

# Doble Global Power Services

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## TRANSFORMER CONDITION ASSESSMENT

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### INTRODUCTION

- Transformer Global Trends
- Transformer Condition Assessment – Overview



## CURRENT GLOBAL TRENDS

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- **Aging Infrastructure - Developed Nations**
- **Rapidly Increasing Demand - Developing Nations**
  - **Increased demand & world market = high commodities cost**
- **Competition**
- **Decreasing Reserve Capacity = Higher Loading PU**
- **Pressures to Reduce Operating Costs**
- **Insurance Companies Becoming “Educated”**
- **Long Equipment Lead Time for New Purchases or Repair**
- **Offshore Markets – Global Market**



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## TRANSFORMER CONDITION ASSESSMENT

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- **A systematic approach to determine the overall health or condition of a power transformer.**
- **Makes use of not just one particular diagnostic tool, but an aggregate of proven technologies, techniques and methods.**
- **Provides dependable benchmark and trending data allowing owners and operators to make informed decisions.**
- **Ongoing TCA provides answers for both short term and long term operations.**
- **Allows for optimal usage (operational, financial, strategic) of critical apparatus.**



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## CONDITION ASSESSMENT - TRANSFORMERS

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- **Make use of all available tools to assess the health condition and viability of large electrical power assets**
  - **Laboratory Testing**
  - **Electrical Testing**
  - **Design Review**
  - **Individual Historical Operating Data**
  - **Family Historical Database (Design Specific)**
  - **Conference Papers**
  - **Manufacturers Service Advisory**
  - **Trouble & Failure Reports**
  - **(ALL AVAILABLE INFORMATION!)**



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## TCA Philosophies, Logic & Methods

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- **Large - Medium Utilities – Virtually all large utilities employ some system of assessing the condition of their transformer fleet.**
- **Small Utilities – Most do, some do not.....**
- **I & Cs – Some do, many do not**
- **Varying methods and concepts exist, but all share most of the same benchmarking and analytical tools.**



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## LEVEL I STUDY

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- **Level I Study**
  - **DGA (Historical)**
  - **Electrical Tests (Historical)**
  - **Operation (Historical)**
  - **Age**
  - **External Inspection**



## LEVEL II STUDY

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- **Level II Study**
  - **DGA**
  - **Oil Tests**
  - **Electrical Tests**
  - **Operation**
  - **Age**
  - **External Inspection**
  - **Maintenance Records**
  - **Troubles & Failures**
  - **Design**
  - **Loading Profile**
  - **Transient Fault Recording Data**
  - **Thermal Imaging**
  - **Acoustic Analysis**
  - **Electromagnetic Interference/ PD**
  - **Internal Inspection**



## A Healthy Family??

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## Only A Qualified Professional Knows

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- **Blood Tests, Urinalysis, CAT Scan, MRI, X-Ray, etc.**
- **Patient History Questionnaire**
- **Genetic Predisposition**
- **Job Stress, Risk, Hazard**
- **Financial Pressures**
- **Location**
- **Lifestyle**

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## A Healthy Transformer??

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## Only a Qualified Professional Knows

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- **DGA, Furans, LRx, SFRA, TTR, MΩ, PF, etc.**
- **Transformer History**
- **Manufacturer/Design History**
- **Load Profile**
- **Location**
- **Maintenance Programs, Condition Assessment**



## The Methodologies are Analogous to Each Other

- Blood Tests, Urinalysis, CAT Scan, MRI, X-Ray, etc.
- Patient History Questionnaire
- Genetic Predisposition  
Family History
- Job Stress, Risk, Hazard
- Financial Pressures
- Lifestyle
- DGA, Furans, LRx, SFRA, TTR, MΩ, PF, etc.
- Transformer History
- Manufacturer/Design History
- Load Profile
- Deregulation, Budget Cuts
- Maintenance Programs, Condition Assessment



## LEVEL I STUDY

- Used as a “first cut” approach
- Reviews existing data
- Identifies obvious issues
- Identifies units that need closer scrutiny



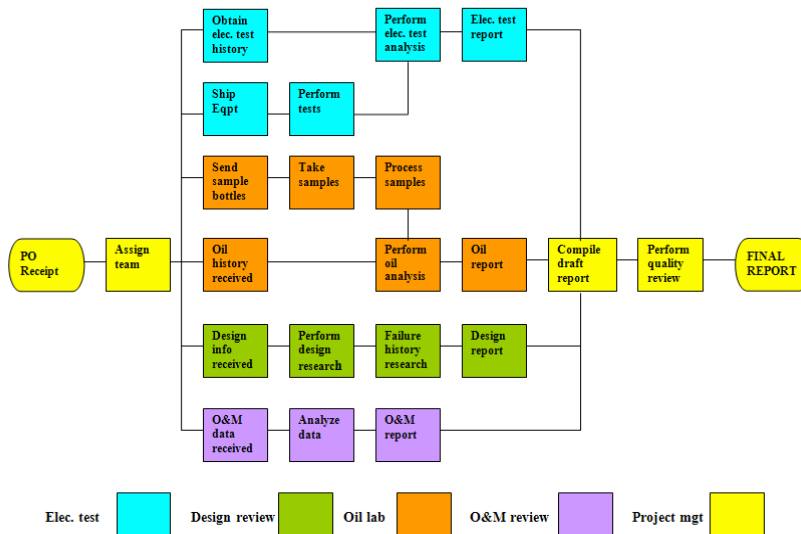
## Level I Analytical Tools

### Level I Study

- DGA (Historical)
- Electrical Tests (Historical)
- Operation (Historical)
- Age & Manufacturer
- External Inspection



Doble Global Power Services  
Condition Assessment Project Flow Chart



**doble**  
Global Power Services  
Doble's Expert Consulting Division

Doble Global Power Services<sup>SM</sup> is proud to present the  
**2009 "REVOLUTIONARY MACHINES" SEMINAR**  
Four days of in-depth training on all critical aspects of motors and generators  
November 9-12, 2009  
Hyatt Regency, San Francisco, California, USA

Doble Global Power Services<sup>SM</sup> is proud to offer the third annual  
**"Revolutionary Machines"** seminar focusing exclusively on generators  
and motors.

The **"Revolutionary Machines"** seminar will cover all aspects of the  
design, manufacturing and application of generators along with  
synchronous and induction motors, rotors and stators.

This is a comprehensive look at design, construction, application, operation,  
protection, failure modes and repair of large motors and generators.

**Highlights include:**

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## 2010 Life of a Transformer

**February 7-12, 2010**

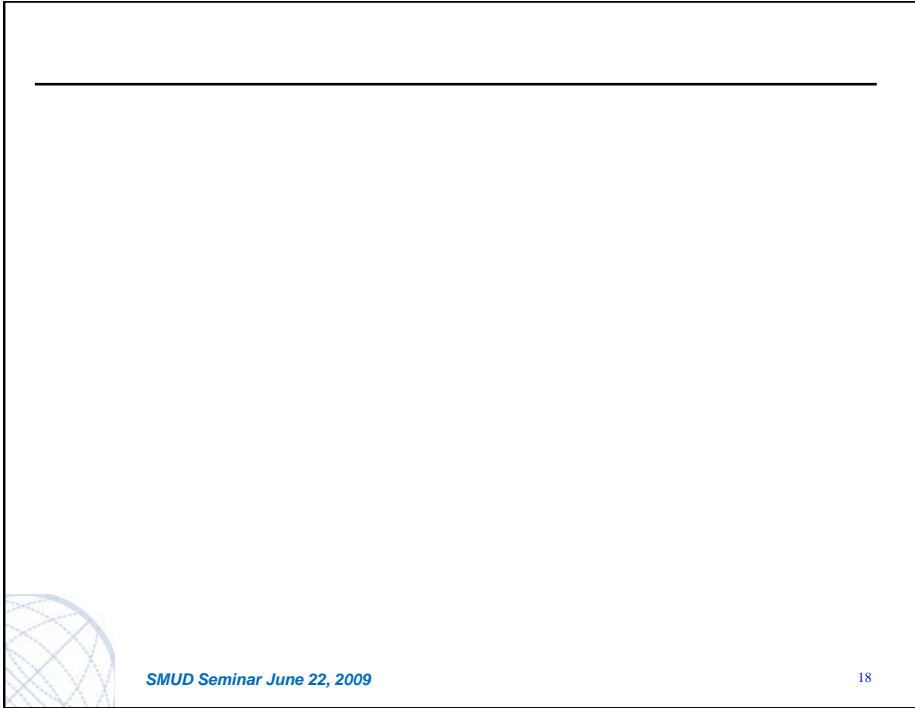
**Buena Vista Palace** (located inside Walt Disney World Resort)

**Lake Buena Vista, Florida, USA**

**Registration**

- The cost of the 4-day seminar is \$1,495 per person
- The fee to attend just the 1-day lab seminar is \$395 per person. To find out details and to register for this 1-day lab seminar only, please go to [http://www.doble.com/events/technical\\_conferences.html/view/101](http://www.doble.com/events/technical_conferences.html/view/101).
- The cost of the 5-day seminar is \$1,890 per person which includes the optional lab seminar on Friday, February 12, 2010.
- Breakfast and lunch is included in the price of the seminar fee.

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## LOW VOLTAGE BUSHINGS



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## HAVE A NICE DAY!



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