

Warranty and Long Term Maintenance Risk of Wind Farms

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ORTECH Power**

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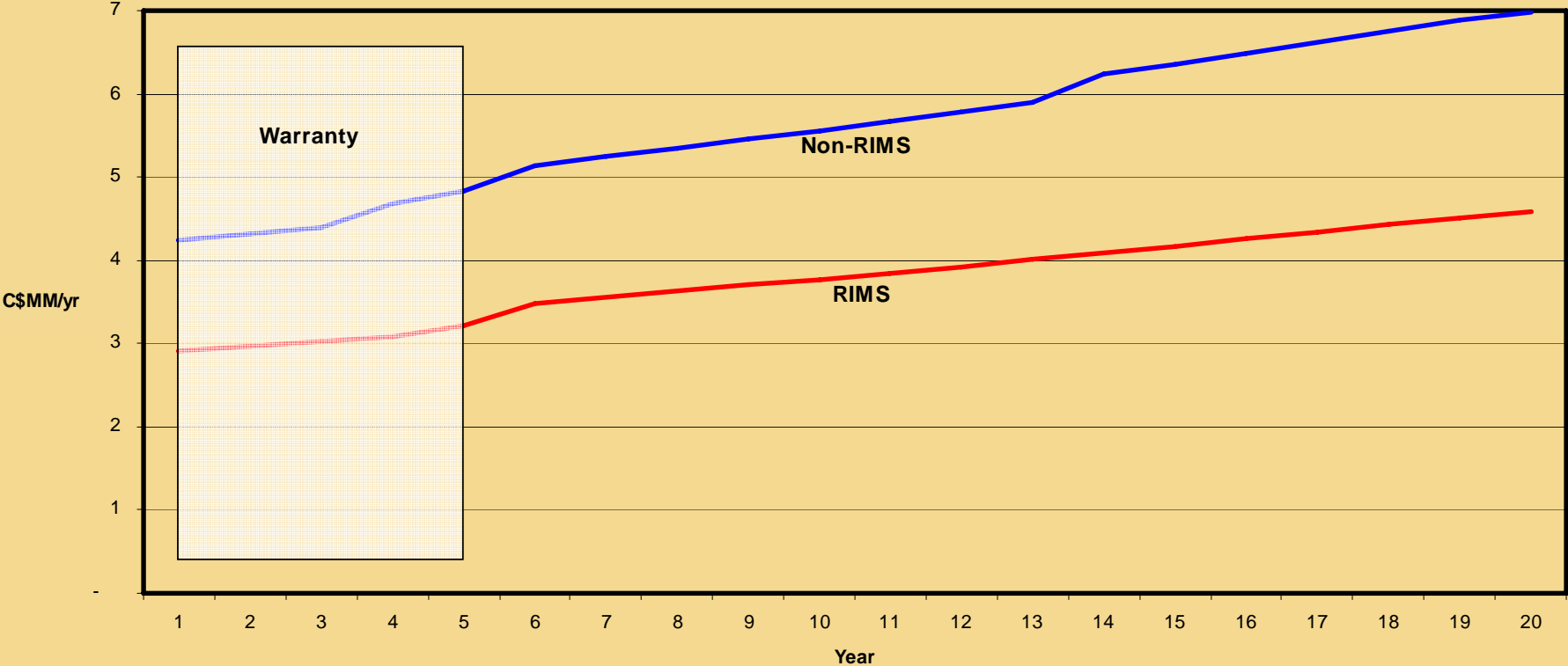
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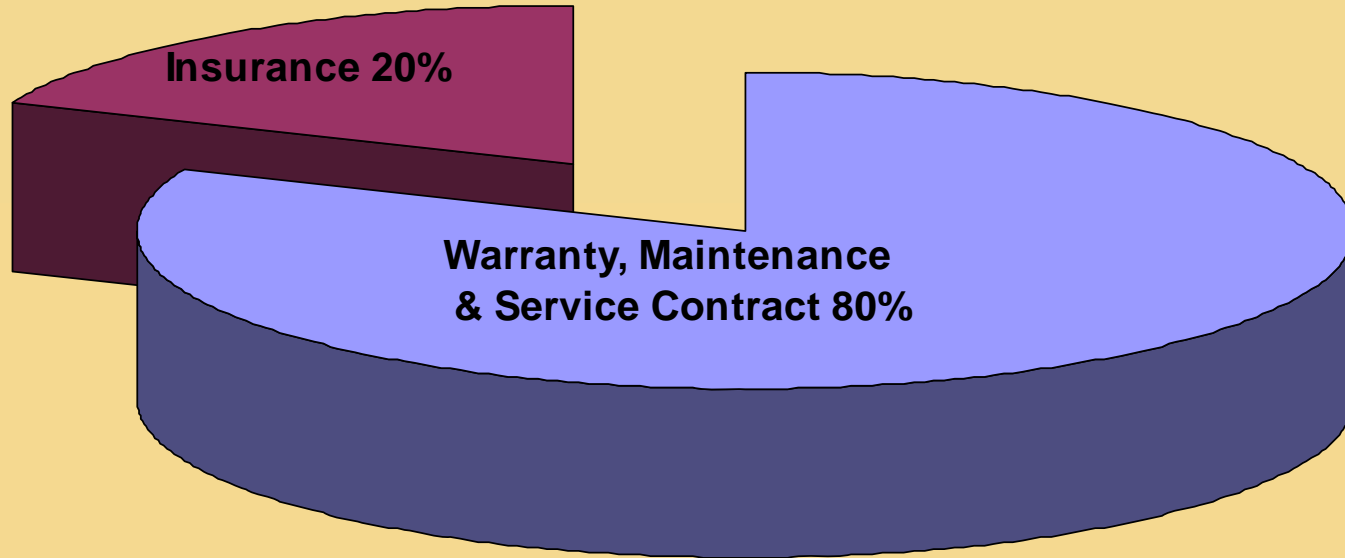
At Issue

- **Repair, Insurance, Maintenance and Service (RIMS) cost and uncertainty is not given adequate attention in financing of Canadian wind projects.**

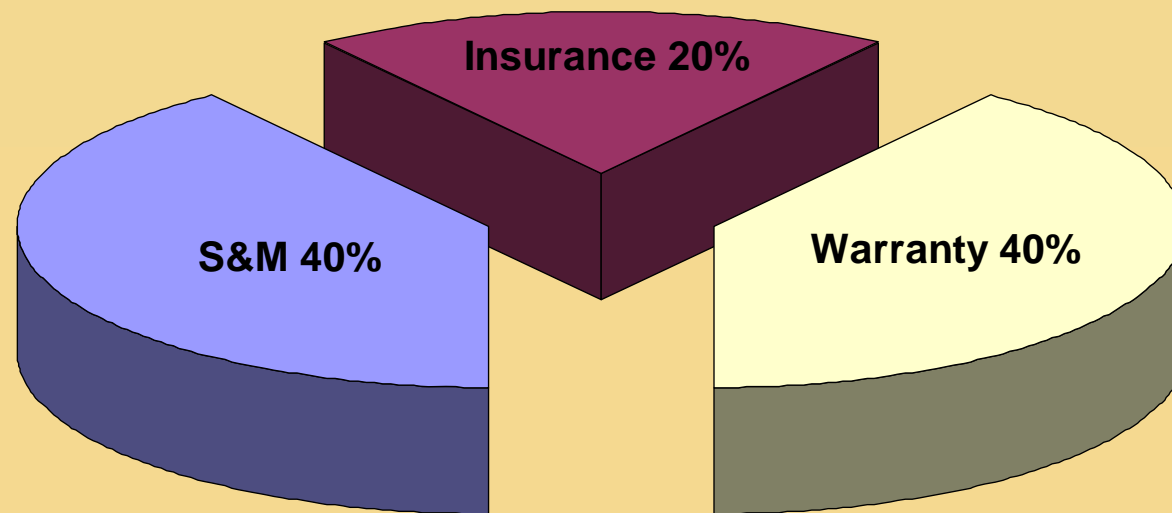
Typical Annual O&M Costs for 100 MW Wind Farm
Repair, Insurance, Maintenance & Service (RIMS) plus Non-RIMS
(source: ORTECH, 2005)



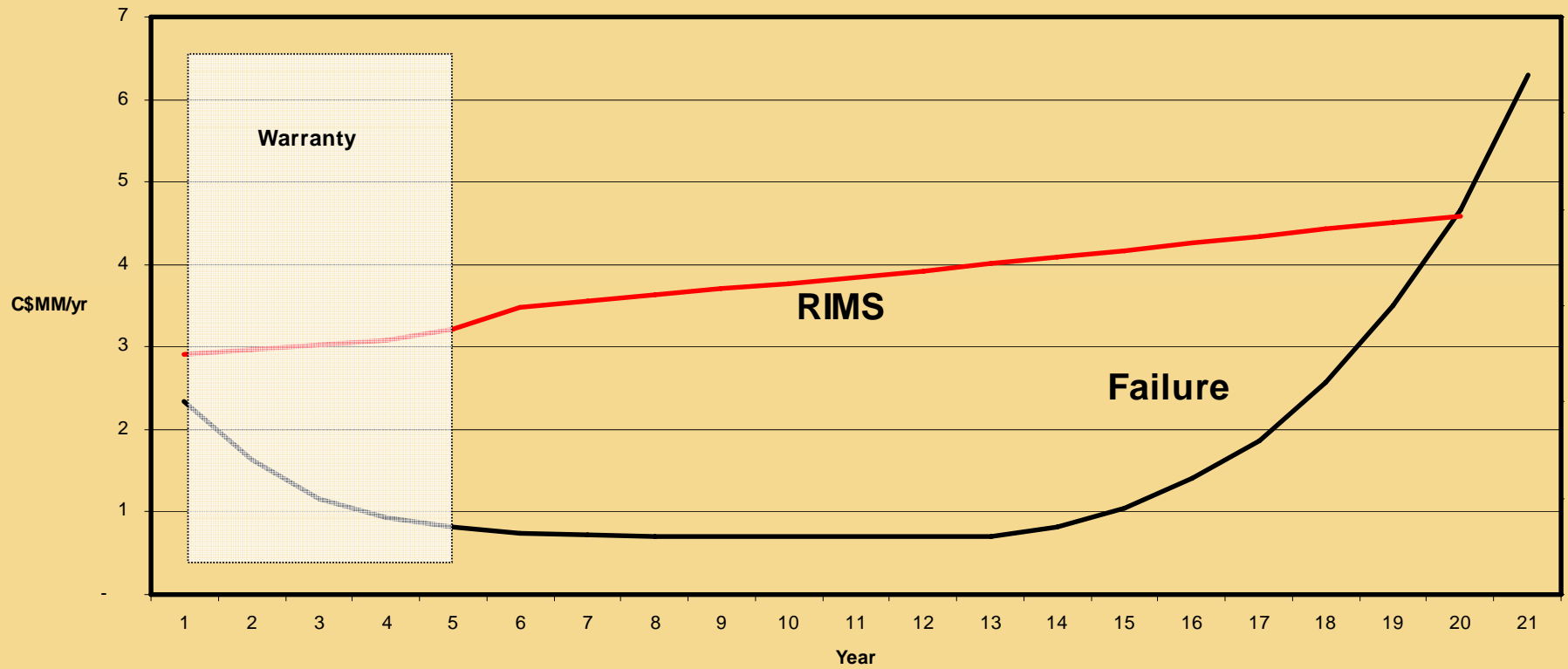
Typical RIMS Cost Make-up
On Various Canadian Projects
(source: ORTECH, 2005)



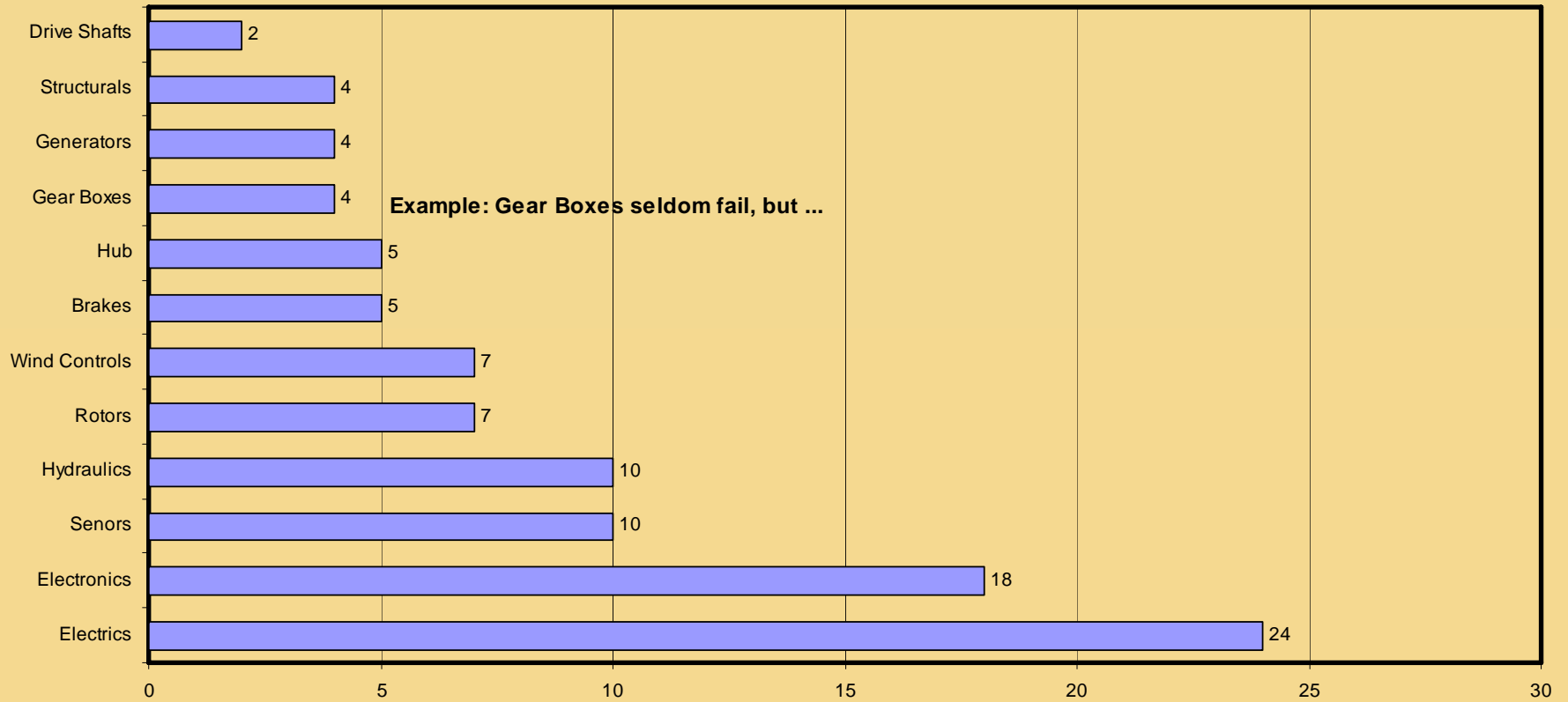
Typical RIMS Cost Make-up
On Various Canadian Projects
(source: ORTECH, 2005)



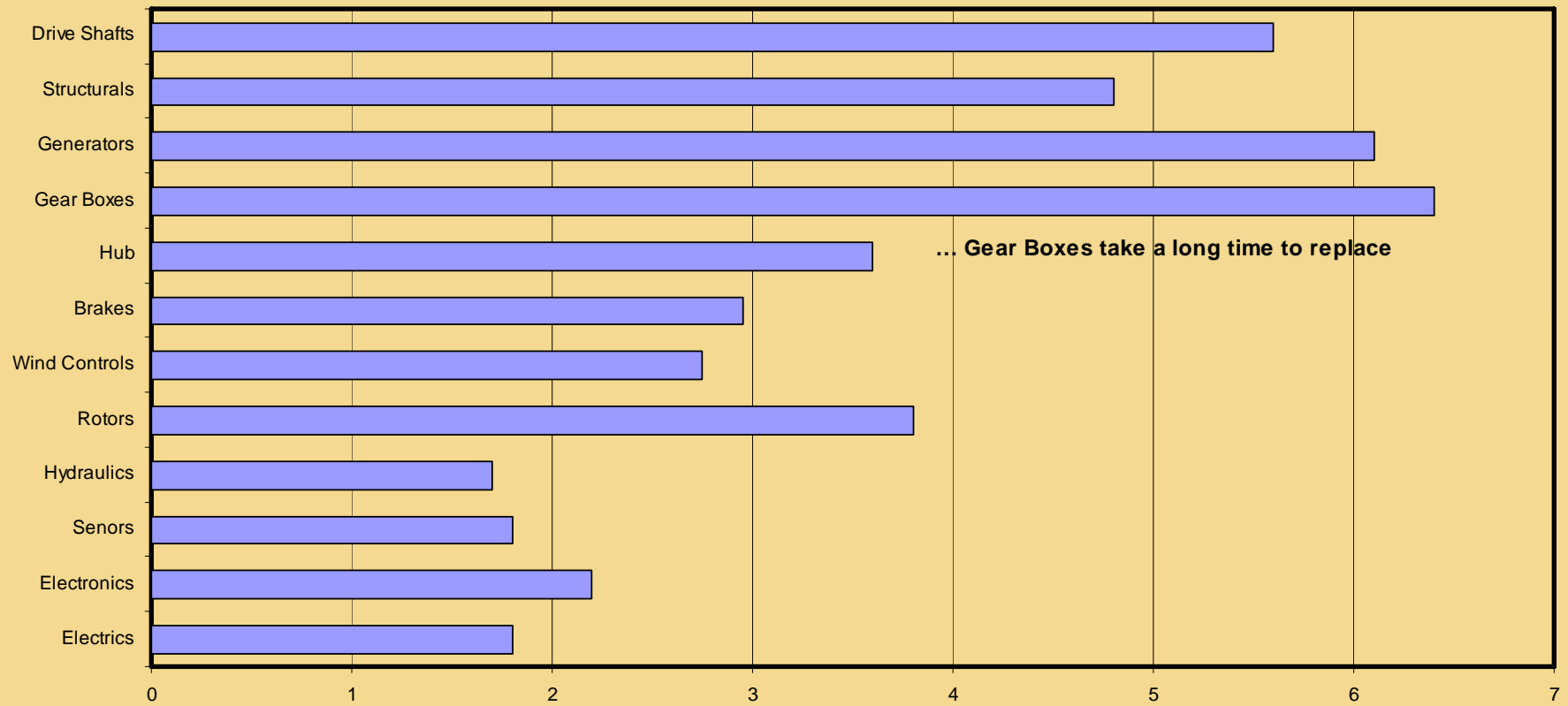
Typical RIMS Assumptions
vs. Typical Mech. Failure Curve
(source: ORTECH, 2005)



Component Failure
in % based on 24186 incidents
(source: B.Hahn, ISET, U of Kassel, 2003)

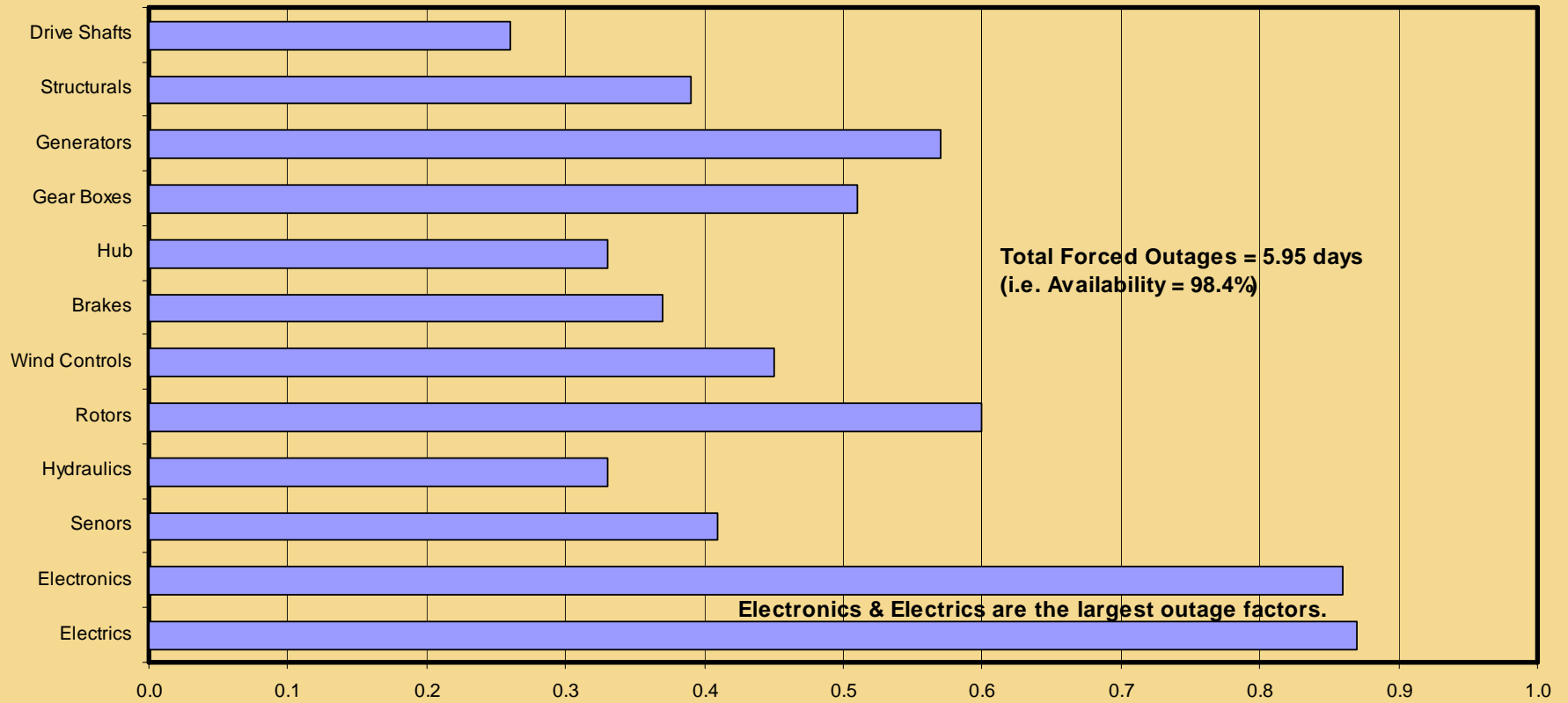


Days to Replace
(source: B.Hahn, ISET, U of Kassel, 2003)

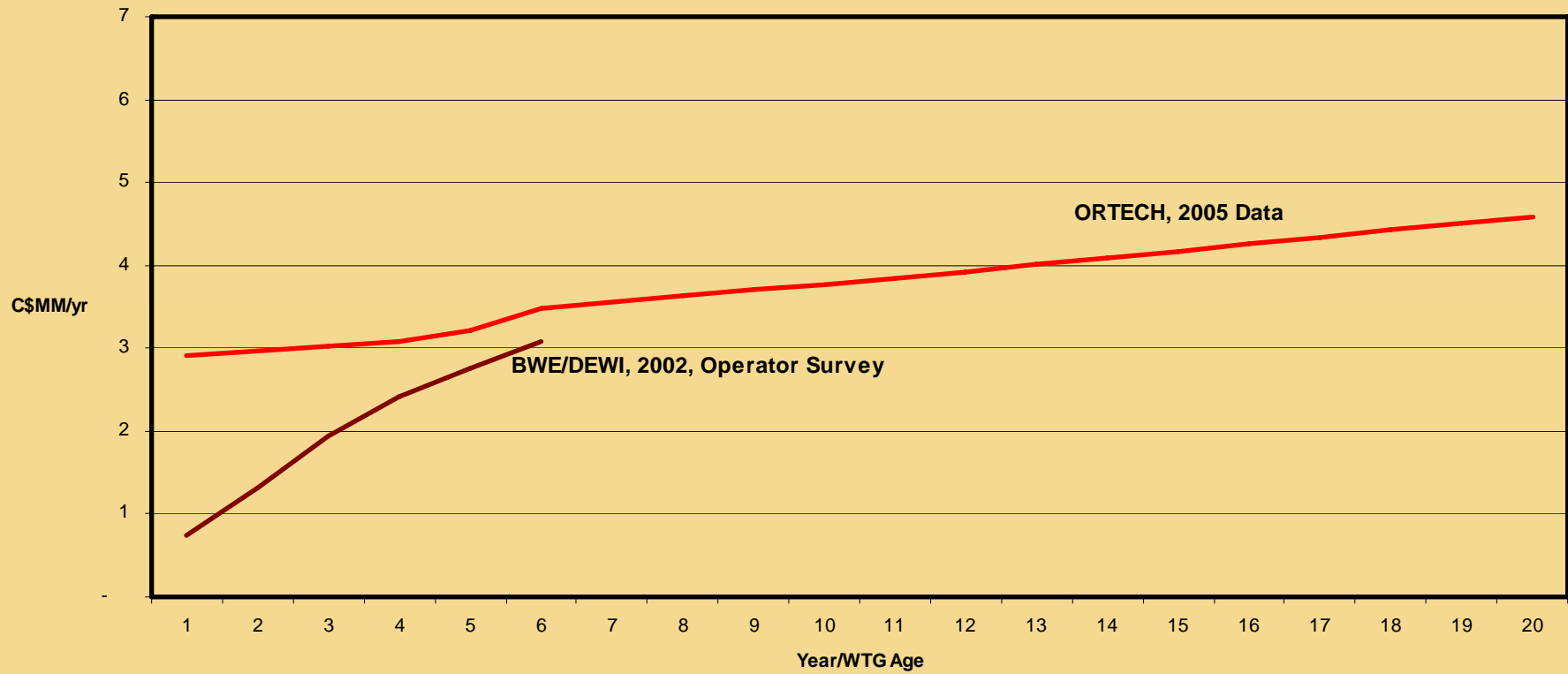


... Gear Boxes take a long time to replace

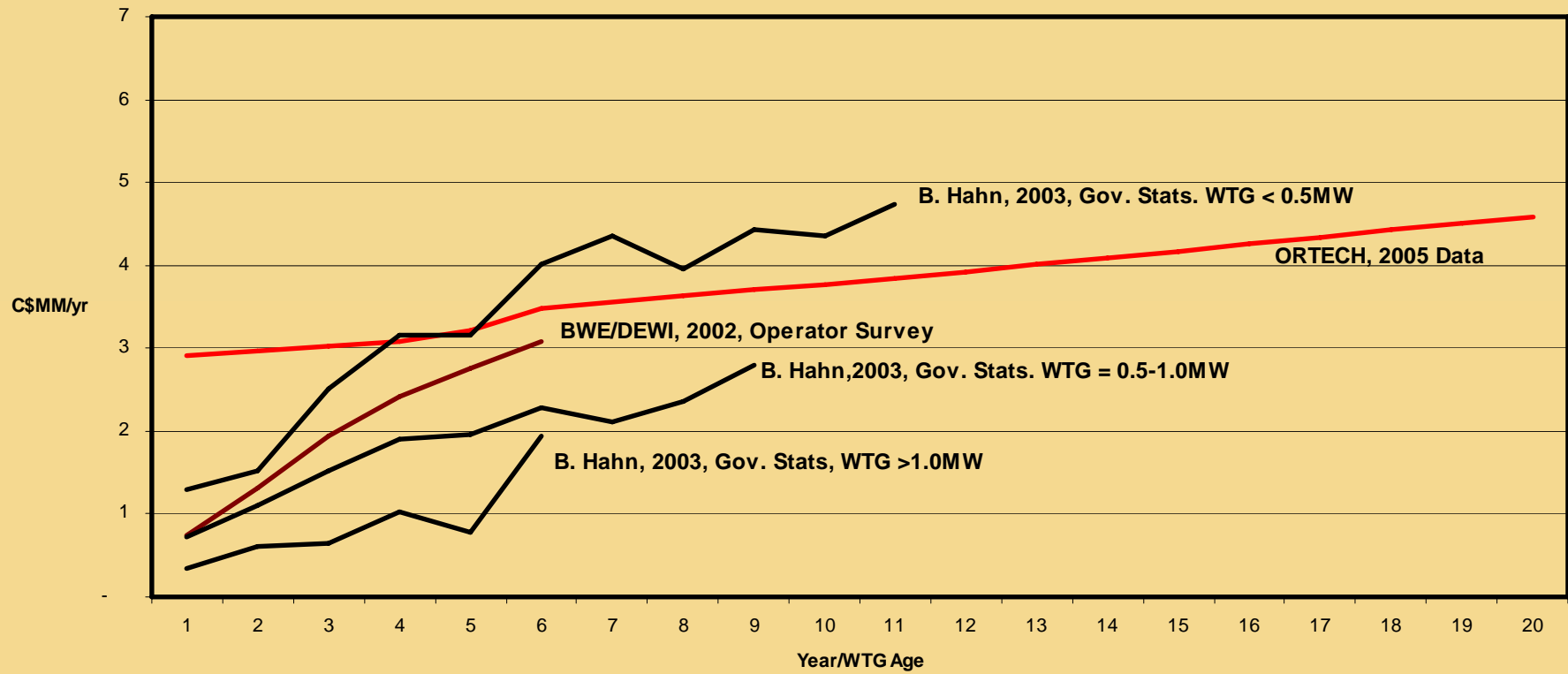
Outage Days by Component
(source: B.Hahn, ISET, U of Kassel, 2003)



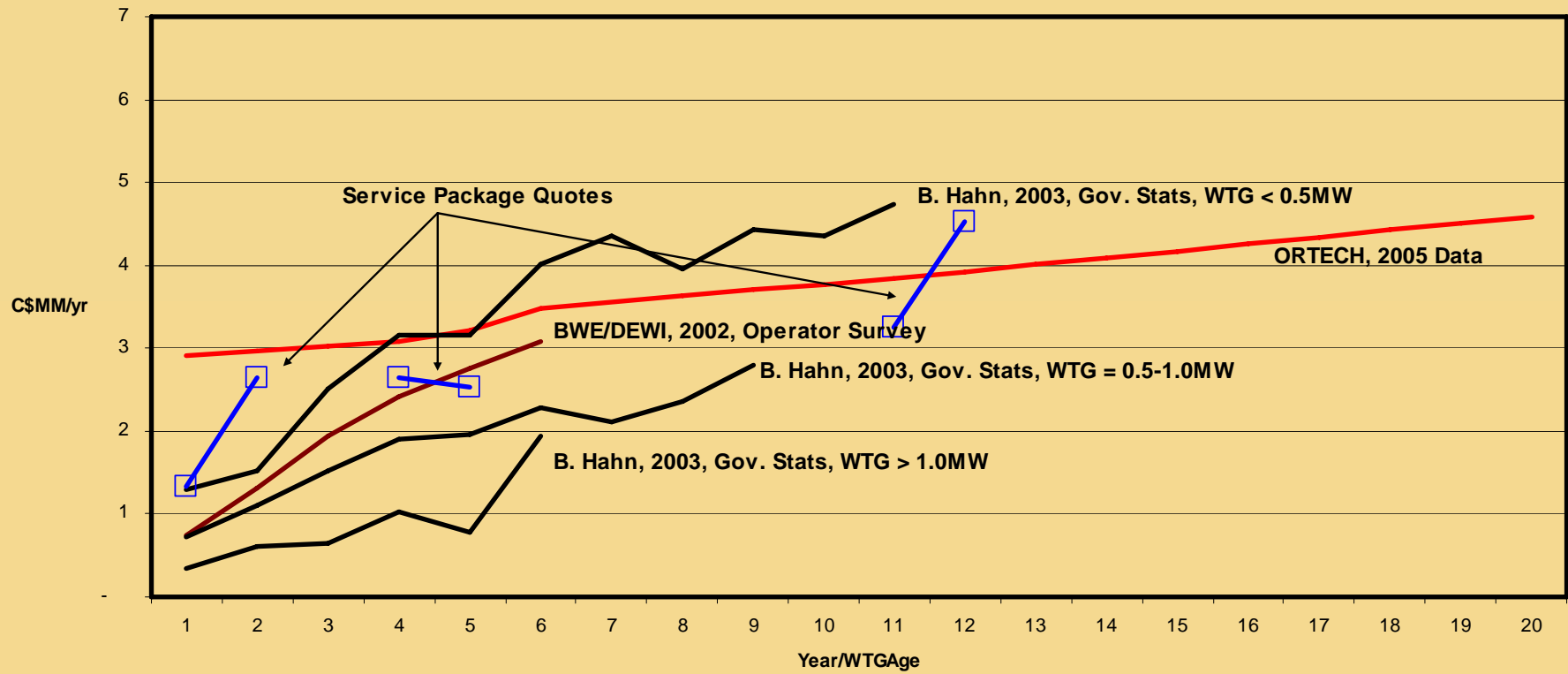
Typical Annual RIMS Costs for 100 MW Wind Farm
Compared to European Statistical Data
(source: ORTECH, 2005; BWE-DEWI 2002)



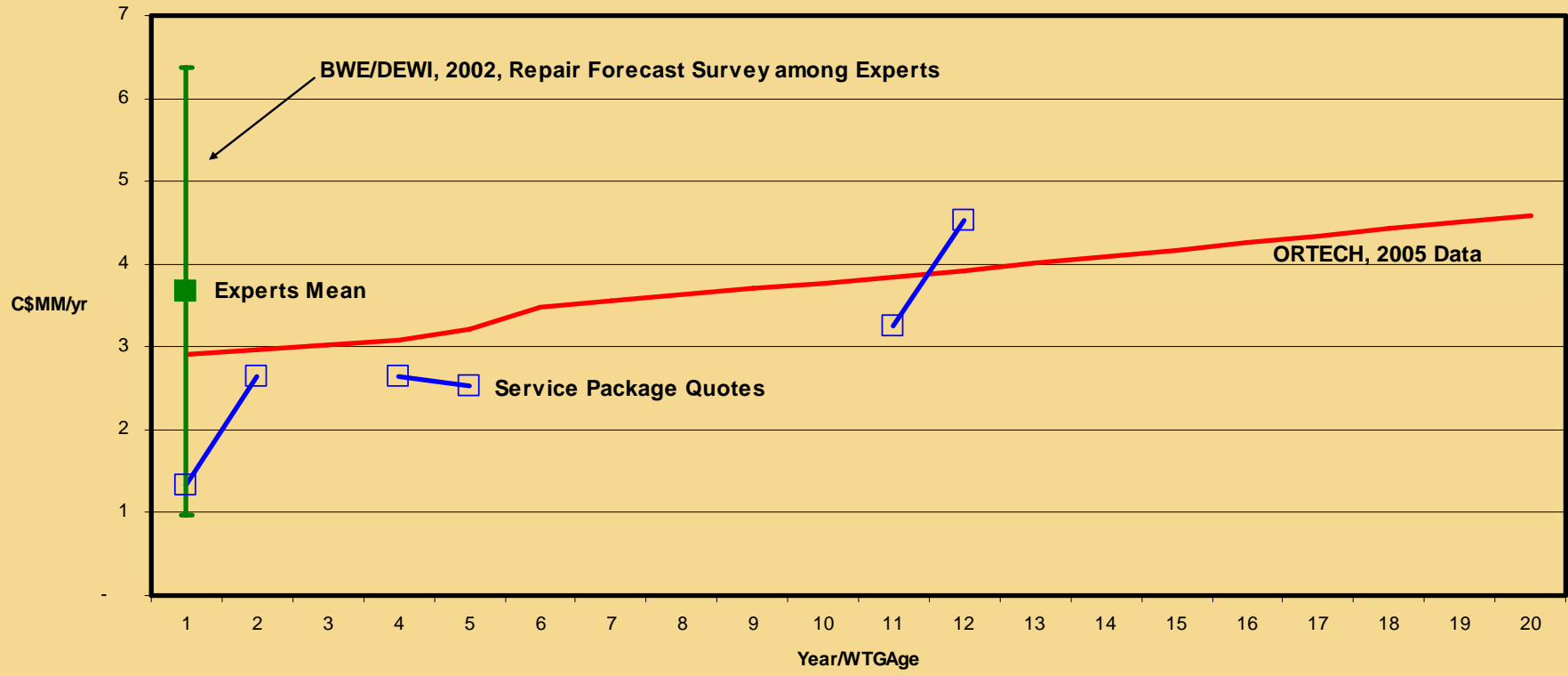
Typical Annual RIMS Costs for 100 MW Wind Farm
Compared to European Statistical Data
(source: ORTECH, 2005; BWE-DEWI 2002)



Typical Annual RIMS Costs for 100 MW Wind Farm
 Compared to European Statistical Data and Service Package Quotes
 (source: ORTECH 2005; BWE-DEWI 2002; ISET-B. Hahn 2003)



Typical Annual RIMS Costs for 100 MW Wind Farm
Compared to Service Package Quotes & Repair Forecast Survey
(source: ORTECH, 2005; BWE-DEWI 2002)



Are our assumptions for long term operating costs reasonable?

- **Quotes for insurance and service packages have varied a lot from 2004 to 2005.**
- **ORTECH's information suggests that insurance quotes went down and service packages went up.**
- **There is evidence that these price fluctuations are not cost based but market based.**
- **It appears that the 2005 quotes are consistent with RIMS costs that existing wind farms experience in operating years 5 to 10.**
- **As such, the assumptions for years 1 to 5 are a given and years 5 to 10 look reasonable.**

Are the O&M service packages offered by manufacturers reasonable?

- **Survey data suggests that actual costs in the first 5 years may be significantly below the price of service packages.**
- **It should be noted that OEM warranties make the data analysis questionable in years 1 and 2.**
- **The difference can be viewed as a risk premium.**
- **Many financial institutions insist on packages.**
- **Typically, the packages are tied to OEM warranties (i.e. must buy).**

Are insurance rates reasonable?

- **The experience with WTG insurance is still limited in Canada.**
- **In Europe, the increase in RIMS costs with age of the WTG fleet has affected claims history.**
- **As a result, European premiums have increased dramatically in recent years in a “bull to bear” trend.**
- **Given the Canadian fleet age, insurance rates for new equipment in Canada seem to be on the high side (i.e. bullish).**

What will RIMS costs be in years 10 to 20?

- **The European experience data indicate that RIMS costs level off towards year 10.**
- **Unfortunately, almost no data exists for operating years 10 to 20.**
- **Opinion surveys among European industry experts forecast that the cost may balloon in years 10 to 20.**
- **The two information sources contradict one another.**

Are 12 year O&M service packages needed in Canada?

- **Financial backing has come into question.**
- **If the provider were to go out of business, the package may be at risk.**
- **Under this circumstance, the WTG owner may have overpaid in the early years and lost the financial risk management bargained for in the later years of the package.**

Recommendations:

- **More work is required to better understand long term RIMS costs.**
- **A Canadian data collection program is needed.**