

POWER TRANSFORMER



ABOUT ELSEWEDY ELECTRIC INDONESIA

Elsewedy Electric Indonesia is a subsidiary of Elsewedy Electric Group, a leading global provider of energy, digital and infrastructure solutions company based in Egypt

Up to

400^{MVA}

500^{kV}

Power Transformer

With more than 80 years of experience, Elsewedy Electric Group operate in five key business sectors: Wire, Cable & Accessories, Electrical Products, Engineering & Construction, Digital Solutions, and Infrastructure Investments.

Elsewedy Electric Indonesia is a regional hub to serve Indonesia, Australia, New Zealand, Malaysia, Vietnam, Philippine and other Southeast Asia and Pacific region.

Being well-known for our End-to-End Solutions for EPC and products of Power Transformer and Mobile Substation, Elsewedy Electric Indonesia provides design, manufacture, delivery, installation, commissioning, and servicing with exceptional expertise and service to our customers, and communities, safely, and efficiently. Our products are equipped with the best European technology used worldwide and individually designed for needs and applications with all international and national standards but not limited to IEC, IEEE/ANSI, NEMA, S-PLN, BS, AS & NZS, DIN, and ASTM.

Supported by well qualified Engineers, Elsewedy Electric Indonesia offers innovative, reliable and efficient Transformer solutions. Advanced computer systems, design techniques and simulation of the field conditions contribute to rapid product development ensuring enhanced reliability that are critical to Transformers.

Our factory is equipped with first-class manufacturing capabilities fully integrated with internal manufacturing processes with modern machinery. Being the only manufacturer in Indonesia capable of producing Mobile Substations, our factory annual capacity is 10,500 MVA up to 400 MVA and 500kV production sizes.

PRODUCT RANGE

Elsewedy Electric Indonesia provide a wide range of product :

Product Range	Power (MVA)	Voltage (kV)	BIL (kVp)
Power Transformer (Three phase)	400	400	1425
Power Transformer (single phase)	250	500	1550
Generator Step-Up Transformers	400	400	1425
Auto-Transformers	400	400	1425
Trackside Transformers	50	220	1050
Shunt Reactors*	100	275	1050
Mobile Transformers	100	275	1050
Transformer Refurbishment/Service/Retrofit/Site Repair Uprating*	400	400	1425

**subject to specification detail and agreement*

ELSEWEDY
ELECTRIC



DESIGN AND COMPETENCIES

Our experience and expertise in high complexity and tailored design requirements enables us to work excellently.

Cost-Effective Universal Transformer Solution

Single universal transformer design can serve various power generations sites at once while at the same time can be utilized as strategic spare for various locations.

Flexible and Upgradable

Designed to meet a wide variety of technical requirements, we provide fully customizable options. Through various drawings study and in-depth discussion with customer, our solution can be implemented on the existing foundation through adjustments and upgrades.

Elsewedy Electric Indonesia universal design is developed to accommodate:



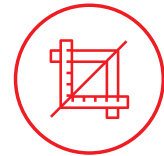
Parallel operation with existing units



Various disconnector link configuration



Various phase sequence



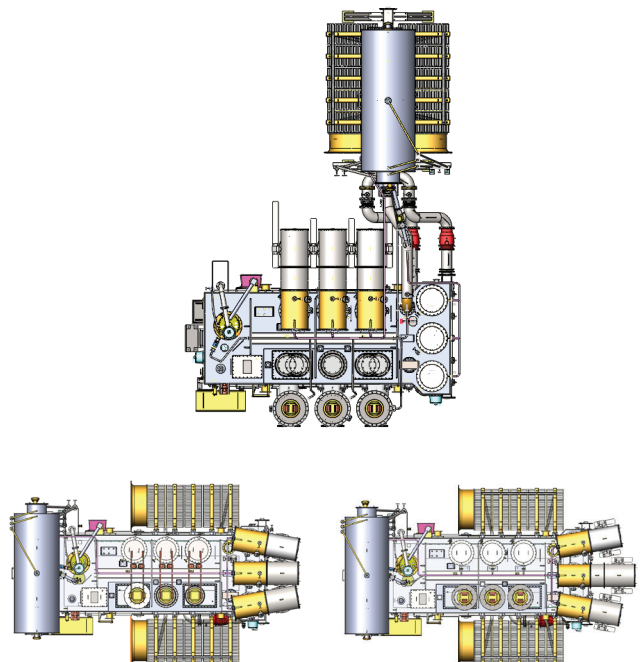
Various layout of HV/LV termination

Universal Transformer

Suitable to fit 5 substation 80/110/150 MVA 132/11kV.



Strategic spare Universal Transformer that we supply for our customer in Malaysia.

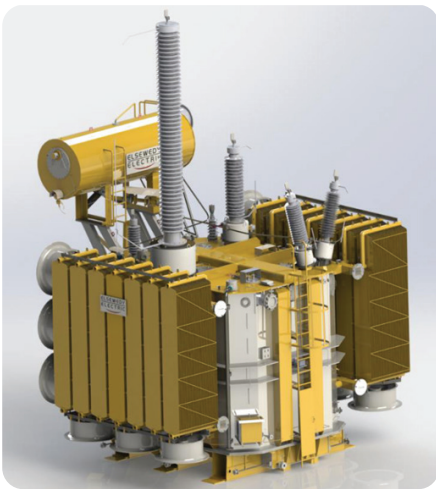


500kV Transformer

A collaboration design for technology transfers, our 500kV design concerned for the material selection

From special laser core type, insulation structure material, resin bonded type conductor, and collector shunt to stray losses in metallic parts. Through strict and through manufacturing process, humidity control, spacer thickness control, winding dimension, and dryness control for insulation materials Elsewedy Electric Indonesia produces high-quality transformer.

This single phase design with two return legs to minimize the height.



As the first 500kV transformer manufacturer in Southeast Asia, Elsewedy Electric Indonesia had produced more than 100 units of 500kV Transformer since 2014.



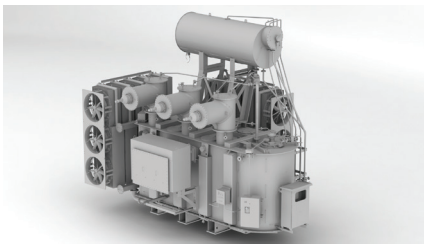
Compact Transformer

Our concern of environment has driven our company to create a compact transformer, designed to preserve least amount of land and supporting infrastructure, reasonable under various circumstances such as high rise building or urban area

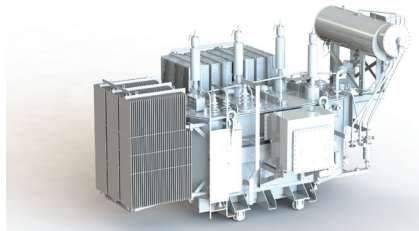
Our compact transformer design saves space and creates easy yet smooth handling with higher efficiency. It ensures and maintains the functionality and quality with competitive value. Why compact design :

- Lighter than the current power transformer
- Applications in renewable energy and high rise building

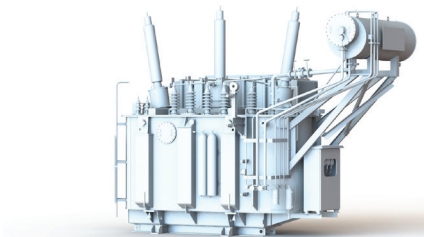
Below is the compact transformer that we delivered for clients. This compact transformer are designed and customized according to customers' requirements without removing important components.



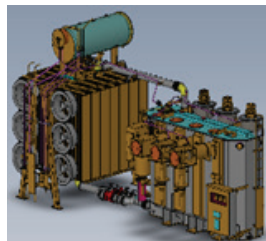
Liverpool S/S, NZ, 75 MVA, 110/ 22kV
Fully directed cooling



Pakuranga S/S, NZ, 120 MVA, 220/33kV
ODAF



Kisaran S/S, Indonesia 30 MVA, 150/20kV
ONAF, zig zag



Yarwun S/S, Aussie 225 MVA, 132/15kV
ODAF, Cooling bank

Green Transformer

Addressing today's and tomorrow's major energy challenges that cover environmental risks, lower emissions, space reduction, and energy efficiency, Elsewedy Electric Indonesia provides a customer-valued network for environmentally friendly solutions.

Our green transformer filled with natural or synthetic ester oil instead of mineral oil. Benefit of Green Transformer are:

- Not flammable
- Biodegradable
- Oxidation stability
- Moisture tolerance
- Saving space on civil works



24 MVA 33/11/6.6 kV at Ward Street Substation, a heritage Substation building in Dunedin NZ

Competencies



Universal Transformer



Low losses design



Low noise: Sound power
<62 dB



Low partial discharge Avg
<30 pC at 1.5 Um/1.58 Ur



Extended Transformer Life



High DP Insulation



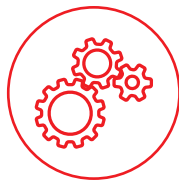
Mobile Transformer



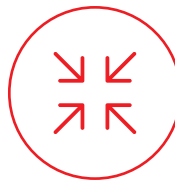
High Seismic Transformer



ODAF and Water cooling



Transformer Management
Systems



Compact Transformer



Double Stock Transformer

Our products are designed with the best European technology used worldwide and individually to meet various technical requirements and features with full customization options. Comply with various international and national standards, Elsewedy Electric Indonesia delivers reliable performance and environmentally friendly solution.

Every transformer is individually designed, customized to its specific requirements and application. The following specially-developed computer programs are used to further ensure the reliability of the product by:

- Optimization of design in relation to quality, cost, losses, sound level, and other technical aspects.
- Distribution of voltage stresses during lightning impulse and switching surge conditions.
- Behaviour during short-circuit conditions.
- Analysis of those areas where high electrical stress can occur.
- Calculations of stray losses and thermal effects.
- A static or a dynamic design analysis for seismic to prove that the capability of power transformer in seismic condition.

TECHNOLOGY TRENDS

Elsewedy Electric Indonesia pays detail attention to the key components of Power Transformers in today's utility needs, especially the electric power network throughout people's lives and connectivity.

We believe that the longevity of Power Transformer plays a major impact on grid reliability and profitability. Seeing the necessities of life, Elsewedy Electric Indonesia Power Transformers are upgradable and equipped with all aspects of these technologies.

Low Losses Design

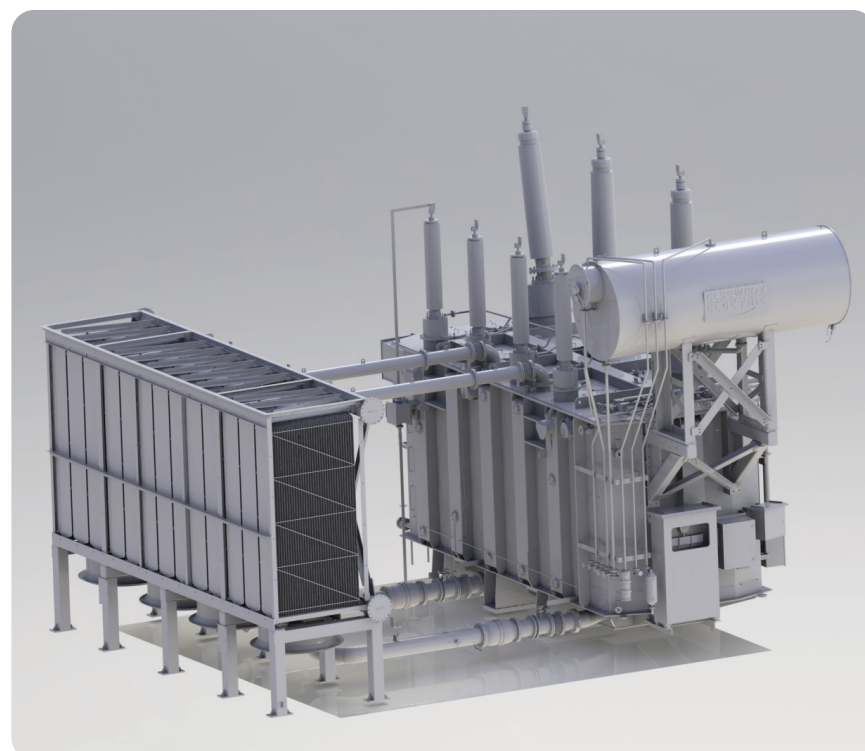
The procedure for improving the accuracy of calculated total losses is the basis of the proposed total loss calculation associated with the temperature rise evaluation.

The optimization technique is based on the genetic algorithms. This proposed design is suitable economical transformer design with very flexible total loss value options for specific purpose, achieving low loss design by using this:

- Using netting Tape Continuous Transposed Cable (CTC) with higher current density, give impact with low gradient temperature
- Using CTC conductor in HV winding, give impact to reduced eddy losses
- Conductor grading in HV winding, give impact to minimizing stray losses
- Low current density in the winding to reduce load losses
- Low flux density in core and use of Hi-B/Laser scribed material to reduce no load losses
- Use of magnetic shunt at tank wall and yoke to reduced stray losses

Low Noise Design

Noise control for better quality of life.



High level of transformers noise is undesirable due to its tonal composition and brings negative effects on people's health and their quality of life. We understand the customer's need for this matter, especially by placing power transformers close to residential areas, the need for low noise transformer arises.

Lowest achievement

<62dB

Low Partial Discharge Transformer Design

Partial Discharge is one of the main contributors to the degradation and failure of insulation systems in all electrical equipment.

Partial discharge is a localized electrical discharge that only partially bridge the insulation between conductors. Partial Discharge is a consequence of the local electric stress voltage concentration either inside of the insulation (internal Partial Discharge) or on the surface of the insulation (Surface Partial Discharge).

If not detected or increased, Partial Discharge may cause dielectric failure of the insulation system and shorten the life of the equipment. This is why Partial Discharge is Important:

- To check the integrity of insulation
- Quality reflection of design, material, process and workmanship of manufacturing
- To ensure the longevity of the Transformer in service
- Main indicator of "Transformer's health"

Experts in Partial Discharge since

1993

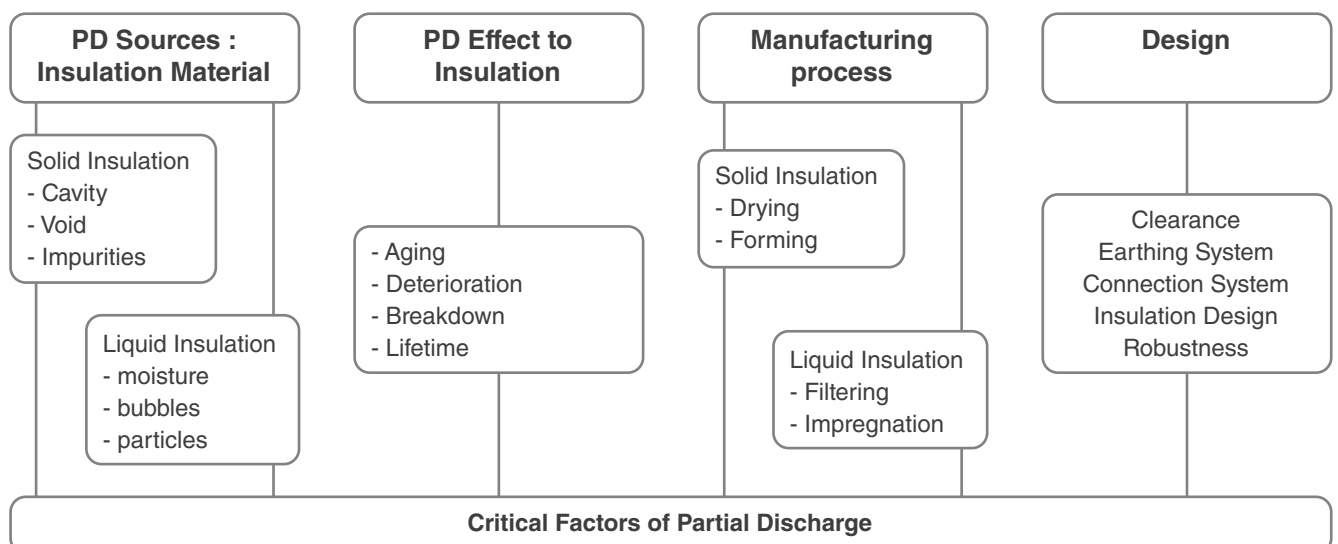
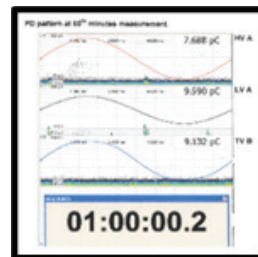
Achievement : average

▼ **30^{pC}** and many units Free PD



IEC acceptance criteria is

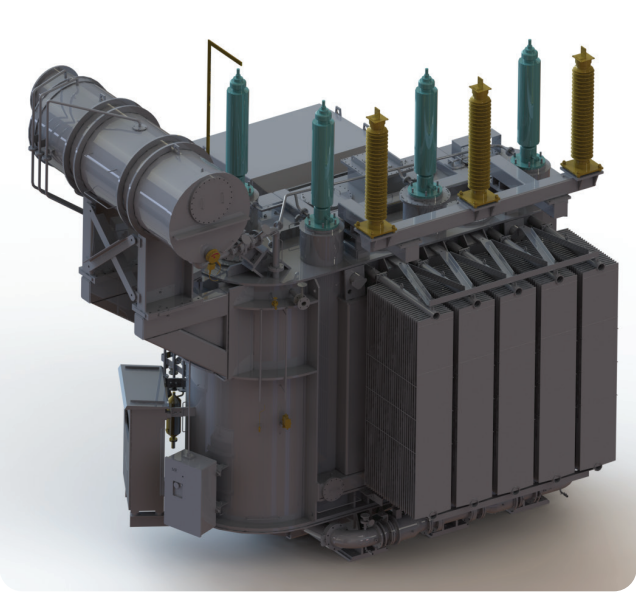
250^{pC} at 1.5 Um/1.58 Ur



High Seismic Transformer Design

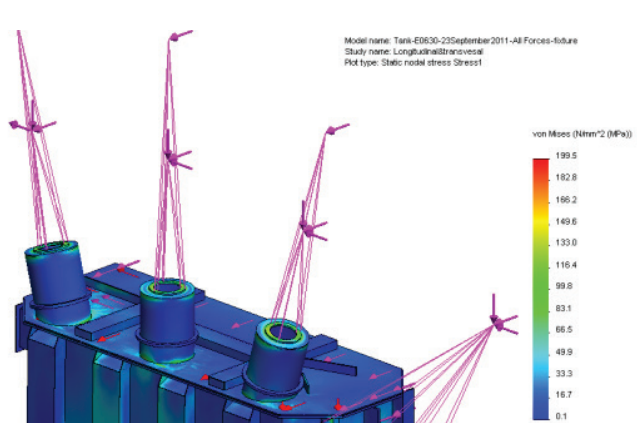
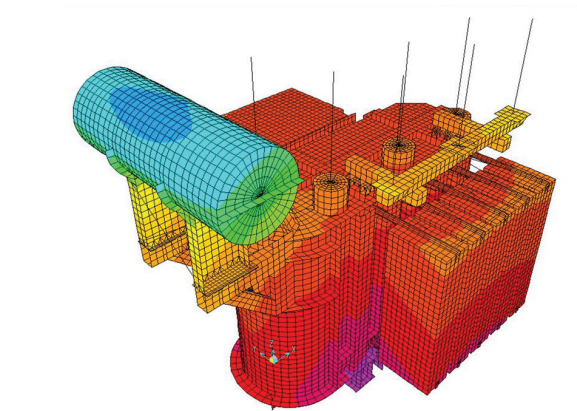
Electrical substations are critical components in the electrical network that supplies power for industrial, business and residential purposes. Several major structural systems exist within these substations, each contributing to the overall functionality of the substation.

Elsewedy Electric Indonesia specifies recommendations for the design and installation of power transformers and reactors to withstand the effects of earthquakes. The calculation and qualification of the seismic response must be based on a numerical analysis using a verified model. One of the components we analyse for seismic compliance is the active part and tank analysis.



The comparison between Normal and High Seismic

Construction	Normal Transformer	High Seismic
Tank and wall steel thickness	8-10 mm	Special
Cover or lid tank thickness	16-20 mm	Special
Reinforcement construction	U bend/ rib	Solid beam
Active part giuder block	Max 3 guider/ axis	More than 3 guider
Radiator construction	3 inch pipe	Increase size & scd
Conservator and support	Cross bracing support	Solid support
Total steel weight	18.500 kg	>26.000 kg



Uses Dynamics Analysis Design Simulation by SAP2000 :

1. Pre stress Analysis
2. Modal Analysis
3. Response Spectrum Analysis

Seismic design comply to IEEE STD 693-2005. Uses digital simulation to know maximum stress and deflection.

Tank Transformer Frequency Above

33^{Hz}

Extended Life Transformer

The life of a power transformer is ultimately dependent on the condition of its solid electrical insulation used in power transformers, and thus estimate the remaining life of the whole unit.

One method to determine the condition of paper is to measure the furan content of the oil to estimate the degree of polymerization of the paper.

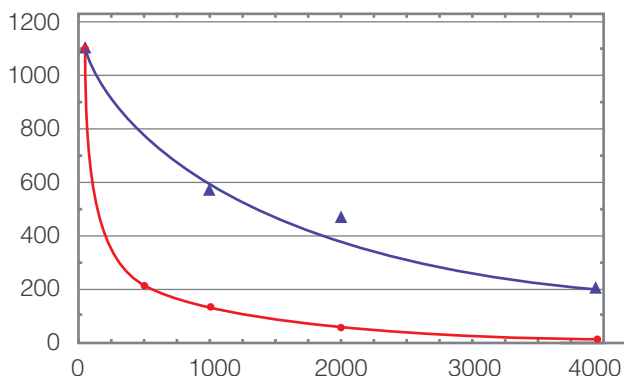
Using Thermally Upgrade Paper

The insulation aging rate of the paper insulation is determined by the hot spot temperature. The use of thermally upgraded paper will reduce the aging rate of the transformer.

Hot Spot Temperature (°C)	Relative Aging Rate as per IEC 60076-7	
	Kraft Paper	Thermally Upgraded
80	0.125	0.036
86	0.250	0.073
92	0.500	0.145
98	1.000	0.282
104	2.000	0.536
110	4.000	1.000
116	8.000	1.830
122	16.000	3.290
128	32.000	5.800
134	64.000	10.100
140	128.000	17.200

DP Range	Remark
<200	Test indicates extensive paper degradation exceeding the critical point. Strongly recommend that the transformer be taken out of service immediately and visually inspected.
200-250	The paper is near or at the critical condition. Recommend that the transformer be taken out of service as soon as possible and thoroughly inspected. Paper samples can be taken for direct DP testing.
260-350	The paper is approaching the critical condition. Suggest inspection be scheduled and/or re-sample within 1 year to reassess condition.
360-450	The paper is starting to approach the critical condition. Suggest a re-sample in 1-2 years time.
460-600	Significant paper deterioration but still well away from the critical point.
610-900	Mild to minimal paper ageing.
>900	No detectable paper degradation.

Degree of Polymerization (DP)

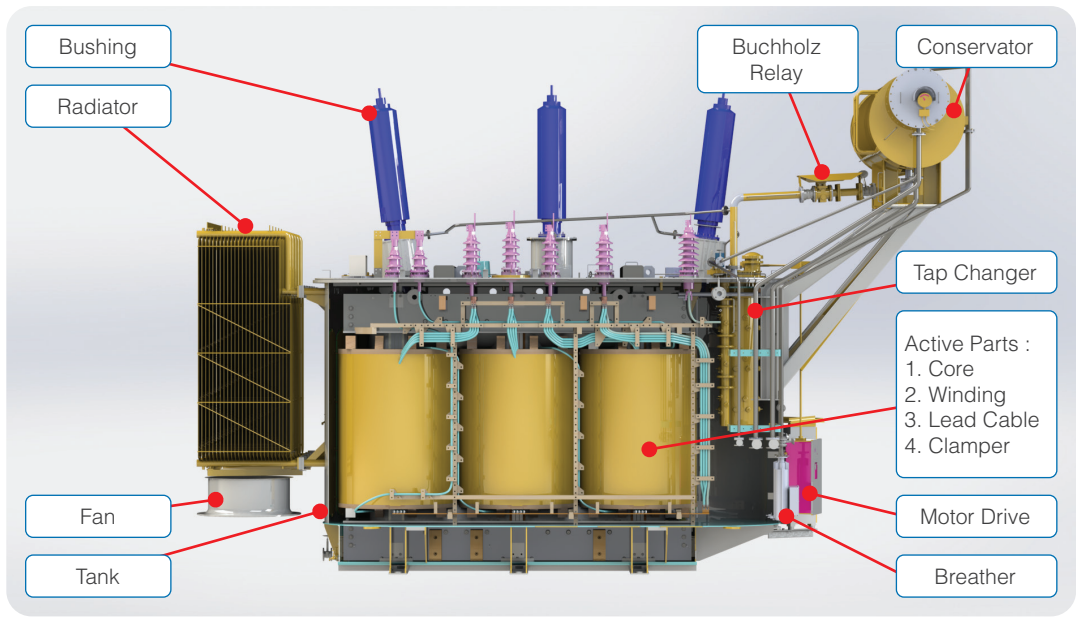


/ Time (h)

▲ Values for thermally upgraded paper

● values for non-thermally upgraded paper

TRANSFORMERS CONSTRUCTION



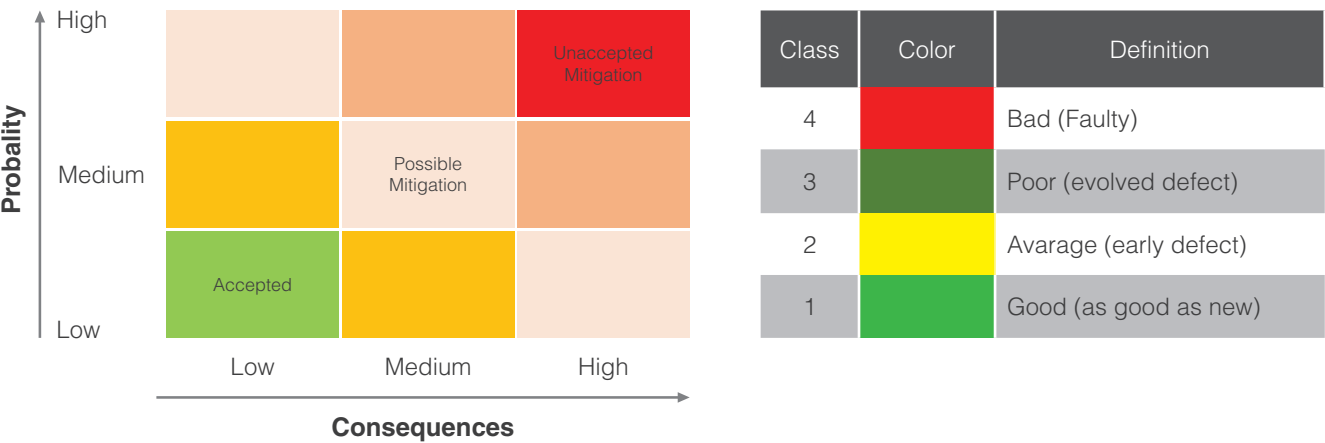
Power Transformer Construction Design

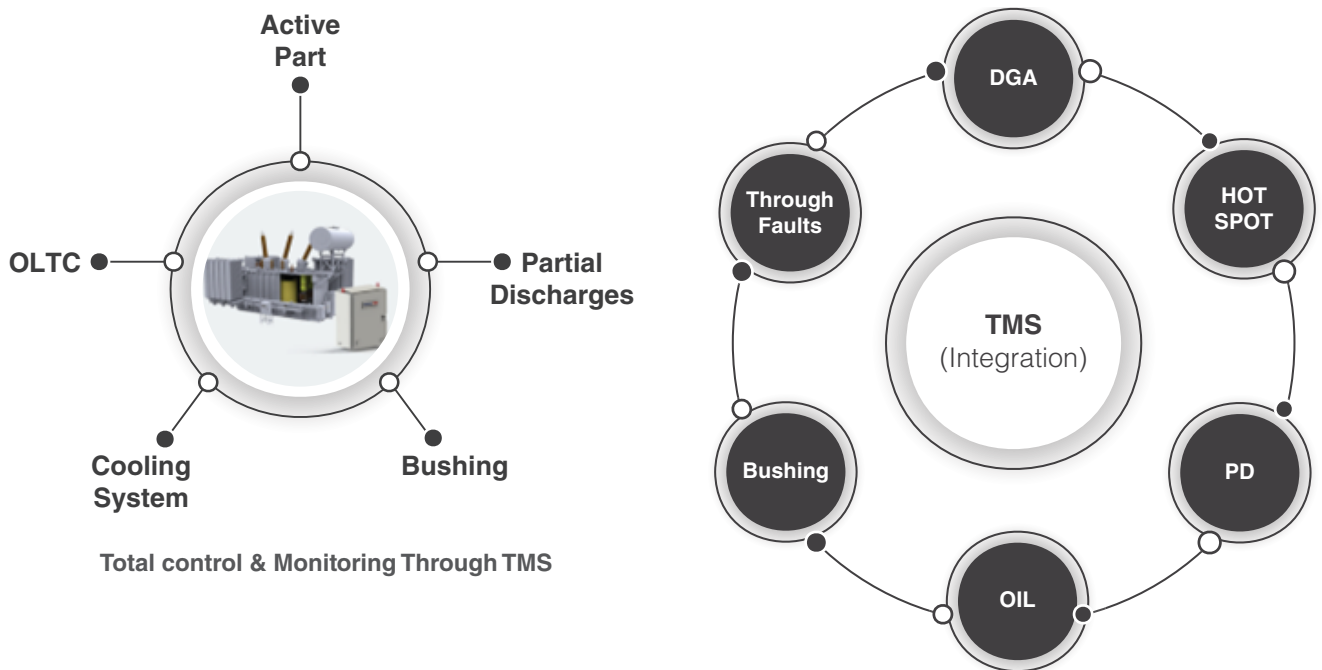
TECHNOLOGY, MONITORING AND CONTROL DEVICES

Technology

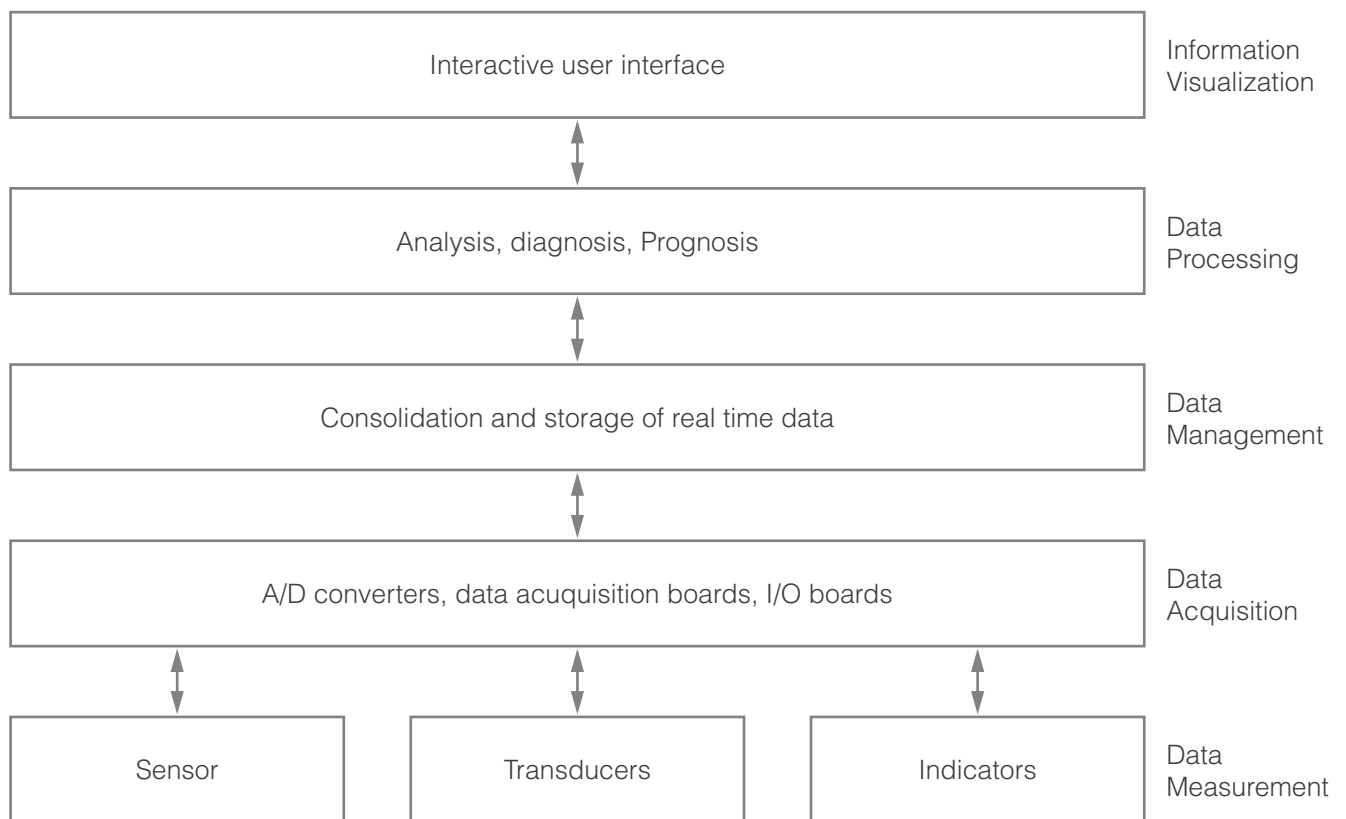
Our Transformers equipped with Transformer Management System (TMS) and Future Ready with up-to-date Technologies, Smart Grid, and Smart System (IoT Products):

Consequences VS Probability



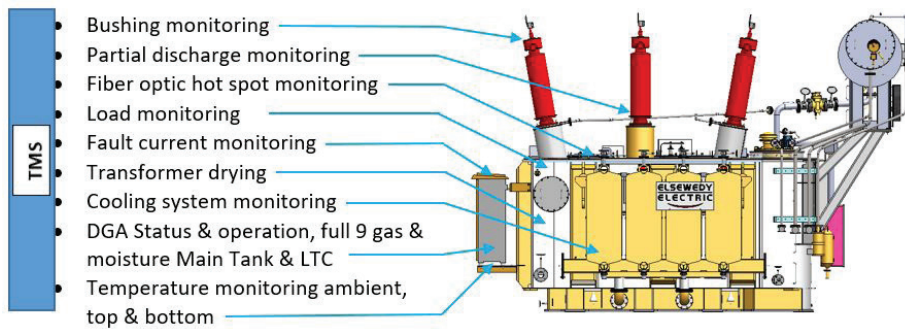


Generic Function Based View of TMS



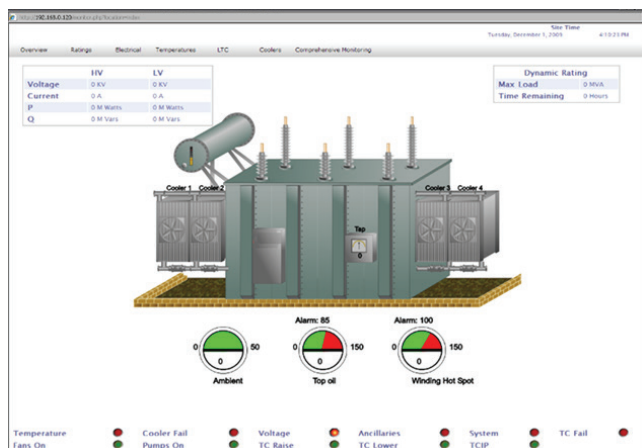
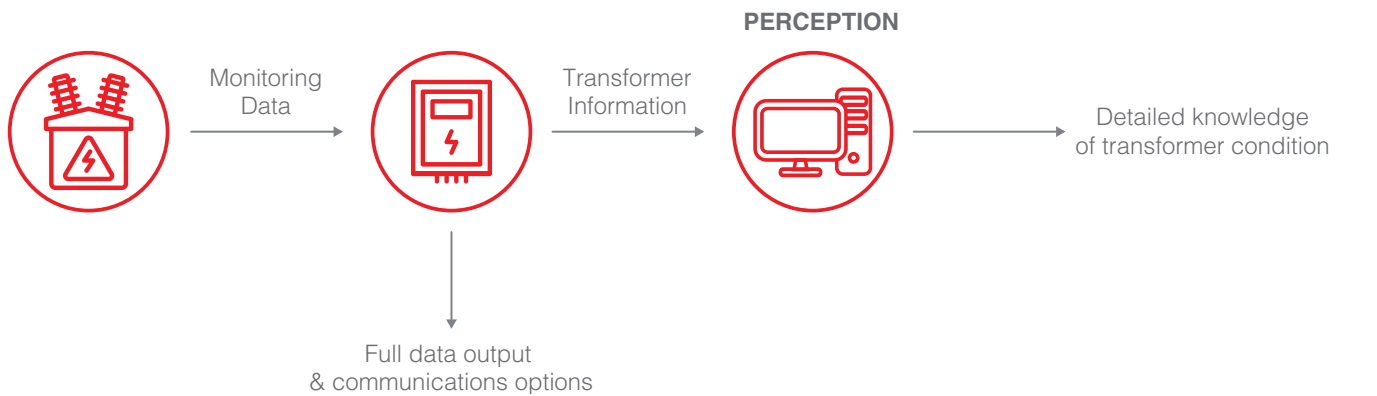
TMS-Integrated Control & monitoring system

The purpose of integrated control and monitoring system is to combine all the control and protection device data to develop the overall visibility of transformer health. Developing the tools to analyse the data to develop Asset Management techniques.



Benefits of TMS:

- Reduce the probability of an unplanned outage with continuous condition monitoring
- Defer replacement costs while maintaining reduced probability of unexpected failures
- Optimize equipment life by monitoring cooling system performance
- Develop maintenance and repair plans based on actual conditions
- Mitigate risks for staff safety and environmental impacts
- Reduce maintenance and monitoring costs
- Better decision making between repair and replacement



The purposes of TMS devices are:

- To ensure the expected operating condition
- To ensure the operational reliability and availability of transformer
- To detect faults and protect the transformer and the subsystem against failure
- To take necessary action in case of unexpected abnormal condition
- To create maintenance strategies
- To reduce the outage time and inconvenience due to unavailability

MANUFACTURING PROCESS

Our factory is certified by ISO 9001, which describes the elements of a quality system designed to ensure that products and services meet all requirements before being delivered to customers.



a. Insulation

In order to maintain the quality of the insulation, we key in and improve the insulation components, kits, also special rooms with air-conditioned rooms to manufacture potential rings and end rings inhouse.



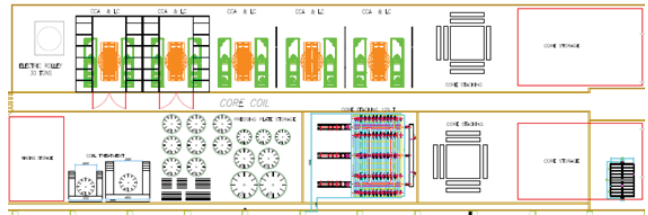
b. Winding

Modern winding machines with adjustable mandrels both Horizontally and Vertically capable of various types of winding and a high experience winder. We also own a dedicated room equipped with an HVAC System which controls the environment room for windings 220kV and above.



c. Core

All cores are stacked, using high-quality grain-oriented silicon steel laminates. Ultra-modern computerized core shear supplies fully mitered, high-efficiency cores. This machines are capable of shearing the maximum width of core steel available today. The core is clamped using structural steel clamps which provide high strength under static (lifting and clamping) and dynamic (short-circuit) mechanical loads.



3 Core Stacking area

5 Core Coil area



d. Active part and drying oven

During the manufacturing Active Part, insulation paper on copper conductors, cylinder pressboard, transformer wood structure, insulation material between windings and insulation parts in supporting structures are exposed to humidity. Vapour Phase Drying (VPD) process will bring the dryness of active part to below 0,5% with a controlled heating process and an intermediate pressure lowering with vacuum on each stage.



e. Final assembly

Our final assembly area is full fitting and equipped with 200 tons Crane and 300 tons Air Cushion.

TEST BAY & OIL LAB FACILITIES



Our Test Bay and Oil Lab facilities able to run several tests such as Complete Routine Test, Type Test, and Special Test up to 400 MVA and 500kV. All transformers are tested in accordance with the latest applicable standards, such as but not limited to:

- Routine, Special, and Type Test as per IEC and ANSI
- Degree Polymerization Measurement of Insulation Paper (In-House)
- Various OIL Test: BDV, Tan Delta, Particle Count, Water Content, DGA
- Inter-strand checks of CTC and Parallel Insulated Wires
- Insulation Resistance Measurement of Active Part Insulation (Megger Test)
- Full Vacuum Test
- Pressure / Oil Leakage Test
- Paint Thickness Measurement
- Dew Point Measurement
- Conductivity of Insulation Paper and Board by Aqueous Extraction

Up to

400^{MVA}

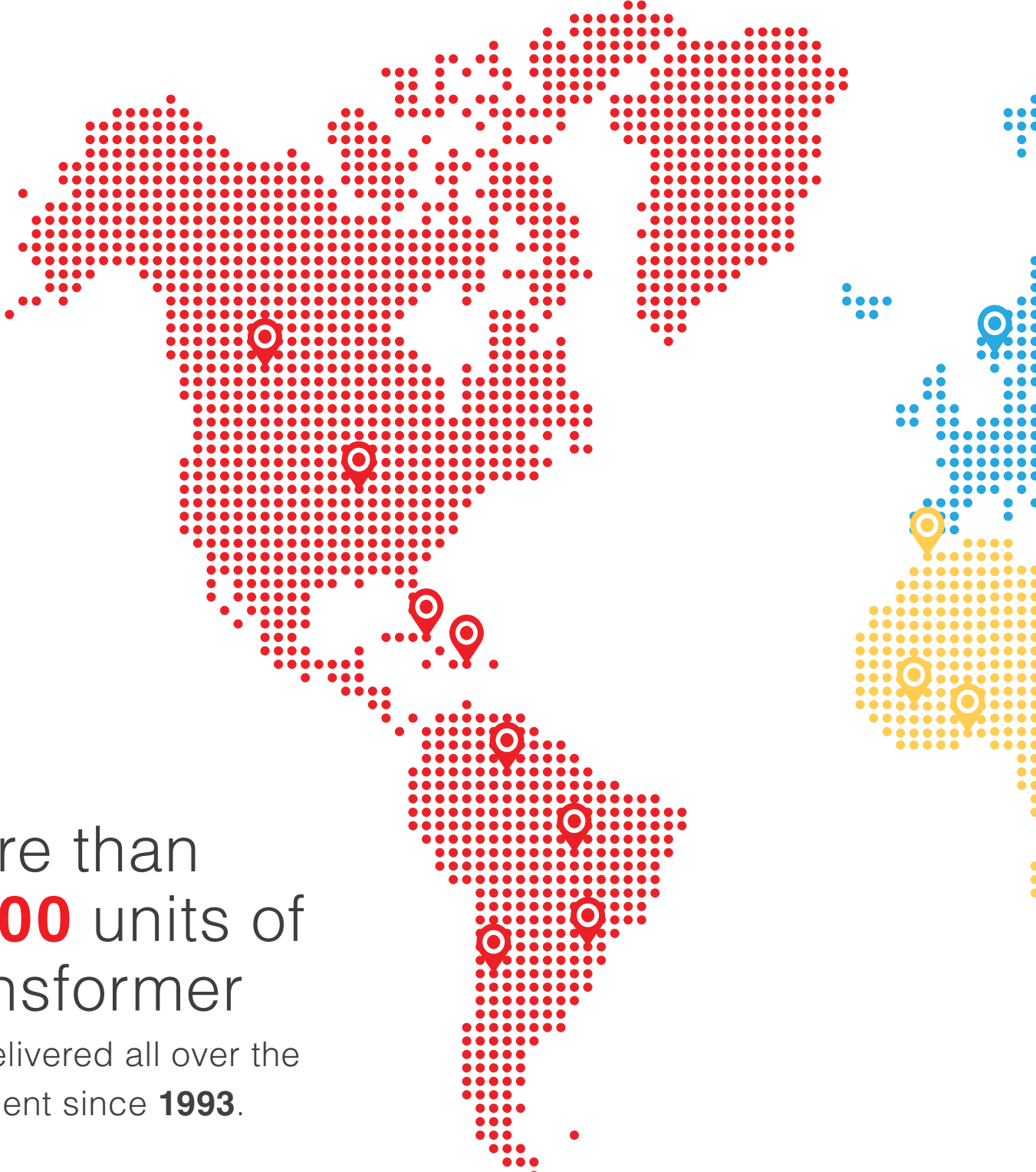
500^{kV}

Power Transformer

Remote FAT Witnessing

In recent innovation and technology, our customers able to witness closely from their home or office through our advance video systems and broadband internet. All graphs and figures presented and grounding wire could be seen clearly.

EXPORT PORTOFOLIO

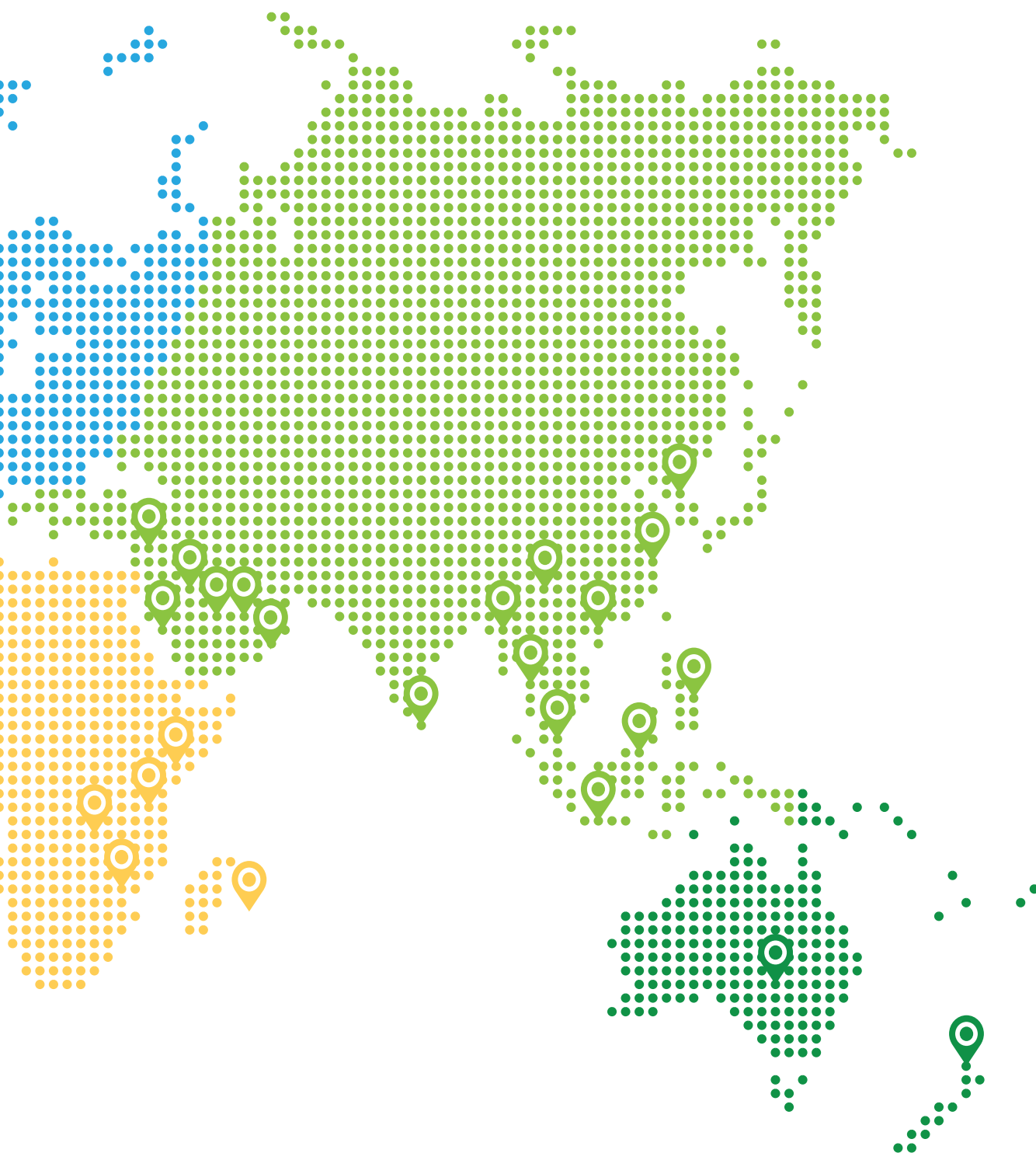


More than
2.300 units of
transformer
are delivered all over the
continent since **1993**.

Asia :
1636 Units

Oceania :
539 Units

America :
68 Units



Africa :
75 Units

Europe :
5 Units

Head Office

Alamanda Tower, 18th Floor

Jl. T.B. Simatupang Kav. 23 – 24, Cilandak Barat
Jakarta 12430 Indonesia

P. +62 21 2966 0055

E. info.id@elsewedy.com

Factory

Kawasan Industri Menara Permai Kav. 10

Jl. Raya Narogong, Cileungsi,
Bogor 16820 Indonesia

P. +62 21 823 0430/ 36



www.elsewedyelectric.com

 Elsewedy Electric Indonesia

 [elsewedyelectricindonesia](https://www.instagram.com/elsewedyelectricindonesia)