Intelligence for Tomorrow

ENGING

enging.pt

Hello,
This is **Enging**!

Founded in 2011, Enging is an innovative Portuguese company, specialized on advanced predictive maintenance and fault detection technological solutions to monitor the condition of the electric machines.

Today, and following the trend of Industry 4.0, the condition monitoring of the several assets in companies has become very important. Enging has developed a completely disruptive monitoring platform, ePreditMntc®, dedicated to the predictive maintenance of electric machines. These valuable assets are the workhorse of modern industry.

Exclusively using electric variables, Enging develops disruptive, non-invasive and real-time monitoring solutions, that allow for an extremely precocious and accurate online fault detection through a mathematical and deterministic algorithm, in constant development by its research and technological development team. Our customers can effectively manage the performance of their assets, anticipate future breakdowns, avoid unplanned downtime and extraordinary costs to their activity.

Oriented by the constant search for innovation as a pillar of its technological developments, Enging offers a pioneering technology in the market and is fully committed to the continuous development of new and disruptive monitoring techniques, with the goal to provide more efficient and effective solutions to the market.

It is also necessary to claim that Enging - Make Solutions S.A. assumes a commitment to quality, through the development of an organizational structure, which is implemented by a Standardized Quality System. This means that the company is certified by NP EN ISO 9001 - which gives Enging - Make Solutions S.A. a status of compliance with the international standard of good practices.

Enging's Value Proposition

Optimize asset life cycle management
Maximize machine lifespan
Prevent catastrophic failures

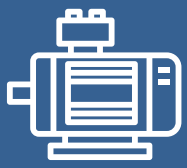
~80%
Detection of future potential faults

~25%
Reduction in regular maintenance costs

~70%
Decrease in unplanned downtime

~15%
Reduction in energy waste

Numerous Applications


Rotating Machines


Transformers


Power Converters


Solar PV Farms


Wind Turbines


Battery Storage

ePreditMntc®

Online Asset Monitoring Platform

PreditMot PreditTransf PreditGen PreditPV PreditWindT PreditBS

Rotating Machines | Transformers | Power Converters | Solar PV Farms | Wind Turbines | Battery Storage

Non-invasive sensors capture electric variables (voltage and current signals) from a variety of mission-critical electric assets

Data Acquisition → Remote Monitoring → User Interface → FAULT DIAGNOSIS, POWER QUALITY, ENERGY EFFICIENCY

Gateway → Server

Enging's online, real-time monitoring platform provides users with timely, sensitive, and reliable fault diagnosis.

PreditMot

ROTATING MACHINES

This solution is based on a continuous remote monitoring system, permanently accessible from any location with internet access, and which allows users to monitor and intervene in real time. Based on the easily measurable electrical quantities acquisition, this approach can be used in all applications, including those where physical access to the motors is limited (eg. submersible pumps or motors in restricted areas). Under these conditions, typical monitoring techniques based on vibration and temperature analysis cannot be applied.

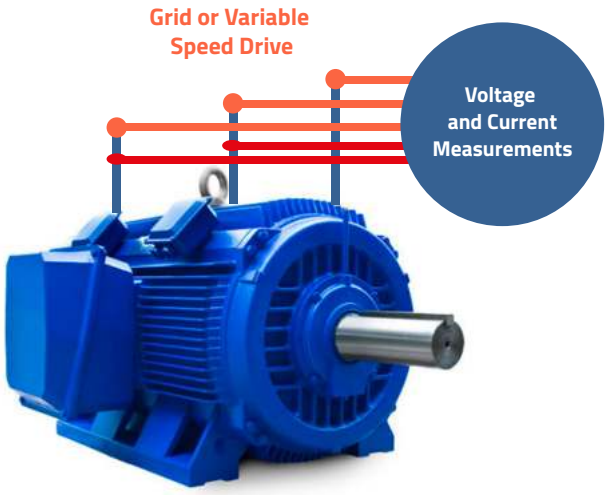
MONITORING APPROACHES FOR ELECTRIC MOTORS

THREE-PHASE MOTORS

LOW OR MEDIUM VOLTAGE

INDUCTION / ASYNCHRONOUS / SYNCHRONOUS

WITH / WITHOUT VARIABLE SPEED DRIVE



SOLUTION HIGHLIGHTS PROVIDE INDUSTRY LEADING SOLUTIONS

ONLINE CONTINUOUS MONITORING:

- 10 second of data acquisition (2500 points per second);
- Periodicity from two minutes to hours.

ALGORITHM CALCULATIONS:

- Electric parameters (voltage, current, power, THD, etc.);
- Mechanical parameters (Speed, slip, shaft power, efficiency);
- Electric Park's Vector analysis;
- Advanced instantaneous power analysis.

BEHAVIOR:

- Initial commissioning using motor nameplate information;
- Fine-tunning of specific load/process parameters;
- Fault diagnosis is done by evaluating Severity Indexes.

FIRST RESULT COMES IN 10/15 MINUTES AFTER COMMISSIONING.

How it works?

In order to the PreditMot system work properly, the acquisition of all these variables will be done simultaneously and synchronously within time intervals of 5 minutes (or more, depending on the customer's preferences), with a period of 10 seconds at a rate of 2.500 samples per second, for each analogue variable. All the relevant data related to the motor's operating condition is presented to the user in a web platform, showing the fault degree and power quality parameters of each asset, individually.

Faults detected:

POWER SUPPLY:
Voltage unbalance;
Variable speed drives and soft starters malfunction;
High harmonic distortion.

STATOR:
Asymmetry in the stator circuit due to the natural aging of the windings / short circuits and / or problems in the magnetic circuit (hot spots).

ROTOR:
Easily differentiation between load oscillations and rotor problems;
Asymmetry in the rotor circuit due to broken bars / connecting rings and / or problems in the magnetic circuit (hot spots);
Unbalance in starting resistors (in winding rotor motors).

ECCENTRICITY / MECHANICAL PROBLEMS:
Rotor eccentricity/bending;
Shaft bending;
Motor/load misalignment;
Loose foundation such as soft foot/loose bolts.

LOAD PROBLEMS:
Mechanical problems in belt/pulleys systems;
Gearboxes;
Strong load oscillations.

Energy efficiency

Taking advantage of the fact that the electrical consumptions of the motor are being measured, energy efficiency improvement data will also be provided, both in the motor power supply and in the motor itself.

Predit**Transf**

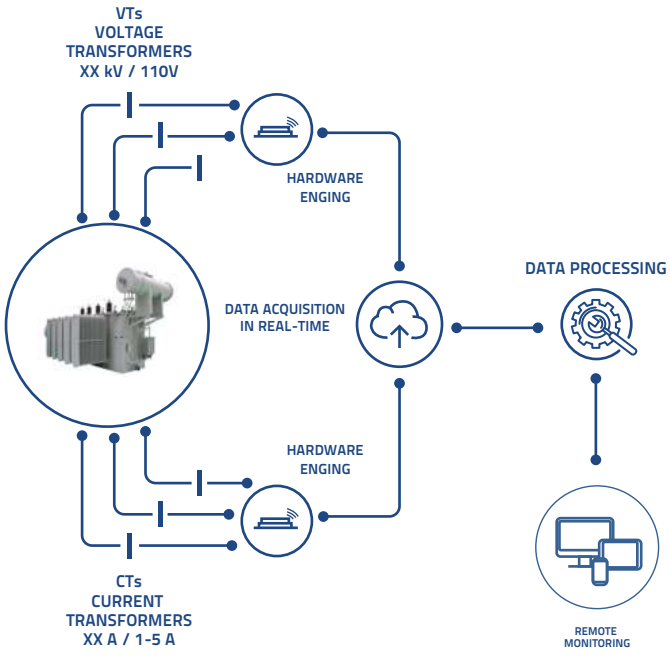
POWER TRANSFORMERS

This solution is based on a real-time monitoring system that can be accessible from any location with internet access, allowing the users to view real-time data and act immediately under the presence of an early fault. Since it is just based on the measurement of electrical variables, this approach is much more advantageous when compared to the traditional techniques.

SOLUTION - DIAGNOSTIC TECHNICS BASED ON **ELECTRIC ANALYSIS**

Data Acquisition | Algorithm | Results

SIMPLE INSTALLATION



ALGORITHMS

- Mathematical model that allows the calculation of all the transformer's internal parameters;
- Analysis of the excitation current;
- Analysis of the short-circuit inductance;
- Analysis of the transformer turns ratio;
- Analysis of the OLTC dynamic impedance;
- Analysis of the harmonics;
- Analysis of the in-rush current.

Enging does it online and in real-time using a non-invasive , proven technique.

ALL IN 3 SECONDS.

How it works?

To perform the diagnostic of a power transformer, Enging's solutions needs to process the variables listed below:

- Three-phase primary voltages;
- Three-phase secondary voltages;
- Three-phase primary currents;
- Three-phase secondary currents;
- Digital signal of the OLTC tap changing order (raise and lower orders);
- Digital signal of actual tap position.

In order to the PreditTransf system work properly, the acquisition of all these variables will be done simultaneously and synchronously within time intervals of 3 seconds to 1 minute (or more, depending on the customer's preferences), with a period of 1 second at a rate of 25.000 samples per second, for each analogue variable. All the relevant data related to the power transformer's operating condition is presented to the user in a web platform, showing the fault degree and power quality parameters of each asset, individually.

The algorithm has the ability to calculate and evaluate very specific parameters of this type of equipment, which are usually evaluated by means of offline tests, by putting some diagnostic techniques to work in an online basis. Some of these techniques concern the analysis of the following parameters:

- Excitation current;
- Short-circuit inductance;
- Transformer turns ratio;
- On-load tap changer dynamic impedance;
- Voltage and current phasors;
- Harmonics;
- In-Rush Current.

With this diagnostic system, faults can be detected in the **transformer windings (short circuits between turns, degradation of the winding insulation system and hot spots), in the ferromagnetic core and faults in the on-load tap changer.**

Predit**Transf**

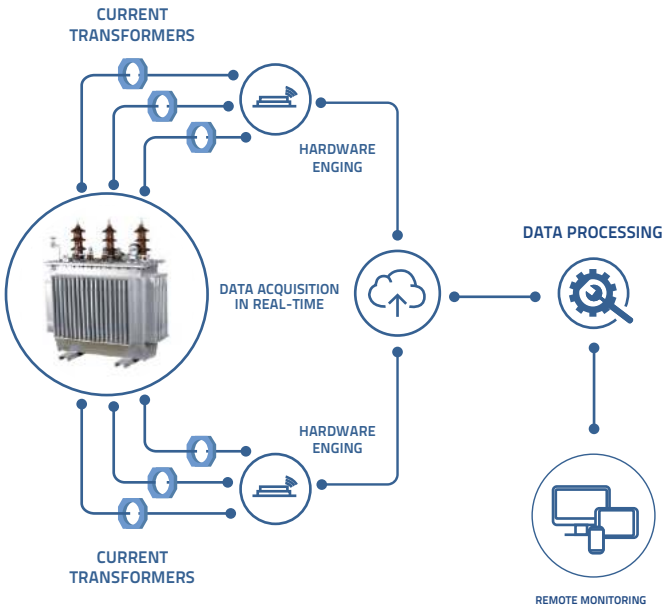
DISTRIBUTION TRANSFORMERS

This solution was developed with the aim to achieve a new technological development in the field of distribution transformers monitoring. It is intended to be a future reference for the predictive maintenance (early detection of faults) of distribution transformers. This solution is based on a continuous monitoring system that can be accessible from any location with internet access, allowing the users to view real-time data and act very quickly under the presence of an early fault. Since it is just based on the easy measurement of electric variables, this approach is much more advantageous when comparing to the traditional techniques based on the oil dissolved gas analysis. Moreover, it can be applied to all type of transformers Oil or Dry-type)

SOLUTION - DIAGNOSTIC TECHNICS BASED ON **ELECTRIC ANALYSIS**

Data Acquisition | Algorithm | Results

SIMPLE INSTALLATION



ALGORITHMS

- Mathematical model that allows the calculation of all transformer's internal parameters;
- Analysis of the excitation current;
- Analysis of the transformer turns ratio;
- Analysis of the harmonics.

Enging does it online and in real-time using a non-invasive, proven technique

ALL IN 15 MINUTES.

How it works?

To perform the diagnostic of a transformer, Enging's solutions needs to process the variables listed below:

- Three-phase primary current;
- Three-phase secondary current.

In order to the PreditTransf system work properly, the acquisition of all these variables will be done simultaneously and synchronously within time intervals of 5 minutes (or more, depending on the customer's preferences), with a period of 1 second at a rate of 20.000 samples per second, for each analogue variable. All the relevant data related to the Transformer's operating condition is presented to the user in a web platform, showing the fault degree and power quality parameters of each asset, individually.

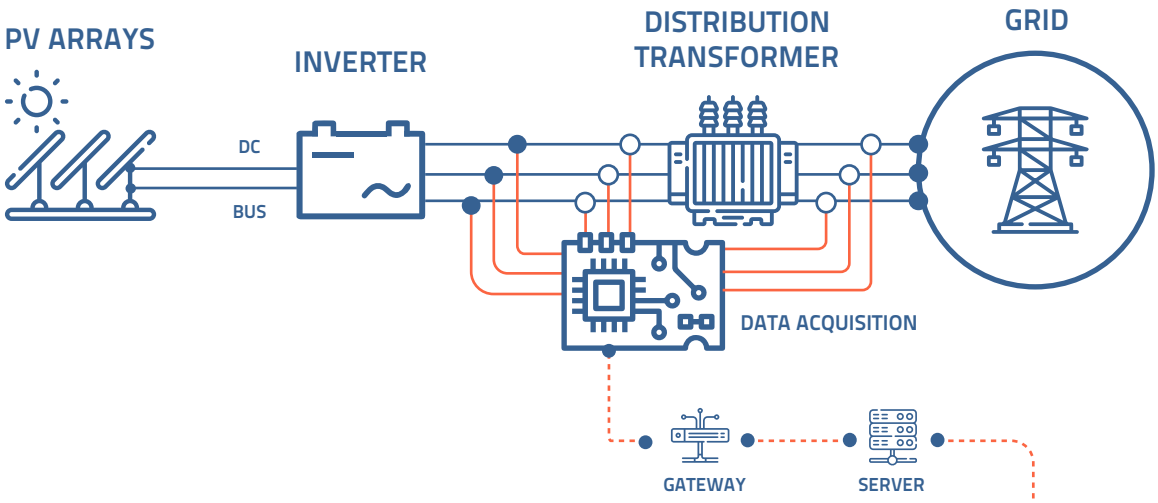
The developed diagnostic system detects main degradation symptoms and faults at the windings and magnetic core of the transformer:

- Windings (turn-to-turn incipient short-circuits, faulty leakage currents);
- Core (hot spot problems, physical deformations);
- High Harmonic Distortion;
- Undesirable Harmonics;
- Current unbalance.

Predit**PV**

SOLAR PV FARMS

This solution is based on a real-time monitoring system that can be accessible from any location with internet access, allowing the users to view real-time data and act immediately under the presence of an early fault. Since it is just based on the measurement of electrical variables, this approach is much more advantageous when compared to the traditional techniques.



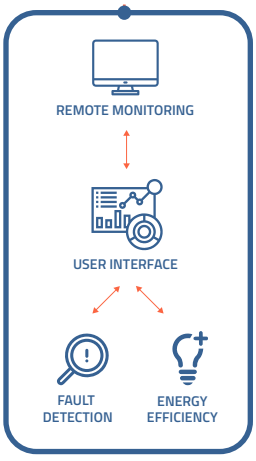
ALGORITHMS

DISTRIBUTION TRANSFORMER

- Mathematical model that allows the calculation of all the transformer's internal parameters;
- Analysis of the excitation current;
- Analysis of the transformer turns ratio;
- Analysis of the harmonics.

INVERTER

- Electric parameters (voltage, THD, unbalance etc.);
- Electric Park's Vector analysis;
- Advanced instantaneous power analysis;
- Harmonics analysis.



Enging does it online and in real-time using a non-invasive, proven technique

ALL IN 15 MINUTES.

How it works?

To perform the diagnostic of a solar inverter and a transformer, Enging's solutions needs to process the variables listed below:

Three-phase solar inverter voltage;

Three-phase primary current;

Three-phase secondary current.

In order to the PreditPV system work properly, the acquisition of all these variables will be done simultaneously and synchronously within time intervals of 5 minutes (or more, depending on the customer's preferences), with a period of 1 second at a rate of 20.000 samples per second, for each analogue variable. All the relevant data related to the Solar Inverter and Transformer's operating condition is presented to the user in a web platform, showing the fault degree and power quality parameters of each asset, individually.

The developed diagnostic system detects the following main degradation symptoms and faults:

Solar Inverters

- Power electronics (transistor open-circuit faults, intermittent PWM switching failures, switching voltage spikes);
- Voltage unbalance;
- High Harmonic Distortion;
- Undesirable Harmonics;
- DC voltage problems.

Distribution Transformers

- Windings (turn-to-turn incipient short-circuits, faulty leakage currents);
- Core (hot spot problems, physical deformations);
- High Harmonic Distortion;
- Undesirable Harmonics;
- Current unbalance.

Energy efficiency

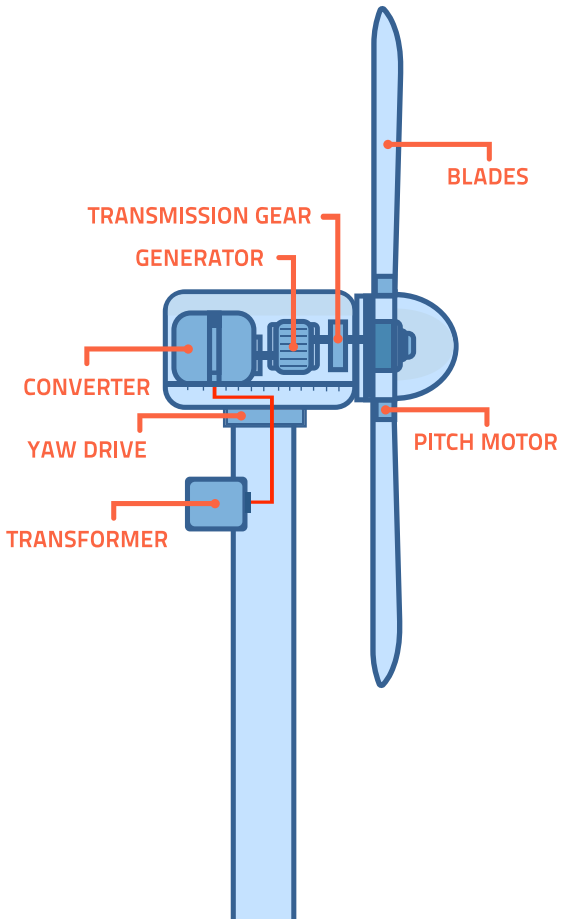
Taking the advantage of the measured electric parameters, it will also be provided data for improvement and indicators of the quality of energy of the electric power supply.

PreditWindT

WIND FARMS

This solution is based on a real-time monitoring system that can be accessible from any location with internet access, allowing the users to view real-time data and act immediately under the presence of an early fault. Since it is just based on the measurement of electrical variables, this approach is much more advantageous when compared to the traditional techniques.

Predit WindT diagnoses and pinpoint faults at the main electric and mechanic components of a wind Turbine



GENERATOR

POWER ELECTRONICS

GEARBOX

PITCH AND YAW MOTORS

TRANSFORMER

ALGORITHMS

DISTRIBUTION TRANSFORMER

- Mathematical model that allows the calculation of all the transformer's internal parameters;
- Analysis of the excitation current;
- Analysis of the transformer turns ratio;
- Analysis of the harmonics.

POWER ELECTRONICS, ROTATION MACHINES AND GEARBOX

- Electric parameters (voltage, THD, unbalance etc.);
- Electric Park's Vector analysis;
- Advanced instantaneous power analysis;
- Harmonics analysis.

How it works?

To perform a fault diagnosis, Enging's solution needs to mainly process the following variables:

MV Distribution transformer's currents;

LV Distribution transformer's currents (all windings);

Generator's stator voltages;

Generator's stator currents;

Generator's rotor current;

Power converter voltages;

Generator's speed.

In order to the PreditWindT system work properly, the acquisition of all these variables will be done simultaneously and synchronously within time intervals of 5 minutes (or more, depending on the customer's preferences). The acquisition is interspersed between periods of 1 second and a sampling frequency of 25,000 samples per second and 10 seconds at a sampling rate of 2,500 samples per second for each variable. All the relevant data related to the motor's operating condition is presented to the user in a web platform, showing the fault degree and power quality parameters of each asset, individually.

The developed diagnostic system detects the following symptoms of degradation and malfunctions in the following components:

Generator

- Problems in the stator windings (short-circuits between turns and to ground);
- Problems in the magnetic-circuit (hot spots);
- Problems in the rotor bars;
- Problems in the rotor connecting rings;
- Rotor eccentricity;
- Shaft bending;
- Misalignment between generator and gearbox;
- Contamination;
- High level bearing failures;
- Loose foundation such as soft foot/loose bolts
- Problems resistors (in winding rotor motor).

How it works?

Mechanic Problems

- Problems in the gearboxes;
- Strong load oscillations due to wind fluctuations.

Power Electronics

- Power electronics (transistor open-circuit faults, intermittent PWM switching failures, switching voltage spikes);
- Voltage unbalance;
- High Harmonic Distortion;
- Undesirable Harmonics;
- DC voltage problems.

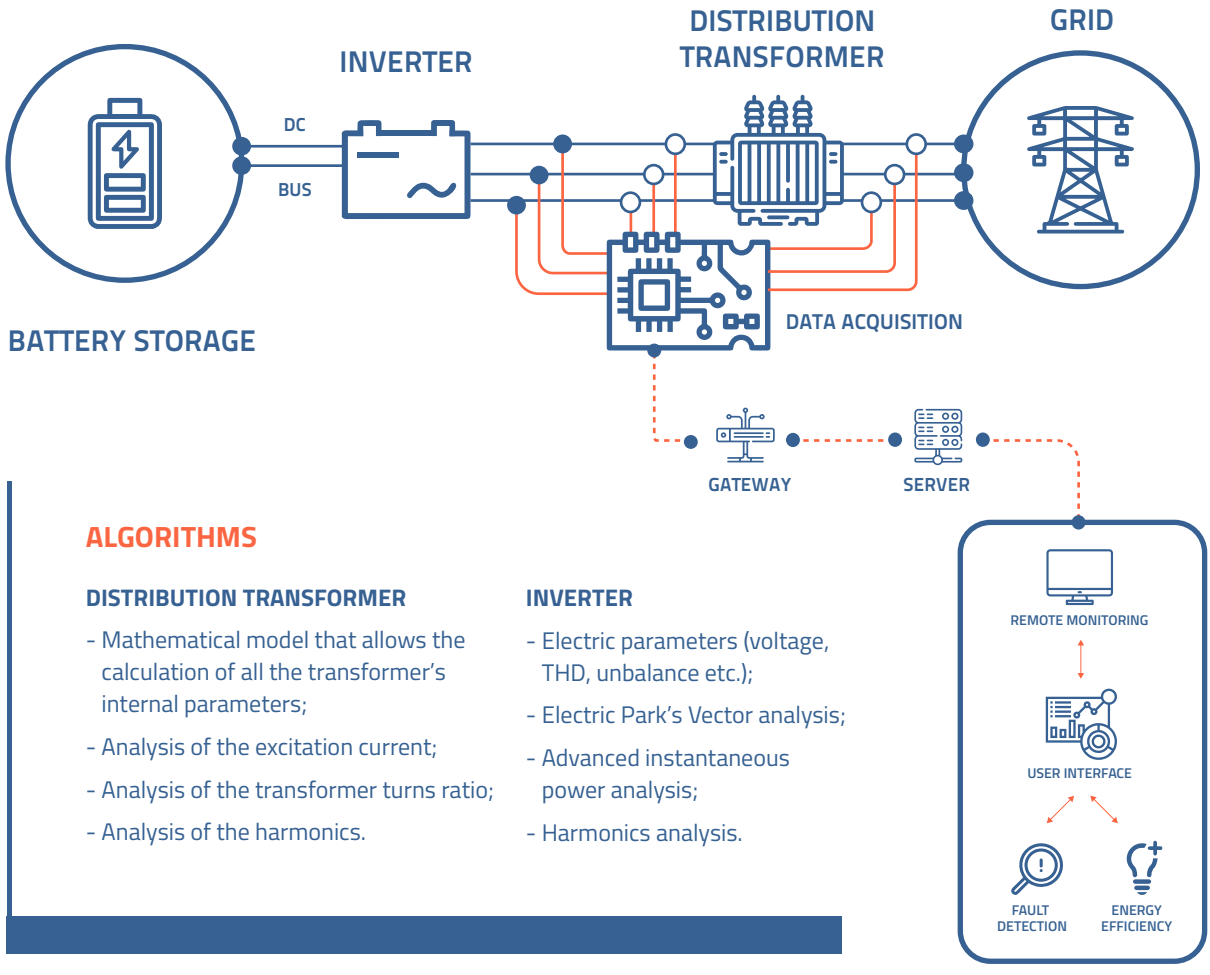
Transformer

- Windings (turn-to-turn incipient short-circuits, faulty leakage currents);
- Core (hot spot problems, physical deformations);
- High Harmonic Distortion;
- Undesirable Harmonics;
- Current unbalance.

PreditBS

BATTERY STORAGE

This solution is based on a real-time monitoring system that can be accessible from any location with internet access, allowing the users to view real-time data and act immediately under the presence of an early fault. Since it is just based on the measurement of electrical variables, this approach is much more advantageous when compared to the traditional techniques.



ALGORITHMS

DISTRIBUTION TRANSFORMER

- Mathematical model that allows the calculation of all the transformer's internal parameters;
- Analysis of the excitation current;
- Analysis of the transformer turns ratio;
- Analysis of the harmonics.

INVERTER

- Electric parameters (voltage, THD, unbalance etc.);
- Electric Park's Vector analysis;
- Advanced instantaneous power analysis;
- Harmonics analysis.

How it works?

To perform the diagnostic of a Battery Storage inverter and a transformer, Enging's solutions needs to process the variables listed below:

Three-phase Battery Storage inverter voltage;

Three-phase primary current;

Three-phase secondary current.

In order to the PreditBS system work properly, the acquisition of all these variables will be done simultaneously and synchronously within time intervals of 5 minutes (or more, depending on the customer's preferences), with a period of 1 second at a rate of, at least, 20.000 samples per second, for each analogue variable. All the relevant data related to the Battery Storage inverter and Transformer's operating condition is presented to the user in a web platform, showing the fault degree and power quality parameters of each asset, individually.

The developed diagnostic system detects the following main degradation symptoms and faults:

Battery Storage inverters

- Power electronics (transistor open-circuit faults, intermittent PWM switching failures, switching voltage spikes);
- Voltage unbalance;
- High Harmonic Distortion;
- Undesirable Harmonics;
- DC voltage problems.

Distribution Transformers

- Windings (turn-to-turn incipient short-circuits, faulty leakage currents);
- Core (hot spot problems, physical deformations);
- High Harmonic Distortion;
- Undesirable Harmonics;
- Current unbalance.

Energy efficiency

Taking the advantage of the measured electric parameters, it will also be provided data for improvement and indicators of the quality of energy of the electric power supply.

Benefits

REDUCING MAINTENANCE COSTS WHILE CONTINUOUSLY INCREASING PRODUCTIVITY

~25%
Reduction in regular maintenance costs

~70%
Decrease in unplanned downtime

~15%
Reduction in energy waste

~35%
Decrease in stoppage time

~80%
Detection of future potential faults

~25%
Increase of Overall Efficiency

BETTER CUSTOMER EXPERIENCE

COSTS REDUCTION

LESS RISK PEOPLE EXPOSURE

LOW CARBON TECH

BETTER MAINTENANCE

BETTER EFFICIENCY

INCREASED PRODUCTIVITY

Business models

WE OFFER A VERY FLEXIBLE WAY TO WORK TOGETHER

ONLINE MONITORING

SaaS - Solution as a Service
Software licenses and hardware renting

One-Time
Software license and hardware selling

MONITORING SERVICES

MaaS - Monitoring as a Service
24/7 Monitoring Service

Helth Checkup service
Punctual diagnostic service

PORTABLE EQUIPMENT

Online Monitoring equipment
24/7 Monitoring Service

Health Checkup Monitoring equipment
Punctual Inspection

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