

The Inflation Factor

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Overview

This presentation considers options for the inflation factor to be used in 4th Generation IR

- Options for inflation in non-labor input prices
- Options for inflation in labor/OM&A input prices
- Options for mitigating volatility in inflation factor

Current Inflation Factor

The inflation factor currently used in 3rd Generation IR is the Gross Domestic Product Implicit Price Index for final demand (GDP-IPI)

An industry specific price index (IPI) was considered in 3rd Generation IR, but the Board found that IPI inflation was volatile and further research needed to “address such volatility and to ensure that the chosen sub-indices appropriately track the inflation faced by the industry” (July 14, 2008, EB-2007-0673, pp. 10-11)

Inflation Factor for 4th Generation IR

In its Renewed Regulatory Framework for Electricity (RRFE) Report, the Board found it is now appropriate to adopt a more industry-specific inflation factor

Volatility will be mitigated by methodology adopted by Board

Board also found:

- Inflation factor must be constructed and updated using data that is readily available from public and objective sources (e.g. StatsCanada)
- To the extent practicable, the component of inflation factor designed to adjust for non-labor price inflation should be indexed by Ontario distribution industry-specific indices
- The component of the inflation factor that adjusts for labor prices will be indexed by an appropriate generic and off-the-shelf labor price index

Capital Input Prices

The cost of capital services can be expressed as the product of the *quantity* of the capital stock and the *price* of capital services i.e.

$$CK_t = WKS_t \cdot XK_{t-1}$$

Where CK_t = the cost of capital services in year t

XK_{t-1} = the quantity of the capital stock at the end of the previous year

WKS_t = the capital service price in year t

The component of the inflation factor designed to adjust for inflation in capital input prices should reflect inflation in WKS, the capital service price

Capital Input Prices (Con't)

A simple but reasonable measure of the capital service price is:

$$WKS_t = r_t WKA_{t-1} + d_t \cdot WKA_t$$

Where WKA_t = an index of capital asset prices in year t

r_t = a measure of the rate of return (sometimes referred to as “the opportunity cost of capital”) in year t

d_t = depreciation of capital in year t

The formula above captures:

- What is paid to purchase capital assets
- The “return on” capital
- The “return of” capital

Empirical Research on Capital Input Prices

PEG computed two alternative measures of capital service prices

PEG tailored both to be more Ontario-electricity distribution industry specific

Both alternatives can be updated using publicly-available data either from official sources or collected directly by the OEB

The alternatives use the same measures for asset prices and rate of return, but differ regarding depreciation

Asset Prices

The asset price PEG used was the electric utility construction price index for distribution systems (from Stats Can)

- Includes distribution construction labor and distribution materials prices
- Most relevant of any potential index for the distribution sector
- Index applies to all of Canada, Ontario-specific index not available

Rate of Return

The rate of return used by PEG was the weighted average cost of capital, as determined by the Board

- Board-approved values for long-term debt rates, short-term debt rates, and return on equity
- Before May 2008, long-term debt and equity returns were determined for different size categories of distributors; PEG used values for medium-small companies before 2008
- Uses current deemed capital structure (40% equity, 56% long-term debt and 4% short-term debt) in all years

Depreciation

Two depreciation options:

1. “Economic depreciation” *i.e.*, a “geometric” rate of capital decay of 4% each year
2. “Regulatory depreciation” computed as total recorded depreciation (amortization) divided by gross plant value, in 2011

In either case, depreciation is assumed to be constant in all years.

Labor/OM&A Inflation

PEG also considered three different, “generic and off the shelf” inflation measures for labor/OM&A input price inflation

1. GDP-IPI

2. Average weekly earnings in Ontario for all workers (AWE)

3. Average hourly earnings in Ontario for hourly workers (AHE)

Composite Inflation Factor Alternatives

PEG analysis yielded six alternative inflation measures

1. GDP-IPI and capital service price using economic depreciation
2. GDP-IPI and capital service price using regulatory depreciation
3. AWE and capital service price using economic depreciation
4. AWE and capital service price using regulatory depreciation
5. AHE and capital service price using economic depreciation
6. AHE and capital service price using economic depreciation

Measured since 2001 on both an annual average and a three-year moving average basis

Capital Price Index (Geometric Decay)

Year	EUCPI	Growth	WACC	Growth	Depreciation Rate	Capital Price Index	Capital Price Inflation	Three Year Moving Average
2001	129.6	0.7%	8.30%	0.00%	4.00%	15.86	1.6%	1.6%
2002	130.5	0.7%	8.30%	0.00%	4.00%	15.97	0.7%	1.1%
2003	130.6	0.1%	8.30%	0.00%	4.00%	16.05	0.5%	0.9%
2004	131.1	0.4%	8.30%	0.00%	4.00%	16.08	0.2%	0.5%
2005	133.6	1.9%	8.30%	0.00%	4.00%	16.22	0.9%	0.5%
2006	142.4	6.4%	7.74%	-6.88%	4.00%	16.04	-1.1%	0.0%
2007	148.8	4.4%	7.35%	-5.22%	4.00%	16.42	2.3%	0.7%
2008	150.3	1.0%	7.27%	-1.11%	4.00%	16.83	2.5%	1.2%
2009	151.1	0.5%	7.32%	0.63%	4.00%	17.04	1.2%	2.0%
2010	155.1	2.6%	7.40%	1.14%	4.00%	17.38	2.0%	1.9%
2011	160.1	3.2%	7.08%	-4.46%	4.00%	17.38	0.0%	1.1%
2002-2011 Average		2.11%		-1.59%			0.91%	0.99%
Standard Deviation		2.05%		2.83%			1.13%	0.63%
Standard Deviation/ Average		96.9%		-178.2%			123.2%	63.5%
2004-2011 Average		2.55%		-1.99%			0.99%	0.98%
Standard Deviation		2.07%		3.07%			1.26%	0.71%
Standard Deviation/ Average		81.4%		-154.4%			126.8%	72.5%

Notes: The weighted average cost of capital is computed using 40% equity, 56% long term debt and 4% short term debt using board provided data



Capital Price Index (Regulatory Depreciation Rate)

Year	EUCPI	Growth	WACC	Growth	Depreciation Rate	Capital Price Index	Capital Price Inflation	Three Year Moving Average
2001	129.6	0.7%	8.30%	0.00%	3.36%	15.03	1.6%	2.6%
2002	130.5	0.7%	8.30%	0.00%	3.36%	15.14	0.7%	1.6%
2003	130.6	0.1%	8.30%	0.00%	3.36%	15.21	0.5%	1.0%
2004	131.1	0.4%	8.30%	0.00%	3.36%	15.24	0.2%	0.5%
2005	133.6	1.9%	8.30%	0.00%	3.36%	15.37	0.8%	0.5%
2006	142.4	6.4%	7.74%	-6.88%	3.36%	15.13	-1.5%	-0.2%
2007	148.8	4.4%	7.35%	-5.22%	3.36%	15.47	2.2%	0.5%
2008	150.3	1.0%	7.27%	-1.11%	3.36%	15.87	2.6%	1.1%
2009	151.1	0.5%	7.32%	0.63%	3.36%	16.07	1.3%	2.0%
2010	155.1	2.6%	7.40%	1.14%	3.36%	16.39	2.0%	1.9%
2011	160.1	3.2%	7.08%	-4.46%	3.36%	16.35	-0.2%	1.0%
2002-2011 Average		2.11%		-1.59%			0.84%	0.99%
Standard Deviation		2.05%		2.83%			1.23%	0.71%
Standard Deviation/ Average		96.9%		-178.2%			145.7%	71.6%
2004-2011 Average		2.55%		-1.99%			0.90%	0.91%
Standard Deviation		2.07%		3.07%			1.39%	0.76%
Standard Deviation/ Average		81.4%		-154.4%			153.4%	83.4%

Notes:

The weighted average cost of capital is computed using 40% equity, 56% long term debt and 4% short term debt using board provided data

The regulatory depreciation rate was calculated as the ratio of Depreciation (amortization) to Gross Plant as per the RRR in 2011.



Labor/OM&A Price Index Options

Year	GDPIPI FDD - Ontario			AWE All Employees - Ontario			AHE - Hourly Employees- Ontario		
	Level	Growth	3-yr MA	Level	Growth	3-yr MA	Level	Growth	3-yr MA
2001	90.31			696.1			97.8		
2002	92.25	2.12%		711.0	2.11%		100	2.22%	
2003	93.54	1.39%		728.1	2.38%		102.8	2.76%	
2004	95.11	1.66%	1.73%	748.8	2.80%	2.43%	104.7	1.83%	2.27%
2005	96.96	1.92%	1.66%	776.1	3.59%	2.92%	107	2.17%	2.26%
2006	98.43	1.51%	1.70%	788.6	1.60%	2.66%	109.1	1.94%	1.98%
2007	100.00	1.58%	1.67%	818.9	3.77%	2.98%	111.5	2.18%	2.10%
2008	102.30	2.27%	1.79%	838.2	2.33%	2.56%	114.1	2.31%	2.14%
2009	103.60	1.26%	1.71%	849.2	1.30%	2.47%	114.4	0.26%	1.58%
2010	105.10	1.44%	1.66%	882.1	3.81%	2.48%	116.5	1.82%	1.46%
2011	107.40	2.16%	1.62%	894.8	1.42%	2.18%	119.9	2.88%	1.65%
2012	na	na	na	na	na	na	na	na	na
2002-2011 Average		1.73%			2.51%			2.04%	
Standard Deviation		0.36%			0.95%			0.72%	
Standard Deviation/ Average		20.8%			38.0%			35.2%	
2004-2011 Average		1.73%	1.69%		2.58%	2.59%		1.92%	1.93%
Standard Deviation		0.36%	0.05%		1.07%	0.27%		0.75%	0.32%
Standard Deviation/ Average		20.8%	3.0%		41.4%	10.3%		39.1%	16.6%

Inflation Measure

GDPIPI- Ontario and Economic Depreciation

Year	OM&A Price			Capital Price			Inflation Measure		
	GDPIPI- Ontario	Growth	Weight	Index	Growth	Weight	Index	Growth	Three Year Moving Average
2001	90.31		47%	15.86		53%	100.00		
2002	92.25	2.12%	47%	15.97	0.70%	53%	101.38	1.37%	
2003	93.54	1.39%	47%	16.05	0.49%	53%	102.31	0.91%	
2004	95.11	1.66%	47%	16.08	0.18%	53%	103.20	0.87%	1.05%
2005	96.96	1.92%	47%	16.22	0.88%	53%	104.63	1.37%	1.05%
2006	98.43	1.51%	47%	16.04	-1.10%	53%	104.76	0.13%	0.79%
2007	100.00	1.58%	47%	16.42	2.32%	53%	106.84	1.97%	1.15%
2008	102.30	2.27%	47%	16.83	2.47%	53%	109.41	2.38%	1.49%
2009	103.60	1.26%	47%	17.04	1.24%	53%	110.79	1.25%	1.87%
2010	105.10	1.44%	47%	17.38	2.01%	53%	112.74	1.74%	1.79%
2011	107.40	2.16%	47%	17.38	-0.03%	53%	113.87	1.00%	1.33%
2002-2011 Average		1.73%			0.91%			1.30%	
Standard Deviation		0.36%			1.13%			0.63%	
Standard Deviation/ Average		20.8%			123.2%			48.8%	
2004-2011 Average		1.73%			0.99%			1.34%	1.32%
Standard Deviation		0.36%			1.26%			0.70%	0.38%
Standard Deviation/ Average		20.8%			126.8%			52.4%	28.7%

Notes: Weights are preliminary and are currently an average from 2002-2011 for all companies with good data.



Inflation Measure

AWE-All Employees- Ontario and Economic Depreciation

Year	OM&A Price			Capital Price			Inflation Measure		
	AWE- All Employees- Ontario	Growth	Weight	Index	Growth	Weight	Index	Growth	Three Year Moving Average
2001	696.12		47%	15.86		53%	100.00		
2002	710.99	2.11%	47%	15.97	0.70%	53%	101.37	1.36%	
2003	728.11	2.38%	47%	16.05	0.49%	53%	102.78	1.38%	
2004	748.76	2.80%	47%	16.08	0.18%	53%	104.24	1.41%	1.38%
2005	776.13	3.59%	47%	16.22	0.88%	53%	106.50	2.15%	1.65%
2006	788.61	1.60%	47%	16.04	-1.10%	53%	106.68	0.17%	1.24%
2007	818.88	3.77%	47%	16.42	2.32%	53%	109.93	3.00%	1.77%
2008	838.16	2.33%	47%	16.83	2.47%	53%	112.60	2.40%	1.86%
2009	849.16	1.30%	47%	17.04	1.24%	53%	114.04	1.27%	2.22%
2010	882.14	3.81%	47%	17.38	2.01%	53%	117.34	2.85%	2.18%
2011	894.80	1.42%	47%	17.38	-0.03%	53%	118.11	0.65%	1.59%
2002-2011 Average		2.51%			0.91%			1.66%	
Standard Deviation		0.95%			1.13%			0.92%	
Standard Deviation/ Average		38.0%			123.2%			55.3%	
2004-2011 Average		2.58%			0.99%			1.74%	1.74%
Standard Deviation		1.07%			1.26%			1.03%	0.35%
Standard Deviation/ Average		41.4%			126.8%			59.2%	20.0%

Notes: Weights are preliminary and are currently an average from 2002-2011 for all companies with good data.



Inflation Measure

AHE- Hourly Employees- Ontario and Economic Depreciation

Year	OM&A Price			Capital Price			Inflation Measure		
	AHE- Hourly Employees- Ontario	Growth	Weight	Index	Growth	Weight	Index	Growth	Three Year Moving Average
2001	97.80		47%	15.86		53%	100.00		
2002	100.00	2.22%	47%	15.97	0.70%	53%	101.42	1.41%	
2003	102.80	2.76%	47%	16.05	0.49%	53%	103.02	1.56%	
2004	104.70	1.83%	47%	16.08	0.18%	53%	104.00	0.95%	1.31%
2005	107.00	2.17%	47%	16.22	0.88%	53%	105.56	1.49%	1.33%
2006	109.10	1.94%	47%	16.04	-1.10%	53%	105.91	0.33%	0.92%
2007	111.50	2.18%	47%	16.42	2.32%	53%	108.32	2.25%	1.36%
2008	114.10	2.31%	47%	16.83	2.47%	53%	110.94	2.39%	1.66%
2009	114.40	0.26%	47%	17.04	1.24%	53%	111.81	0.78%	1.81%
2010	116.50	1.82%	47%	17.38	2.01%	53%	113.98	1.92%	1.70%
2011	119.90	2.88%	47%	17.38	-0.03%	53%	115.51	1.34%	1.35%
2002-2011 Average		2.04%			0.91%			1.44%	
Standard Deviation		0.72%			1.13%			0.64%	
Standard Deviation/ Average		35.2%			123.2%			44.6%	
2004-2011 Average		1.92%			0.99%			1.43%	1.43%
Standard Deviation		0.75%			1.26%			0.73%	0.28%
Standard Deviation/ Average		39.1%			126.8%			50.8%	19.8%

Notes: Weights are preliminary and are based on current 2002-2011 data.



Inflation Measure

GDPIPI- Ontario and Regulatory Depreciation

Year	OM&A Price			Capital Price			Inflation Measure		
	GDPIPI-Ontario	Growth	Weight	Index	Growth	Weight	Index	Growth	Three Year Moving Average
2001	90.31		47%	15.03		53%	100.00		
2002	92.25	2.12%	47%	15.14	0.70%	53%	101.38	1.37%	
2003	93.54	1.39%	47%	15.21	0.51%	53%	102.32	0.93%	
2004	95.11	1.66%	47%	15.24	0.16%	53%	103.21	0.87%	1.05%
2005	96.96	1.92%	47%	15.37	0.82%	53%	104.60	1.34%	1.04%
2006	98.43	1.51%	47%	15.13	-1.54%	53%	104.49	-0.10%	0.70%
2007	100.00	1.58%	47%	15.47	2.19%	53%	106.50	1.90%	1.05%
2008	102.30	2.27%	47%	15.87	2.56%	53%	109.11	2.42%	1.41%
2009	103.60	1.26%	47%	16.07	1.29%	53%	110.51	1.28%	1.87%
2010	105.10	1.44%	47%	16.39	1.97%	53%	112.43	1.72%	1.81%
2011	107.40	2.16%	47%	16.35	-0.23%	53%	113.45	0.90%	1.30%
2002-2011 Average		1.73%			0.84%			1.26%	
Standard Deviation		0.36%			1.23%			0.69%	
Standard Deviation/ Average		20.8%			145.7%			54.5%	
2004-2011 Average		1.73%			0.90%			1.29%	1.28%
Standard Deviation		0.36%			1.39%			0.77%	0.40%
Standard Deviation/ Average		20.8%			153.4%			59.5%	31.5%

Notes: Weights are preliminary and are based on current 2002-2011 data.



Inflation Measure

AWE-All Employees- Ontario and Regulatory Depreciation

Year	OM&A Price			Capital Price			Inflation Measure		
	AWE- All Employees- Ontario	Growth	Weight	Index	Growth	Weight	Index	Growth	Three Year Moving Average
2001	696.12		47%	15.03		53%	100.00		
2002	710.99	2.11%	47%	15.14	0.70%	53%	101.37	1.36%	
2003	728.11	2.38%	47%	15.21	0.51%	53%	102.79	1.39%	
2004	748.76	2.80%	47%	15.24	0.16%	53%	104.24	1.40%	1.38%
2005	776.13	3.59%	47%	15.37	0.82%	53%	106.48	2.12%	1.64%
2006	788.61	1.60%	47%	15.13	-1.54%	53%	106.41	-0.06%	1.15%
2007	818.88	3.77%	47%	15.47	2.19%	53%	109.58	2.93%	1.66%
2008	838.16	2.33%	47%	15.87	2.56%	53%	112.29	2.45%	1.77%
2009	849.16	1.30%	47%	16.07	1.29%	53%	113.75	1.29%	2.23%
2010	882.14	3.81%	47%	16.39	1.97%	53%	117.03	2.83%	2.19%
2011	894.80	1.42%	47%	16.35	-0.23%	53%	117.67	0.55%	1.56%
2002-2011 Average		2.51%			0.84%			1.63%	
Standard Deviation		0.95%			1.23%			0.97%	
Standard Deviation/ Average		38.0%			145.7%			59.3%	
2004-2011 Average		2.58%			0.90%			1.69%	1.70%
Standard Deviation		1.07%			1.39%			1.08%	0.37%
Standard Deviation/ Average		41.4%			153.4%			64.2%	21.7%

Notes: Weights are preliminary and are based on current 2002-2011 data.



Inflation Measure

AHE- Hourly Employees- Ontario and Regulatory Depreciation

Year	OM&A Price			Capital Price			Inflation Measure		
	AHE- Hourly Employees- Ontario	Growth	Weight	Index	Growth	Weight	Index	Growth	Three Year Moving Average
2001	97.80		47%	15.03		53%	100.00		
2002	100.00	2.22%	47%	15.14	0.70%	53%	101.42	1.41%	
2003	102.80	2.76%	47%	15.21	0.51%	53%	103.03	1.57%	
2004	104.70	1.83%	47%	15.24	0.16%	53%	104.01	0.95%	1.31%
2005	107.00	2.17%	47%	15.37	0.82%	53%	105.54	1.46%	1.32%
2006	109.10	1.94%	47%	15.13	-1.54%	53%	105.64	0.10%	0.83%
2007	111.50	2.18%	47%	15.47	2.19%	53%	107.97	2.18%	1.25%
2008	114.10	2.31%	47%	15.87	2.56%	53%	110.64	2.44%	1.57%
2009	114.40	0.26%	47%	16.07	1.29%	53%	111.53	0.80%	1.81%
2010	116.50	1.82%	47%	16.39	1.97%	53%	113.67	1.90%	1.71%
2011	119.90	2.88%	47%	16.35	-0.23%	53%	115.08	1.23%	1.31%
2002-2011 Average		2.04%			0.84%			1.40%	
Standard Deviation		0.72%			1.23%			0.69%	
Standard Deviation/ Average		35.2%			145.7%			48.9%	
2004-2011 Average		1.92%			0.90%			1.38%	1.39%
Standard Deviation		0.75%			1.39%			0.78%	0.31%
Standard Deviation/ Average		39.1%			153.4%			56.2%	22.1%

Notes: Weights are preliminary and are currently an average from 2002-2011 for all companies with good data.



Inflation Measure Summary- Economic Depreciation

Year	Option 1- GDPIPI- Ontario and Economic Depreciation			Option 2- AWE- All Employeess- Ontario and Economic Depreciation			Option 3- AHE- Hourly Employeess- Ontario and Economic Depreciation		
	Index	Growth	Three Year Moving Average	Index	Growth	Three Year Moving Average	Index	Growth	Three Year Moving Average
2001	100.00			100.00			100.00		
2002	101.38	1.37%		101.37	1.36%		101.42	1.41%	
2003	102.31	0.91%		102.78	1.38%		103.02	1.56%	
2004	103.20	0.87%	1.05%	104.24	1.41%	1.38%	104.00	0.95%	1.31%
2005	104.63	1.37%	1.05%	106.50	2.15%	1.65%	105.56	1.49%	1.33%
2006	104.76	0.13%	0.79%	106.68	0.17%	1.24%	105.91	0.33%	0.92%
2007	106.84	1.97%	1.15%	109.93	3.00%	1.77%	108.32	2.25%	1.36%
2008	109.41	2.38%	1.49%	112.60	2.40%	1.86%	110.94	2.39%	1.66%
2009	110.79	1.25%	1.87%	114.04	1.27%	2.22%	111.81	0.78%	1.81%
2010	112.74	1.74%	1.79%	117.34	2.85%	2.18%	113.98	1.92%	1.70%
2011	113.87	1.00%	1.33%	118.11	0.65%	1.59%	115.51	1.34%	1.35%
2002-2011 Average		1.30%			1.66%			1.44%	
Standard Deviation		0.63%			0.92%			0.64%	
Standard Deviation/ Average		48.8%			55.3%			44.6%	
2004-2011 Average		1.34%	1.32%		1.74%	1.74%		1.43%	1.43%
Standard Deviation		0.70%	0.38%		1.03%	0.35%		0.73%	0.28%
Standard Deviation/ Average		52.4%	28.7%		59.2%	20.0%		50.8%	19.8%

Notes: Weights are preliminary and are currently an average from 2002-2011 for all companies with good data.



Inflation Measure Summary- Regulatory Depreciation

Year	Option 4- GDPIPI- Ontario and Regulatory Depreciation			Option 5- AWE- All Emploeyss- Ontario and Regulatory Depreciation			Option 6- AHE- Hourly Emploeyss- Ontario and Regulatory Depreciation		
	Index	Growth	Three Year Moving Average	Index	Growth	Three Year Moving Average	Index	Growth	Three Year Moving Average
2001	100.00			100.00			100.00		
2002	101.38	1.37%		101.37	1.36%		101.42	1.41%	
2003	102.32	0.93%		102.79	1.39%		103.03	1.57%	
2004	103.21	0.87%	1.05%	104.24	1.40%	1.38%	104.01	0.95%	1.31%
2005	104.60	1.34%	1.04%	106.48	2.12%	1.64%	105.54	1.46%	1.32%
2006	104.49	-0.10%	0.70%	106.41	-0.06%	1.15%	105.64	0.10%	0.83%
2007	106.50	1.90%	1.05%	109.58	2.93%	1.66%	107.97	2.18%	1.25%
2008	109.11	2.42%	1.41%	112.29	2.45%	1.77%	110.64	2.44%	1.57%
2009	110.51	1.28%	1.87%	113.75	1.29%	2.23%	111.53	0.80%	1.81%
2010	112.43	1.72%	1.81%	117.03	2.83%	2.19%	113.67	1.90%	1.71%
2011	113.45	0.90%	1.30%	117.67	0.55%	1.56%	115.08	1.23%	1.31%
2002-2011 Average		1.26%			1.63%			1.40%	
Standard Deviation		0.69%			0.97%			0.69%	
Standard Deviation/ Average		54.5%			59.3%			48.9%	
2004-2011 Average		1.29%	1.28%		1.69%	1.70%		1.38%	1.39%
Standard Deviation		0.77%	0.40%		1.08%	0.37%		0.78%	0.31%
Standard Deviation/ Average		59.5%	31.5%		64.2%	21.7%		56.2%	22.1%

Notes: Weights are preliminary and are currently an average from 2002-2011 for all companies with good data.



Consultation Issues

- Capital service price sub-index?
- Labor/OM&A price sub-index?
- Measure inflation annually or as a three-year moving average?
- Other options for sub-indices?
- Other options for mitigating volatility?