

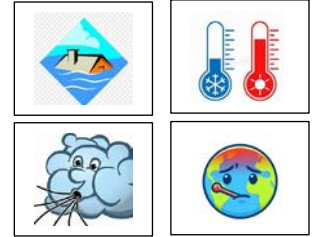
# Opto-Sensor Applications



## Climate Change Adaptation

**Higher Ambient, Temperature Swings, High Winds, Flooding:**

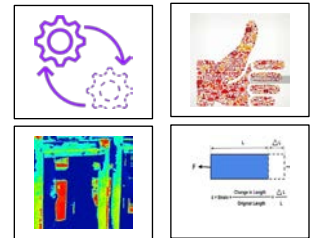
- **New De-Rating Factors** (Equipment Thermal Limits, System Impact)
- **Real-time Operating Headroom** (Reliability, Resiliency, Control)
- **Preventing Damage** (Forecast, Dynamic Ratings, Sizing, Safe Shutdowns)
- **Managing Assets** (Maintenance, Operations, Remote monitoring)



## Digital Twins & Model Validation

**Thermal and Strain Measurements:**

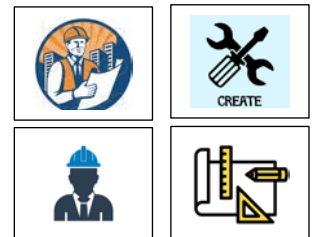
- **Equipment Models** (Computation augmented by actual measurements)
- **Dynamic Models** (Varying ambient & internal equipment measurements)
- **Setting Dynamic limits** (Forecasted ramps on current status)
- **Model Validation** (Hotspots, weak-links, safe operations)



## Prototype and OEM Testing

**Testing based on detailed internal measurements:**

- **Engineering Designs** (validate design changes)
- **Prototype** (Varying ambient & internal equipment measurements)
- **Factory Acceptance Test** (Impact of forecast on current status)
- **Superior Products** (Hotspots, weak-links, safe operations)



## Certification & Safety Analysis

**Augmented Analysis with internal measurements:**

- **Third Party Validation** (Overseas markets)
- **Safety Analysis** (Domestic and overseas markets)
- **Market Leader** (Industrial excellence)
- **Better Recognition** (Domestic and Overseas markets)



## Assessing Aging Assets

**Thermal and Strain cumulative impact:**

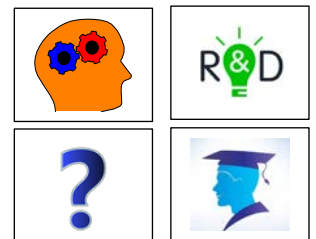
- **Performance curves** (Remaining useful life, Refurbishment timelines)
- **Field Failure Analysis** (Lab tests and failure mode mechanism)
- **Asset End-of-Life** ("bathtub" curves, asset refurbishment and replacement)
- **Extending Useful Life** (Revised operating threshold)



## Academic R&D

**Advancing Knowledge:**

- **University R&D Centers** (Industry-Academia collaboration)
- **Validating Advance Theories** (Research Lab testing)
- **Education** (advancing student knowledge)
- **Innovation** (Solutions, intellectual property, patents)



## Why Measure?

Thermal ratings are often derived from empirical formulae using a few temperature measurements. This is because it is impractical to insert hundreds of thermocouples or RTDs to map the entire asset. *With Opto-Sensors, the fiber loop can be arranged internally/externally to suit the physical asset in three-dimension. It can measure numerous data points within the asset to get an accurate thermal model map in real time. No need for approximations.*

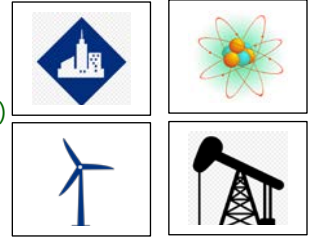
# Opto-Sensor Industry Verticals



## Smart Infrastructure

Knowing Thermal and Material limits in real-time (temp. and strain):

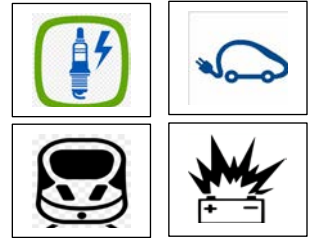
- **Smart Grid** (G,T&D - Fossil, Nuclear, Gas, Hydrogen, Renewables, Transmission, Distribution)
- **Smart Cities** (Underground cables, Transportation, Water, Gas, Others)
- **Oil & Gas** (Extraction, Refining, Pipelines)
- **Buildings and Factories** (Fire Solutions, Building Integrity)



## Automotive, Transportation

Knowing Thermal and Material limits in real-time (temp. and strain):

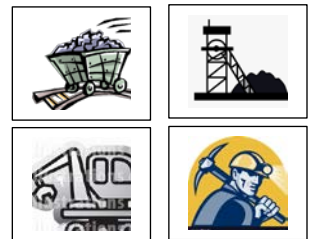
- **Internal Combustion Vehicles** (Cooling, Structural)
- **Electric Vehicles** (Battery Thermal/Cooling, Fire-safety, Battery Structural)
- **Hydrogen Vehicles** (Fuel Cell Thermal/Cooling, Fire-safety, Hydrogen storage safeguards)
- **Train Stations** (Fire Solutions, Building integrity)



## Mining, Extractives

Knowing Thermal and Material limits in real-time (temp. and strain):

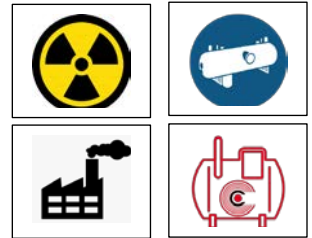
- **Power Distribution** (Power Cables, Power Equipment)
- **Fire-Safety** (Temperature detection, Timely alarms and alerts to avert fires)
- **Personnel/Occupational Safety** (Temperature monitoring, Timely alerts, Comfort)
- **Operations** (Real-time Monitoring and Alarms)



## Nuclear, Heavy Engineering, Pressure Vessels

Knowing Thermal and Material limits in real-time (temp. and strain):

- **Pressure Vessels** (Pressure limit monitoring, Thermal limits, Realtime monitoring)
- **Nuclear** (SMR, Primary/Secondary heat cycles, Calandria, Balance of Plant)
- **Process** (Rolling, Fabrication, Welding process, equipment and system thermal/strain limits)
- **Buildings and Factories** (Fire Solutions, Building Integrity)



## Aviation, Ports, Shipbuilding, Defence

Knowing Thermal and Material limits in real-time (temp. and strain):

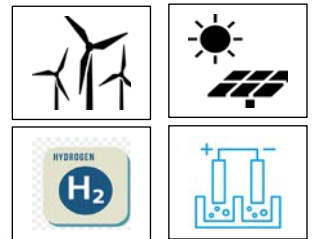
- **Deflection/Strain Measurements** (Plane Fuselage/Wing, Ship Hulls, Other)
- **Material Degradation** (Thermal and mechanical stresses)
- **Thermal Measurements** (Internal, Fire-safety, explosions)
- **Airport, Hangars, Shipyards, Ports** (Fire Solutions, Plant Integrity)



## Renewable Power

Knowing Thermal and Material limits in real-time (temp. and strain):

- **Large Wind Turbines** (Blade flexes, Nacelle strain, Tower structure integrity)
- **Large Solar PV Plants** (Temperature profiles/cooling/output impact, wind-shear flexes)
- **Hydrogen** (Electrolyser, Methanol Reformation, PEM/SOFC operational monitoring)
- **Buildings and Factories** (Fire-solutions, Plant integrity)



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or a trial project**