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New Solutions for Replacing Unavailable or Obsolete Power Electronics in Turbines

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Before We Start

- This webinar will be available at www.windpowerengineering.com & via email
- Q&A at the end of the presentation
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Windpower Engineering & Development

Webinar: Septebmer 12, 2013

Change: Welcomed or Shunned?

Do you welcome change or run from it? It probably depends on the type of change.

Everyone wants a new cell phone or car every year, but do you really want a new computer each year? Or how about a new house?

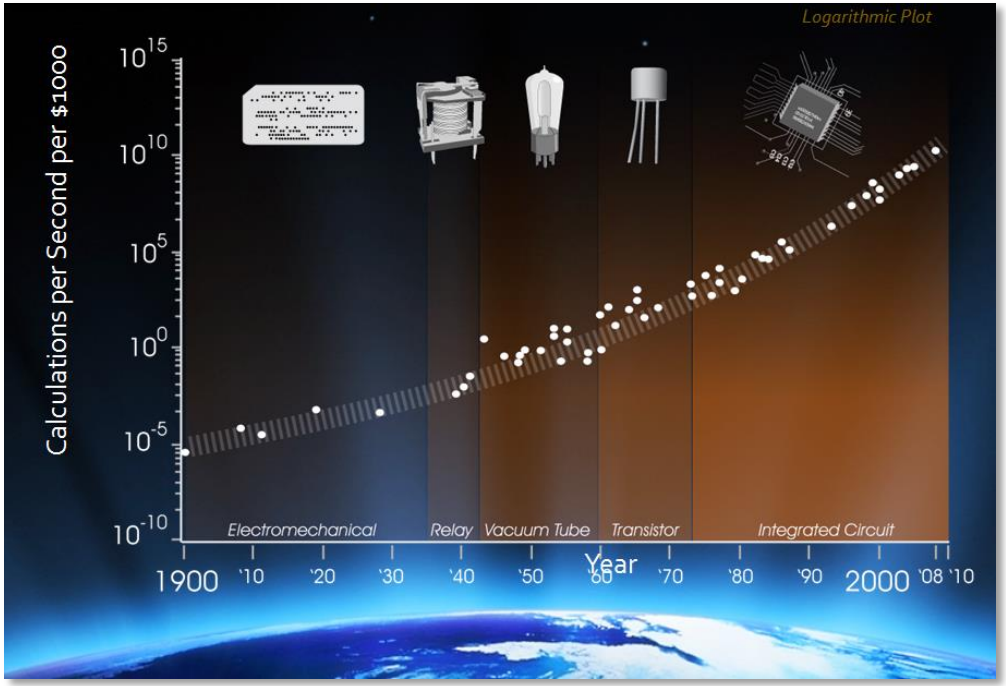
Some changes are determined by our needs others are forced upon us.

Obsolescence in Electronics

Americans want the latest and greatest new technology every year. Buying a new cell phone each year epitomizes the need for best and most recent features. Unfortunately, it is this consumer market that drives the semiconductor industry. New parts are released at a dizzying pace, with their predecessors becoming obsolete.

Moore’s Law

Moore's law is the observation that, over the history of computing hardware, the number of transistors on integrated circuits doubles approximately every two years.



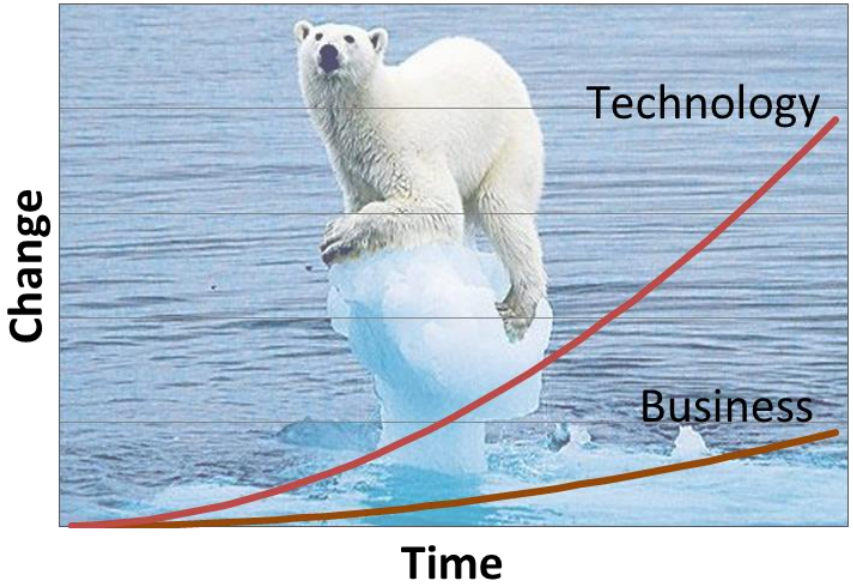
The Economic Advantage

The economic advantage to utilize the latest technology is clear. The manufacturer who changes quickly will lower costs as they produce more powerful products and gain market share.

Future Cost With Moore's Law			
Year	iPhone	Kindle	Computing Power
2010	$600	$139	1x
2020	$18.75	$4.34	32X
2030	<$1	<$1	1,024X

You Can’t Ignore Change

Unfortunately, the business model for large capital equipment has a longer cycle. Hence, the dilemma: You can do nothing. You can choose to ignore the reality of obsolescence or sustainment. But, at some point, you will be forced to deal with it.



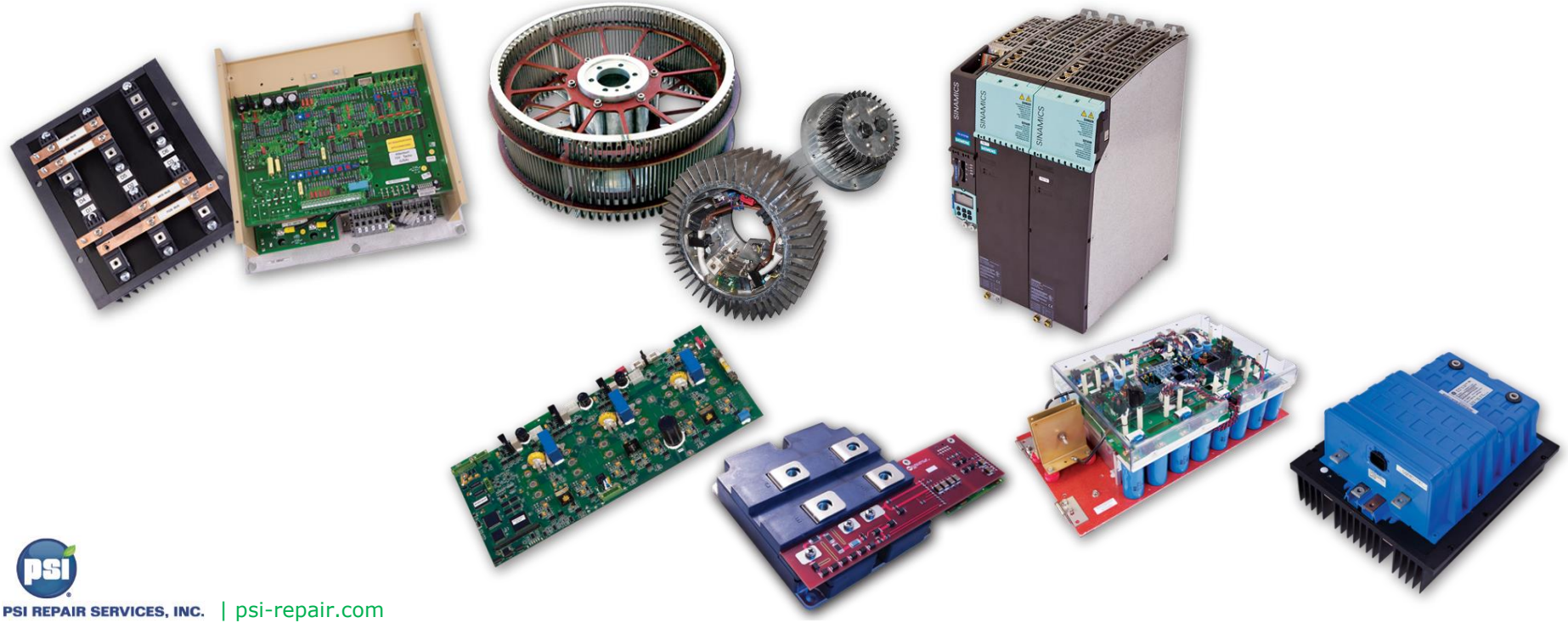
Sustaining Electronic Parts Which Are No Longer Available

- Your wind turbine was designed to last 20 years
- Your financial model was based on 20 years
- 10 years later, you find parts which cannot be purchased

Sustainment Issues

- So, how do you support a 20 year design when the core component cannot be purchased?
- The wind Industry is beginning to see the effects of this phenomenon. Would you know what to do, or who to call?
- Let's examine one particular case and look at other examples.

Meet PSI Repair Services: The Aftermarket Component Supplier with Engineering Services



An Unsupported Key Component

PSI has been repairing Xantrex Matrix inverters for several years. One customer has been expediting their repairs more frequently. The cause? Too little inventory to support their installed base of turbines.

This phenomenon is caused by what we call the “drop out rate.”

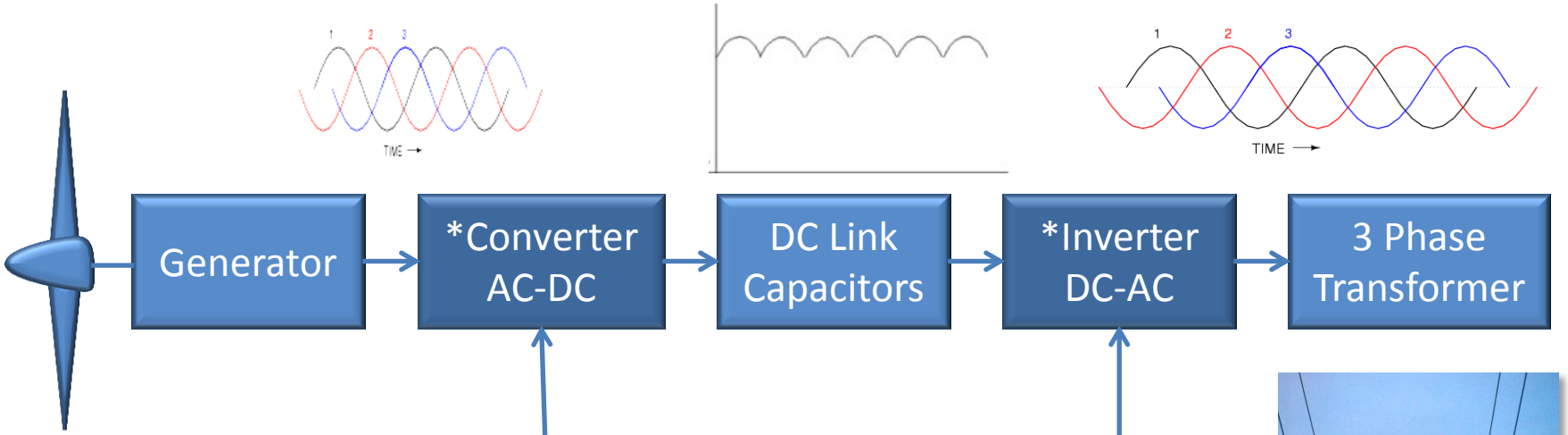
Example

200 Turbines, 2 inverters/ turbine
= 400 Inverters

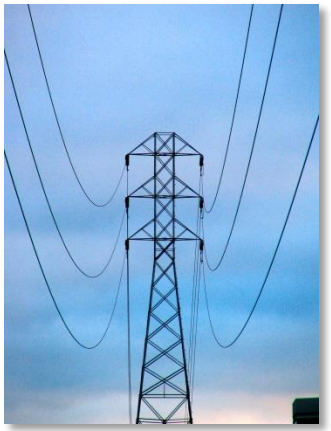
Spare parts 10% =40 units
Failure rate 1% , 4/month normal, 66/yr.
Failure rate 2.5%, 10/month peak

Not repairable rate 5%. Loss of inventory due to catastrophic failures or damage caused by frequent repairs. In 6 years, you will lose half of your spares inventory.

The Converter/Inverter



* The Converter/Inverter takes AC from the generator and converts it to DC or DC from the DC link bus and inverts it back to AC



Xantrex Matrix

The Xantrex Matrix system is comprised of an IGBT (Insulated Gate Bipolar Transistor) switching section. These devices are located on the top of the main control cabinet at the base of the tower.

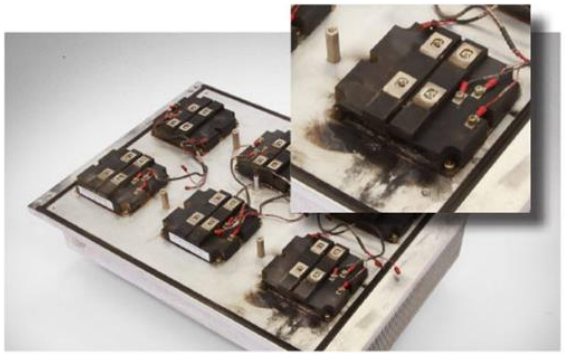
They are controlled by a custom Current Control Unit, or CCU.

Your Options

- OEM
  - — Obsolete Part
- Standard Commercial Inverters
  - — Risky and requires redesigned control cabinets
- Upgrade your control system
  - — Expensive and time consuming
  - — Risky, many boards affected
- Engineering Services
  - — **Low effort**. PSI handles redesign
  - — **Low risk.** No purchase is product does not work
  - — **Low Costs.** No changes to your system
  - — **No control redesign or modifications**
  - — **Fastest solution**

Advantages of Wind Engineering Services

- **Familiar with product**
  - Thermal Performance is a key factor in reliability.
  - Fault Protection is important
  - All harnesses and fiber optic cables are supplied with each unit.
  - Interchangeable Design



A blown Xantrex Matrix Inverter from a GE 1.5MW S Series wind turbine.

An upgraded replacement inverter from PSI Repair Services.

More Wind Engineering Services Advantages

- **Familiar with environment**
- **Familiar with support**

POWEREX

ABB

Fuji Electric

PSI Inverter Goals

Design Tasks

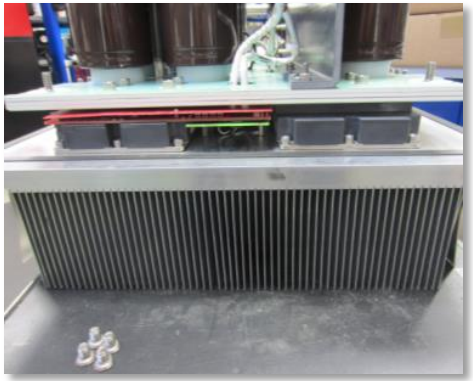
IGBT Selection

- Performance
- Form
- Simulations

Driver Design

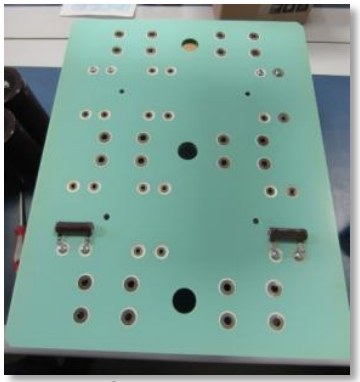
- Fault Detection
- Switching Speeds
- Customer Input

Heat Sink Design



- Design Base
- Design Fins
- Assembly

Bus Board Design

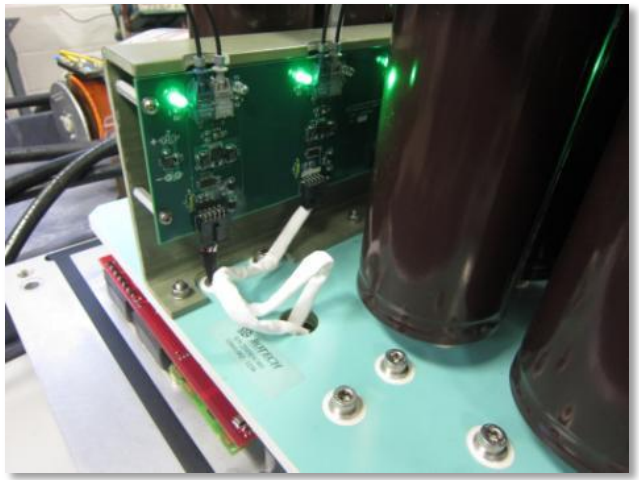


- Interface to IGBT
- Capacitor Mounting

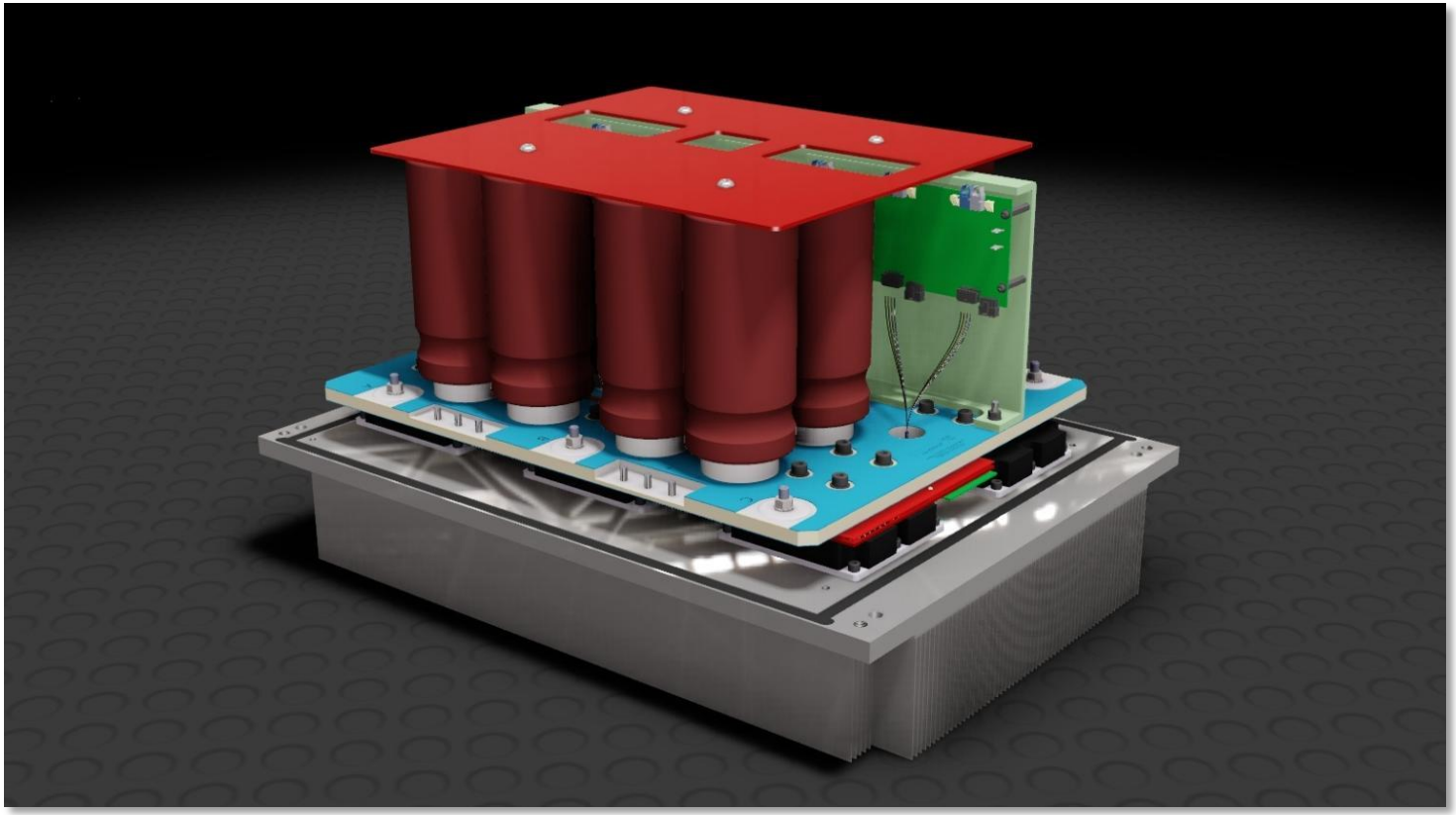
AC Input Voltage 518 to 633 VAC, Rotor Voltage 600VDC,
Line Frequency 60 HZ, Line Current 380 A AC, Rotor Current 600 A AC

Internal Tests

- Turn on/off drive signals
- Turn on/off switching signals
- Full current switching signal
- High voltage switching signals
- Fault detection
- Clearances
- Assembly issues concerns
- Final Form and Fit



The PSI Inverter



Field Tested

- Prototypes installed in the field for 11 months.
  - Rotor and Line together in same turbine
  - Rotor and Line separated in different turbines
  - Installed in most difficult rotor side location
- Results
  - PSI Inverter Shutdown (protected), OEM device failed (destroyed)
  - Operating cooler

Back To Our Twenty Year Model!

- Multiple customers have ordered units to support their inventory requirements.
- The Inverters are drop-in replacements, with no modifications necessary.
- The price for these inverter is similar to the original purchase price from the OEM.
- There were no design fees.

http://www.psi-repair.com/repair-services/wind-turbine-parts-repair

Questions?

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