

WIND AFTERMARKET (USA)

Gearbox Bonus Turbines

Castrol Optigear® 1100/320*

ANNUAL SAVINGS: \$142,310



THE SITUATION

- A leading wind farm maintenance provider was using an approved gear oil from Company "T" for Bonus, Kenetech, KV's and Zond sub MW turbine gearboxes per the OEM recommendations (200 total turbines).
- Annual changes were required. During these changes, they discovered several issues: sludge, premature gear wear, and rust.
- As wind energy grows, the demand on maintenance becomes very costly with more turbines and more labor time required. The expected gear box life was 7 years.

BEFORE CASTROL

- This farm consists of 200 turbines with 10 gallons of gear oil each.
- Oil was changed annually and in some cases semi-annually
- Approximately 10% of the gearboxes were rebuilt prematurely, every 3 years, causing excessive downtime and lost income from power generation
- Average gearbox life was 4 - 6 years.
- Cost to rebuild 1 gearbox is \$15,000

AFTER CASTROL

- Castrol recommended Optigear® 1100/320 to ensure extended life with minimal micro-pitting and sludge.
- The Castrol offer was to supply product, service, and measure the Optigear 1100 series product performance.

THE SOLUTION

- Optigear® 1100/320 provided extended life of the gearboxes. A small number of gearboxes were changed after 7 years, but a majority of the gearboxes have now exceeded 11 years of service with a few reaching as long as 14 years.
- Premature gearbox rebuilds have been virtually eliminated.
- Maintenance requirements (at \$60 per hour) were minimized making the Bonus fleet very manageable with existing maintenance personnel.
- Optigear® 1100/320 has exceeded expectations in cost of maintenance, extended gearbox life, countless hours of downtime, and has greatly increased energy production.

NO PREMATURE GEARBOX FAILURES, GREATLY INCREASING UPTIME AND ENERGY PRODUCTION

RECOMMENDATIONS

The OEM product approved was much less expensive but ultimately much more costly. The reduced requirement of maintenance insured peak performance during maximum wind energy production times with no risk of failure.

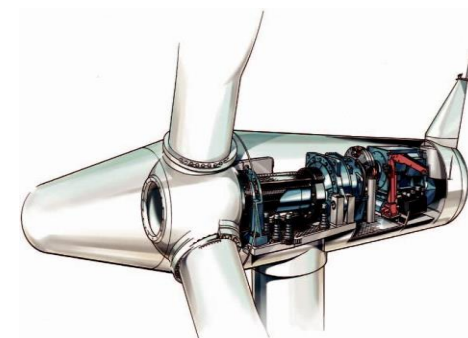
PRODUCT PROPERTIES

Castrol Optigear 1100 gear oils with the TGOA (Tribol Gear Oil Additive) additive system represent a significant advancement in gear oil technology.

Developed for service in enclosed gear drives, journals, and roller bearings, Optigear 1100 gear oils are typically used where heavy and shock load conditions prevail.

CONCLUSION

Optigear 1100/320 far exceeded any prior performances of competitive products. These gearboxes were designed to last 7 years but with Optigear 1100 series oils, they have lasted in excess of 11 years. Maintenance costs have been driven down and rebuilds virtually eliminated.



Turbines	Lubricants Cost *		Labor Cost**		Cost of Rebuilds***		Cost of Downtime****	
	Castrol	Previous	Castrol	Previous	Castrol	Previous	Castrol	Previous
Years	200	200	\$60	\$60	\$15,000	\$15,000	\$43	\$43
1	\$56,000	\$20,000	\$48,000	\$48,000	\$0	\$0	\$8,600	\$34,400
2	\$5,600	\$20,000	\$12,000	\$48,000	\$0	\$0	\$8,600	\$34,400
3	\$5,600	\$20,000	\$12,000	\$48,000	\$0	\$300,000	\$8,600	\$34,400
4	\$5,600	\$20,000	\$12,000	\$48,000	\$0	\$0	\$8,600	\$34,400
5	\$5,600	\$20,000	\$12,000	\$48,000	\$0	\$0	\$8,600	\$34,400
6	\$5,600	\$20,000	\$12,000	\$48,000	\$0	\$0	\$8,600	\$34,400
7	\$56,000	\$20,000	\$12,000	\$48,000	\$0	\$300,000	\$8,600	\$34,400
8	\$5,600	\$20,000	\$48,000	\$48,000	\$0	\$0	\$8,600	\$34,400
9	\$5,600	\$20,000	\$12,000	\$48,000	\$0	\$0	\$8,600	\$34,400
10	\$5,600	\$20,000	\$12,000	\$48,000	\$0	\$0	\$8,600	\$34,400
11	\$5,600	\$20,000	\$12,000	\$48,000	\$0	\$300,000	\$8,600	\$34,400
Totals	\$162,400	\$220,000	\$204,000	\$528,000	\$0	\$900,000	\$94,600	\$378,400
Savings	\$57,600	\$0	\$324,000	\$0	\$900,000	\$0	\$283,800	\$0

Total Savings for 11 years = \$1,565,400.

Average Annual Savings = \$142,310

OTHER POTENTIAL APPLICATIONS

Castrol Optigear® 1100/320 should be considered for any turbine technology where mineral oils are currently used.

Notes:

*) Previous oil at \$10.00 per gallon changed annually. Optigear 1100/320 at \$28.00/gal, top off one gallon per year per turbine.

**) 4 hours for complete oil change out (at \$60 per hour labor cost) each year with previous oil. 1 hour to top off each turbine per year with Optigear 1100/320.

***) 10% of Fleet rebuilds every 3 years with previous oil at \$15,000 per gearbox. No lubricant related gear failure for 11 years with Optigear 1100/320.

****) Downtime 4 hours (at \$43 per hour) for complete oil change out each year with previous oil. Downtime 1 hour to top off each turbine per year with Optigear 1100/320.

