

# DTE Energy

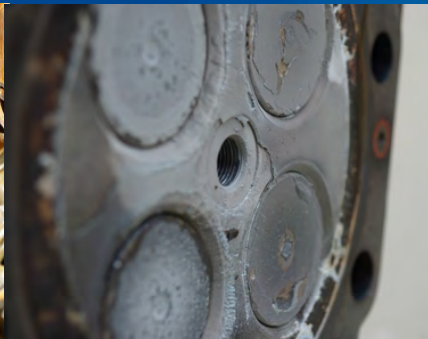


*DTE Biomass Energy*

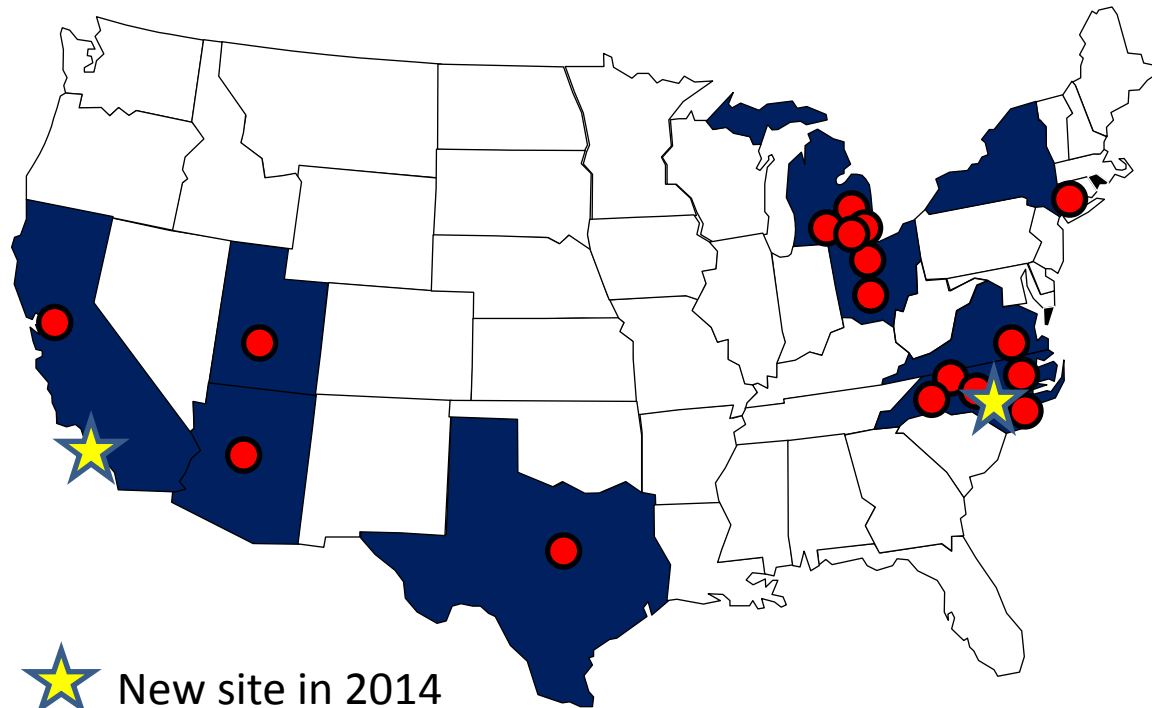
## Reducing Operating Costs by Over 35% at a CAT 3520 LFGTE Facility

**LMOP 2014**

**Mark Hill - Regional Operations Director**



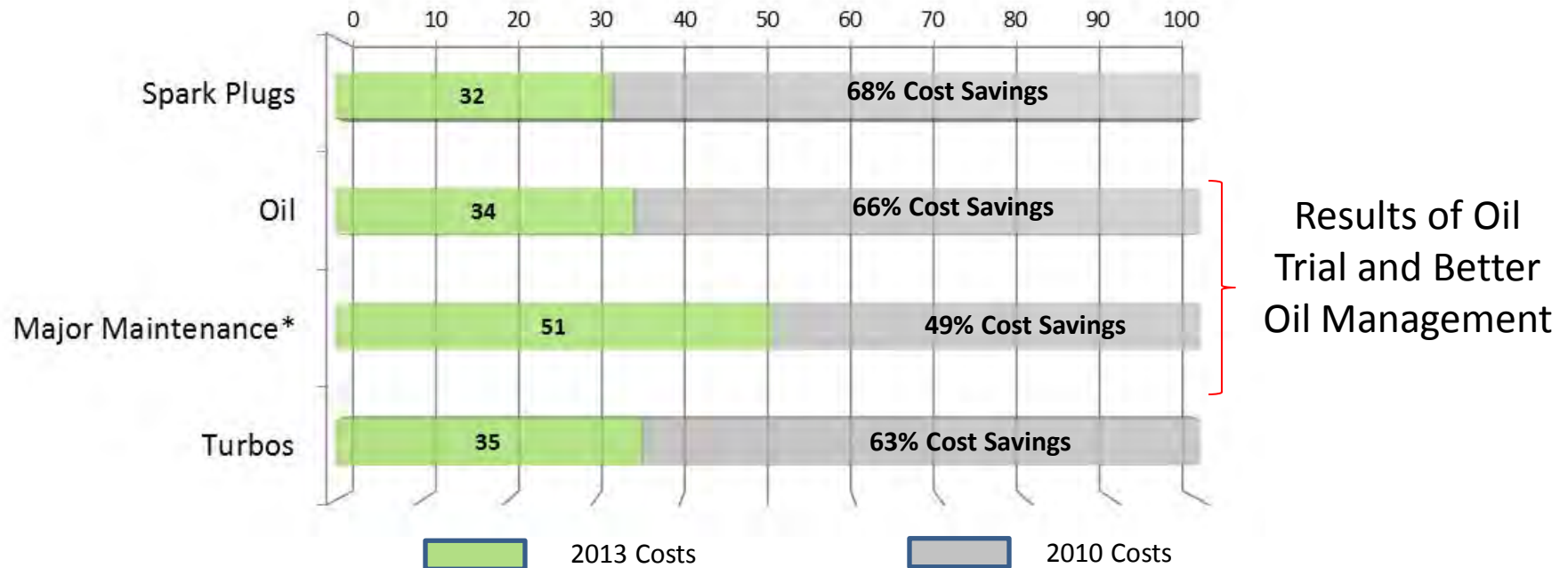
DTE Biomass Energy is a subsidiary of DTE Energy and owns/operates landfill gas to energy projects nationwide



- DTE Energy is an \$9 billion/yr S&P 500 company
- DTE Biomass Energy owns and operates landfill gas to electricity, direct use, and high-BTU sites across the country. These sites include (12) CAT 3520 engines
- DTE Biomass Energy has internal financing, construction, wellfield operations, and plant operations capabilities
- 30 MW of new landfill gas to electricity capacity coming on-line in 2014

# The Spoiler Slide

Cost Reduction Percentage 2010 to 2013  
CAT 3520 Site  
0-100 Scale 2010 = 100



On-stream Rate increase from 93.2% (2010) to 96.2% (2013)

\*Includes Cylinder Head Cleanings, Top-end Overhauls, In-frame Overhauls, and Major Overhauls

- Spark Plug Program
- Oil Program (Infineum Trial Oil)
- Major Maintenance Cost Savings
- Turbo Cost reductions
- Recruiting the Right People

A study was done comparing different spark plug performance under different cleaning intervals to determine the lowest cost per operating hour plug

## Study Objectives

1. Determine best spark plug type
2. Determine best cleaning practices
3. Determine best gapping scheme based on LFG and engine conditions



**A box of \$11,000 worth of dirty spark plugs found in a cabinet**

Trials have shown that spark plug life of over 3,000 hours is achievable. Spark plug changes were timed with other maintenance to reduce engine down-time

### Spark Plug Set #1

Run #	Run life (hrs)	Total Plug Life (hrs)	Reason for change
Run 1	523	523	Estimate 1/2 life of oil
Run 2	666	1189	Oil change
Run 3	620	1809	Estimated 1/2 life of oil change
Run 4	601	2410	Oil Change
Run 5	528	2938	2 Failures
Run 6	87	3025	Top-end interval
Run 7	429	<b>3454</b>	Frequent failure - end of life

### Spark Plug Set #2

Run #	Run life (hrs)	Total Plug Life (hrs)	Reason for change
Run 1	525	525	Estimate 1/2 life of oil
Run 2	304	829	Estimate 1/2 life of oil
Run 3	673	1502	Oil Change
Run 4	561	2063	Oil Change
Run 5	282	2345	Other maintenance issues
Run 6	535	2880	Estimate 1/2 life of oil
Run 7	87	2967	Top-end interval
Run 8	453	<b>3420</b>	Frequent failure -end of life



Current single plug record holder –  
 4,200+ hours (porcelain failure)

Cleaning spark plugs takes about 3 minutes per plug and requires less than \$1000 in tools.

1. Determine when plugs need cleaning (frequent failures or high transformer temps)
2. Shutdown engine— change plugs using ½ inch impact gun
3. Bead blast using #8 glass bead
4. Clean threads with wire wheel
5. Tap ground strap flush against electrode to ensure highest point of electrode is where spark occurs
6. Re-gap to .007” to .011” depending on methane quality and engine temperature
7. Discard if frequent failures



A change in spark plug philosophy from “use and toss” to experimentation to find the best value plug and the best re-use techniques led to a 68% decline in spark plug costs

2010 Situation

2013 Situation

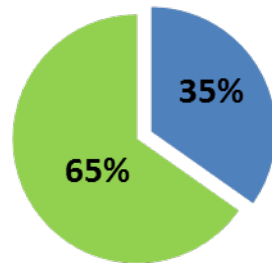
OEM Spark Plug → 3<sup>rd</sup> Party Spark Plug

Change at 1,000 hrs → Change based on transformer voltage or failure rate

Throw plugs away after use → Clean and Re-use

No Gap Changes → Re-gapping based on methane levels and other considerations

**Drivers of 68%  
lower Spark  
Plug costs**



Lower Spark Plug Pricing

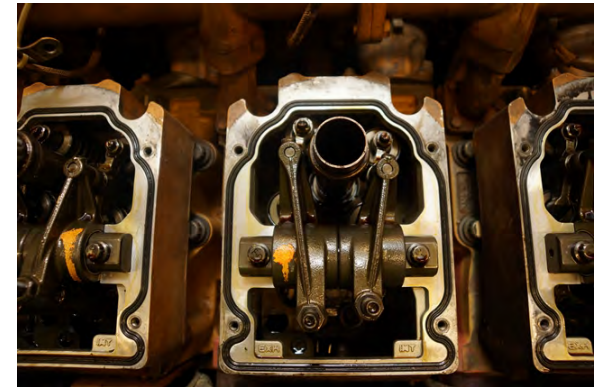
Extend Spark Plug Life



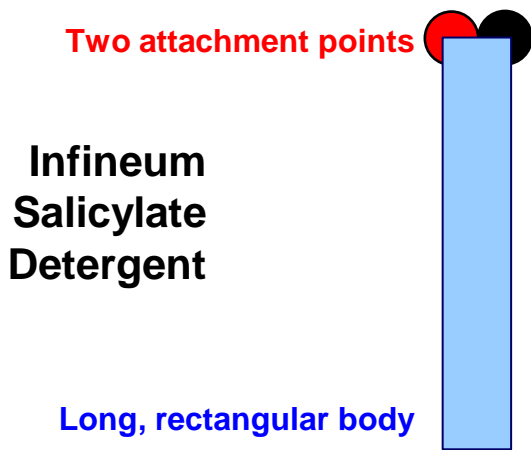
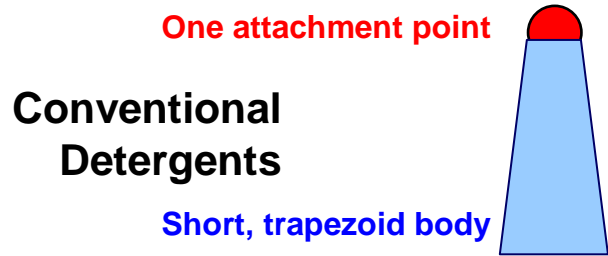
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Oil sampling evolved from a monthly test report from the oil vendor to a weekly program designed to diagnose problems early

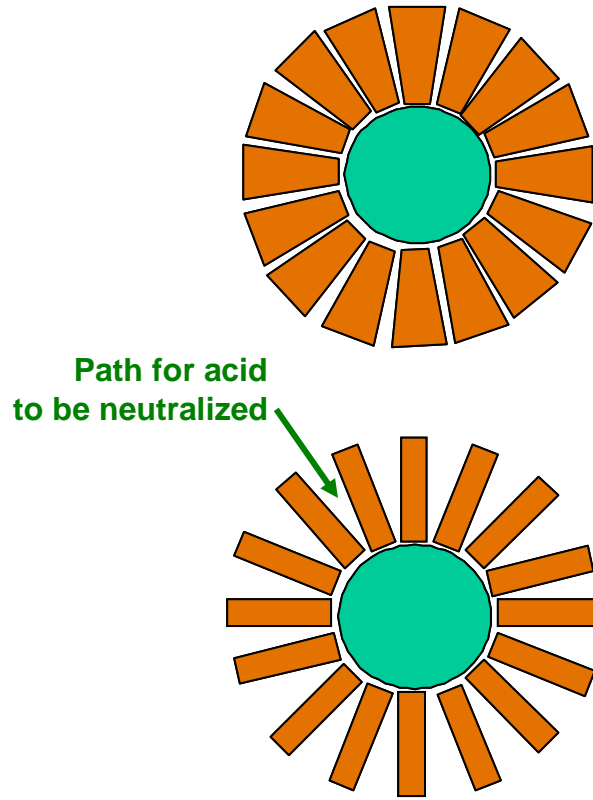
<u>2010 Situation</u>	→	<u>2013 Situation</u>
Monthly Oil Sampling	→	Weekly Oil Sampling
Oil Vendor Testing	→	3 <sup>rd</sup> Party Testing
Oil changes based on expected interval (up to 5,000 hours)	→	Oil changes based on condemning limits in oil testing
Synthetic Oil	→	Non-synthetic oils
Un-trained technicians	→	Trained Subject Matter Experts



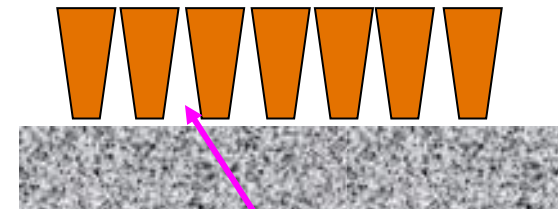
Both the salicylate “head” and long linear “tail” of the unique Infineum detergent contribute to the deposit control and acid neutralization required for LFGTE performance



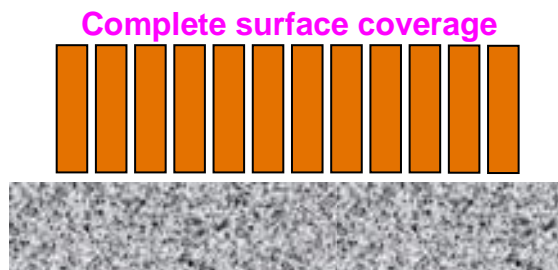
**Molecule**



**In Oil Solution**

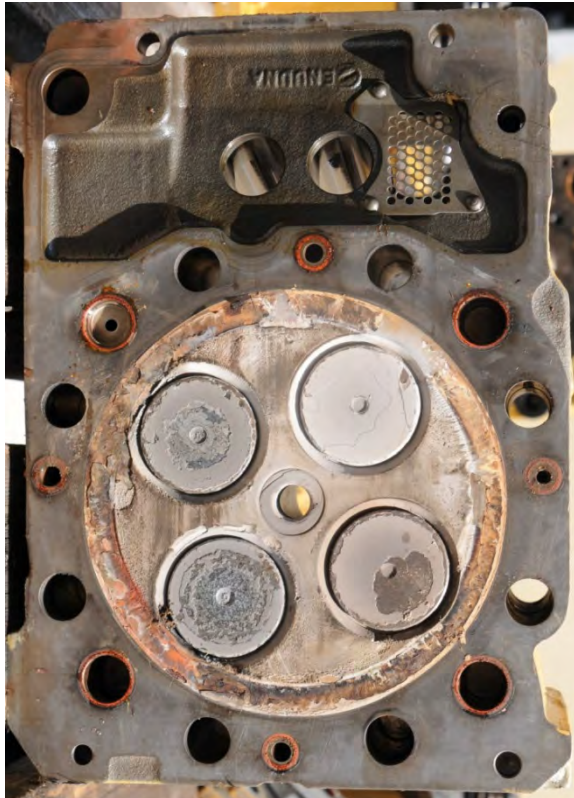


Space for deposits to form



**On Metal Surface**

Better control of cylinder head deposits, due to enhanced detergent technology, reduces valve torching and increases time required between top-end overhauls



**Reference Oil 1**  
**4028 hours**

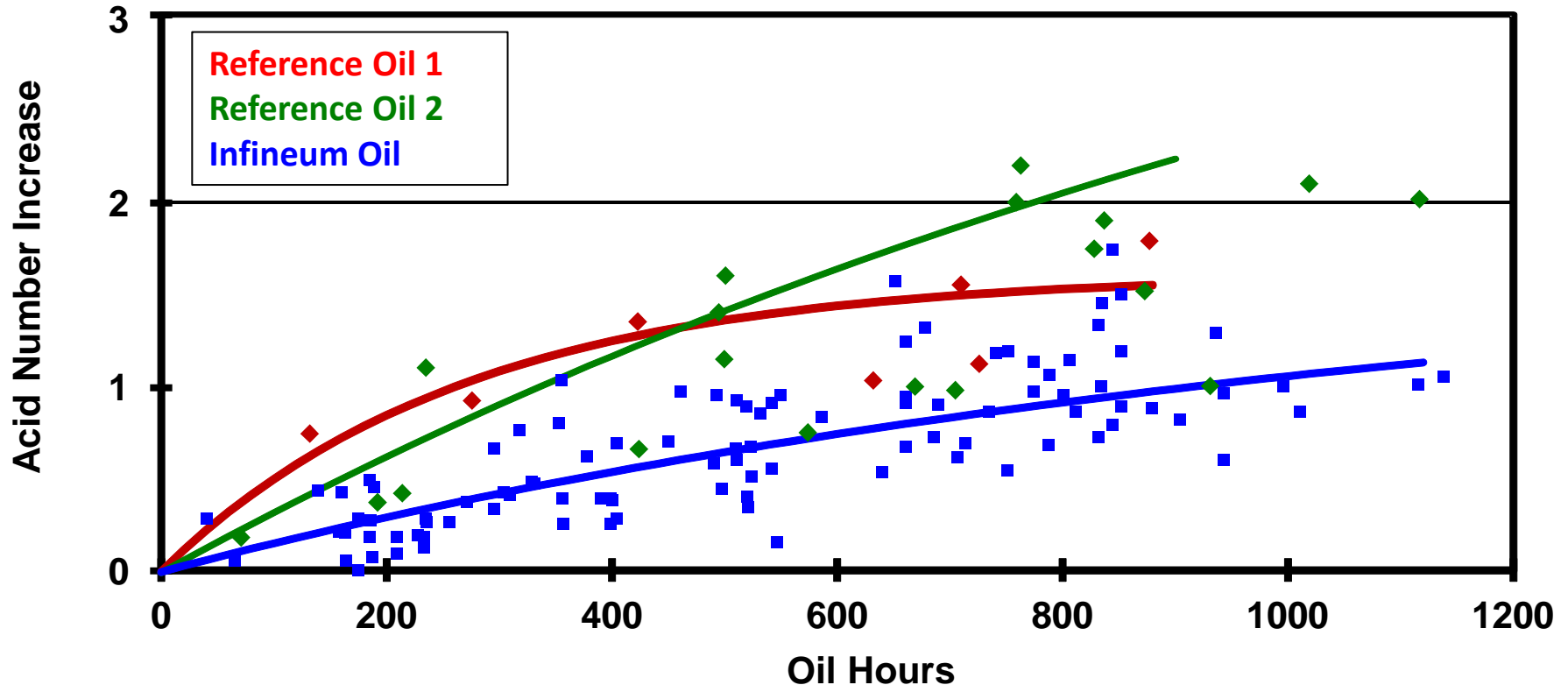


**Reference Oil 2**  
**4730 hours**



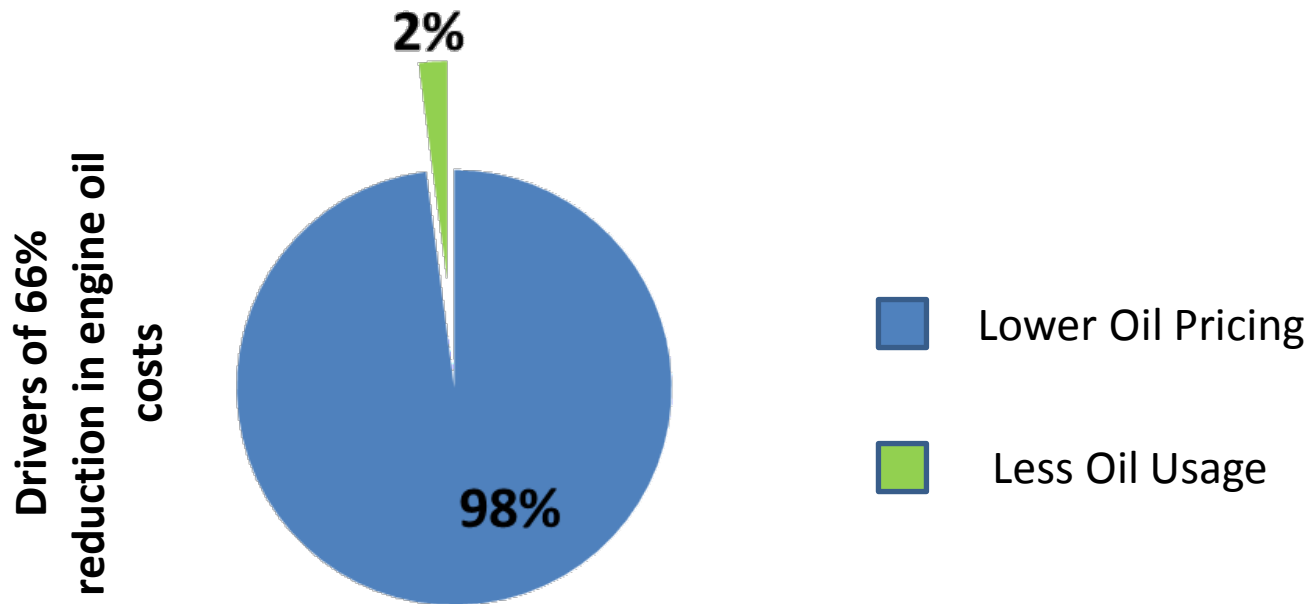
**Infineum Oil**  
**8024 hours**

Control of Acid Number Increase reduces corrosion and suggests possibility to increase oil change interval (for this test, oil change interval was kept constant for all oils)





By switching from synthetic oil to conventional oil (and eventually the Infineum Oil), oil costs dropped by 66% from 2010 to 2013



While the savings from lower conventional oil pricing was expected, the drop in oil consumption was not. While synthetic oil was run 5 times longer than conventional oil between changes, the daily burn was 5 gallons per day with synthetic oil instead of 2 gallons per day with conventional oil. Switching to conventional oil actually decreased the amount of oil used.

# Agenda

- Spark Plug Program
- Oil Program (Infineum Trial Oil)
- Major Maintenance Cost Savings
- Turbo Cost Reductions
- Recruiting the Right People

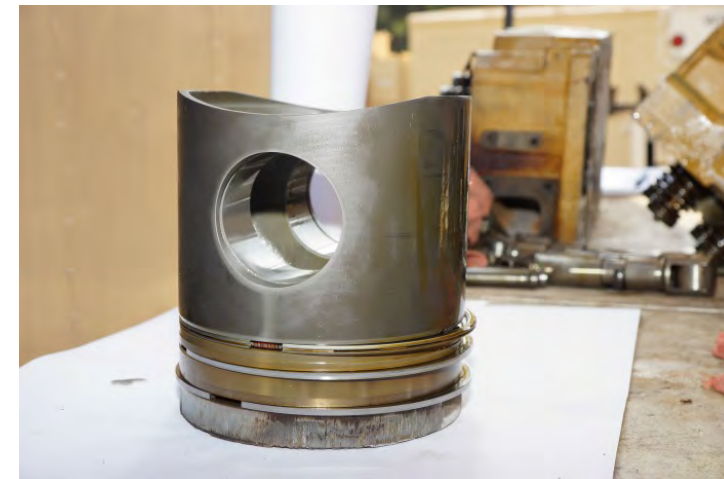


The Infineum oil, combined with better tuning and oil change intervals, has led to significantly better major maintenance cycles

Major Maintenance Cycle	Engine Hours											
	4,000	8,000	12,000	16,000	20,000	24,000	28,000	32,000	36,000	40,000	44,000	48,000
Shortened Cycle (2010)	C	T	I	C	T	I	C	T	M	C	T	I
CAT Recommended Cycle		T		T		I		T		M		T
Extended Cycle (2013)		T		T		I		T		T		M

**C** – Cleaning of Heads    **T** – Top-End Overhaul    **I** – Inframe Overhaul    **M** – Major Overhaul

- Changing oil before condemning limits and using Infineum oil removed the need for cylinder head cleaning and restored the cylinder pack life to 24,000 hours
- After inspecting the crank, decision was made to push major overhaul to 48,000 hrs to maximize the 24,000 hr life of the cylinder packs
- Pushing top-end overhauls past 8,000 hrs has little benefit if you can't also push the in-frame overhaul and major overhaul life out as well





In addition to extending the maintenance intervals, DTE Biomass examined the part cost and time associated with the major maintenance



Technicians at a team-building event

“Pit stop style” top-end overhauls with pre-positioned parts, tools and rehearsed jobs

**Work is DTE Biomass Energy led**



Technicians at an engine-building event

**2010 Situation**

Labor Costs

48hrs of 3 OEM Techs (Four 12 hour day/night shifts)  
36hrs of 2 DTE Techs (Three 12 day hours shifts)

Engine Down Time

Approx. 55-72 hours

**2013 Situation**

Labor Costs

24hrs of 2 OEM Techs (Two 12 day hour shifts)  
24hrs of 3 DTE Techs (Two 12 day hours shifts)

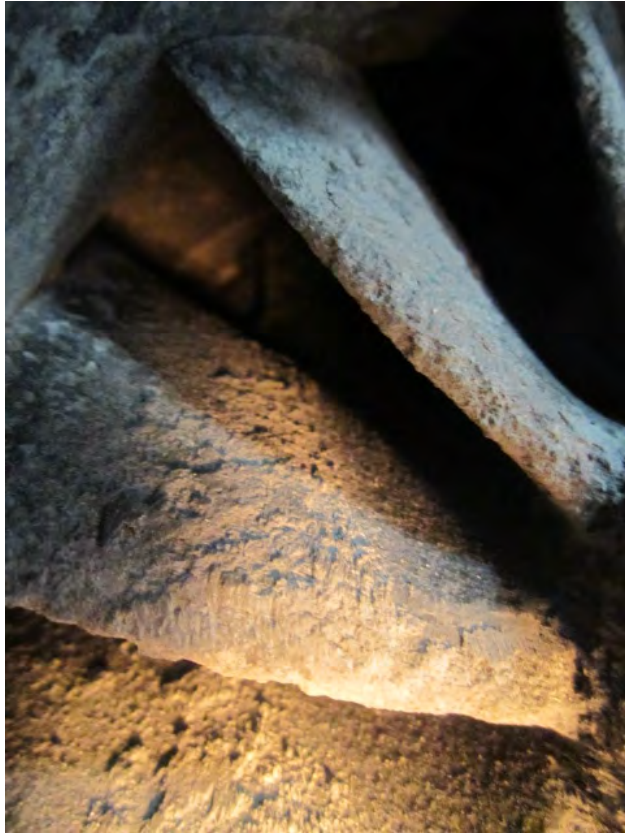
Engine Down Time

Approx. 30-40 hours (Record of 18 hours)

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Turbo Costs were reduced by 63% through remanufacturing turbos rather than returning them to OEM and running the turbos past the OEM recommended 8,000 hrs.



Turbo exhaust blades coated in siloxane after 13,000 hrs

2010 Situation

Changed turbos every 8,000 hours

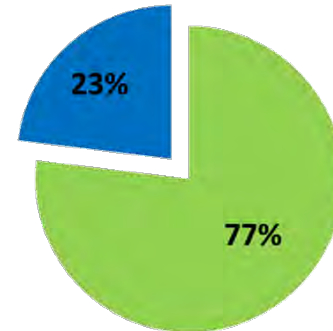
Only changed OEM cartridges

2013 Situation

Changed turbos every 11,000-23,000 hrs

3<sup>rd</sup> Party remanufactured housing and turbo

Drivers of 63% reduction in turbo costs



- Cost savings by remanufacturing turbos
- Cost savings running turbos past 8,000 hrs

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None of the above improvements are secrets – they were all common sense and were Technician Driven. Hiring the right people is the most important activity any manager does.



**Jason – Facility Technician**

DTE Biomass continuously recruits and has developed a 3 interview process that selects fewer than 10% of those who interview



**Jason – Facility Technician**



**Jon - Facility Technician**

We are proud to have hired 5 veterans in the past year – bringing our operations work force to 50% military veteran



**Awkward Operations Director**

# Conclusion

**DTE Energy**



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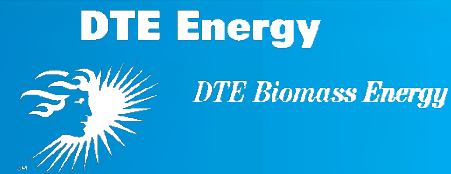


DTE Biomass Energy continues to use cost saving techniques in its new plants, allowing profitable partnerships with host landfills

## **Uwharrie National Forest – North Carolina**

(6) CAT 3520 LFGTE project under construction – 10 MW of electric production online in Spring 2014

# Contact Information



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## *Infineum*

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