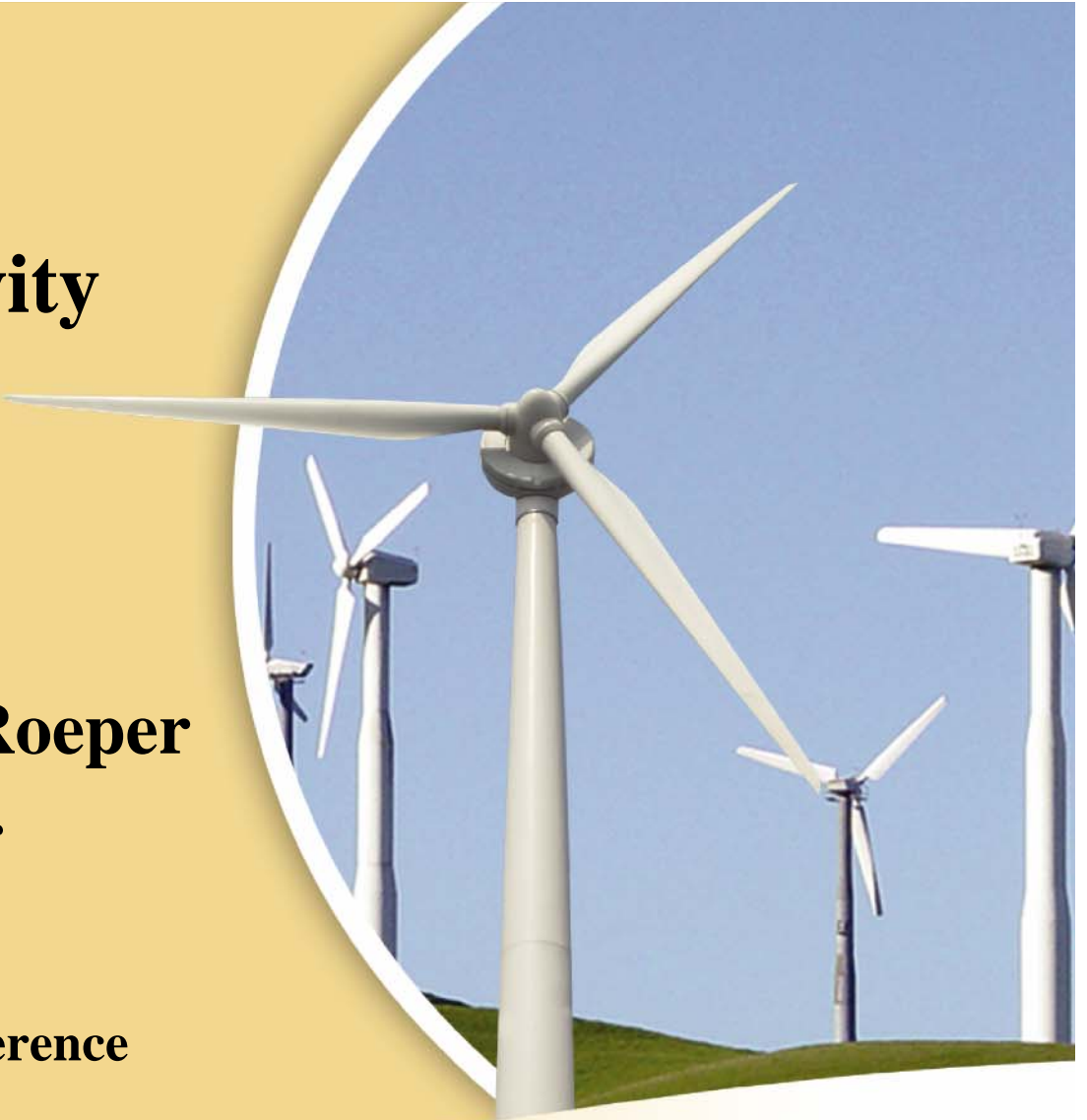


Financial Sensitivity of Wind Farm Investment

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ORTECH Power**

**2005 CanWEA Annual Conference
October 16 – 19, 2005**



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1. Purpose

- **To illustrate the effects of various factors on the rate of return of a wind facility and to rank the changes in order of sensitivity.**

2. Methodology

- **Use a financial model with parameters based on a typical 100 MW wind facility located in Ontario with capital cost of \$2,000,000 per MW and a capacity factor of 30 per cent to illustrate the relative effect of changes in variables in order to achieve a target rate of return.**

3. Summary of Basic Model

4. Variables:

(a) Long Term Interest Rates

(b) Capital Cost

**(c) Changes in Output/Operating
Costs**

5. Conclusions – Ranking of Factors

FINANCIAL MODEL

- **Basic Assumptions**
 - 100 MWs
 - 56 1.8 MW Turbines
 - 30 per cent capacity factor = approximately 250,000 MWh annual output
 - Capital cost \$205 MM
 - 50 % funded fully amortizing 20 year debt at 6%
 - priced at \$96.30/MWh + WPPI to give pre-tax IRR of 10%

100 MW Wind Facility Assumptions

Item	Description	Unit	Value	Note
1	Wind Farm			
1.1	Name		100 MW Wind Facility	
1.2	Area	km ²		
1.2	Turbine Type		1.8	
1.2	No. of Turbines	#	56	
1.3	Installed Capacity	MW	100	
1.4	Average Energy Factor	%	30.0	
1.5	Average Annual Energy Production	MWh	249,782	
1.6	Total Capital Cost	\$Million	205.000	
1.7	1st Year Operating cost	\$Million	4.763	
1.8	Cost/MW	\$Million	2.1	
1.9	Year-in-Service		2008	
2	Financial Variables			
2.1	Power Price	\$/MWh	96.30	
2.2	WPPI	\$/MWh	10	Upgraded to reflect 2005 federal budget
2.3	% of Construction Debt	%	50	
2.4	% of In-Service Debt	%	50	
2.5	Inflation Rate	%	2.5	
2.6	Construction Interest Rate	%	6.00	
2.7	Primary Debt Interest Rate	%	6.00	
2.8	Primary Debt Term	Year	20	
2.9	Secondary Debt Interest Rate	%	0	
2.10	Secondary Debt Term	%	0	
2.11	CCA Rate	%	50	Amended to reflect 2005 federal budget
2.12	Tax Rate	%	40	
2.13	Construction Duration	Year	2	
3	IRR Summary			
3.1	IRR on Equity before Tax (levered)		10.0%	
3.2	IRR on Equity after Tax (levered)		8.1%	
3.3	IRR on Project before Tax (unlevered)		8.0%	
3.4	IRR on Project after Tax (unlevered)		5.8%	

100 MW Wind Facility Capital Costs

	<u>(CAN\$MM)</u>
Owner's Costs	6.00
Engineering & Design	4.00
Generating Equipment	140.00
Transmission & Balance of Plant	40.00
Miscellaneous & Contingencies	10.00
Subtotal	<u>200.00</u>
Construction Financing Costs	<u>5.00</u>
Total Capital Cost	<u><u>205.00</u></u>
Cost per MW	2.05

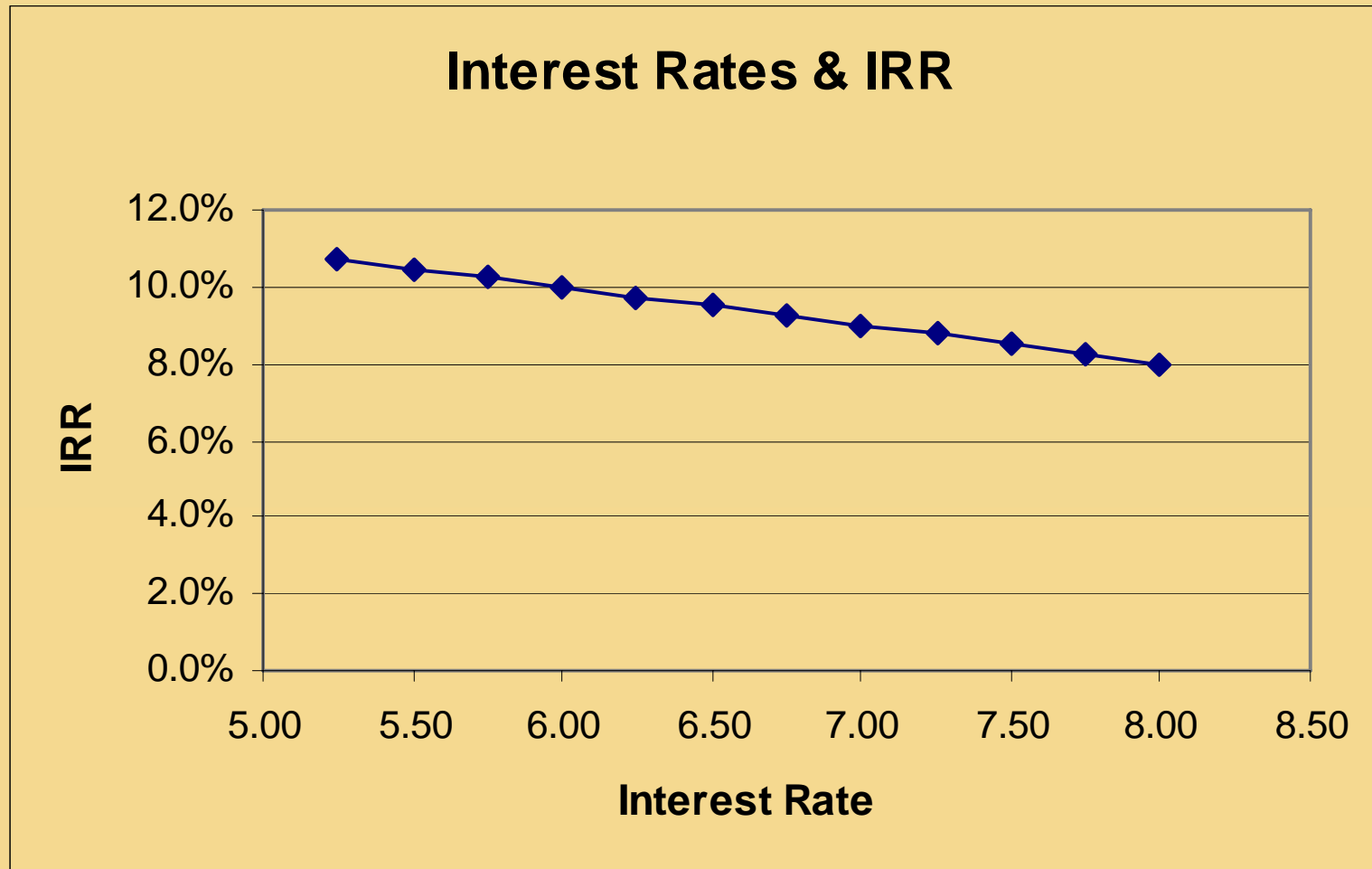
100 MW Model Operating Costs
(Inflation Adjusted from 2005)

Number of Turbines = 56	2008	2009	2010	2011	2012	2013
Output MWh	249,782					
Revenues @ \$95/MWh	24,054,007	24,126,169	24,198,547	24,271,143	24,343,956	24,416,988
WPPI	2,497,820	2,497,820	2,497,820	2,497,820	2,497,820	2,497,820
Total Revenues	26,551,827	26,623,989	26,696,367	26,768,963	26,841,776	26,914,808
Operating Expenses						
Warranty Contract for Wind Farm	2,545,896	2,596,814	2,648,750	2,701,725	2,755,760	
Service Contract for Wind Farm						1,405,437
Reactive Maintenance (30% of Service)						421,631
Equipment Repair Reserve						980,891
Subtotal Maintenance	2,545,896	2,596,814	2,648,750	2,701,725	2,755,760	2,807,960
Insurance	528,145	541,349	554,882	568,754	582,973	597,548
Land Lease	586,828	601,499	616,536	631,950	647,748	663,942
Property Tax & Community Support	205,390	209,498	213,688	217,962	222,321	226,767
Capital Tax						
Owner's Administration and Operation	241,187	246,011	250,931	255,950	261,069	266,290
Legal Support						
Engineering Support						
Post Construction Environmental Monitoring/Wind Monitoring						
Owner's Operator	134,400	137,088	139,830	142,626	145,479	148,388
Owner's Maintenance Crew	334,665	341,358	348,185	355,149	362,252	369,497
Contingencies	185,989	189,709	193,503	197,373	201,320	205,347
Total Operating Costs	4,762,500	4,863,325	4,966,306	5,071,489	5,178,922	5,285,739
Net Operating Revenue	21,789,327	21,760,664	21,730,062	21,697,474	21,662,854	21,629,069
Operating Expenses as % of Generating Revenue	19.8	20.2	20.5	20.9	21.3	21.6

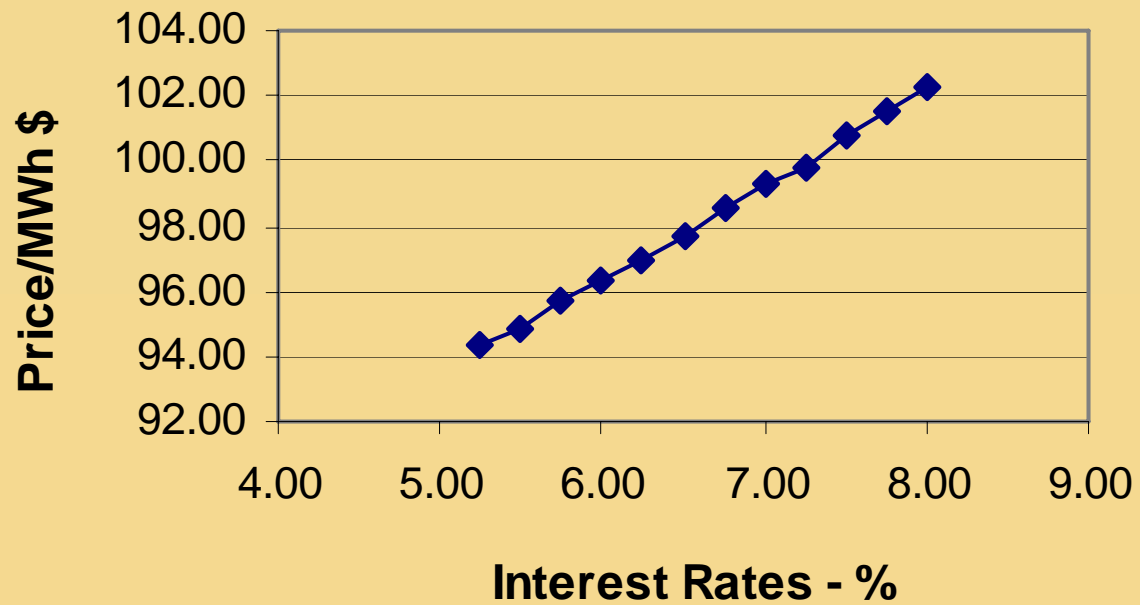
INTEREST RATE SENSITIVITY

- **Assumptions**
 - Based on 10 year Gov't of Canada bond rate, currently 3.94%
 - Estimated one year out at 4.25%
 - Project Rate at 4.25 + 175 basis points = 6%
- **Effects of Increase**
 - Limited effect on IRR, 250 basis point increase reduces IRR by 250 basis points
 - Project still acceptable although reduced Rate of Return
 - Can be compensated for by bid price; to cover 100 basis point increase require bid price of \$99.25 or approximately \$3.00 per MWh
- **Conclusions**
 - Unless interest rates surge, probably a controllable factor
 - Obvious pricing advantage to large corporations with access to debt markets

Interest Rates & IRR



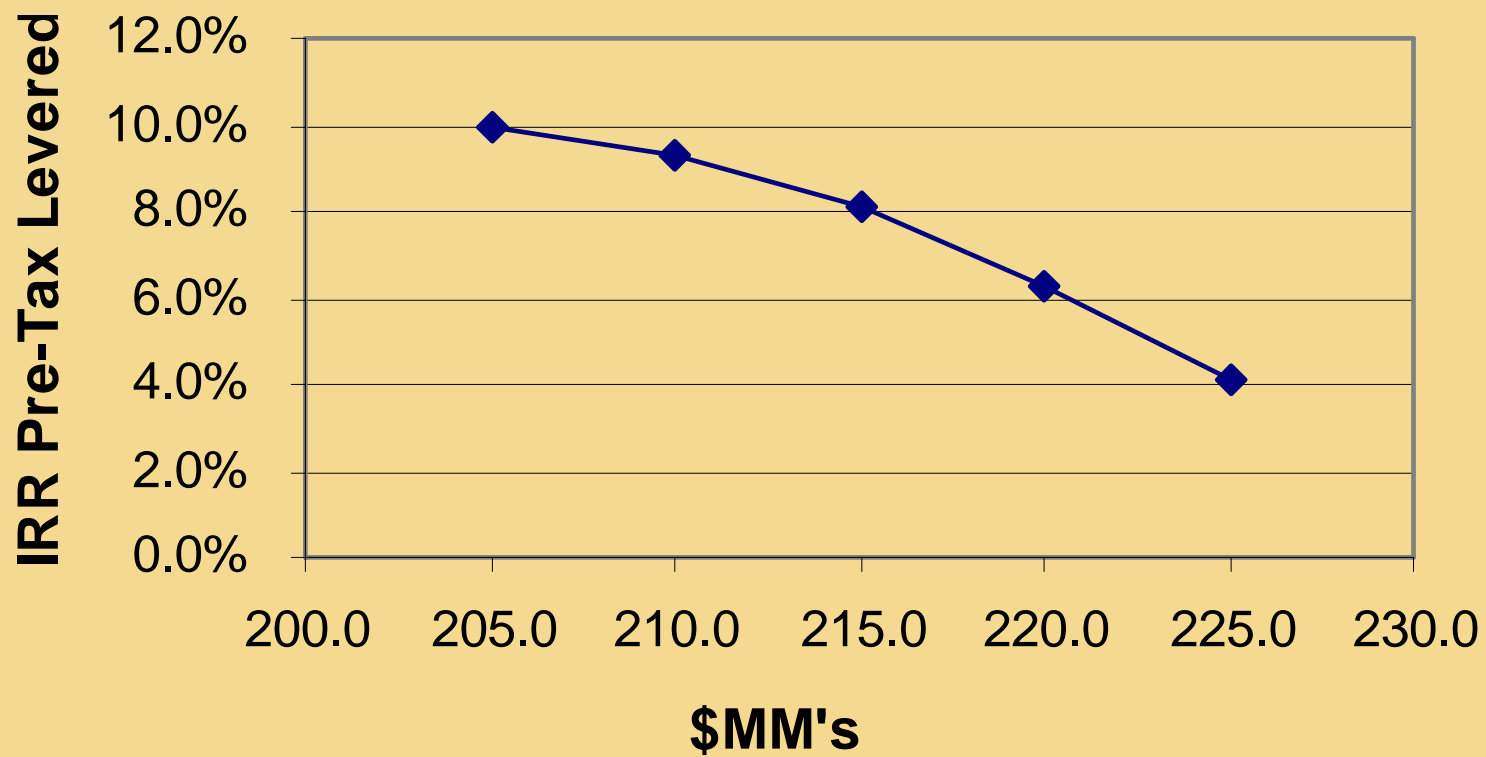
Pricing vs Interest Rates



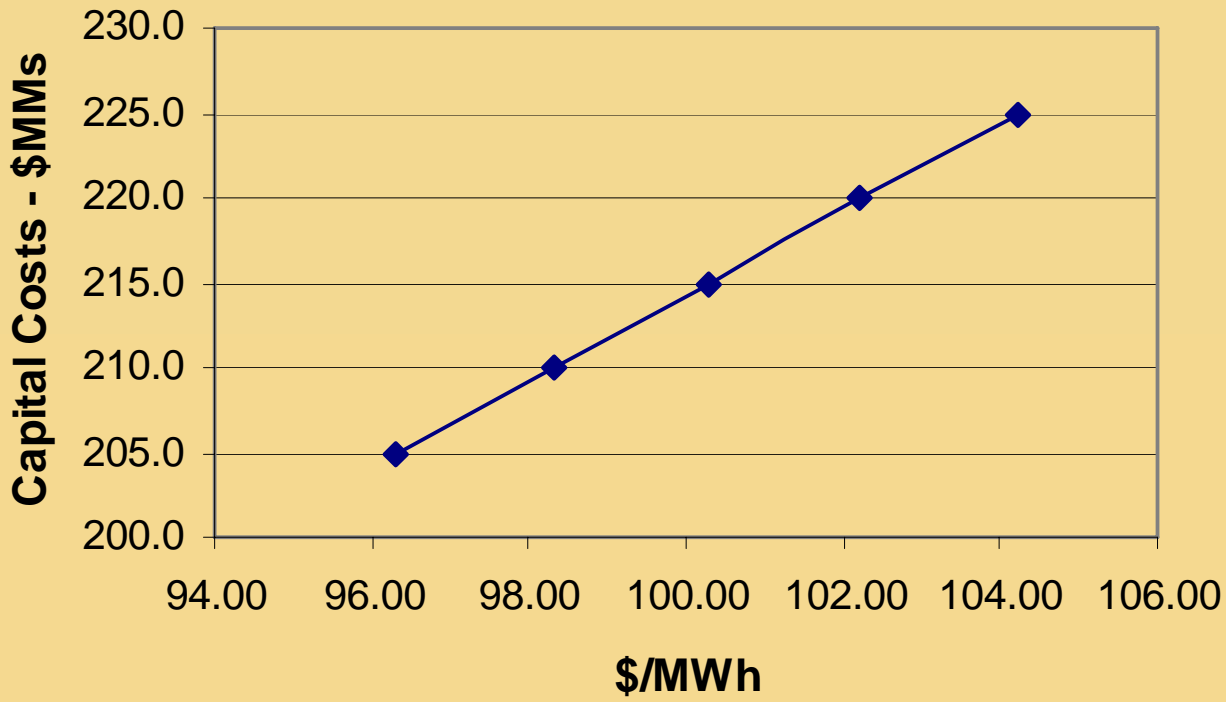
CAPITAL COST SENSITIVITY

- **Assumptions**
 - Capital costs including construction period interest \$205 MM
 - Assume potential increases in \$5 MM increments
- **Effects of Increases**
 - For every \$5 MM require approximately \$2.00 increase in price per MWh
 - Moderate effect on IRR; 10% cost overrun reduces Rate of Return from 10% to 4%; project still profitable but barely attractive.
- **Conclusions**
 - Capital costs, particularly equipment, usually consistent for most developers
 - Risk can be partially controlled with good advanced engineering and planning.

Capital Cost & IRR



Capital Cost vs Price/MWh



REVENUE/OPERATING COSTS SENSITIVITY

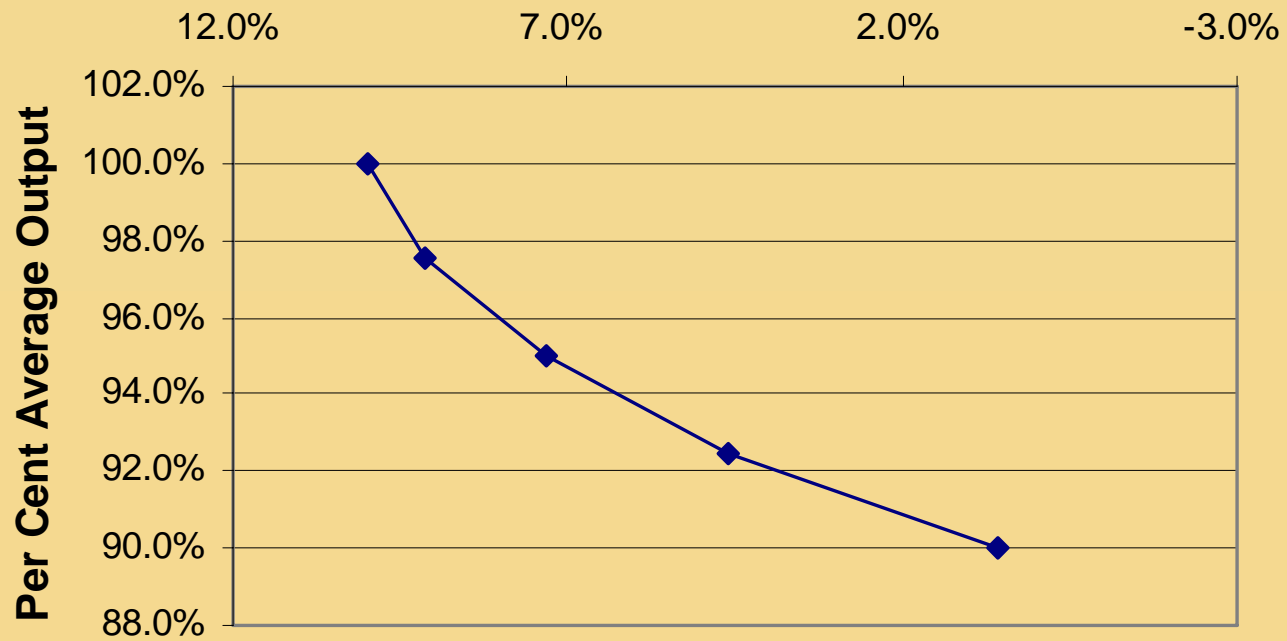
- **Assumptions**
 - **Model's operating costs approximately 20% of revenues increasing to approximately 30% after year 20 as maintenance and repair costs increase**
 - **Model assumes initial 5 year manufacturer's warranty and service programs**
 - **Uncertainties either from output (revenue) or operating costs or combination of both**
 - **To test sensitivity, assumed incremental decreases of 2.5% in output.**
- **Effects of Decreases**
 - **Relatively rapid and severe drop in Rate of Return: 5% decrease gives an approximate 7% Rate of Return; 10% eliminates equity return completely**
 - **Increasing price per MWh quickly results in non-competitive bid; to cover 2.5% drop in revenues requires additional \$2.70 for bid price of \$99.00. Each additional 2.5% requires on average a further \$2.85 increase.**

Revenue/Operating Costs Sensitivity - Continued

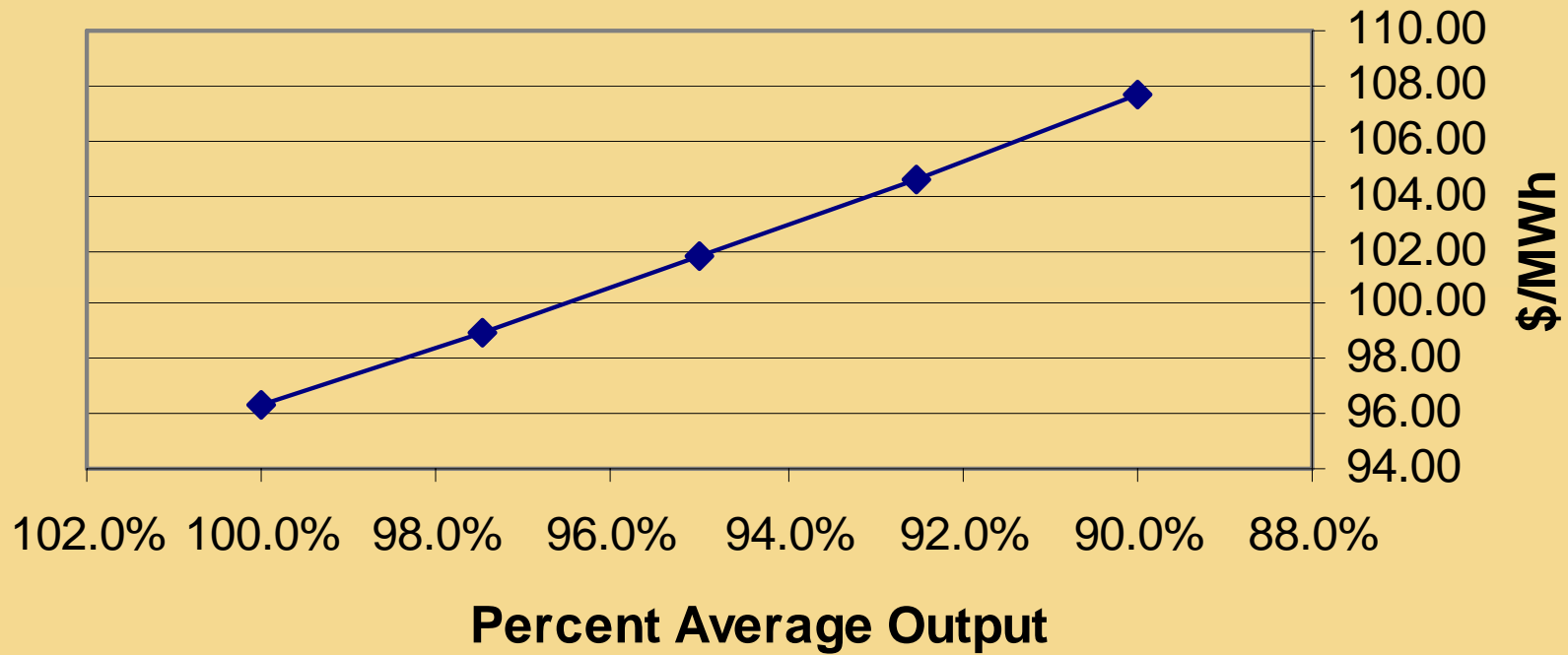
- **Conclusions**
 - **Biggest danger in wind facility financing is the inability to predict output or operating expenses, particularly maintenance and repair costs.**
 - **Extensive wind resource analysis is required for output, but forecasting is an inexact science. P 50's vary widely. If -10%, investment is unsatisfactory given levels of equity capital required.**
 - **Test turbines with CRCE financing may be a practical alternative.**
 - **Maintenance and Service Costs: Developers may be lulled into false sense of security with 5 year warranty programs. Extensive long range planned maintenance programs will be required.**
 - **Some comfort may be derived from likely residual value at end of projected economic life of the project but not currently bankable.**
 - **From point of view of equity investor, potential rates of return (e.g. 10% used in ORTECH model) do not reflect true equity risk; however, in current competitive bid environment difficult to factor in higher rates of return. If interest rates move up, equity return requirements will further increase.**

IRR - Revenue & Op Costs

IRR - Levered Pre Tax



Revenue/Op Cost Pricing Sensitivity



CONCLUSIONS

1. Interest Rate Risk

- Probably manageable unless sudden unexpected large increases.
- Universal factor affecting all developers.
- Pricing advantage to developers with access to public debt markets.

2. Capital Costs

- Moderate effect on rate of return
- Risk can be minimized by careful engineering and planning
- Fixed price “turn key” contracts shift risk to contractor but at a cost and not foolproof.

3. Revenue & Operating Costs

- Most dangerous area for developers; in extreme cases may wipe out equity returns.
- Future maintenance and service costs largely unknown and may not be adequately provided for.
- Equity returns may not adequately reflect equity risk undertaken.