



CapEx, OpEx, Feasibility

Houston Workshop

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ORTECH Power

- **Wind Consulting:**
 - **Technical & Financial Advisors**
 - **Affiliated with DEWI**
 - German Wind Energy Institute
 - **Wind Resource Assessment**
 - **Development Plans**
 - **Operations Support**
 - **Feasibility & Sector Analysis**
 - **Due Diligence / Independent Engineers.**

Outline

- **Estimating CapEx**
 - Turbines
 - Construction
 - Other
- **Estimating OpEx**
 - O&M
 - Fixed & Variable
 - Parts
- **Analyzing Feasibility**
 - Revenue / Costs
 - IRR
 - Cost of Funds

CapEx

(Example 100 MW, \$200 million)

- **Development Costs**
 - Land, Wind, Grid, Permits
- **Financing Costs**
 - Cost of Funds, Construction Interest
- **Construction Costs**
 - Turbines, Commissioning, BOP

Development Costs (Illustration)

- **Land** **\$100k**
- **Wind** **\$200k**
- **Grid** **\$100k**
- **Permits** **\$200k**
- **Sub-total \$600k (0.3% of Capital)**
- **Pre-Constr.** **\$1,400k (0.7% of Capital)**
- **Total** **\$2,000k (1.0% of Capital)**

Financing Costs (Illustration)

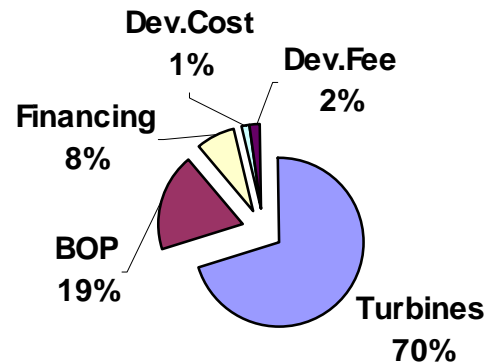
- **Due Diligence** **\$500k**
- **Equity Fee** **\$2,500k**
- **Debt Fee** **\$2,000k**
- **Constr. Int.** **\$12,000k**
- **Total** **\$16,500k (8.3% of Capital)**

Construction Costs (Illustration)

- **Turbines** **\$150mill.**
- **BOP** **\$40mill.**
- **Financing** **\$17mill.**
- **Development** **\$2mill.**
- **Developer Fee** **\$5mill.**
- **Total (2010)** **\$214mill.**
 - **(\$2.1mill./MW)**

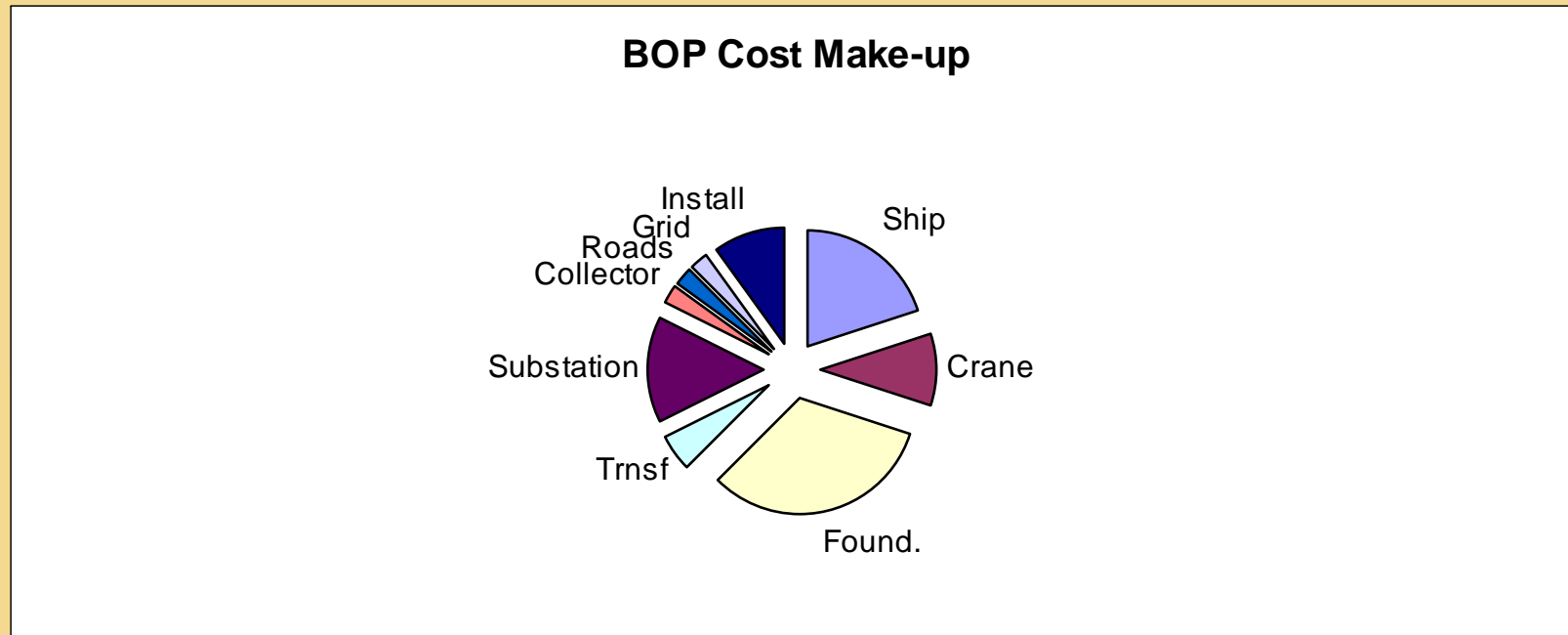
CapEx Summary

CapEx (100MW, \$214mill.)



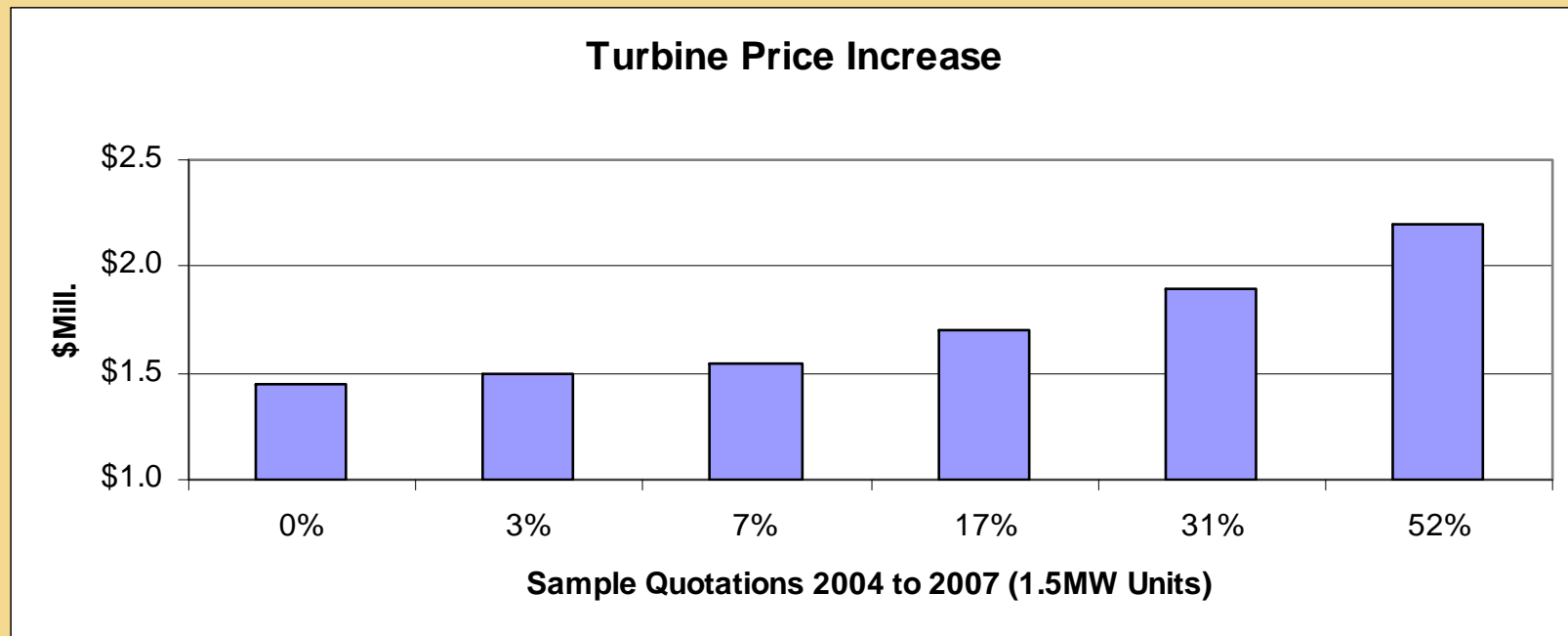
- **Turbines – majority cost, rapid increases**
- **BOP – site dependent, modest increases**
- **Financing – going up due to project timing.**

Balance of Plant Portion



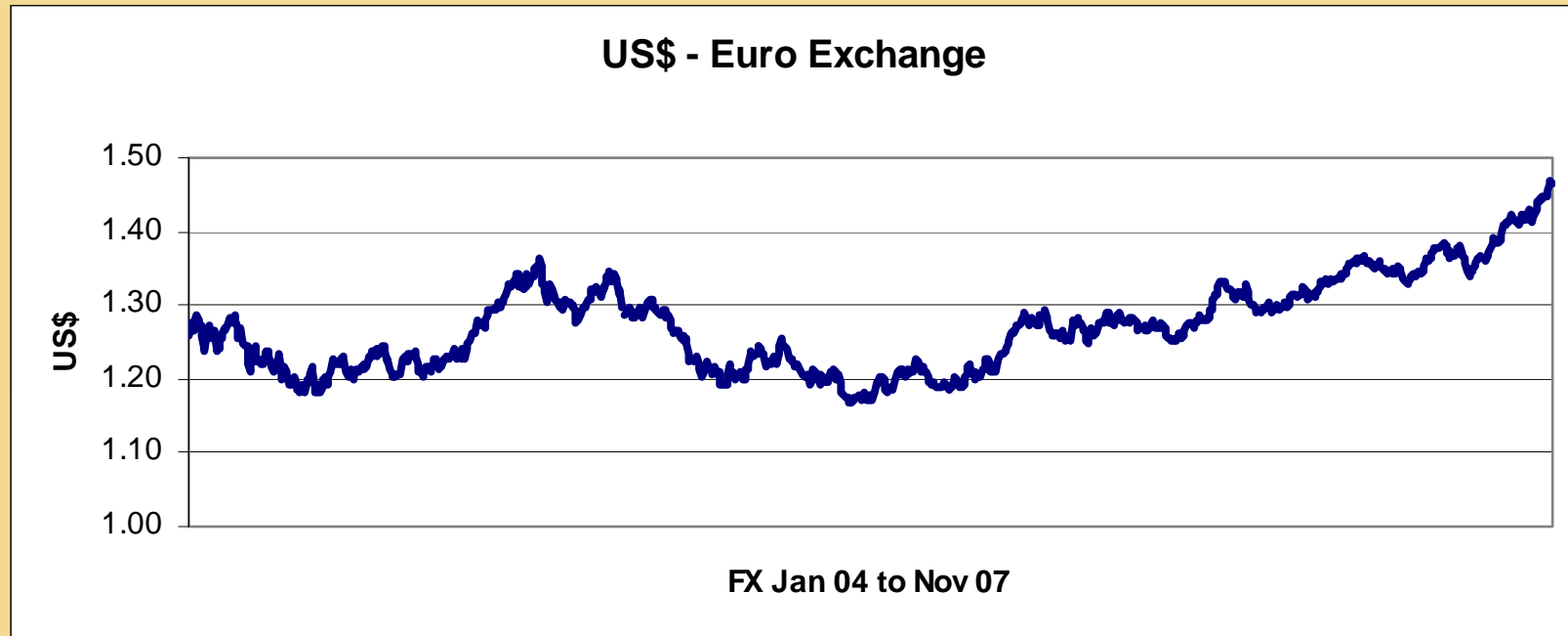
- **Foundations are the often the largest BOP cost. BOP costs can vary widely depending on connection costs and the site location.**

Turbine Costs



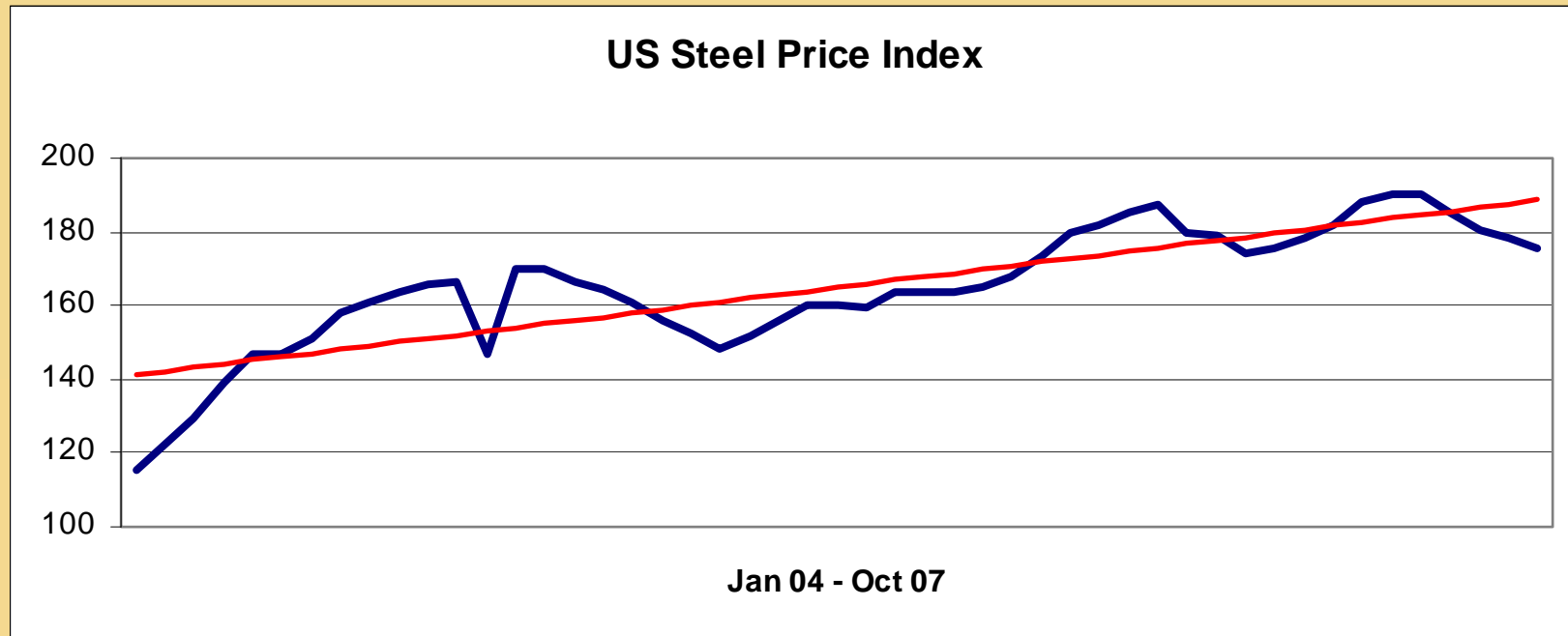
- **Very large increase 2004 to 2007**
- **Latest figure for 2009 delivery, could be special circumstance**
- **Several factors, currency, input costs, global market.**

Changes in Euro exchange



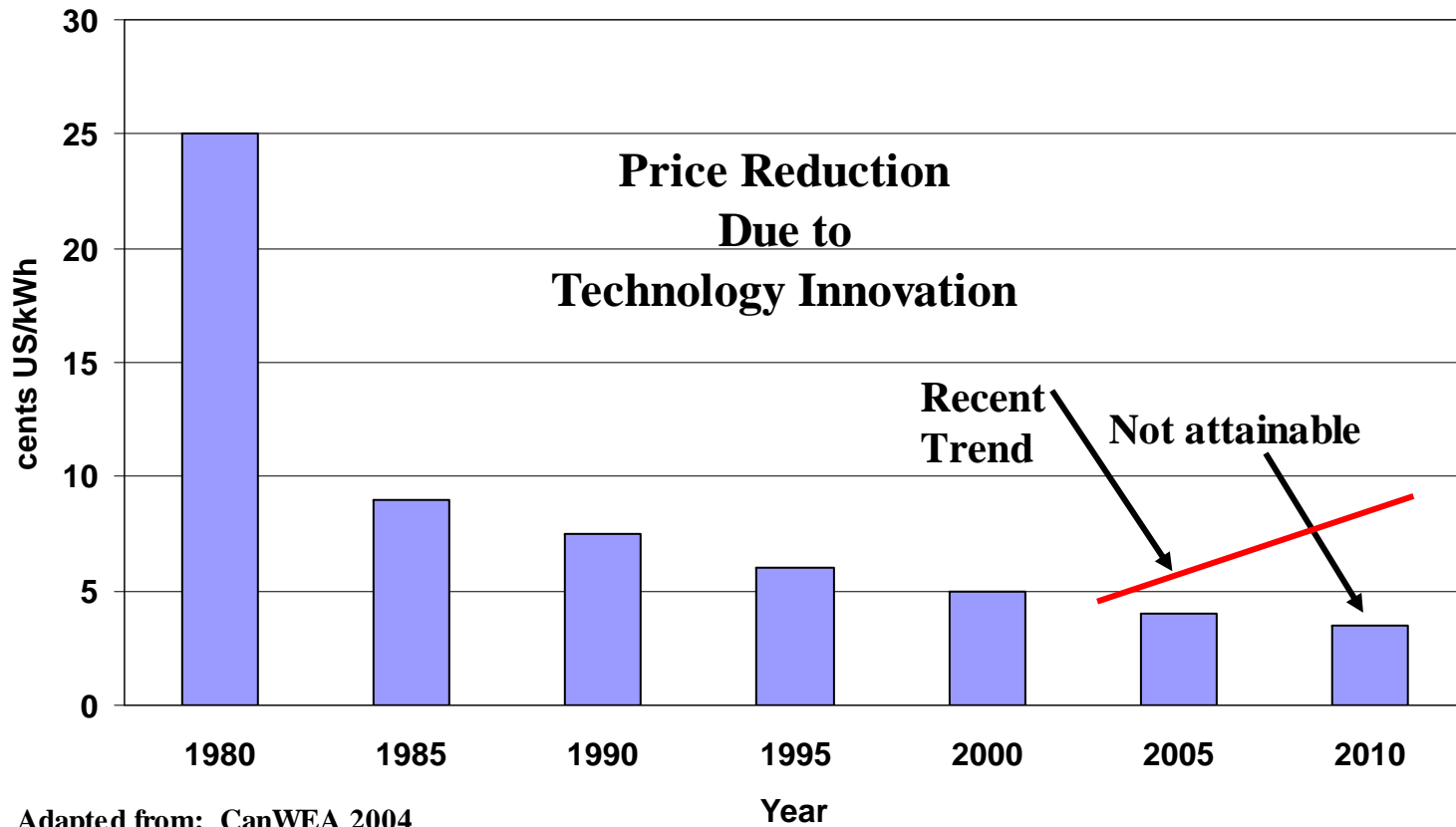
- **Euro exchange is significant because many turbine components come from Europe. Recent weakening of the US \$ could put addition pressure on turbine pricing. However, not main recent for price incrs.**

US Steel Price Index



- **Steel prices and other commodities have increased substantially. This contributes to the price pressure, but does not account for all the increases. Bulk is due to supply demand of turbines on the global market.**

Historical & Projected Wind Energy Costs



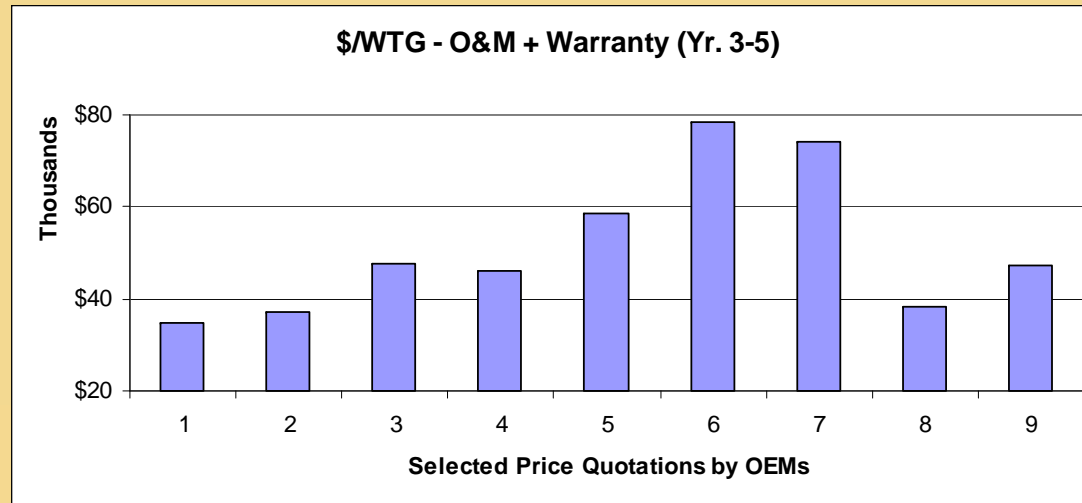
Key Issue

- **What impact will the significant increases in turbine prices have on prices of wind power, and how could this affect the continued expansion of the wind industry in the US in the coming years?**

OpEx

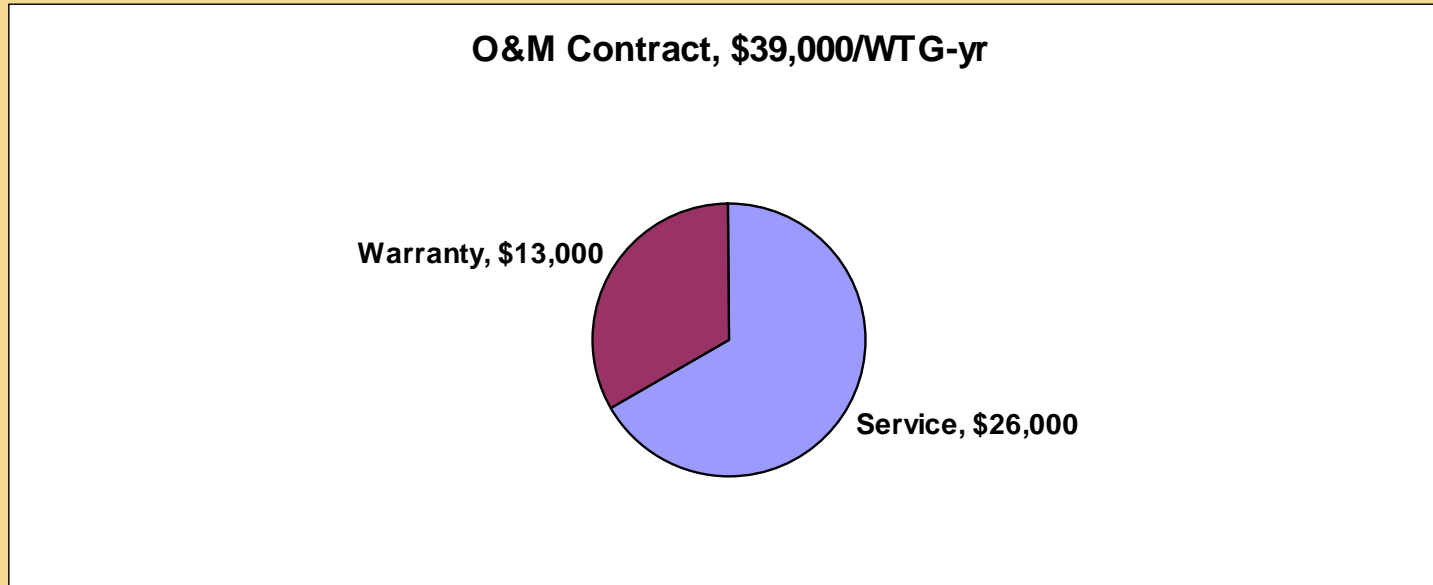
- **Turbine design life 20 years, op. experience < 10 years.**
- **Owners & manufacturers hesitant to share experience data.**
- **Few government statistics (except ISET in Europe).**
- **O&M costs are site specific and model specific.**
- **Estimating long term costs is challenging.**

Cost of Warranty, Service Maintenance Contracts



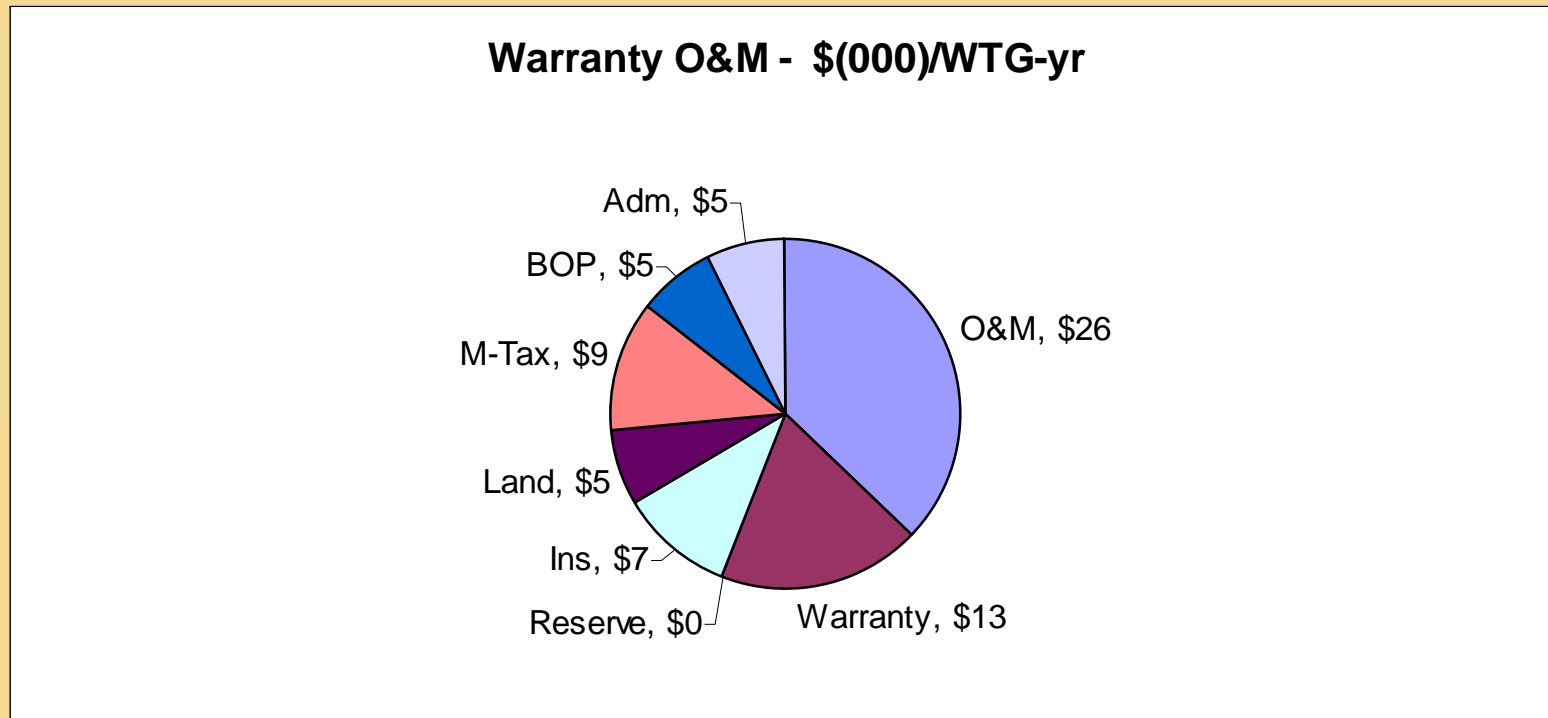
- **Example of price variability in WMS contracts.**
- **Hi quotes related to remote sites.**
- **Large WTGs typically have slightly higher \$/WTG-yr.**
- **We will use \$39,000/WTG-yr as typical for 1.5 MW turbine (limited ext. wty. + srvc.)**

Wty. portion of WMS



- **Warranty cost seldom broken out.**
- **Contractual exclusion vary.**
- **1/3 Assumed as wty. portion of contracts.**

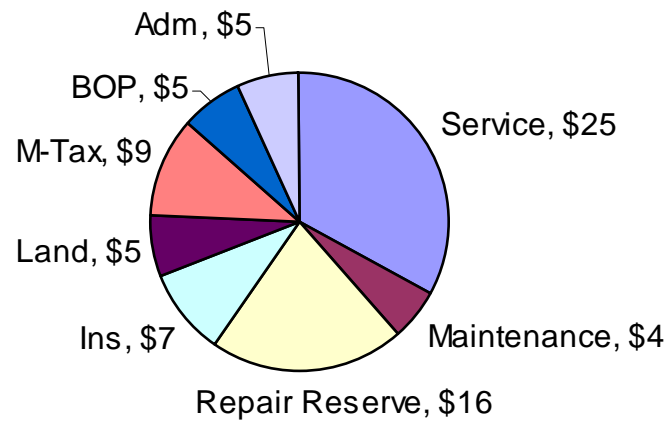
WMS as part of total O&M



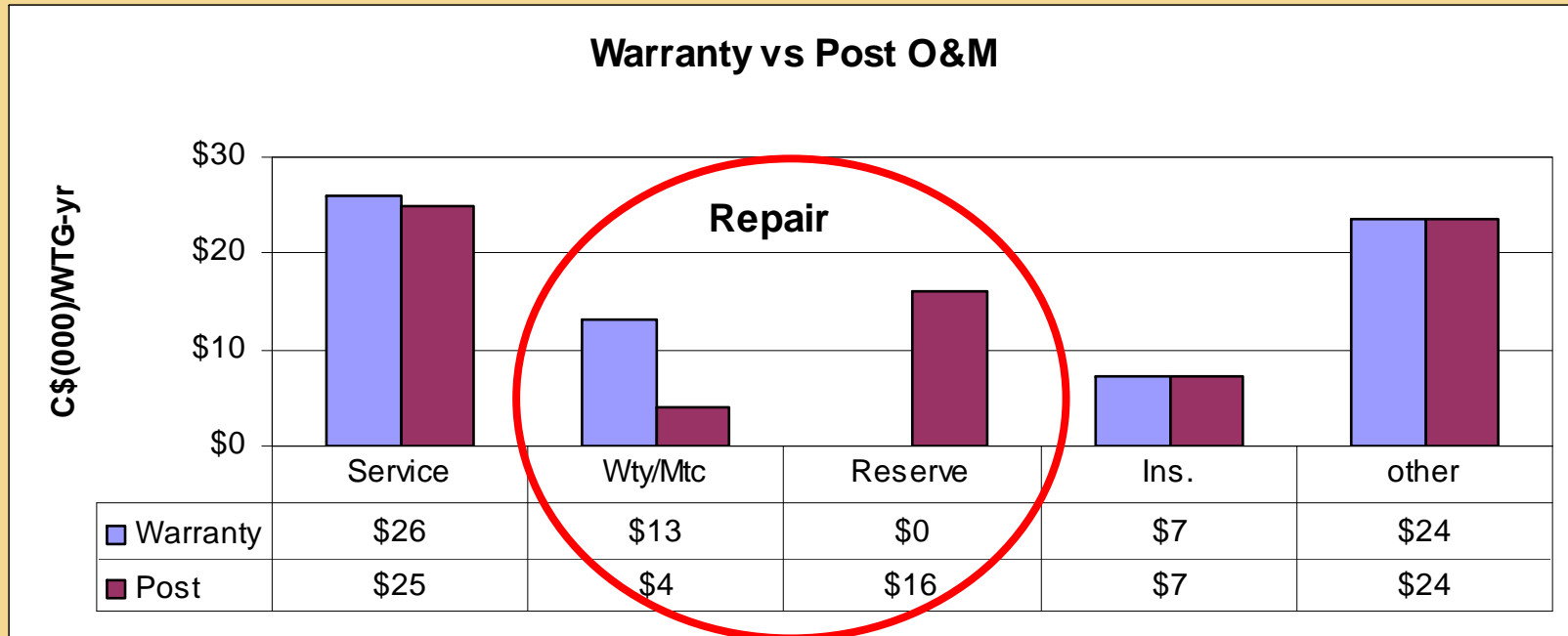
- **WMS typically amounts to approx. 60%**
- **Largely market based, not indicative of actual.**
- **Avail. only for early years (few repairs).**

Post wty. Costs

Post O&M - \$(000)/WTG-yr



Wty. Vs. Post Comparison



- **Maintenance is the expensed portion (recurring annully), Reserve is the capital portion.**
- **Mtc. + Reserve = \$20,000/WTG-yr.**

Service

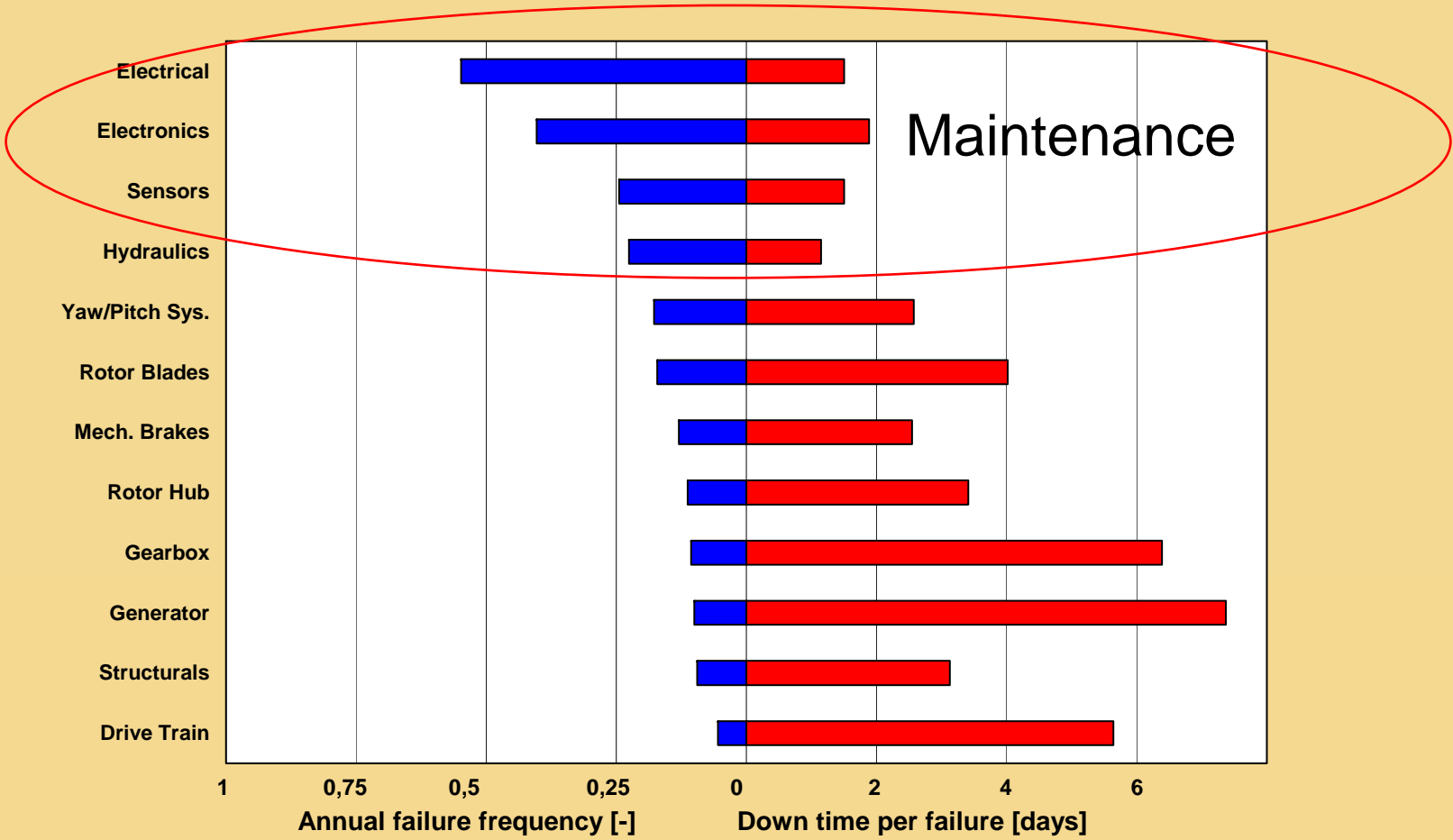
- **Routine day to day operation**
 - **24/7 Remote monitoring**
 - **Scheduled maintenance**
 - **On-site services**

Unscheduled Maintenance

- **Unscheduled minor maintenance highly variable by site / model.**
- **Budget figure meant to refer to minor recurring small part replacement.**
- **Excludes major component repairs.**

Unscheduled Maintenance

- **Unscheduled extension of on-site service.**
- **Relies on parts inventory or readily available parts that can be replaced by on-site service team.**
- **Involves recurring outages of short duration due to minor parts.**
- **Is tracked as operating expense, not as capital replacement expense.**

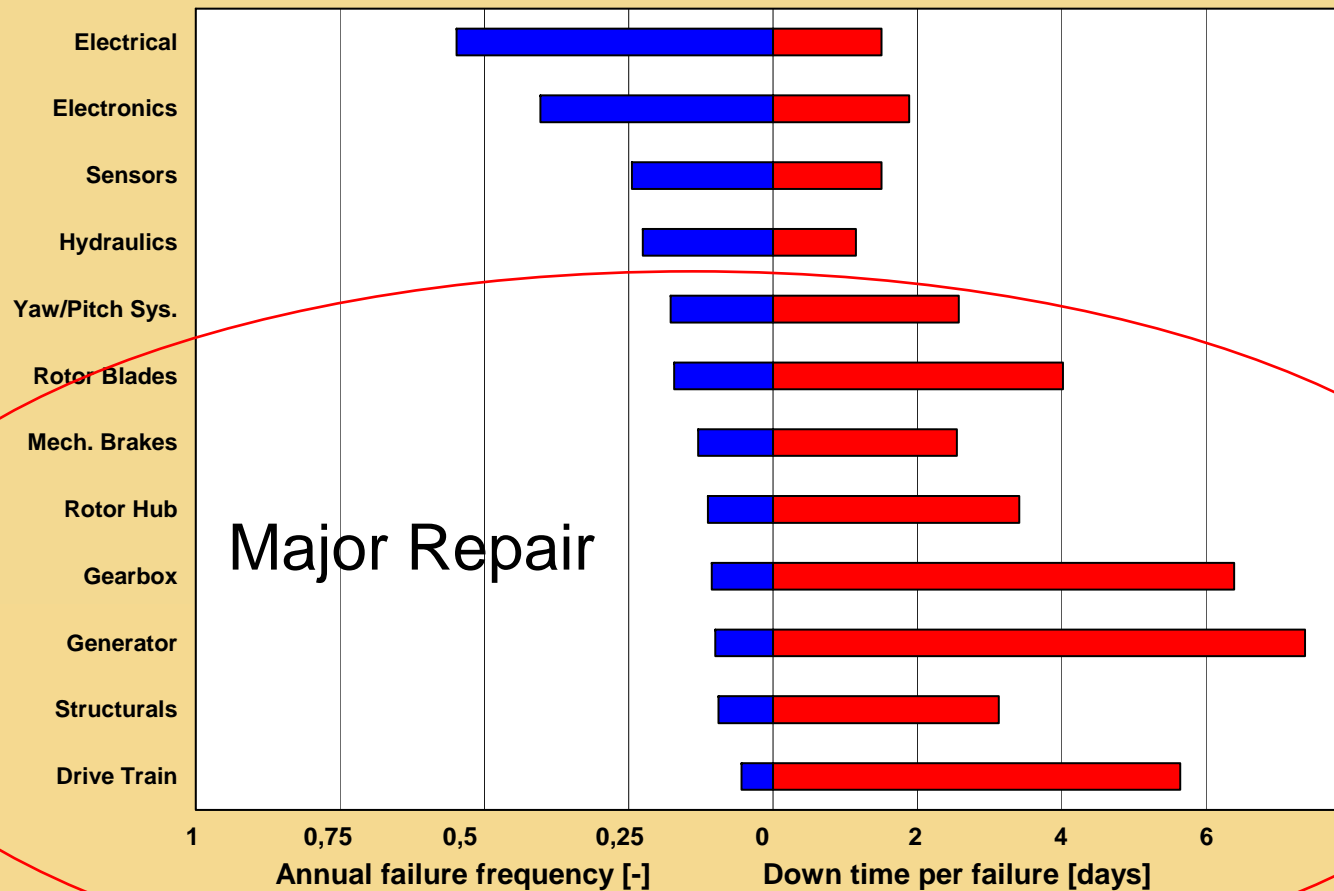


FAILURE FREQUENCY & DOWNTIME

Courtesy: B. Hahn, ISET: "Wind Energy Report Germany 2006" (draft)

Repair Reserve

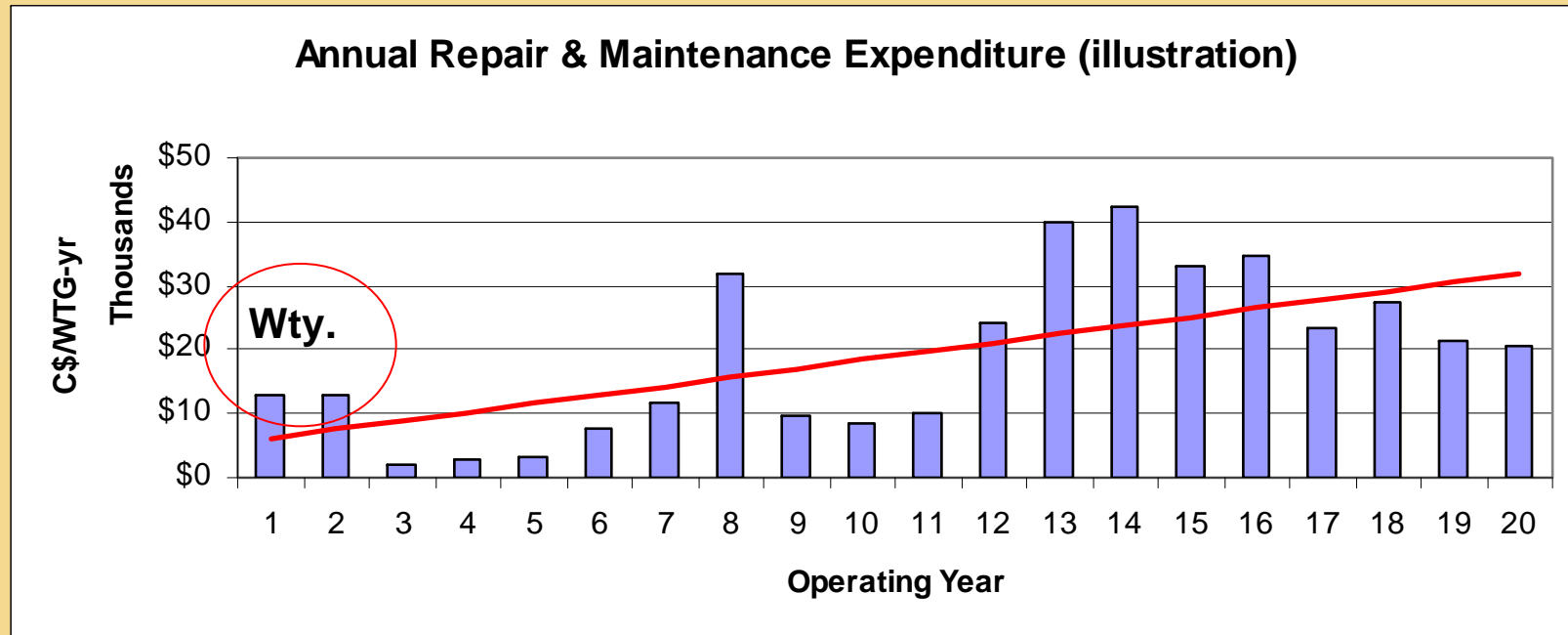
- **Planned or unplanned major repairs.**
- **Highly variable by site / model / age.**
- **Best to track as Capital Account – Repair Reserve.**
- **Expected to occur only a few times during 20 year life.**



FAILURE FREQUENCY & DOWNTIME

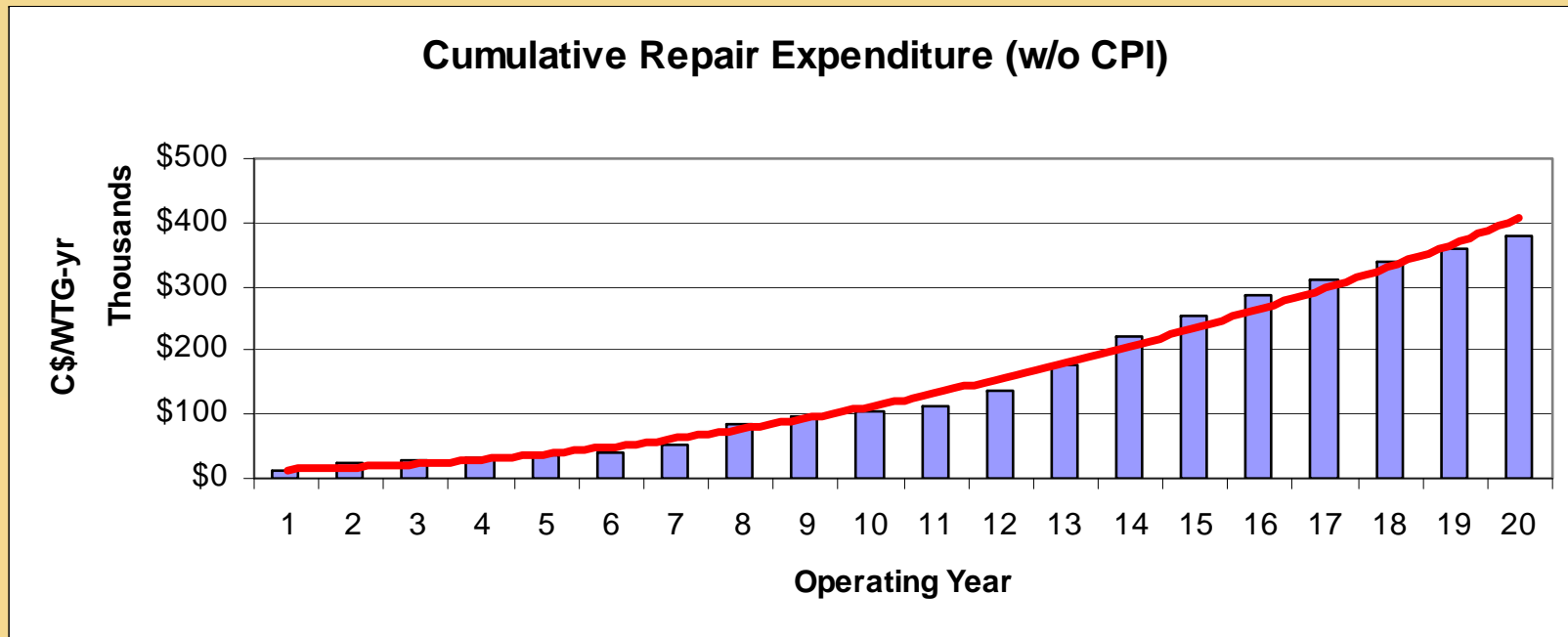
Courtesy: B. Hahn, ISET: "Wind Energy Report Germany 2006" (draft)

Variable Annual Repair Costs



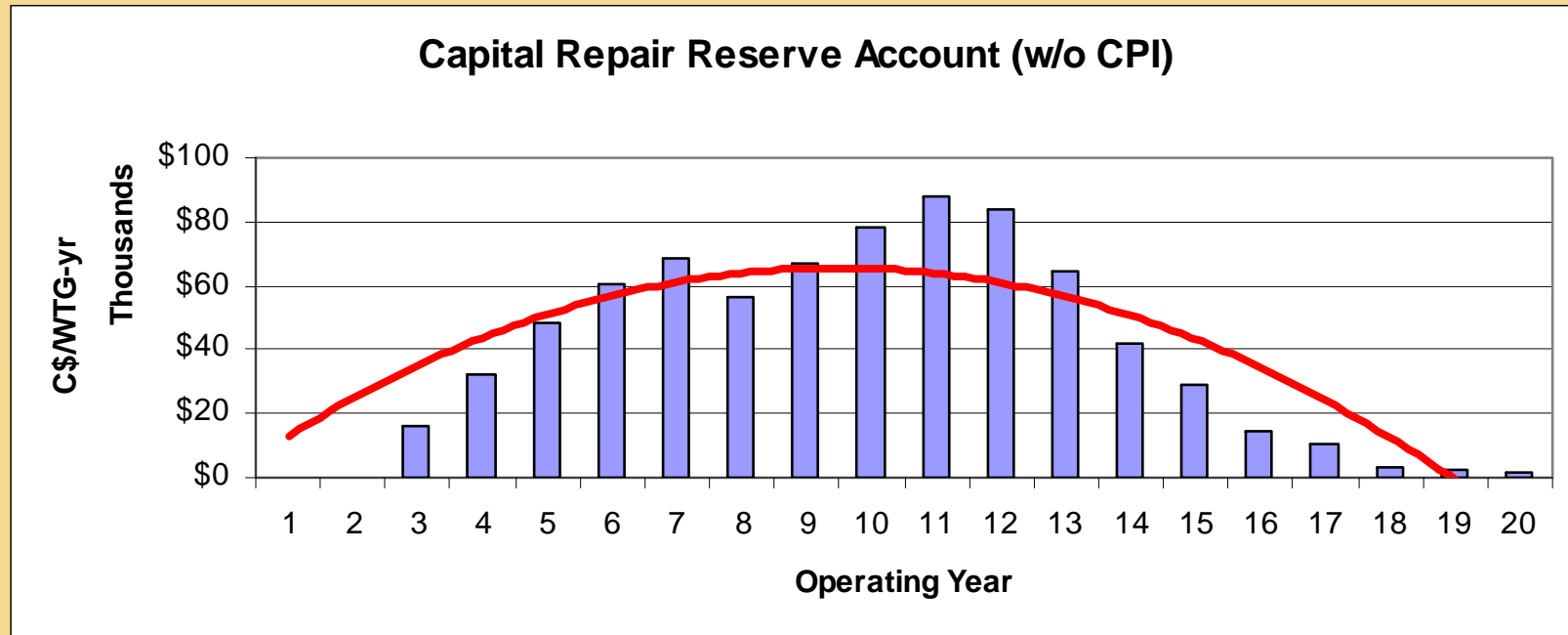
- Major repair costs will vary from year to year, occur in intervals and increase in cost with age.

Total life cycle cost



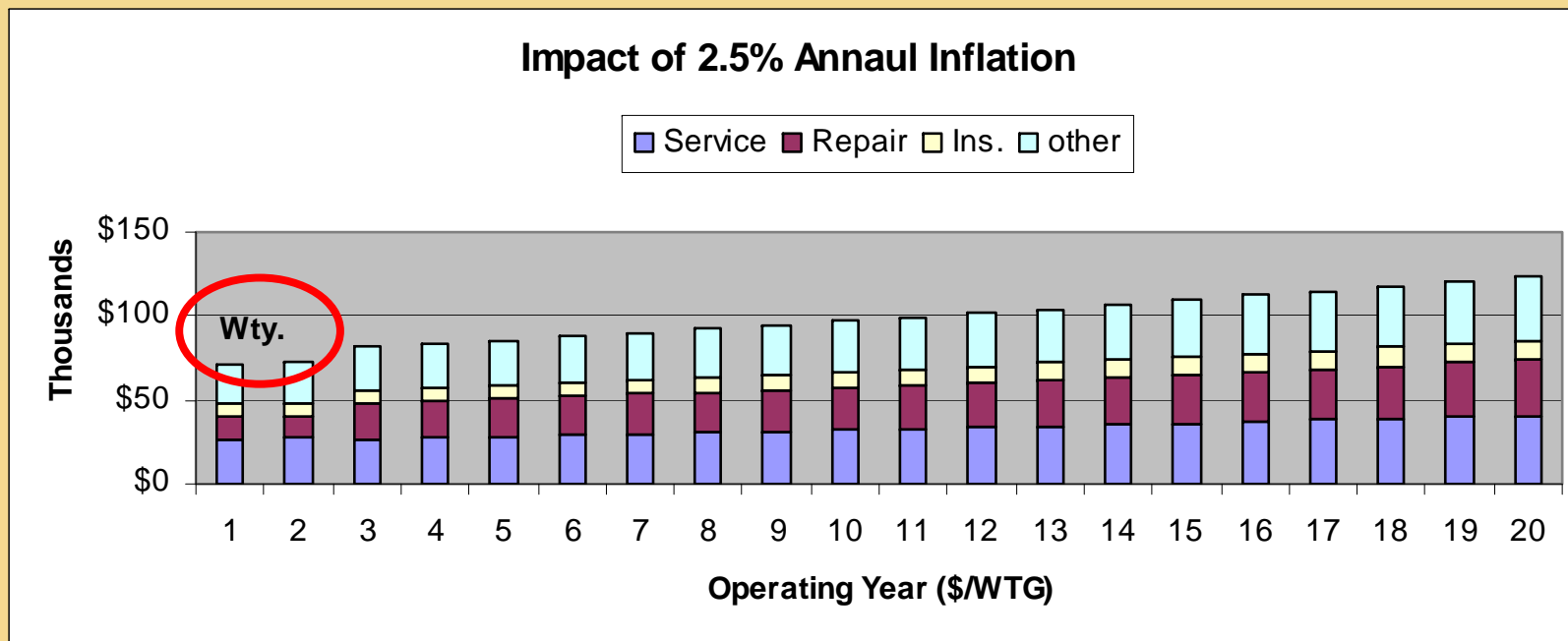
- **The operating goal is minimize the cumulative total through preventative maintenance, early detection, reduction of outage times etc.**
- **Small expenditure now may save big later.**

Capital Account



- Purpose of the capital account is to ensure that the cost has been budgeted and the funds are available, regardless of the year in which the repair occurs.
- In early years, repairs are less than \$16,000/WTG-yr, excess is saved. In later years the reverse happens.

Accounting for Inflation



- **Budgets can be inflation project forward by assuming inflation rate.**
- **Parts and labour costs may move differently than inflation.**

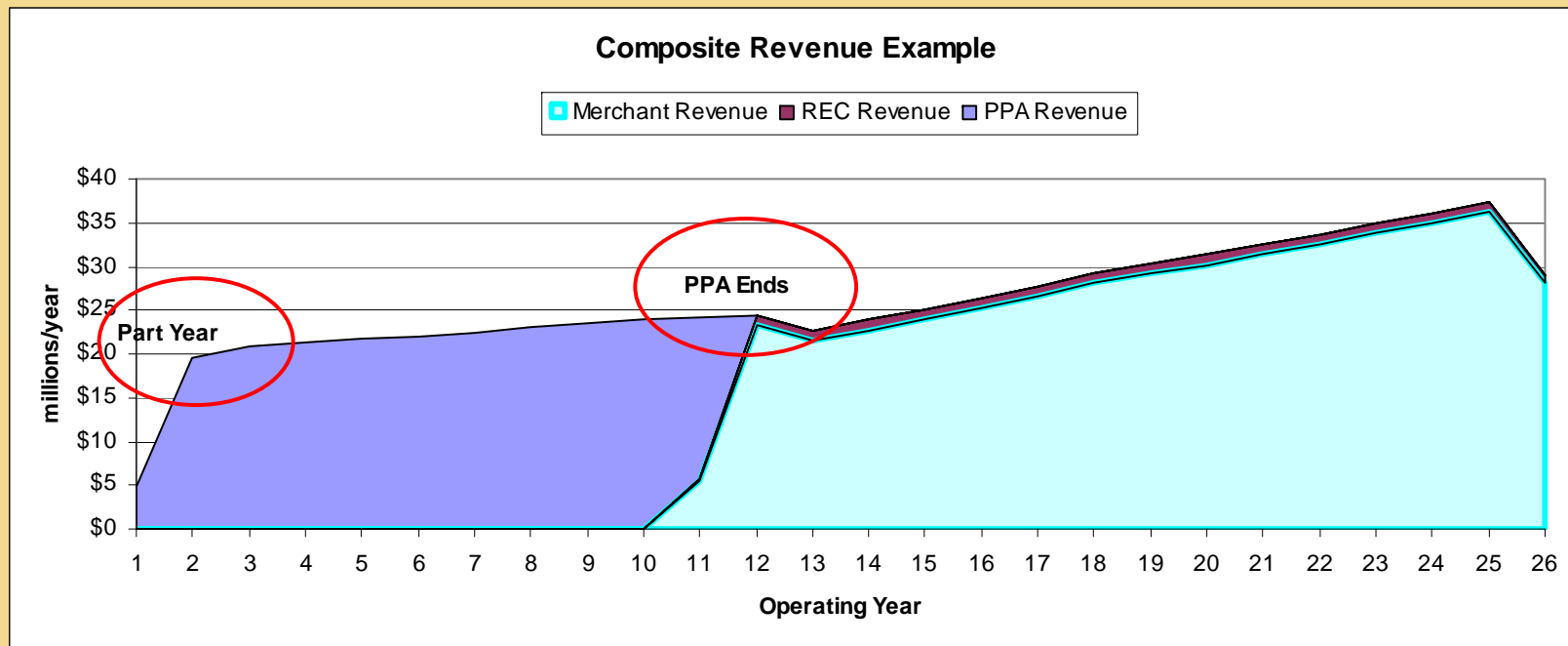
Key Issue

- **What is the financial risk related to the uncertainty of long term repair costs of wind turbines?**

Feasibility

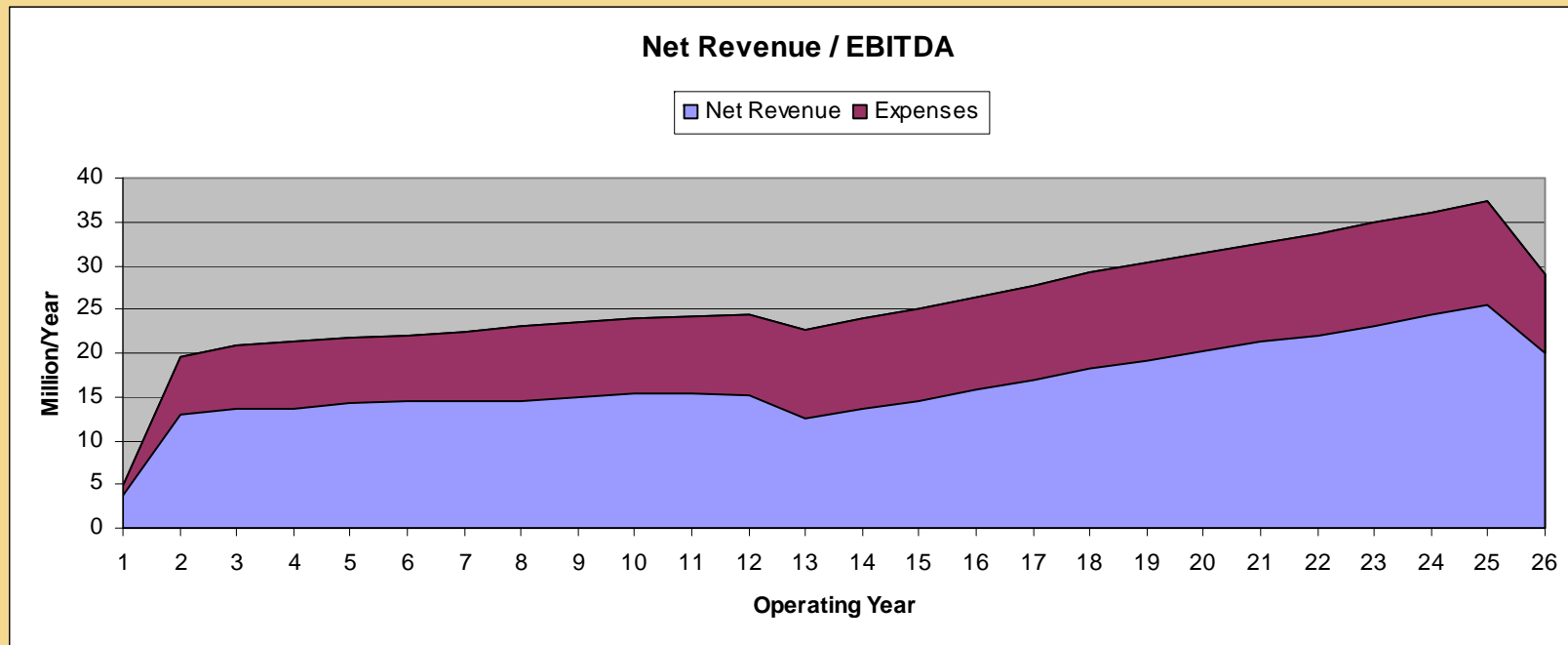
- **Typical project feasibility**
 - **CapEx, OpEx, Revenue**
- **Wind project feasibility**
 - **CapEx, OpEx, Revenue, Tax**
 - **Revenue market complex**
 - **Tax driven structure complex**
 - **Revenue / tax structure unique to U.S.**

Composite Revenue (PPA, REC, Merchant, Hedges)



- Various market structures by State / Region.
- Revenue subject to complex policies / rules.

Net Revenue (EBITDA)

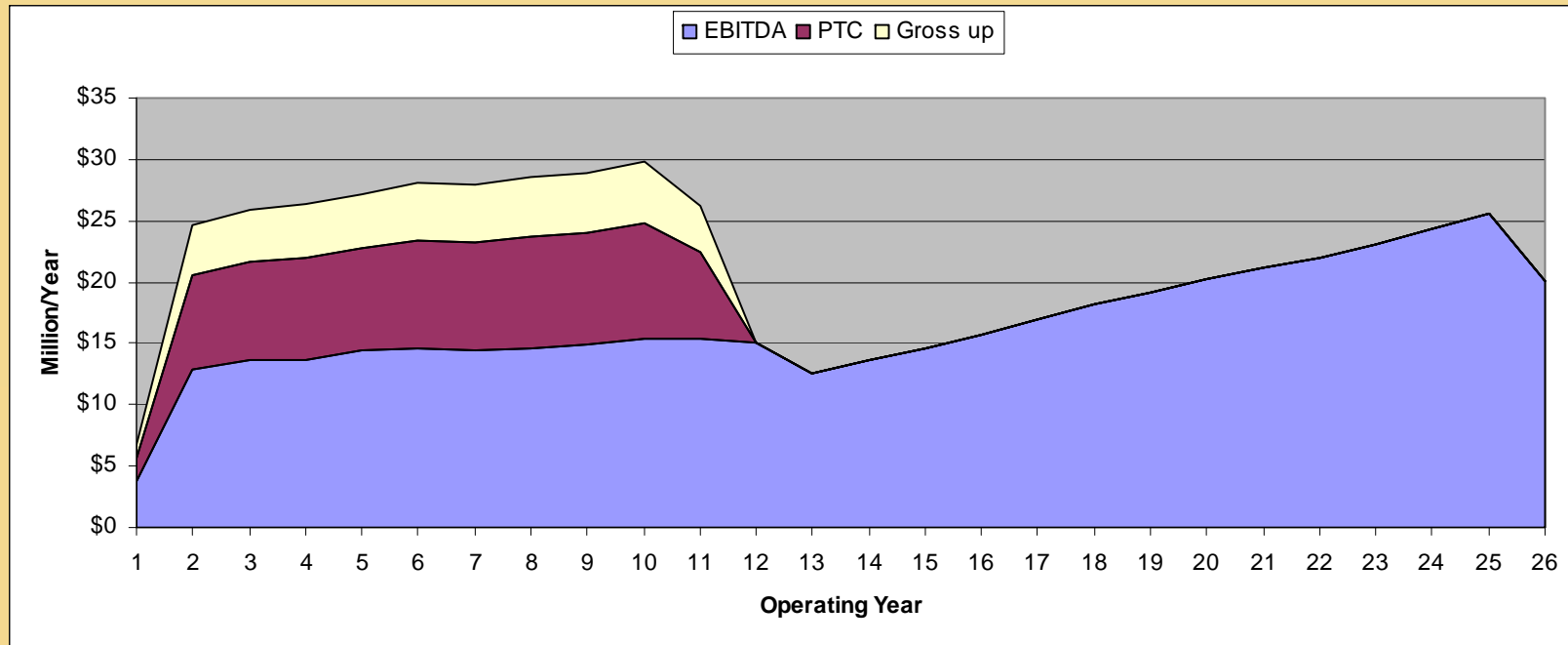


- **EBITDA = earnings before interest, tax, depreciation, amortization (and before PTC) (but after OpEx)**
- **Basis for cash flow feasibility (IRR = internal rate of return)**

Earnings Perspective

	Yr 2	Yr 15
Revenue	20	25
OpEx	-7	-10
EBITDA	13	15
PTC	8	0
Gross up	4	0
Adj. EBITDA	25	15

Adjusted EBITDA

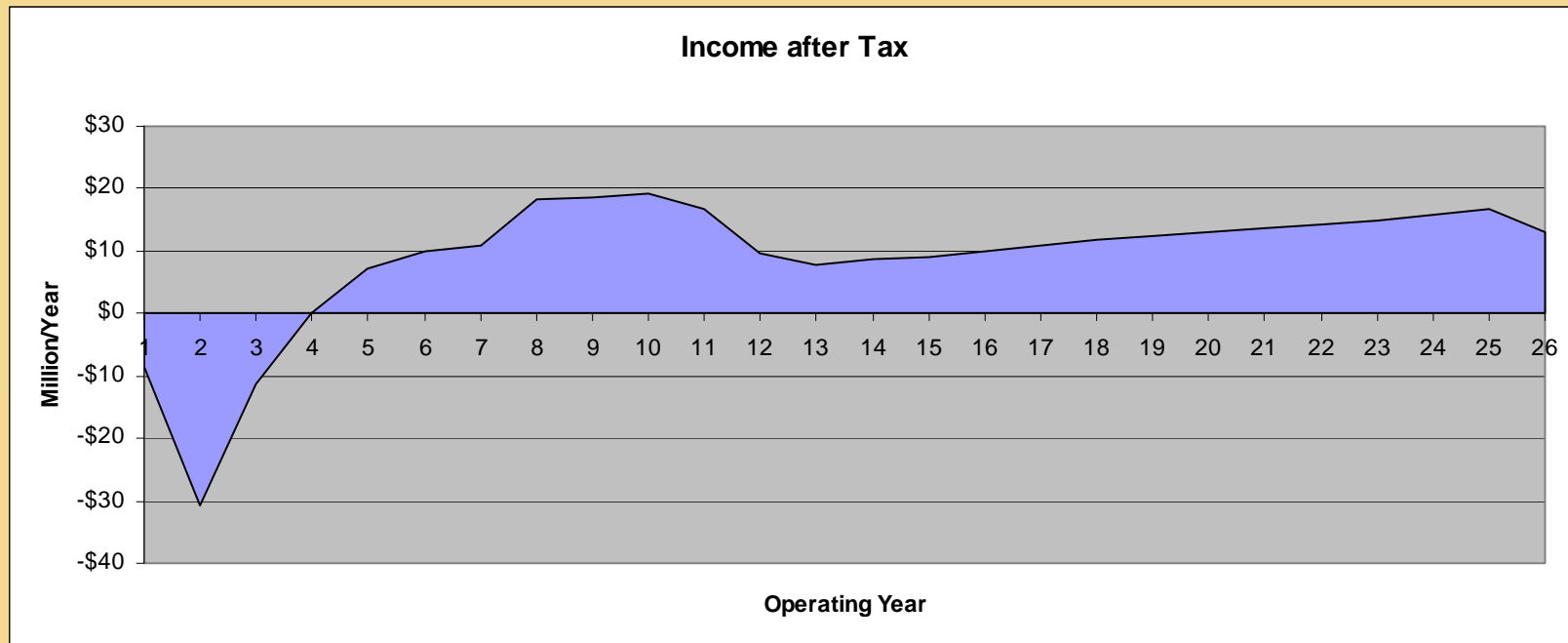


- **PTC and PTC Gross-up create large earnings shift to first 1/2 of project life.**

Tax Perspective

	Yr 2	Yr 15
EBITDA	13	15
Tax DA	-72	-1
Taxable	-59	14
Taxes	21	-5
PTC	8	
Income a. tax	-31	9

After Tax (incl. PTC & tax benefit)

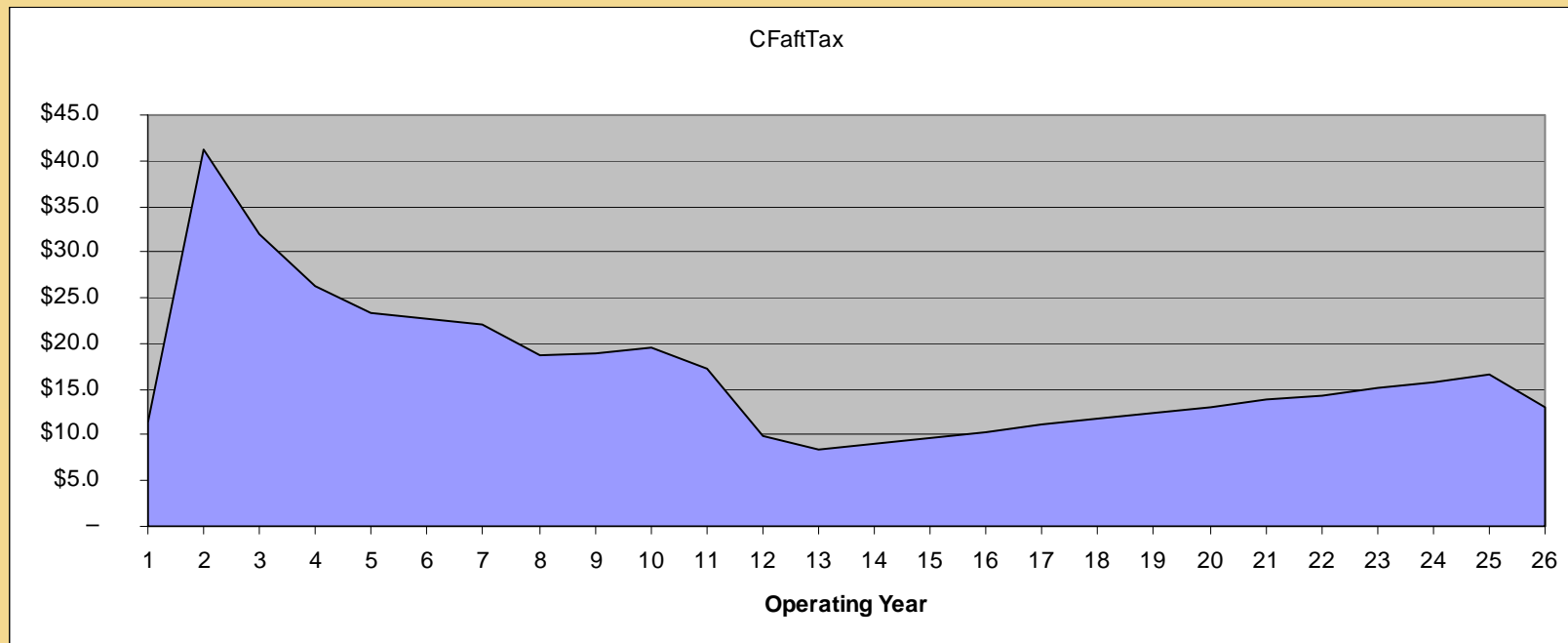


- **Wind projects generate large tax benefits in early years. PTC add-back creates large after tax income in year 7 to 11.**

Cash Flow Perspective

	Yr 2	Yr 15
EBITDA	13	15
CapEx	(first yr. only)	
PTC	8	
Taxes	21	-5
Cash F. a. tax	42	10

Cash Flow after tax (unlevered)



- Large after tax CF in early years reduces long term risk.

Additional Feasibility Drivers

- **Cost of debt / long term int. rates**
- **Cost of equity**
- **Wind resource compared to competing projects in the region**
- **Access to grid connections**

Conclusions

- **CapEx**
 - **Highly predictable**
 - **On rise, concern to project economics**
- **OpEx**
 - **Difficult to estimate long term costs**
 - **Repair uncertainty managed by capital reserve**
- **Feasibility**
 - **Revenue and tax issues more complex than other types of projects.**
 - **In U.S. project feasibility is highly dependent on tax, energy and environment policy.**