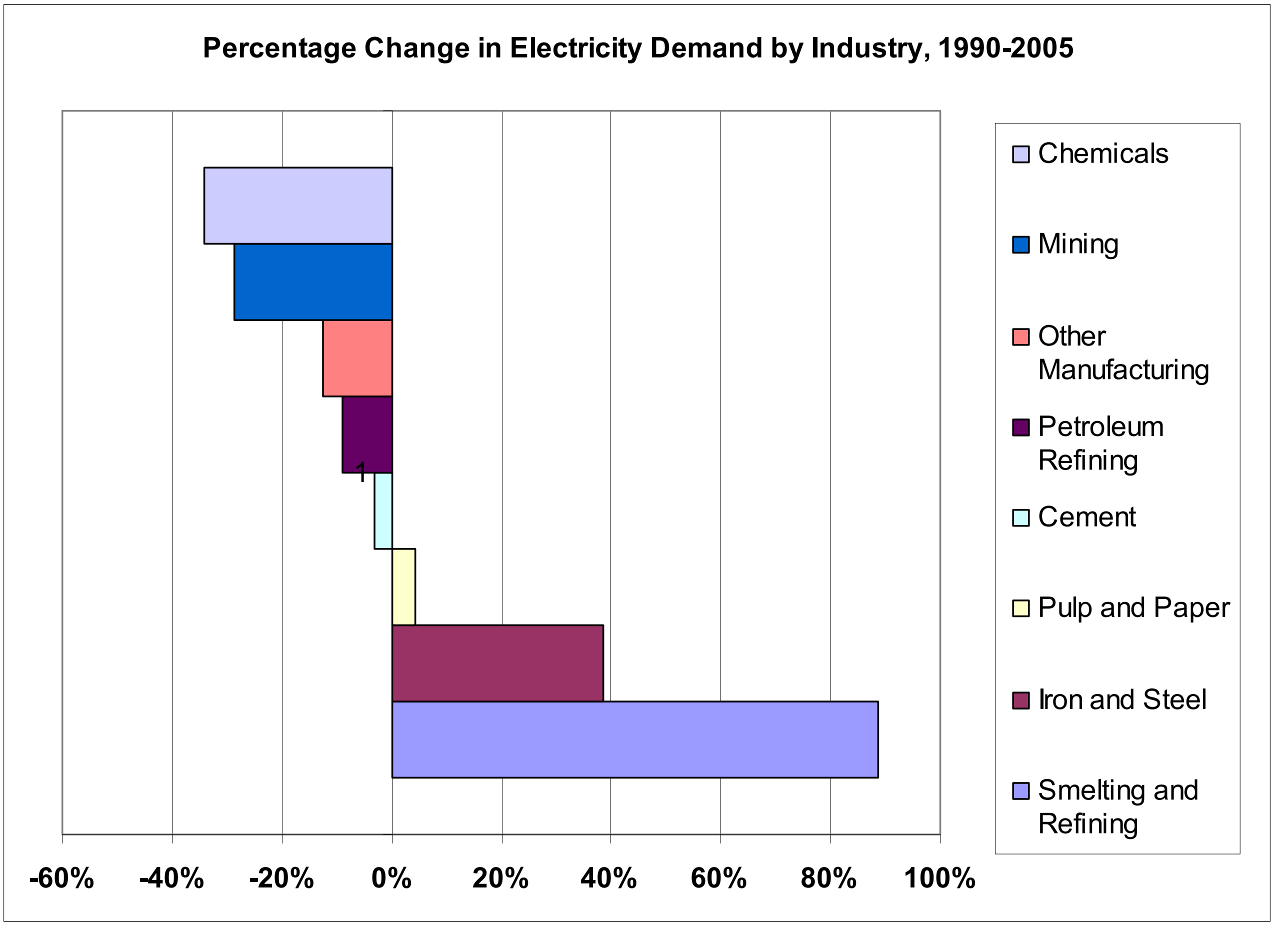


Focusing on electricity use at the sub-industry level, Figure 32 shows the historical trajectory of electricity demand in the eight industries catalogued by the OEE.[23] Measured in absolute terms, electricity demand did not change significantly over the period in any industry, with the exception of other manufacturing[24], where demand plummeted from 15,900 GW.h in 2001 to 13,900 GW.h in 2004.

Measured in percentage terms, however, electricity demand in most industries underwent dramatic changes (see Figure 33). Electricity use in the chemicals industry declined by nearly 35% between 1990-2005 while, at the other end of the spectrum, electricity demand in the smelting and refining industry grew by 88%.

[23] Since the construction and forestry industries did not use electricity during the historical period, they are excluded from this analysis.
[24] The Office of Energy Efficiency uses 'other manufacturing' as a residual category.

Figure 33



Comparing changes in electricity demand with changes in industry-specific GDP (see Table 1) shows that two industries –cement and other manufacturing—experienced negative growth in electricity demand and positive growth in economic output, reflecting improved electrical productivity (or reduced electrical intensity) over the period. The divergence is particularly striking in other manufacturing.

Far from declining electrical intensity, two industries (pulp and paper and smelting and refining) faced rising electricity demand and declining economic output over the period, implying declining economic utility for each GW.h of electricity.

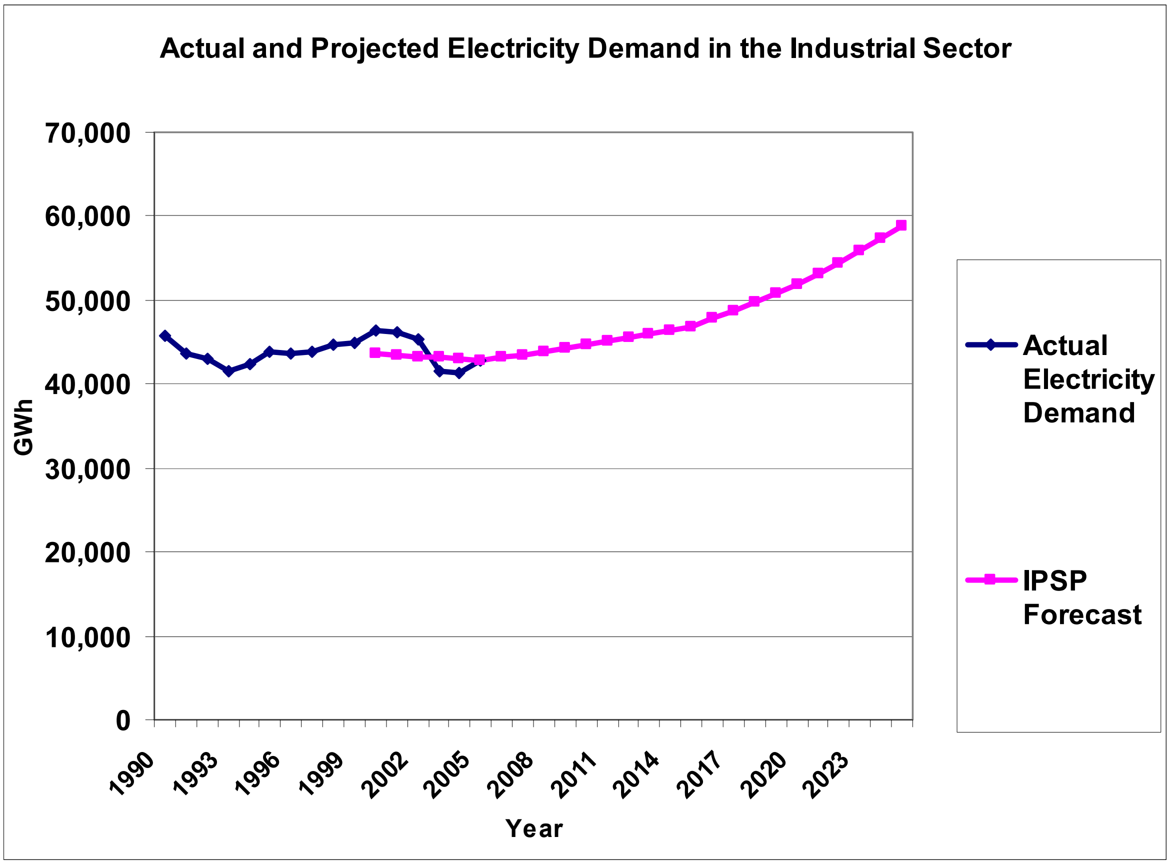
Table 1

	Growth in Electricity Use, 1990-2005	Growth in GDP (millions 1997$), 1990-2005
Construction	0.00%	18.35%
Pulp and Paper	4.31%	-6.11%
Smelting and Refining	88.54%	-59.91%
Petroleum Refining	-8.96%	-31.96%
Cement	-3.13%	5.59%
Chemicals	-34.28%	-7.08%
Iron and Steel	38.60%	7.12%
Other Manufacturing	-12.58%	73.42%
Forestry	0.00%	15.96%
Mining	-28.56%	-16.36%

Analysis of the IPSP Forecast

Under the IPSP reference case forecast, industrial sector electricity demand is expected to grow from 43,650 GW.h in 2000 to 58,800 GW.h in 2025, an increase of 16,000 GW.h or 35%. The IPSP thus anticipates more growth in electricity use in the industrial sector (both in absolute and percentage terms) than in either the residential or commercial sectors. This forecast is interesting in light of the fact that industrial electricity demand experienced *negative* growth over the 1990-2005 period (the only sector in which negative growth took place). The average annual growth rate from 1990-2005 was -0.42%, while the average annual growth rate of the IPSP forecast is 1.2%.

Figure 34



The overwhelming majority (87%) of the forecasted growth comes from the other manufacturing sector.[25] Figure 35 shows how the IPSP forecast failed to anticipate the pronounced decline in other manufacturing electricity demand that begin in 2000. Since this is base year of the IPSP forecast, the IPSP forecast assumes that growth (however marginal) that had occurred up until that point would continue. This explains the 'jump' that occurs in 2005 between actual electricity demand and the IPSP forecast.

[25] Unlike the OEE, which simply defines 'other manufacturing' as a "residual" sector, the IPSP states that 'other manufacturing' is comprised of the following sub-sectors: electronics and other; transportation equipment; furniture, printing and machinery; wood products; leather, textiles and clothing; rubber and plastics products; and food, tobacco and beverage.

Figure 35

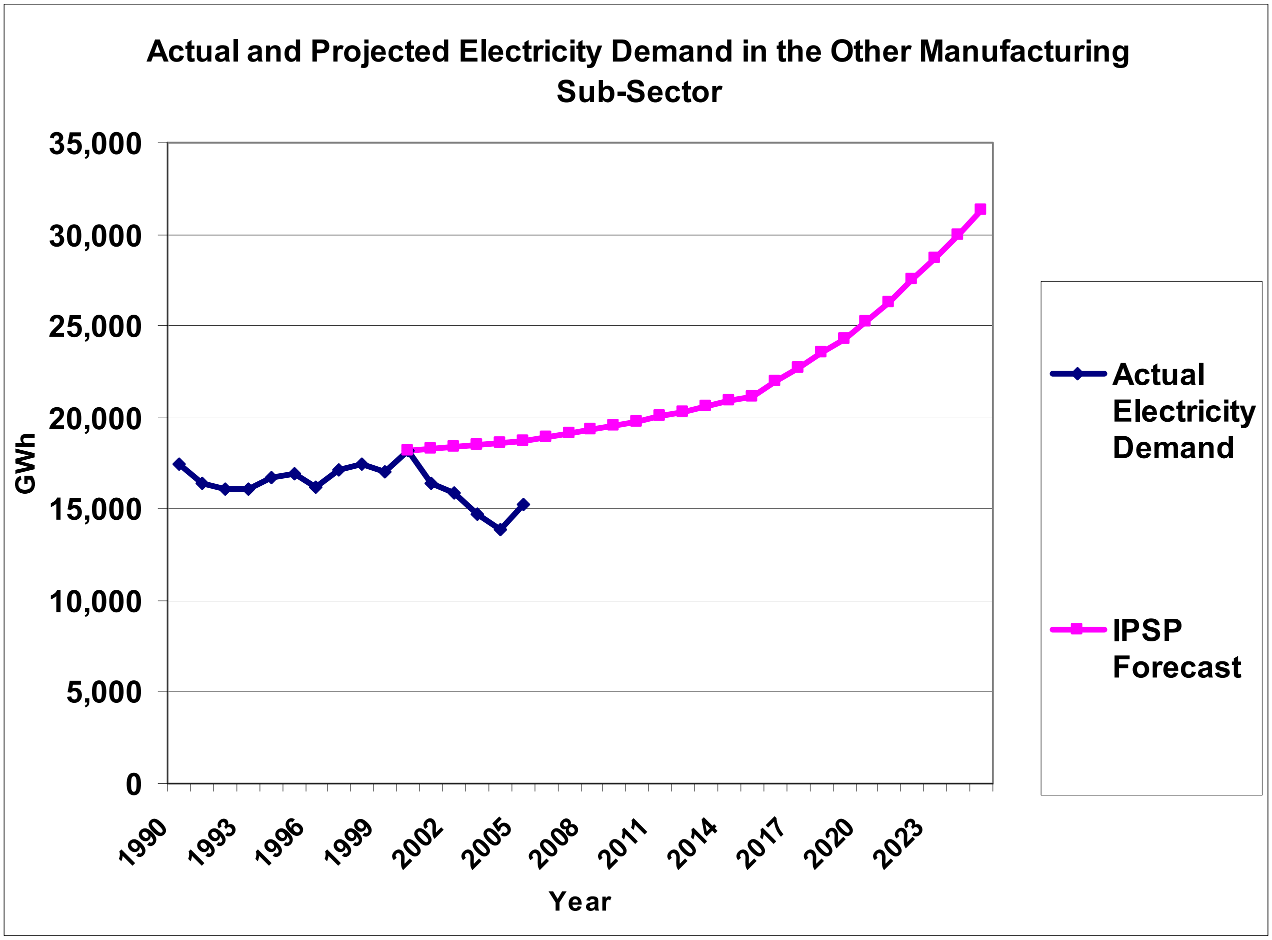
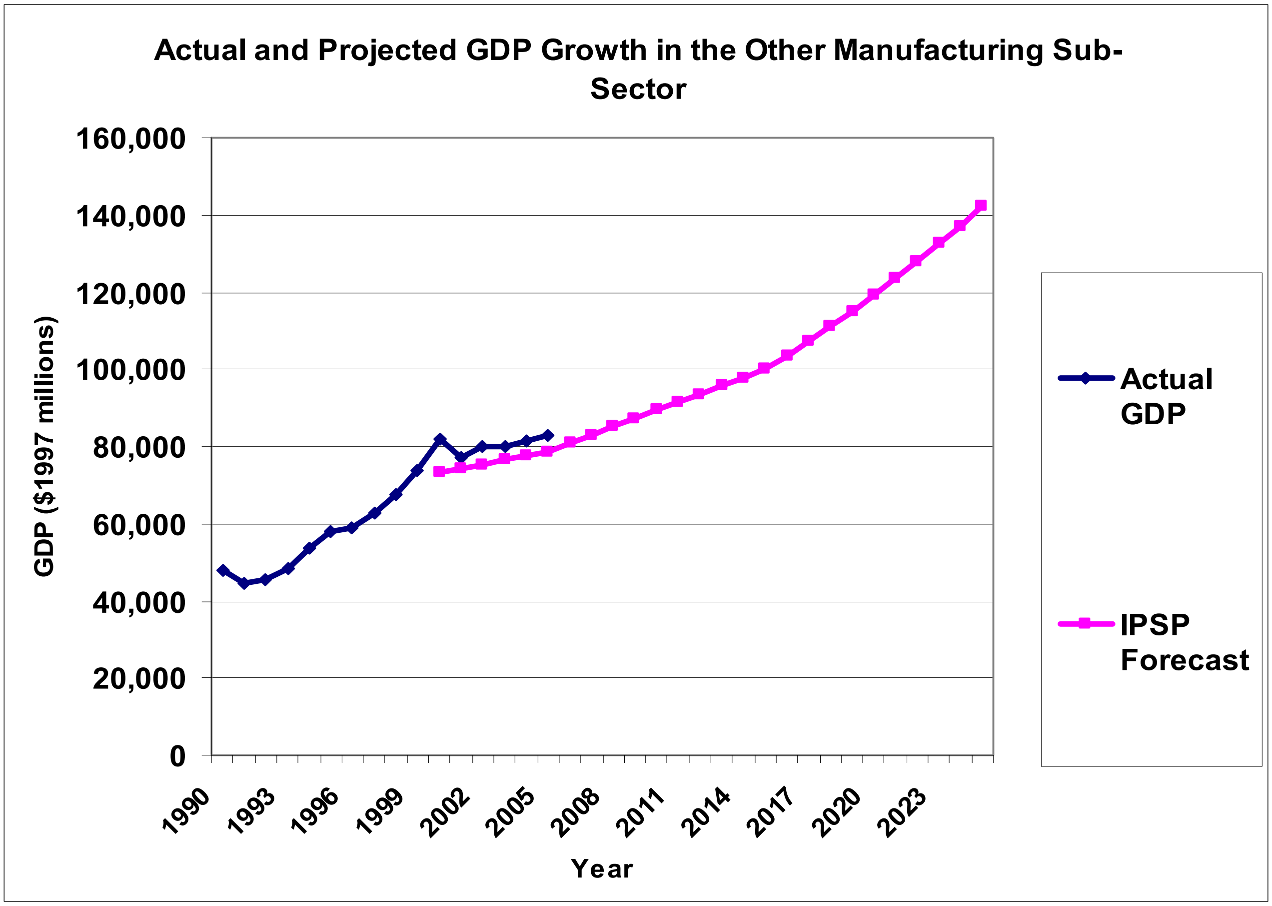


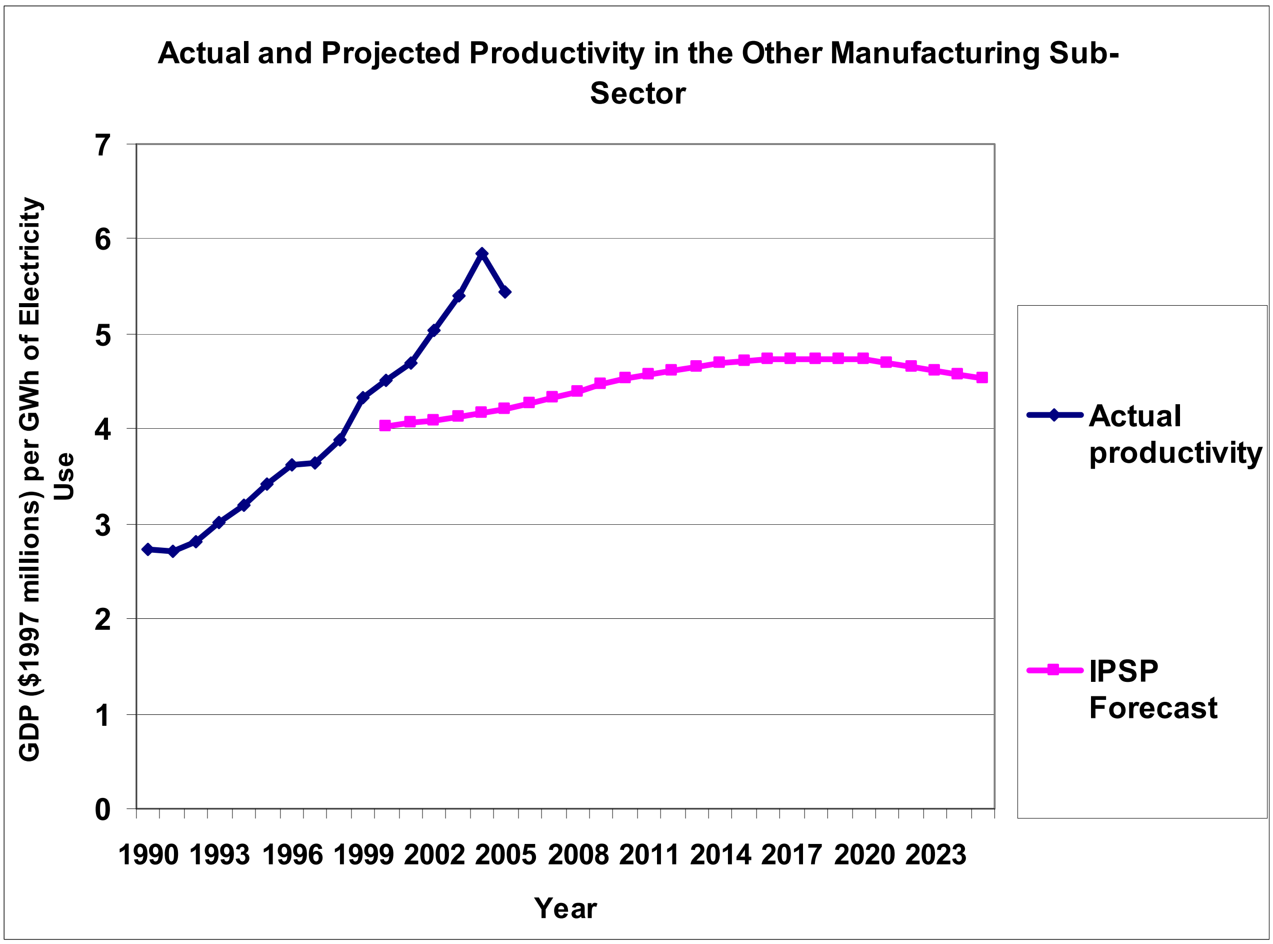
Figure 36 tracks actual GDP growth in the other manufacturing sub-sector and projected growth in the IPSP forecast.

Figure 36



By assuming a relatively high growth rate for electricity demand and a relatively low growth rate for GDP, the IPSP forecast diverges sharply from the historical pattern over the 1990-2005 period when it comes to the productivity of the other manufacturing sub-sector, measured in terms of GDP per unit of electricity demand (see Figure 37). The increasing electricity productivity of the "other manufacturing" sector is one of the most visible and important trends to emerge in industrial sector electricity use over the 1990-2005 period. Other manufacturing productivity nearly doubled over the historical period, growing from 2.7 in 1990 to 5.4 in 2005. During the 5 year overlap period (2000-2005) for which we have actual data and forecasted numbers from the IPSP, we can see that the IPSP dramatically underestimated the productivity of this sub-sector. While the historical trend line points toward continued productivity gains in this sub-sector, the IPSP reference case anticipates a flattening out of productivity in other manufacturing followed by *declining* productivity beginning in 2020.

Figure 37


Actual and Projected Productivity in the Other Manufacturing Sub-Sector
GDP ($1997 millions) per GWh of Electricity Use
0
1
2
3
4
5
6
7
1990 1993 1996 1999 2002 2005 2008 2011 2014 2017 2020 2023
Year
Actual productivity
IPSP Forecast

Conclusion

Previous long term power sector expansion plans for Ontario were rendered useless (and their associated public reviews irrelevant) largely because they were based on long range forecasts that incorrectly assumed (or adopted assumptions that led to the conclusion that there would be) a reversal of the longstanding downward trend in the electricity demand growth rate. The OPA forecast and the associated MKJ/Marbek repeat this pattern, supporting a forecast of Ontario electricity demand in which growth rates stop falling, turn around, and then accelerate through the forecast period.

The absolute amount of growth in the OPA forecast (some 40 TW.hours over a twenty year period) is lower than the absolute growth in the previous ill-fated long range forecasts of electricity demand in Ontario, and unlike in previous planning rounds, is now comparable in size to the technical potential for DSM. This makes it all the more important to develop the capacity (models, analysts, databases) to be able to take an integrated approach to the future demand for electricity, in which the forecast and the DSM potential estimates are no longer separate and sequential exercises.

The end use calibration of the OPA forecast does not provide a convincing case that history will not repeat itself in this current round of long range electric power planning. An examination of the MKJ/Marbek end use calibration of the end use forecast indicates a number of instances where the demand growth derives from assumed or unsubstantiated departures from historical trends with respect to the growth of the activity drivers, with respect to the relationship between the activity drivers and electricity demand, and with respect to the relative growth rates of end uses with variable “natural conservation” potential.

The electricity growth in the residential and commercial sectors is highly concentrated in a couple of end uses -- almost all residential electricity growth is in the “other appliance” category and nearly 90% of commercial sector electricity growth is for lighting, but the underlying justification for this lopsided distribution of growth is not convincing. In the industrial sector the forecast growth rests on the assumed departure from recent trends toward greater electricity productivity, and instead assumes deterioration in electricity productivity.

Even accepting the forecast level of electricity demand, the end use calibration of the electricity demand underlying the MKJ/Marbek in at least some instances has under-allocated electricity to important end uses with high DSM potential (e.g. residential furnace fans) at the expense of end uses where the end use and related DSM potential is poorly understood and assumed to be below average (e.g. residential “other” appliances). This results in an end use calibration that sets up a DSM potential analysis that will return too low a result as the end use with the high DSM potential is underrepresented in the forecast.

An overestimate in the forecast will also result in an overestimate in the DSM potential (one cannot apply DSM to a kilowatt. hour of demand that never materializes) but the impact on the aggregate DSM potential is dominated by opportunities to save electricity (and peak) from the existing demand, and so the impact of a lower forecast on the DSM potential estimate is dampened considerably. If the long range decline in electricity demand growth rates in Ontario continues through this forecast period, very little if any of the 40 TW.hours of growth in this forecast would come about. The potential for DSM would also be reduced, but only to the portion of the DSM potential that derives from load growth. If the forecast growth in Ontario's electricity demand were not to materialize, the corresponding technical potential for DSM would decline by roughly 25% as compared to the potential estimated relative to the OPA forecast.