Fraser Alert

October 2004
ELECTRICITY POLICY SERIES

THE FRASER INSTITUTE

Market solutions to public policy problems

Power Jolt Required:
Measuring the Impact of Electricity Deregulation

Introduction

Participants in electricity markets appear to be despondent. The public opinion fallout from the failed California market opening and corporate malfeasance at Enron has caused even industry insiders to believe that market-based policies may not work as expected.

For example, MacDonald (2003) writes that "Although the jury is out on deregulation—whether in

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ACKNOWLEDGEMENTS
Myron Genyk provided exemplary research support for this *Alert*, courtesy of a generous contribution from the Donner Canadian Foundation.

Main Conclusions

- **Electricity market deregulation, as measured by the RED Index, is related to greater supply and lower prices**
- **Alberta and thirteen US states are leading the way in North American deregulation. Ontario has turned the furthest away from deregulation reforms since 2000 and now ranks below California.**
- **Reforming jurisdictions have attracted more new generation than non-reformers, with 80 percent faster per capita growth in the US—and even more in Canada**
- **Deregulation has lowered after-inflation prices in the US, the UK and Australia. Prices in Alberta and New Zealand have risen for exceptional reasons.**
- **US states that have yet to reform could deregulate and drop prices there by 7 percent to almost 9 percent over five years. This is double the price drop that actually occurred in non-reforming states between 1997 and 2002.**
- **Moving Ontario and the rest of Canada to the Alberta level of deregulation would drop prices in Canada by an equivalent amount—and save residential customers alone over $1 billion**
- **Moving New South Wales and Queensland to the higher Victoria level of deregulation would drop prices there by 3 percent to 4 percent over five years and yield up to A$300 million in savings**
- **Consumers and taxpayers can reap these economic gains from deregulation by introducing customer choice, competition, privatization, market pricing and effective regulation**

purgatory or another unpleasant place where the song never ends—it is clear that in most jurisdictions the process has not delivered significant benefits to the residential consumer."

Trebilcock and Hrab (2004) also recently repeat a Borenstein and Bushnell (2000) quote that "short-run benefits [of deregulation] are likely to be small or non-existent, and the long-run benefits, while compelling and supported in theory, may be very difficult to document in practice."

These pessimistic notes are out of keeping with the significant deregulation benefits that have accrued over the past several decades in telecommunications, natural gas transmission, and air, rail, and truck transportation, not to mention the worldwide successes achieved through privatization and alternative service delivery.[1]

Is it true, as asserted by Thomas (2004) when writing from an international public service union perspective, that electricity as a commodity is fundamentally incompatible with market reforms? Or is it simply that the evidence is not yet widely disseminated on the economic benefits of freer electricity markets?

This *Alert* takes the latter view and sets out to measure the price and supply impacts of deregulation in the leading reform jurisdictions around the world.

American and Australian states and Canadian provinces are compared within country and the experiences of the United Kingdom and New Zealand are also highlighted. A regulatory measure is examined as one explanatory factor behind US state-level retail electricity prices. This *Alert* makes reform recommendations so that consumers and taxpayers can continue to reap economic gains from deregulation in the future.

Electricity Deregulation

The traditional electricity market model was structured as a state or private monopoly, with vertically integrated generation, transmission, and distribution of power. This entity was often price regulated by a public utility commission but, in many cases, was practically self-regulating.

The political nature of the structure, with politicians liable for industry issues to voters and an absence of market-based financial incentives, typically led to over-investment in new capacity and high internal costs.[2] Subsequent stranded debt issues and upward pressure on prices were key reasons why policy makers examined the potential of deregulation to better serve customers and increase supply at a market-clearing price.

The deregulation process began in the United Kingdom in 1990 and has gone the farthest in the United States and Australia. The typical mix of policies separates the functions of generation, transmission, and distribution, introduces competition to generation and distribution, sets up an independent performance-based regulatory regime, and often privatizes state assets.

The Center for the Advancement of Energy Markets (CAEM) developed a very sophisticated measure of deregulation in the late 1990s, the Retail Energy Deregulation or RED Index.[3]

Table 1 shows the attributes of the index, which emphasize the importance of consumer choice, competition, privatization, market pricing and effective regulation. The index has existed since 1997 for the American states and has been calculated for Canadian provinces, several Australian states, the United Kingdom and New Zealand since then.[4]

Table 2 shows RED Index scores by jurisdiction. US states have been placed into three groups: those reforming the most, swing states that either had modest deregulation or backtracked on deregulation after 2000 (including California which is shown separately owing to its large size and notoriety), and non-reformers.[5] The Appendix tables show summary statistics for these jurisdictions, highlighting differences in size, standard of living, and type of electricity generation.

The strong reformers (13 US states, Alberta, the state of Victoria, the UK, and New Zealand) have high and rising deregulation scores in table 2.

The swing group (including Ontario) achieved impressive gains by 2000 but then backtracked owing to political pressure. It is notable here that Ontario swung the farthest away from the market of any jurisdiction (dropping from a peak RED Index score of 45 in 2002 to 10 in early 2003) and is now below California, widely seen as the pre-eminent government policy failure.[6]

The non-reform group have continuing negative scores, reflecting the fact that a number of them have deliberately closed off deregulation options.[7]

Supply Impact

Table 3 examines the extent to which jurisdictions with varying

Table 1: The Retail Energy Deregulation (RED) Index

Attribute	*Description*	*Weight*	*Question*
	COMPETITIVE FRAMEWORK CLUSTER (35%)		
1	Deregulation Plan	5%	Does a detailed restructuring plan exist?
2	Percent of Eligible Customers	5%	What percentage of customers is eligible for retail access?
3	Percent Switched	5%	What percentage of retail customers has switched to a non-utility supplier?
4	Competitive Safeguards for Generation	5%	What safeguards prevent affiliate favouritism by utilities?
5	Competitive Safeguards for Distribution	5%	What safeguards prevent affiliate favouritism by utilities?
6	Uniform Business Practices	5%	To what degree are business practices standardized?
7	Competitive Billing	3%	Is retail customer billing a competitive service?
8	Competitive Metering	2%	Is retail customer metering a competitive service?
	MARKET STRUCTURE CLUSTER (30%)		
9	Generation Market Structure	10%	What is the market structure for generation?
10	Wholesale Market Structure	10%	How centrally controlled is the wholesale market?
11	Retail Market Structure	10%	Are public plants providing retail services in the jurisdictions?
	STRANDED COST CLUSTER (3%)		
12	Stranded Cost Calculation	1%	Do stranded costs meet a market test?
13	Stranded Cost Implementation	2%	Are stranded cost charges fixed?
	CONSUMER CLUSTER (10%)		
14	Customer Information	2%	Are suppliers granted effective access to customer information?
15	Consumer Education	4%	Is a comprehensive customer education program required?
16	Default Provider	4%	How are default customers handled?
	DISTRIBUTION CLUSTER (20%)		
17	Default Provider Price Risk	4%	Do default prices allow effective competition from suppliers?
18	Default Provider Rates	4%	Are default rates properly set?
19	Performance-Based Regulation for Network Facilities	5%	Is performance-based pricing used for network facilities?
20	Network Pricing	2%	Are efficient pricing principles used for network pricing?
21	Interconnection to Grid	5%	Do policies allow small-scale generation?
	COMMISSION CLUSTER (2%)		
22	Commission Reengineering	1%	Has the commission reengineered its processes for a new regulatory regime?
23	Commission Budget	1%	Is the commission's budget commensurate with its new responsibilities?

Table 2: Retail Energy Deregulation (RED) Index Scores

		1997	*2000*	*2003*
Canada	Alberta	0	57	61
	Ontario	0	29	10
	Non-Reformers	-8	-7	-5
USA	Reformers	4	46	51
	Swing States	1	31	21
	California	9	38	11
	Non-Reformers	0	-1	-1
Australia	Victoria	N/A	N/A	50
	New South Wales	N/A	N/A	29
	Queensland	N/A	N/A	22
	Other States	N/A	N/A	N/A
UK		N/A	N/A	88
New Zealand		N/A	N/A	75

Note: Canadian data for 1998, 2001 and 2003
Source: Center for the Advancement of Energy Markets (CAEM)

Table 3: Annual Growth in Electricity Generation

		Generation ('97-'02)	*Generation /Pop ('97-'02)*	*Generation /GDP ('97-'01/02)*
Canada	Alberta	3.6%	1.7%	0.4%
	Ontario	1.0%	-0.5%	-3.3%
	Non-Reformers	0.3%	0.1%	-2.9%
USA	Reformers	2.1%	1.2%	-1.6%
	Swing States	2.7%	1.4%	-2.1%
	California	1.3%	-0.2%	-1.7%
	Non-Reformers	1.8%	0.7%	-1.9%
Australia	Victoria	3.4%	2.2%	-0.9%
	New South Wales	2.0%	0.7%	-1.6%
	Queensland	7.2%	5.1%	2.4%
	Other States	4.2%	3.2%	0.9%
UK		2.2%	1.9%	-0.2%
New Zealand		0.9%	0.0%	-1.6%

Source: See Appendix

deregulation progress have seen new generation supply, a prerequisite for customer reliability and low and stable prices. Average annual growth rates in new generation for the latest available five years are shown, along with generation growth scaled to population and the size of the economy.

The main finding is that reformers have attracted much more new generation than non-reformers. This is clear in the Canadian and American examples, where the two groups can be directly compared. For example, US reformers saw 11 percent faster generation growth and 80 percent faster generation growth per capita than non-reformers. Alberta's growth in the Canadian context was even stronger.

Australian states generally had high generation supply growth, consistent with the fact that all of them have been deregulating (though not all of them have a RED Index score—see table 2). The UK has also had strong generation growth.

The New Zealand performance is less attractive. This may be partly due to the heavy reliance there on state-owned hydro generation (see Appendix table 2) and a regulatory backtrack in March 2004; thus, incentives and expectations for investment in generation have been tempered in New Zealand.

The second result from table 3 is that backing away from deregulation can have a significant effect on new supply. Such political interference introduces uncertainty to the market and raises risk premiums on investment. The effect can be seen especially in California and Ontario, where delays and politicized market openings affected investment intentions and lowered new supply growth.

Price Impact

A positive attribute of a successful deregulation is that electricity prices (including all subsidies) are lower than they would be under a continuation of the former state monopoly structure. This does not necessarily mean that prices are absolutely lower than before, as many jurisdictions hid price increases behind mounting debt loads and priced power below full costs. Prices may also have to rise in a deregulated market to attract new investment to restore the demand-supply balance and ensure that reliability conditions (continuous power when needed) are met.

The results in table 4 are rather heartening given these caveats. The table shows annual average retail price growth after inflation from 1997 to the latest available year for residential and non-residential customers. The fourth and sixth columns show how this growth compares to the prior five-year period, with negative numbers indicating that price growth was lower in the later deregulation period.

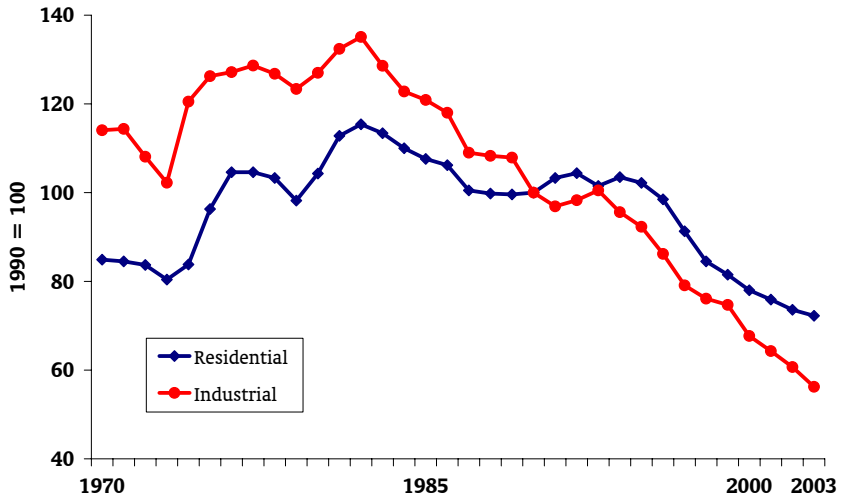
US reformers show significantly lower electricity price growth than non-reformers. Reformer jurisdiction prices are also absolutely

Table 4: Inflation-Adjusted Retail Electricity Prices

		Residential		*Non-Residential*	
		% Annual Growth 1997-2002/04	*Growth Difference 1992-97 to 1997-02/04*	*% Annual Growth 1997-2002/04*	*Growth Difference 1992-97 to 1997-02/04*
Canada	Alberta	1.5%	0.7%	N/A	N/A
	Ontario	0.8%	1.5%	N/A	N/A
	Non-Reformers	-1.1%	-1.0%	N/A	N/A
USA	Reformers	-2.8%	-1.1%	-1.8%	0.8%
	Swing States	-3.3%	-0.8%	-1.4%	1.7%
	California	-0.7%	0.5%	4.2%	7.0%
	Non-Reformers	-1.6%	0.8%	-1.1%	1.8%
Australia	Victoria	0.6%	-0.9%	-0.9%	3.4%
	New South Wales	-0.6%	1.3%	-1.4%	6.4%
	Queensland	0.3%	2.4%	-3.5%	-3.3%
	Other States	0.4%	0.7%	-0.1%	3.9%
UK		-3.5%	-0.8%	-6.5%	-2.1%
New Zealand		1.4%	-1.7%	0.0%	2.0%

Note: Canada for 2004, U.S. for 2002, Others for 2003. Non-residential prices for industrial users in UK.

Figure 1: U.K. Inflation-Adjusted Electricity Prices



lower than before deregulation in the US, in the UK, and for Australian non-residential customers. Residential customers in Alberta and New Zealand are exceptions to these general results, as are non-residential customers in California.

Table 4 shows that retail residential prices for US reformers dropped 80 percent faster than non-reformers and non-residential prices dropped 65 percent faster. US reformer prices also improved more from the five years prior to deregulation than did non-reformer prices. Figure 1 shows the longer and equally positive UK deregulation experience with declining inflation-adjusted electricity prices.

Alberta and New Zealand are the exceptional results that need further explanation.

According to Wellenius and Adamson (2003), the primary drivers of higher Alberta electricity prices were high natural gas fuel prices (more important there than elsewhere because of the absence of stable hydro or nuclear base generation), high import prices (partially influenced by the California situation) and low capacity reserves created by prior underinvestment. None of these factors were related to deregulation of the Alberta market.[8]

New Zealand residential prices have increased over time partly due to a reduction in cross-subsidies from commercial customers, according to MED (2004). This is a natural outcome of ensuring that customers pay the true cost of electricity. Some price relief came following an increase in supply in 1998 and 1999, but prices rose again after 2001 owing to supply shortages from a decline in natural gas availability and a drought that affected hydro generation.[9] As noted above, the New Zealand market has not seen large increases in generation since deregulating.

Statistical Results

The results discussed above are consistent with a generally positive impact of deregulation on increasing electricity supply and decreasing prices. A more formal statistical test can be done for the US states, where there are RED Index scores over a number of years and there is a spectrum of deregulation progress.

Tables 5 and 6 show the results of just such an exercise. A number of variables are used to explain the variation of residential and non-residential price growth from state-to-state between 1997 and 2002:

- The change in the RED Index score between 1997 and 2002,
- The extent to which the RED Index score backtracked after 2000,
- Electricity price growth between 1992 and 1997 (a trend effect),
- The electricity price level in 1997,
- The level of generation in 1997 (a market size effect),
- Growth in the economy (a demand effect)[10],
- Productivity growth (output per employee) in the utilities industry,
- Shares of energy sources in generation, and
- Energy fuel prices adjusted for inflation

The reduced set of estimated effects in the last two columns of the tables use only those factors that are most statistically significant, with the T-statistic as the measure of significance.

The most important result is that the extent of deregulation is related to electricity prices, even after taking all of these other factors into account. The estimated effect implies that prices after inflation decline between 0.2 percent to 0.3 percent per year over a five-year period for every 10-point increase in the RED Index score.

The implication of this result for non-reforming US states is especially profound.

Table 5: Explaining Inflation-Adjusted Residential Price Growth

	All Variables		*Reduced Set*	
Variable	*Estimate*	*T-Stat*	*Estimate*	*T-Stat*
RED Index * 10	-0.316%	-3.4	-0.275%	-3.4
RED Backtrack * 10	-0.005%	0.0		
Prior 5 Year Price Growth	0.825	3.8	0.700	4.6
Price Level in 1997	-0.005	-4.3	-0.004	-5.2
Generation in 1997	0.000	1.7		
GDP Growth	0.029	0.2		
Productivity Growth	-0.061	-1.0		
Share of Coal	0.004	0.3		
Share of Natural Gas	0.015	1.0		
Share of Nuclear	0.010	0.7		
Share of Hydro	0.020	1.4	0.023	2.4
Coal Fuel Price	0.065	0.8		
Natural Gas Fuel Price	0.040	2.0	0.044	2.6
Nuclear Fuel Price	0.077	1.0		
Constant Term	0.035	2.3	0.033	3.2
Adjusted R-squared	66%		68%	

Source: Author's calculations

Table 6: Explaining Inflation-Adjusted Non-Residential Price Growth

	All Variables		*Reduced Set*	
Variable	*Estimate*	*T-Stat*	*Estimate*	*T-Stat*
RED Index * 10	-0.293%	-2.1	-0.220%	-1.8
RED Backtrack * 10	0.588%	1.3		
Prior 5 Year Price Growth	0.322	1.2		
Price Level in 1997	-0.006	-2.2	-0.006	-3.8
Generation in 1997	0.000	0.9		
GDP Growth	0.037	0.2		
Productivity Growth	0.197	2.0	0.196	2.4
Share of Coal	-0.045	-2.2	-0.063	-6.2
Share of Natural Gas	0.011	0.5		
Share of Nuclear	-0.028	-1.2	-0.037	-2.6
Share of Hydro	0.019	0.8		
Coal Fuel Price	-0.056	-0.5		
Natural Gas Fuel Price	0.083	2.7	0.080	3.0
Nuclear Fuel Price	-0.005	0.0		
Constant Term	0.046	1.8	0.060	4.4
Adjusted R-squared	52%		55%	

Source: Author's calculations

Moving from the non-reformers' current RED Index score to the average reformers' score would reduce residential electricity prices by 1.4 percent to 1.6 percent a year after inflation, or between 7.3 percent and 8.5 percent over five years. For non-residential prices, non-reformers' prices would decline by 1.1 percent to 1.5 percent per year, or between 5.9 percent and 7.7 percent over five years.

All of these effects are double the price drop that actually occurred in non-reforming states between 1997 and 2002. These are the tangible costs of the current stall in deregulation in the US.

Translating the US results to Australia, New South Wales and Queensland would see a price drop of 2.9 percent to 3.7 percent over five years by moving to Victoria's higher level of deregulation. This would yield A$280 million to A$300 million in savings for residential and non-residential customers there.

If the results are applied to the Canadian context, a deregulation move in Ontario to Alberta levels would drop electricity prices by 5.8 percent to 8.3 percent over five years and in the other provinces by 7.5 percent to 10.8 percent. This is a saving across Canada of $950 million to $1.1 billion on residential electricity bills alone, based on current household expenditures.[11]

These gains are solely due to the impact of the deregulation process. Provincial governments outside Alberta are consciously foregoing this billion-dollar consumer benefit by not deregulating.[12]

Recommendations

The basic recommendation is straightforward: deregulate electricity markets.

More specifically, the way that any jurisdiction can reap the benefits of greater electricity supply and lower prices is to implement the reforms underpinning the RED Index:

- Create a competitive framework
  - Prepare a deregulation plan backed by legislation
  - Open the market to all customers
  - Full competition in generation and distribution
  - Competitive billing and metering
- Restructure the generation sector
  - Separate generation from transmission

- Privatize generation assets
- Encourage bilateral contracting in wholesale markets
- Recover all stranded costs

- Restructure distribution
  - No automatic default provider
  - Performance-based price regulation
  - Full cost network pricing
  - Open access to the transmission grid

- Empower consumers
  - Customer education programs
  - Full choice to switch providers
  - Open access to customer information

- Improve regulation
  - Integrate retail gas and electricity regulation
  - Reform regulatory organization and practices
  - Provide sufficient funding for regulatory duties

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Appendix

Data were gathered from national and regional statistical agencies and industry associations for each country. Genyk (2004) provides sources and bibliographical detail.

Appendix tables 1 and 2 show shares of generation, size of population, income per capita and generation by fuel type for each jurisdiction or group. It is noteworthy that only a small segment of the national markets in Canada, the US and Australia have fully deregulated. There are also significant differences between jurisdictions regarding fuel types, from Australia's reliance on coal to the high share of marginal-pricing natural gas in Alberta, California and the UK. These are important differences to consider when assessing the impact of deregulation.

Table A1: Electricity Market Statistics

		Generation % of Country (2002)	*Population Million (2003)*	*Income Per capita (2001)*
Canada	Alberta	11%	3	$41,137
	Ontario	27%	12	$31,011
	Non-Reformers	62%	16	$25,995
USA	Reformers	33%	110	$38,188
	Swing States	14%	31	$34,138
	California	5%	35	$39,361
	Non-Reformers	48%	114	$32,227
Australia	Victoria	24%	5	$26,616
	New South Wales	30%	7	$27,375
	Queensland	23%	4	$22,690
	Other States	23%	5	$25,656
UK		100%	60	$26,345
New Zealand		100%	4	$20,249

Note: Income per capita in $US using OECD Purchasing Power Parities

Table A2: Generation by Fuel Type (2002)

	% of Total	*Coal*	*Natural Gas*	*Nuclear*	*Hydro*	*Other*
Canada	Alberta	66%	30%	0%	3%	1%
	Ontario	25%	8%	43%	23%	1%
	Non-Reformers	N/A	N/A	N/A	N/A	N/A
USA	Reformers	44%	25%	23%	3%	5%
	Swing States	52%	11%	25%	11%	2%
	California	1%	49%	19%	17%	15%
	Non-Reformers	59%	12%	17%	7%	5%
Australia	Victoria	97%	1%	0%	2%	0%
	New South Wales	98%	2%	0%	0%	0%
	Queensland	95%	4%	0%	1%	0%
	Other States	34%	30%	0%	36%	1%
UK		35%	34%	24%	0%	6%
New Zealand		4%	26%	0%	62%	7%

Note: Ontario data for 2003 - natural gas category includes oil

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Footnotes

1 See Crandall (2003) on deregulation gains, Megginson and Netter (2001) on privatization, and Domberger and Rimmer (1994) on alternative service delivery.

2 For a description of the Ontario experience, see Trebilcock and Hrab (2005).

3 See CAEM (2003). The Index has scores that can vary from –50 to +100 and is described there as "a reference tool that measures the progress states are making in moving from the monopoly model of public utility regulation to the competitive model."

4 Two other deregulation measures can be found in EIA (2003) and OXERA (2003). The former simply classifies American states according to whether their electricity industries are restructuring or not. The latter shows competitiveness rankings for eight countries and eight regions in 2001. However, the index screens out jurisdictions based on a minimum market size (excluding Alberta, for example) and a requirement for 100 percent market opening. The RED Index is superior because of its detailed structure and its time dimension. However, it does ignore a number of recently deregulating jurisdictions, notably Scandinavia, Germany, Austria, Spain, Singapore and several South America countries, that are therefore not considered in this *Alert*.

5 The states (in descending order of RED Index score) by group are: Reformers—Texas, Pennsylvania, Maine, New York, Washington D.C., Maryland, Michigan, New Jersey, Massachusetts, Virginia, New Hampshire, Ohio, Connecticut; Swing States—Arizona, Delaware, Illinois, Rhode Island, Montana, Oregon, West Virginia, California, Nevada, Arkansas; and Non-Reformers—all other states.

6 John Grant at the University of Toronto, in a review of this *Alert*, notes that "Ontario has evolved, and is still evolving, quite a complex governance structure that combines private entrepreneurship/competition-driven price signals/effective consumer response with overarching governmental direction of the generation mix and regulatory responsibility for adequacy and reliability." Though this suggests how the form of deregulation can vary by jurisdiction, it is still the case that the Ontario RED Index score of a year ago is unlikely to rise much, if at all, under current provincial government policies.

7 Of the Canadian provinces in this group, New Brunswick has partially opened its market as of October 1, 2004 by allowing 42 large electricity customers to enter into long-term bilateral contracts. The province now allows the sale or lease of some generation assets and has reorganized NB Power, the public monopoly, as a holding company. These modest reforms could raise its RED Index score from –8 to –4 or slightly higher.

8 Alberta also has no public sector electricity debt, the existence of which in most other provinces is a subsidy from taxpayers to ratepayers. If this debt was paid down by ratepayers over 25 years, it would add more than 30 percent to the average household electricity bill in Canada (outside Alberta). Thus, prices outside Alberta have been kept artificially low owing to rising public debt. Data source: *http://www.energy.gov.ab.ca/com/Room/Public+Reference/Commodity-Info/Facts+On+Electricity.htm*

9 See IEA (2003) on this latter point and Appendix table 2 that shows New Zealand's dependence on hydro generation.

10 Individual industry growth rates were also examined but discarded as explanatory factors after only non-durable manufacturing showed a significant (positive) impact on electricity prices. Upon further examination, this was wholly due to the apparel, paper, and printing industries, which together account for only 1.6 percent of the US economy and a small share of electricity demand.

11 The average impact splits as $350 million to Ontario and $675 million to non-reforming provinces. The numbers are calculated based on estimates of the number of households in 2004 (derived from the Census) and average household electricity expenditure in 2004 (derived from the Survey of Household Spending and the Consumer Price Index).

12 There are other monetary benefits from deregulation, notably from lower non-residential prices, sales of state assets and the termination of state-funded debt. These gains would collectively be greater than the estimated residential price decline effect.