

ABB Automation & Power World: April 18-21, 2011

WCS-153-1

Transformer risk assessment and contingency planning

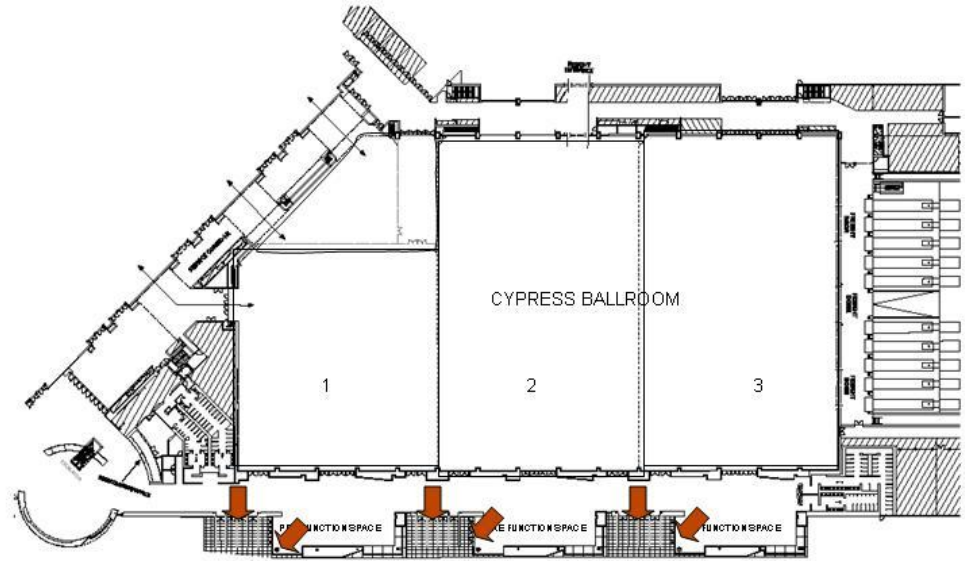
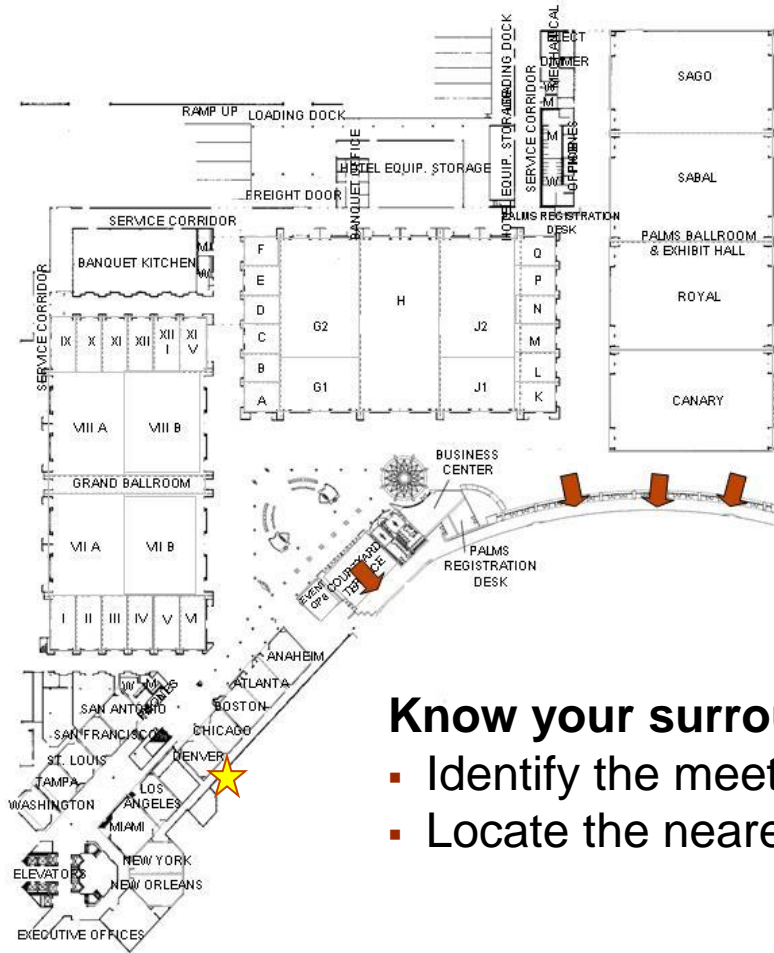
Your safety is important to us

Please be aware of these emergency procedures

- In the event of an emergency please dial ext. 55555 from any house phone. Do not dial 9-1-1.
- In the event of an alarm, please proceed carefully to the nearest exit. Emergency exits are clearly marked throughout the hotel and convention center.
- Use the stairwells to evacuate the building and do not attempt to use the elevators.
- Hotel associates will be located throughout the public space to assist in directing guests toward the closest exit.
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Your safety is important to us

Convention Center exits in case of an emergency



Know your surroundings:

- Identify the meeting room your workshop is being held in
- Locate the nearest exit

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Transformer risk assessment and contingency planning

- Petter Fiskerud
- GM and VP, TRES North America
- ABB
- Raleigh, NC

- Andrew Wall
- Director, Marketing and Sales, TRES North America
- ABB
- Raleigh, NC

Goal and benefits

Today's discussion

- **Goals**

- Open dialogue environment
- Share ideas and lessons from other's in this room
- Generate actions required to support you

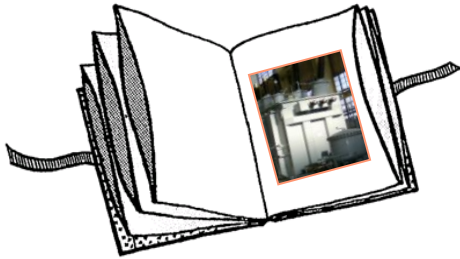
- **Benefits**

- Clear picture for risk assessment of transformers
- Solid ideas for contingency planning of transformer assets
- Proactive and actionable plan to mitigate risk of downtime

Agenda

Recipe for Contingency Planning of Power Transformers

RECIPE

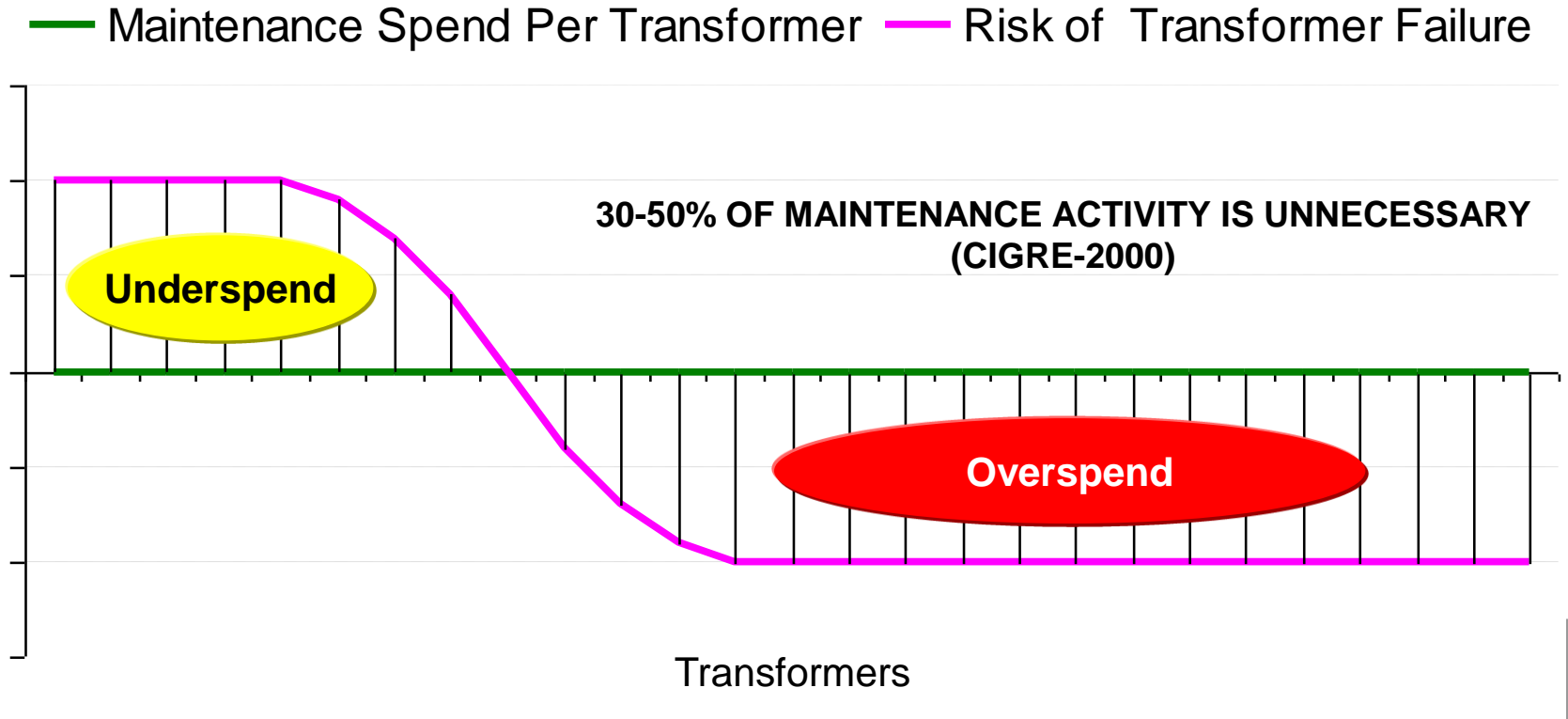


BOOK

- **Mature Transformer Management Program**
 - Condition based assessment of transformers to identify what is solid and which transformers require action to improve their condition
- **Spare Strategy and Availability**
 - Review existing spares and identify gaps
- **Pre-Engineered Solutions**
 - Critical path transformers can be designed and in some cases upgraded in advance
- **Advanced Procurement**
 - Long-lead time commodities will no longer control the project by either procuring in advance or taking advantage of materials and components that are available for short delivery times
- **Pre-Determined Logistics Plan**
 - No surprises and identified costs, designs that are fast to install from the ground up, complete with installation instructions that focus on speed to energize
- **Factory Capacity Reservation**
 - Proactive plan allows for “factory reservations,” and if the design is complete only the material lead times set the transformer lead time

Transformer Management Program

Reliability Centered Maintenance to Limit Risk



- Time based spend vs. condition based spend

Transformer Ageing and Failure Model

Thermal ageing

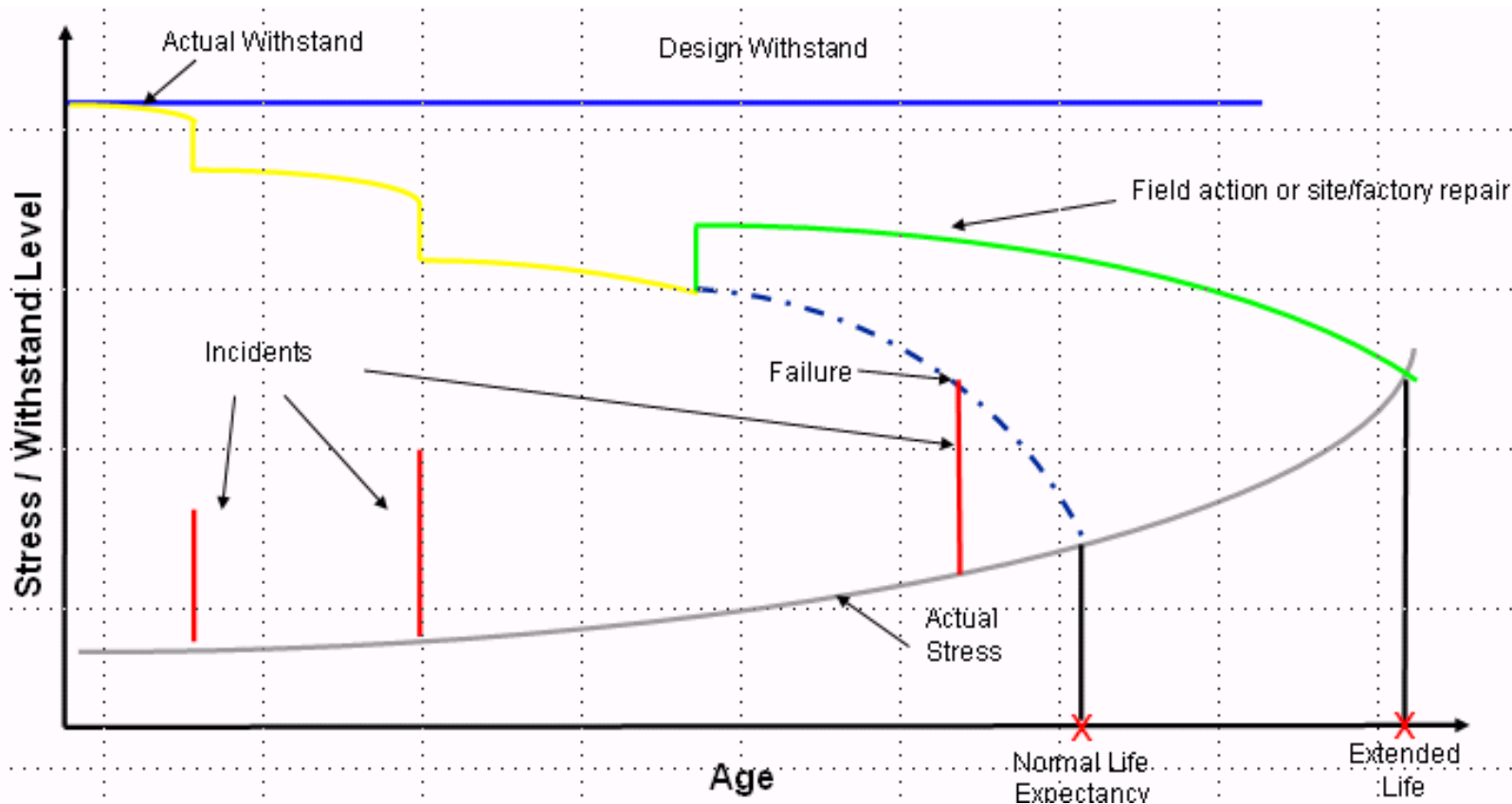
- Temperature
- Moisture
- Oxygen

Mechanical ageing

- Delta temperature
- Over current
- Vibration

Electrical ageing

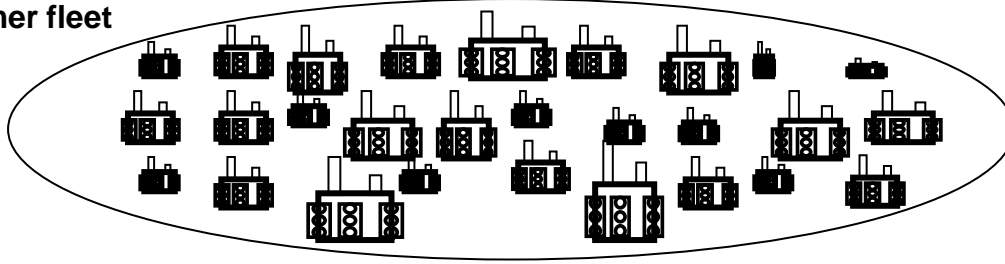
- Over voltage
- Over current
- Harmonics



Mature Transformer Management Program

Condition and risk assessment

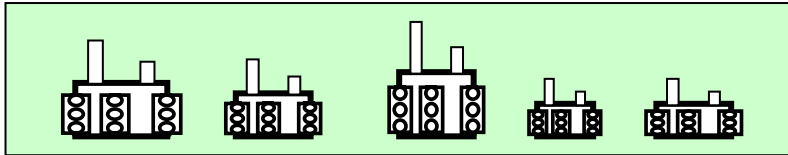
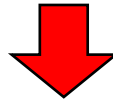
Transformer fleet



Step 1

- Fleet Screening
- Number of unit: 20 – 100+
- Objective: Maintenance Strategy & Budget

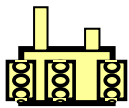
- Regular Diagnostics
- History



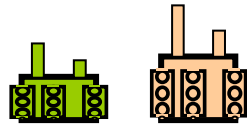
Step 2

- Transformer Design & Condition Assessment
- Number of unit: 10 – 20
- Objective: Maintenance Plan & Actions per unit

- Advanced Diagnostics
- Design Review



Replacement



Refurbishment



Cooling Upgrade

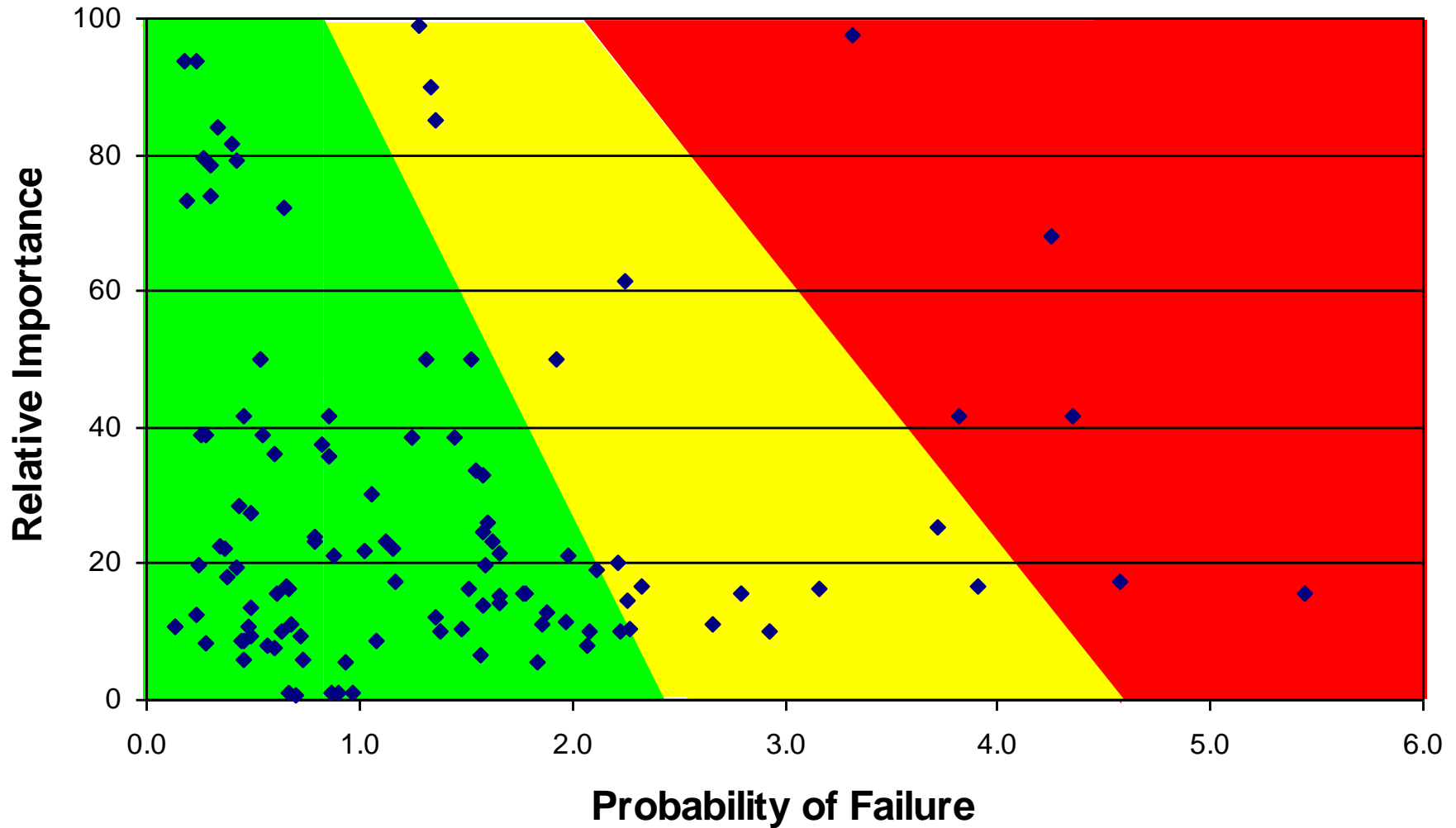
Step 3

- Life Assessment / Profiling
- Number of unit: 1 – 10
- Objective: Troubleshooting / Upgrade proposal



Engineered solutions

Transformer Management Program Contingency Program



Contingency Planning Spare Strategy and Availability



- Availability of spare units on the system
 - Units that fit multiple sites
 - Investment in “poly-transformers”
- Availability of long lead time components
 - Sharing of inventory between sites
 - Direct replacement vs. engineered solution
- Upgrading of load bottlenecks
 - Transformer retrofit and upgrades
- On-line Monitoring

Contingency Planning Pre-Engineered Solutions

- On the shelf design can save 8-12 weeks
 - Relatively small investment with large time savings
 - Procurement documentation ready to be sent to suppliers
 - New, remanufacturing, and retrofit / upgrade
- Design reviews and approved quality plans
- Engineered solutions for obsolete components
 - Bushings, tap changers, controls, and coolers
- Value of speed and efficient execution

Recipe for Contingency Planning Advanced Procurement



- Procuring in long lead time materials in advance
- Traditional long lead time materials
 - Bushings
 - Copper
 - Core steel
 - Insulation packages
 - Controls
- Complete winding packages
- On-the-shelf storage in controlled environment
- Long-lead time commodities will no longer control the project resulting in less downtime

Recipe for Contingency Planning

Pre-determined logistics plan

- Designs that are fast to install that match footprint; “built to install”
- Complete installation instructions that focus on safety and speed to energize
- Crossed all hurdles
 - Route map from factory to site
 - Permitting
 - Qualified transport plan (boat, rail, rigging, truck, etc.)
 - Site clearances
 - Site safety assessments and protocols
- Efficient delivery with no surprises and unidentified costs



Recipe for Contingency Planning Factory Capacity Reservation



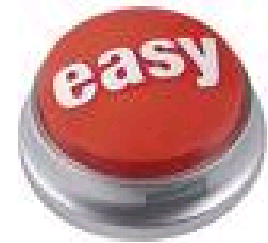
- Proactive plan enables factory reservations
 - Established lead time for emergencies
 - Slot reserved with your name on it
 - Push button, material procurement and production begins

- Experienced in slot reservations with many alliance utilities
 - No competition for slots in bull markets

- Avoid weeks or months of time elapse
 - RFP-RFQ process
 - Contracts
 - Legal
 - Slot availability determination

Recipe for Contingency Planning

Open Discussion



- Do these ingredients make sense and fit your needs?
 - Mature Transformer Management Program
 - Spare Strategy and Availability
 - Pre-Engineered Solutions
 - Advanced Procurement
 - Pre-Determined Logistics Plan
 - Factory Capacity Reservation
- Will this support your organization's engineering and transformer expertise gaps?
- What did we miss?

THANK YOU

Reminders

Automation & Power World 2011

- Please be sure to complete the workshop evaluation
- Professional Development Hours (PDHs) and Continuing Education Credits (CEUs):
 - You will receive a link via e-mail to print certificates for all the workshops you have attended during Automation & Power World 2011.
 - **BE SURE YOU HAVE YOUR BADGE SCANNED** for each workshop you attend. If you do not have your badge scanned you will not be able to obtain PDHs or CEUs.

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