

ONLINE CONTINUOUS MOISTURE MANAGEMENT

One of the Lowest-Cost Ways to Extend Transformer Life



The Hidden Cost of Moisture

Utilities invest millions of dollars in transformers. Yet one of the most damaging aging accelerators often receives attention only after a problem appears: Moisture.

Moisture continuously accumulates inside transformers through:

- Natural insulation aging
- Breather moisture ingress
- Seal degradation
- Maintenance activities
- Environmental exposure

Once present, moisture accelerates:

- Paper insulation aging
- Dielectric deterioration
- Bubble formation risk
- Failure probability



The challenge is simple:

Moisture never stops being generated. Even a healthy transformer continuously creates moisture as cellulose insulation ages.



The Financial Reality

Every utility faces four major asset management questions:

- 1 How can we extend transformer life?
- 2 How can we reduce unexpected failures?
- 3 How can we reduce maintenance costs?
- 4 How can we improve return on asset investment?



Moisture management directly contributes to all four objectives.



KEY MESSAGE

A transformer may cost millions to replace. Moisture management costs only a fraction of that investment.



EXTEND ASSET LIFE

Slow insulation aging and maximize the return on your transformer investment.



REDUCE COSTS

Lower maintenance requirements and avoid costly emergencies.



PREVENT FAILURES

Minimize the risk of unexpected outages and associated penalties.



IMPROVE RELIABILITY

Ensure a healthier grid with higher operational availability.



BETTER SUSTAINABILITY

Extend asset life, reduce waste and support environmental responsibility.



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FROM REACTIVE MAINTENANCE TO CONTINUOUS MOISTURE MANAGEMENT

Manage the Cause. Improve the Asset. Protect the Investment.



TRADITIONAL APPROACH

Most utilities manage moisture through:

- Oil testing
- Oil filtration
- Oil replacement
- Corrective maintenance

THE PROBLEM

These activities are periodic.



Moisture generation is continuous.



Therefore moisture begins accumulating again immediately after maintenance.



THE NEW ASSET MANAGEMENT PHILOSOPHY



MANAGING THE CAUSE

instead of



MANAGING THE SYMPTOMS

Moisture is one of the few aging accelerators that can be **continuously controlled** during operation.



Change the Approach.
Protect the Value.
Extend the Life.

BENEFITS OF CONTINUOUS MOISTURE MANAGEMENT



REDUCED MAINTENANCE INTERVENTIONS

Less dependence on:

- Emergency filtration
- Oil processing campaigns
- Unplanned maintenance activities



IMPROVED TRANSFORMER RELIABILITY

Lower moisture levels help maintain:

- Dielectric strength
- Insulation integrity
- Operational margins



IMPROVED ASSET AVAILABILITY

Fewer outages mean:

- Higher network reliability
- Better service continuity
- Reduced operational disruptions



BETTER ENVIRONMENTAL PERFORMANCE

Life extension means:

- Fewer replacements
- Reduced oil disposal
- Reduced carbon footprint

REACTIVE MAINTENANCE



- HIGHER COSTS**
- HIGHER RISK**
- UNEXPECTED FAILURES**

VS.

CONTINUOUS MOISTURE MANAGEMENT

- LOWER COSTS**
- LOWER RISK**
- LONGER ASSET LIFE**



Continuous Moisture Management is not just better maintenance. It is smarter asset management that delivers **measurable value.**



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BUILDING A BUSINESS CASE FOR MOISTURE MANAGEMENT

PROTECT ASSET VALUE. REDUCE RISK. IMPROVE ROI.

MOISTURE MANAGEMENT IS AN ASSET INVESTMENT STRATEGY

“ The value is not measured by how much moisture is removed. The value is measured by what is avoided. ”

AVOIDED COSTS

TRANSFORMER REPLACEMENT DEFERMENT
Every additional year of service life can represent significant capital savings.

REDUCED MAINTENANCE EXPENDITURE
Lower spending on:

- Oil processing
- Oil replacement
- Emergency interventions
- Reactive maintenance activities

REDUCED OUTAGE COSTS
Avoiding a single critical transformer failure can save:

- Repair costs
- Replacement costs
- Outage penalties
- Production losses
- Revenue losses

THE VALUE YOU CREATE WITH CONTINUOUS MOISTURE MANAGEMENT



IMPROVED ASSET UTILIZATION

BETTER OPERATIONAL CONFIDENCE

- Improved reliability
- Reduced uncertainty
- Better condition visibility

IMPROVED LOADING FLEXIBILITY

- Better insulation condition
- Improved operating margins
- Lower moisture-related risk

BETTER LONG-TERM PLANNING

- Improved asset forecasting
- More predictable maintenance budgets
- Better replacement planning

WHERE SHOULD UTILITIES START?

USE A RISK-BASED DEPLOYMENT STRATEGY TO MAXIMIZE RETURNS

PRIORITY 1
OLDEST TRANSFORMERS
Higher aging risk, greater potential life extension.

PRIORITY 2
WETTEST TRANSFORMERS
Higher moisture = higher risk.

PRIORITY 3
MOST CRITICAL TRANSFORMERS
Focus on assets where failure impact is highest.

PRIORITY 4
TRANSFORMERS SUPPLYING CRITICAL INFRASTRUCTURE

- Hospitals
- Data Centres
- Airports
- Industrial Plants
- Strategic Infrastructure

This risk-based deployment strategy ensures maximum return from available maintenance budgets.



KEY MESSAGE

Continuous Moisture Management is not a maintenance expense. It is an **investment in asset reliability, asset life, and return on infrastructure capital.**



CONCLUSION & INTERNATIONAL GUIDANCE

Manage Moisture. Protect Value.
Build a More Reliable Grid.

The Bottom Line:

Moisture cannot be completely eliminated from a transformer, but it can be continuously managed. The utilities that proactively manage moisture are the ones that extend asset life, reduce risk, and maximize return on infrastructure investment.



THE DRYTRANS IMPACT



Extend Transformer Life

Slows insulation aging and defers costly replacement.



Reduce Failure Risk

Continuously removes moisture, lowering the probability of failure and outages.



Lower Maintenance Cost

Minimizes oil processing, oil replacement, and emergency interventions.



Improve Reliability

Stronger insulation performance ensures operational stability and network reliability.



Better Asset Utilization

Enables higher loading confidence and more effective asset planning.



Support Sustainability

Less oil disposal, fewer replacements, lower carbon footprint.

WHY ONLINE CONTINUOUS MOISTURE MANAGEMENT?



REMOVES MOISTURE



MAINTAINS DRYNESS



DELIVERS MEASURABLE RETURNS



PROTECTS ASSET VALUE

- ✓ Works 24/7 in sync with transformer operation
- ✓ Permanent installation with minimal maintenance
- ✓ Proven technology used globally by leading utilities and industries
- ✓ Fast ROI through extended life and reduced risk
- ✓ Measurable results and long-term value

INTERNATIONAL GUIDANCE & KEY REFERENCES



IEC STANDARDS

- IEC 60422 – Mineral insulating oils in electrical equipment – Supervision and maintenance guidance
- IEC 60814 – Determination of water in insulating liquids
- IEC 60076 Series – Power Transformers



IEEE STANDARDS

- IEEE C57.91 – Guide for Loading Mineral-Oil-Immersed Transformers
- IEEE C57.140 – Guide for the Evaluation and Reconditioning of Liquid-Immersed Power Transformers
- IEEE C57.143 – Guide for Transformer Condition Assessment



CIGRÉ PUBLICATIONS

- CIGRÉ Technical Brochures on Moisture Assessment
- CIGRÉ TB 761 – Condition Assessment of Power Transformers



TECHNICAL REFERENCES

- Oommen, T.V. – Moisture Equilibrium in Paper-Oil Insulation Systems
- Koch, M. & Tenbohlen, S. – Moisture Assessment Using Dielectric Response Methods
- Utility and Industry Publications on Transformer Life Management and Moisture Control



Moisture Management is not just a maintenance activity – it is a strategic investment in your most valuable assets.



Protect today.
Perform tomorrow.
Preserve for the future.



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