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SPURRING INNOVATIVE IDEAS IN WIDE OPEN SPACES

Welcome

FORT WORTH, TEXAS MAY 7-10, 2017

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Supply Chain Quality ...a key Success / Survival Decision?

RANDY ROBERTS
ELECTRIC SUPPLIER QUALITY MANAGER
PACIFIC GAS & ELECTRIC
MAY 9, 2017

Pacific Gas & Electric (PG&E)

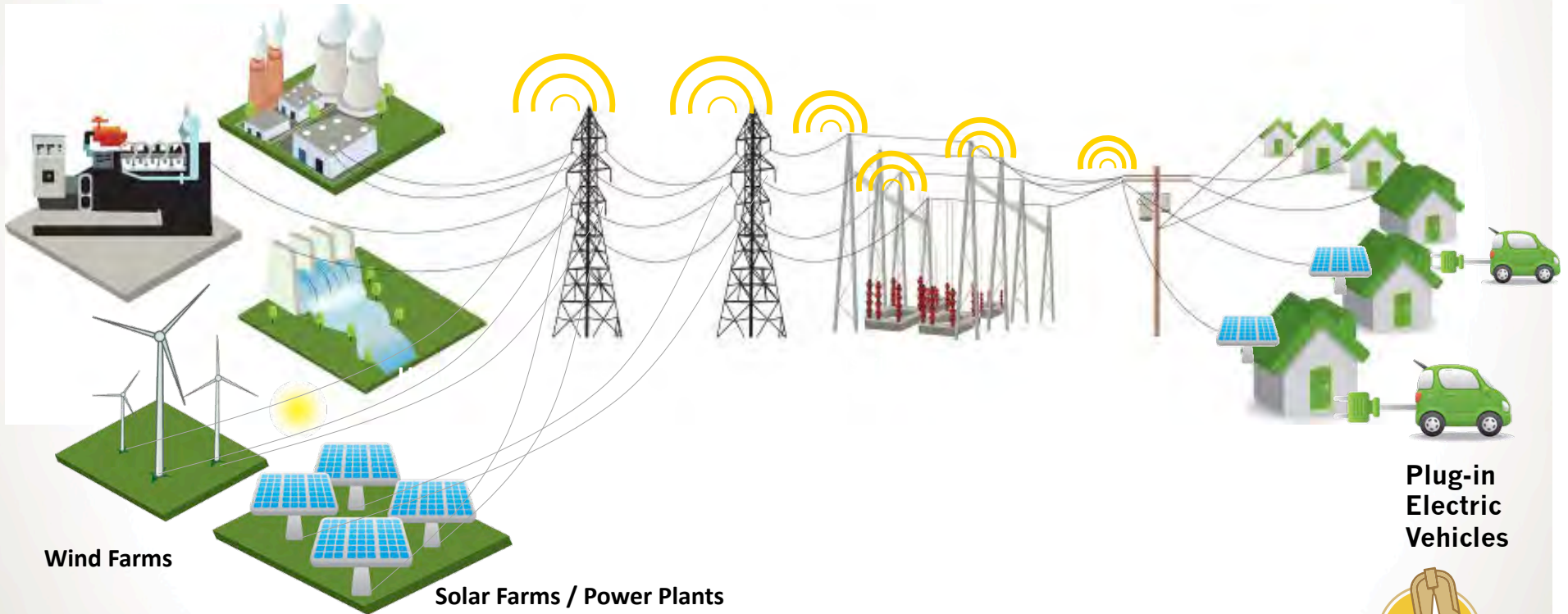
PG&E Electric System

Power Plants

Electric Grid

Customers

Nuclear Power Plant (Diablo)



Wind Farms

Solar Farms / Power Plants

Plug-in
Electric
Vehicles

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PG&E Overview

- ✓ California Utility serving 5.1 million electric customers
- ✓ Electric, Gas, Hydro-Generation, Solar, Nuclear
- ✓ \$6 billion of yearly spend on services/procured products
- ✓ 20,000 employees (7,000 contractors)
- ✓ Use 16,000 ea, 1 ϕ pole mounted transformers/year
- ✓ Use 2,500 ea, 3 ϕ pole mounted transformers/year

think we

We are the most supplier quality conscious utility in the U.S.!



The Thesis

Quality = Safety

And....

Quality = Long Term Cost Savings (Supplier/Utility)

And for Utility Suppliers...

Quality = Differentiation from low cost suppliers





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QUALITY = SAFETY

The Big Issue: Quality = Safety

San Bruno Fire Ball



Rancho Cordova



Why I was hired



The Result?

PG&E's Wake-Up Calls:

- ✓ 12/2008: Gas explosion (defective pipe (1 death))
- ✓ 9/2010: Gas explosion (defective pipe (8 deaths)). Not strictly a purchased part problem...but could have been
- ✓ 11/2012: Electrical Fire: Bushing failed, dropping a neutral line. House burned

PG&E's Reality:

- ✓ San Bruno: Penalties and Criminal conviction...Cost **\$2.5 Billion**
 - We have a "probation officer" with 5 years of oversight
- ✓ California CPUC is very aggressive in it's oversight of PG&E
 - Product defect caused injuries and near-hits receive in-depth attention by CPUC
- ✓ Other states' utility commissions increasingly model California



Continuing Quality Concerns



One phase horizontal transformer:
Exploded...Note the steel street cover was thrown in the air



Continuing Quality Concerns



Na

Pad Mount Transformer:
Rusting and removed
after 3 years



Continuing Quality Concerns



Leaking Transformer:
Oversize cut-out:
Gasket won't seal to
prevent leaks



Continuing Quality Concerns



Bleeding Poles:
Pending law suits
related to exposure of
children to the
treatment chemicals



TSP Quality Concerns

Natural




Continuing Quality Concerns (remember Monday Night Football?)

Auto Splice: Quality / Design Issue: No drain holes, carbon steel and aluminum, dissimilar metalsmillions of them



More Reasons To Worry About Part Quality

- ✓ Increasing risk of litigation—\$  settlements
- ✓ Distributed Generation is resulting in a serious loss of revenue
 - 7,000 customers / month installing solar in PG&E service area

Can't afford "throw-away parts" anymore....
- ✓ Labor to replace flawed products is 4x failed product costs
- ✓ "Unplanned Outage" a metric that affects rate decisions
- ✓ 1st World manufacturers *can't compete with 3rd world on cost only*
- ✓ Improved quality creates happy customers/higher sales prices
- ✓ Defects in quality costs manufacturers (rework/lost customers)



Are We Facing Unprecedented Challenges?

Maybe not.....Aerospace industry is similar to ours (**really!**) and has gone through a similar transition

- ✓ Product failures can result in deaths
- ✓ Both products have to survive harsh elements
- ✓ Both must last for many decades without a much maintenance
- ✓ Failures result in huge liability risk to the manufacturers
- ✓ The Aerospace sector (25 years ago) had a lax regard for quality as the utility sector does today- **not anymore...DPPM in 100's**
- ✓ Suppliers that embraced quality took market share and thrived

We think we are seeing the same Paradigm shift today in the Utility Sector.

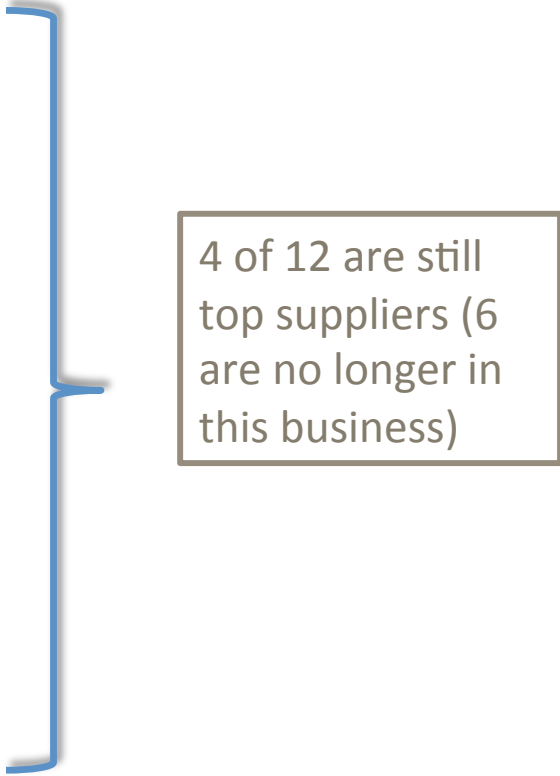


When Manufacturers Don't Adapt to More Cost Conscious Markets

(Top Defense Suppliers..1990 vs 2010)

1990

- ✓ McDonnell
- ✓ General Dynamics
- ✓ GE
- ✓ Raytheon
- ✓ GM
- ✓ Lockheed
- ✓ UTC
- ✓ Martin Marietta
- ✓ Boeing
- ✓ Grumman
- ✓ GTE
- ✓ Rockwell



4 of 12 are still top suppliers (6 are no longer in this business)



Our Vision for this Industry

Quality For Utilities...Big Picture

- ✓ **Partner** with key suppliers to instill a vision for zero material defects
- ✓ Certify to ISO9001 (PG&E certified in 3/2016)
- ✓ Train and Certify quality staff: ASQ Quality Engineers, Auditors, & Inspectors
- ✓ Qualify & audit key suppliers (can they build repeatable product?)
- ✓ Share Quality Programs via Utility Benchmarking Events
- ✓ Create a Utility industry forum to support material suppliers

PG&E is ACTIVELY conducting benchmarking with the largest Utilities and sharing our procedures and approach...we want to CHANGE the industry



Key Quality Actions for Utilities....The Details

- ✓ Inspect 100% high value/safety related products (with inspection plans)
- ✓ Collect/analyze field failure data to rate suppliers' products & tune inspection
- ✓ Source only suppliers with top rate quality – Work with the others... **if they will commit to getting better**
 - Measure quality for all suppliers using DPPM
 - Require suppliers to conduct RCA for each defect found
 - Qualify all new suppliers/audit all key suppliers
 - *De-source suppliers for poor quality – only when nothing else works*



Key Features Of PG&E SQ Program

Process begins with Standards Engineering....they define the critical/high risk ranking manufacturers and create enforceable standards (roadmap for SQ)

PG&E's basic Quality Roles:

SQ Audit Team

QMS review
SCAR (QMS process)
QSL database

SQ Inspection Team

Receiving Inspection
Source (site) Inspection

SQ Engineers

PPQP
MPR/SCAR (part defect)
DPPM & Scorecard
eSCR



Document Those Policies / Procedures

To eliminate confusion and assure roles & responsibilities are known, these documents must be clear & standardized

Web Based

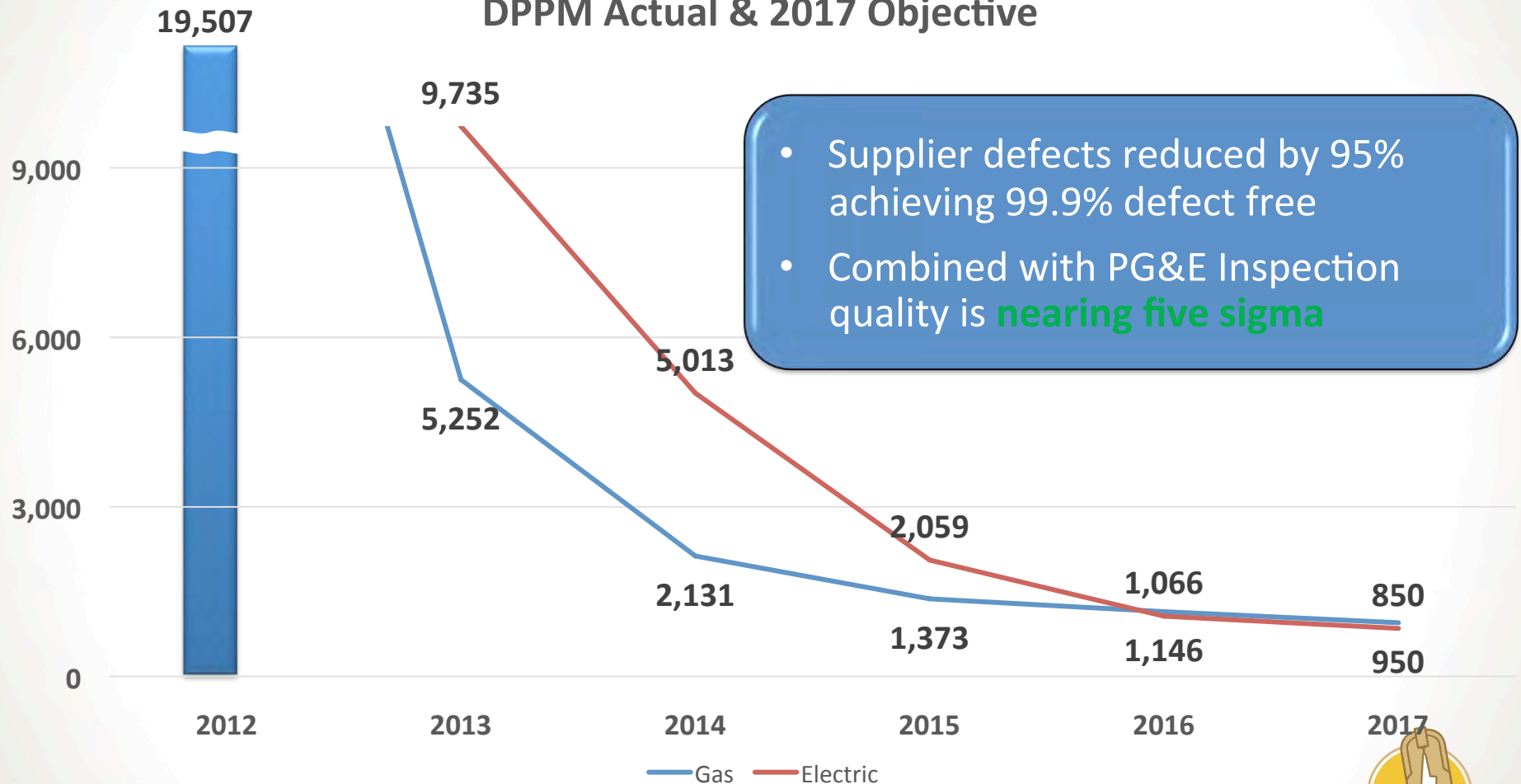
- 68 procedures@ PG&E
 - Manuals
 - Policies
 - Inspection Procedures
 - Job Aids
 - Check lists

Supplier Quality - 2100		
Document Number	Title	Date
SCM-2100M-01	Quality Management Manual	09/2014
SCM-2101P-01	Receiving Inspection Procedure	09/2014
SCM-2101P-01-JA01	Att. 1 Job Aid: Oil Filled Equipment	08/2014
	Att. 2 Transformer Checklist	09/2012
	Att. 3 Oil Filled Equipment Checklist	09/2012
SCM-2101P-01-JA02	Att. 4 Job Aid: Plastic Pipe and Tubing	04/2013
SCM-2101P-01-JA03	Att. 5 Job Aid: Plastic Pipe and Tubing Direct Shipment	09/2012
	Att. 6 Plastic Pipe and Tubing Checklist	04/2013
SCM-2101P-01-JA04	Att. 7 Job Aid: 600 Volt Cross - Linked Polyethylene Insulated Cable	06/2014
SCM-2101P-01-JA05	Att. 8 Job Aid: Crossarms	09/2012
SCM-2101P-01-JA06	Att. 9 Job Aid: Prefabricated Risers	09/2014
SCM-2101P-01-JA07	Att. 10 Job Aid: Gas Meter Service Valves	09/2014
SCM-2101P-01-JA08	Att. 11 Job Aid: Full Face and Flat Ring Gaskets	04/2013
SCM-2101P-01-JA09	Att. 12 Job Aid: Iron and Steel Threaded Steel Fittings	09/2014
SCM-2101P-01-JA10	Att. 13 Job Aid: Plastic Electrofusion Fittings - Couplings and Reducers	04/2013
SCM-2101P-01-JA11	Att. 14 Job Aid: Plastic Electrofusion Fittings - Tapping Tees	04/2013
SCM-2101P-01-JA12	Att. 15 Job Aid: Plastic Saddle Fittings	04/2013
SCM-2101P-01-JA13	Att. 16 Job Aid: Plastic Socket and Butt Fusion Fittings	04/2013
SCM-2101P-01-JA14	Att. 17 Job Aid: Plastic Mechanical Fittings	05/2013
SCM-2101P-01-JA15	Att. 18 Job Aid: Recording Inspection Results	09/2012
SCM-2101P-01-JA16	Att. 19 Job Aid: Containment Storage Unit	09/2012
SCM-2101P-01-JA17	Att. 20 Job Aid: Manual Inspection Lots	09/2012
SCM-2101P-01-JA18	Att. 21 Job Aid: 100% Sort Criterion	09/2014
SCM-2101P-01-JA 19	Att. 22 Job Aid: Wood Poles	09/2014
SCM-2101P-01-JA 20	Att. 23 Job Aid: EPR Insulated Cable	09/2014
SCM-2101P-01-JA 21	Att. 24 Job Aid: CRS Automatic Splice	09/2014
SCM-2101P-01-JA 22	Att. 25 Job Aid: Wedge Dead-End	09/2014
SCM-2101P-01-JA 23	Att. 26 Job Aid: Splice Assembly Kits	09/2014
SCM-2101P-02	Ball Valve Inspection Procedure	05/2013
	Att. 1 Ball Valve Inspection Checklist	05/2013



PG&E's Suppliers' Quality Journey

DPPM Actual & 2017 Objective



Our Suppliers' Quality Journey

Denial Phase: “Our products are **↑** highest quality!!!!”

Reality Phase: When problems start to show:

- ✓ SCARS (photos of problems and returned material)
- ✓ Cadence meetings (2x/month)
- ✓ Plant visits and feedback
- ✓ Possible Loss of business / quoting other suppliers **(if actions not taken)**

Recovery Phase:

- ✓ Add Inspection plans (end of line)
- ✓ Hire professional quality team
- ✓ Add process enhancements / make capital expenditures
- ✓ Add in-process controls
- ✓ Expect high inspection and rework costs
- ✓ Containment plans installed to protect the customer

Nirvana:

- ✓ DPPM down
- ✓ Decreased rework \$\$\$
- ✓ Efficiency and decreased manufacturing costs
- ✓ Solid customer relationships / Supplier of the year award



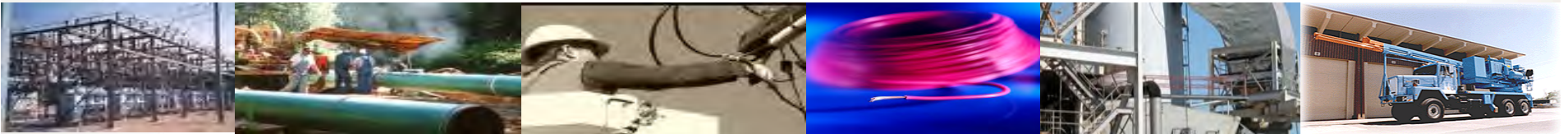
Signs Of A Company “Vested In” Quality

- ✓ An independent Director or VP of Quality (trained and empowered)
- ✓ An ability & willingness to derive Root Cause for defects every time
- ✓ An ability to stop the line with support of Sr. Exec’s
- ✓ A culture of “tiger teams” with resources to improve process
- ✓ Regular cadence meetings with customers with action registers
- ✓ Continuous improvement philosophy throughout company
- ✓ In depth training programs
- ✓ A capital budget to address process and equipment enhancements
- ✓ A good internal metrics collection system



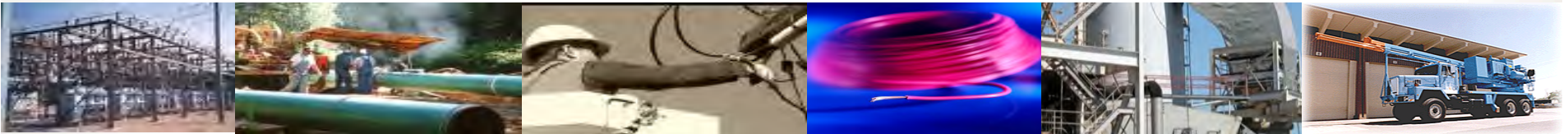
Can Things Really Change? (PG&E Example: Transformers)

- ✓ New HALT tested paint systems...longer lasting
- ✓ New SST pad-mount bottom sections (resist rust)
- ✓ New Leak check technologies
- ✓ New weld technologies / weld wire / robots /procedures
- ✓ New crimp technology, tools and products
- ✓ New torque tools and methods
- ✓ Bar code tracking systems
- ✓ New testing equipment and procedures
- ✓ New gasket designs
- ✓ New oil fill methods



What A Utility Owes It's Suppliers:

- ✓ **Honest and frank feedback**
- ✓ **Clear product requirements**
- ✓ **Clear metrics goals**
- ✓ **Fair advocacy during disputes**
- ✓ **Clear feedback (accurate and timely)**
 - **Material Problem Reports (MPRs)**
 - **Supplier Corrective Action Request (SCAR) as needed**
- ✓ **SQ Engineering support to help with supplier process enhancements**



What Suppliers Owe Utilities:

- ✓ Strong metrics performance numbers..... *A great manufacturing process*
- ✓ Long lived, low maintenance and easy to install products
- ✓ Controlled Change process (EscR)
 - Change to any major sub-tier supplier
 - Change of manufacturing location
 - Break in production of that product for more than 2 years
 - Change of key manufacturing equipment
- ✓ Controlled “Escape Process” in Factory
 - Warning and “containment” if there is a material problem
 - Corrective action (SCAR) that identifies and corrects discrete and systemic problems
- ✓ Qualified Products
 - Products are safe to use (over the long term)
 - Products have been subjected to rigorous accelerated age tested (HALT)
 - Products that will not negatively affect the environment





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AN OPPORTUNITY

An Opportunity

- ✓ Listen to your customer's needs (LoB) What is important about your products?
- ✓ Products can't be "good enough" any longer
- ✓ Sell your team members that change is here...Explain the risks/opportunities
- ✓ Ensure your team maintains an edge

Andy Grove: "Only the paranoid survive"

- ✓ Hire the right people with a forward view and free them to improve things
- ✓ Invest in Quality and training, better processes and better design

Don't get caught during this major market paradigm shift ...stay ahead of the change

