ECOTAP® VPD®

에너지 전환에 따른 송배전용 OLTC 기술동향

Transformer Service

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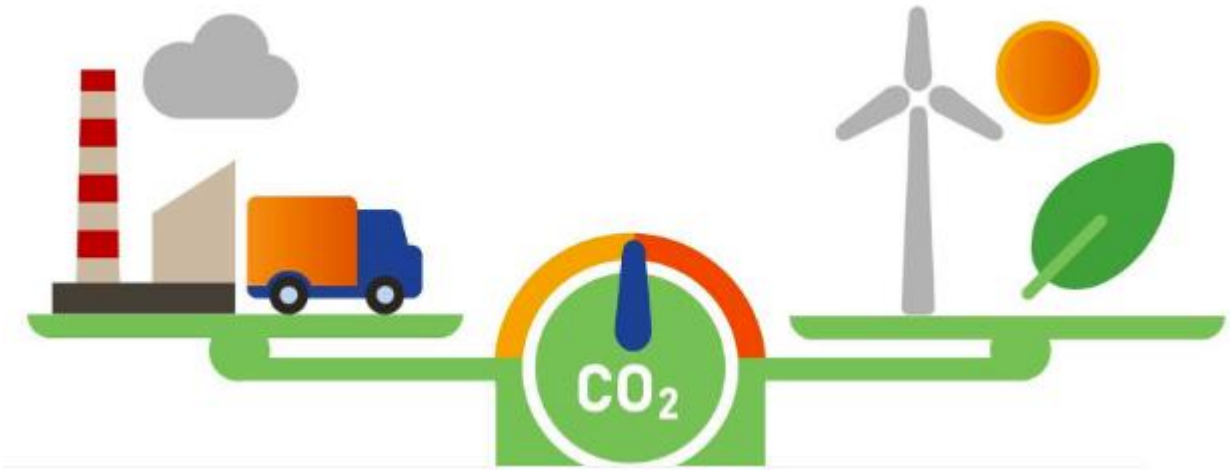
ENERGY TRANSITION FOR ENVIRONMENT

2050 Carbon neutrality (2050 탄소중립)

인간의 활동에 의한 온실 가스 배출을 최대한 줄이고, 남은 온실가스는 흡수,제거해서 실질적인 배출량이 0(zero)를 달성하는 개념



ENERGY TRANSITION FOR ENVIRONMENT

RE100

RE100

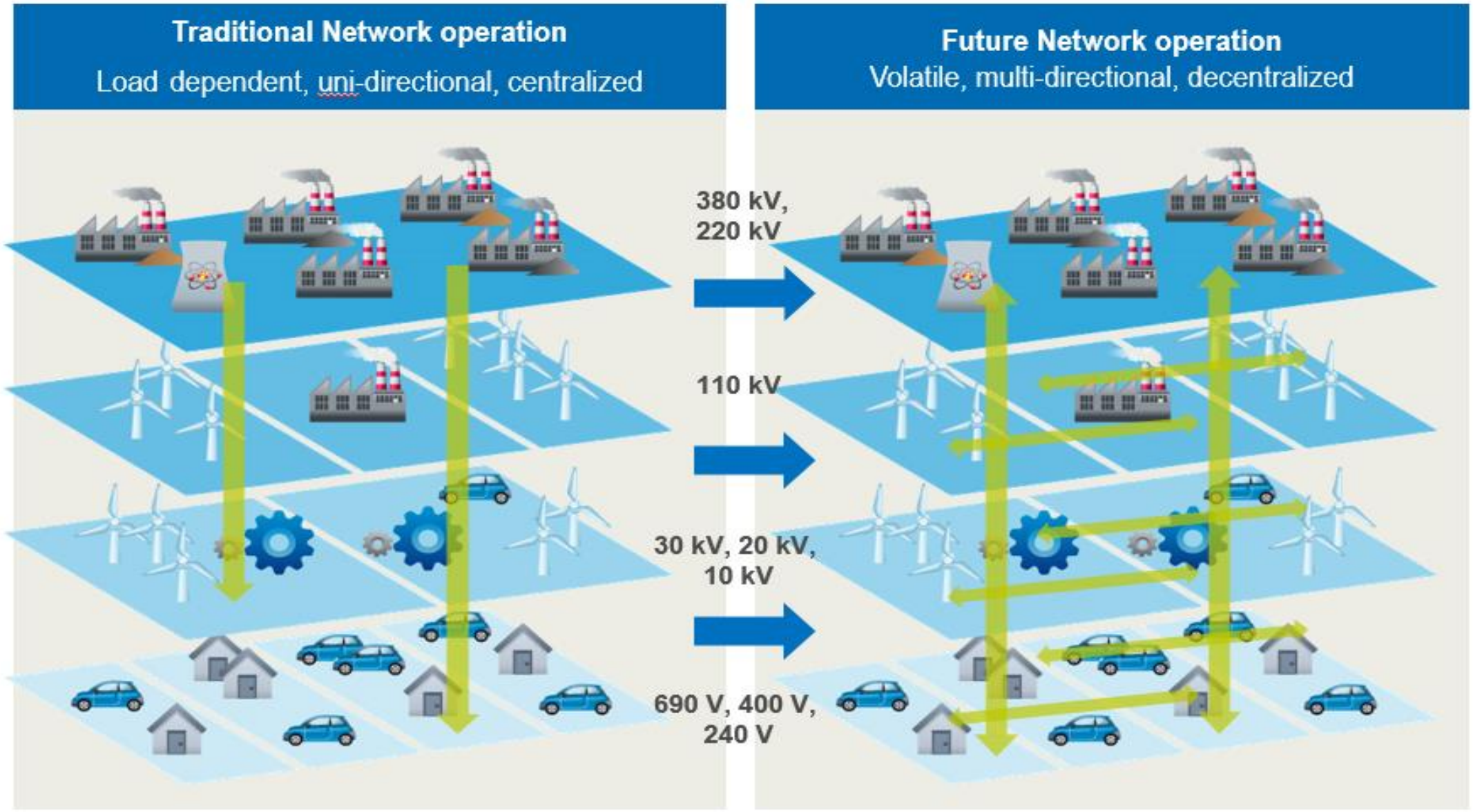
100% 재생에너지 전력 사용을 약속한 영향력 있는 기업들이 한데 모여 기업의 재생에너지 수요와 공급을 크게 늘리기 위해 협력하는 글로벌 이니셔티브입니다. 2014년 국제 비영리 단체인 The Climate Group과 CDP(Carbon Disclosure Project)가 연합하여 개최한 2014년 뉴욕 기후주간에서 처음 발족되었습니다.

ENERGY TRANSITION FOR ENVIRONMENT

ESG

환경(Environment), 사회 (Social), 지배구조(Governance)의 약자로 기업 경영 활동을 환경 경영, 사회적 책임, 건전하고 투명한 지배구조에 초점을 둔 지속가능성을 달성하기 위한 기업 경영의 가치 핵심요소를 의미함

ENERGY TRANSITION: PARADIGM SHIFT TO NETWORK

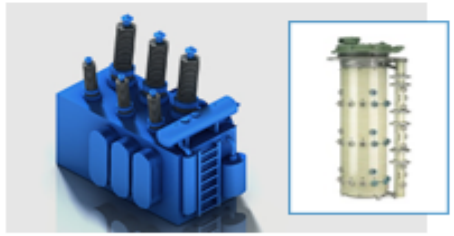


FUNCTIONAL PRINCIPLE OF TAP CHANGERS

Regulated Transformer:

Energy consumption increases

Automatic voltage regulator detects voltage change, sends control command to tap changer



Tap changer sets transformer windings to new ratio

Constant Voltage

Car with cruise control:

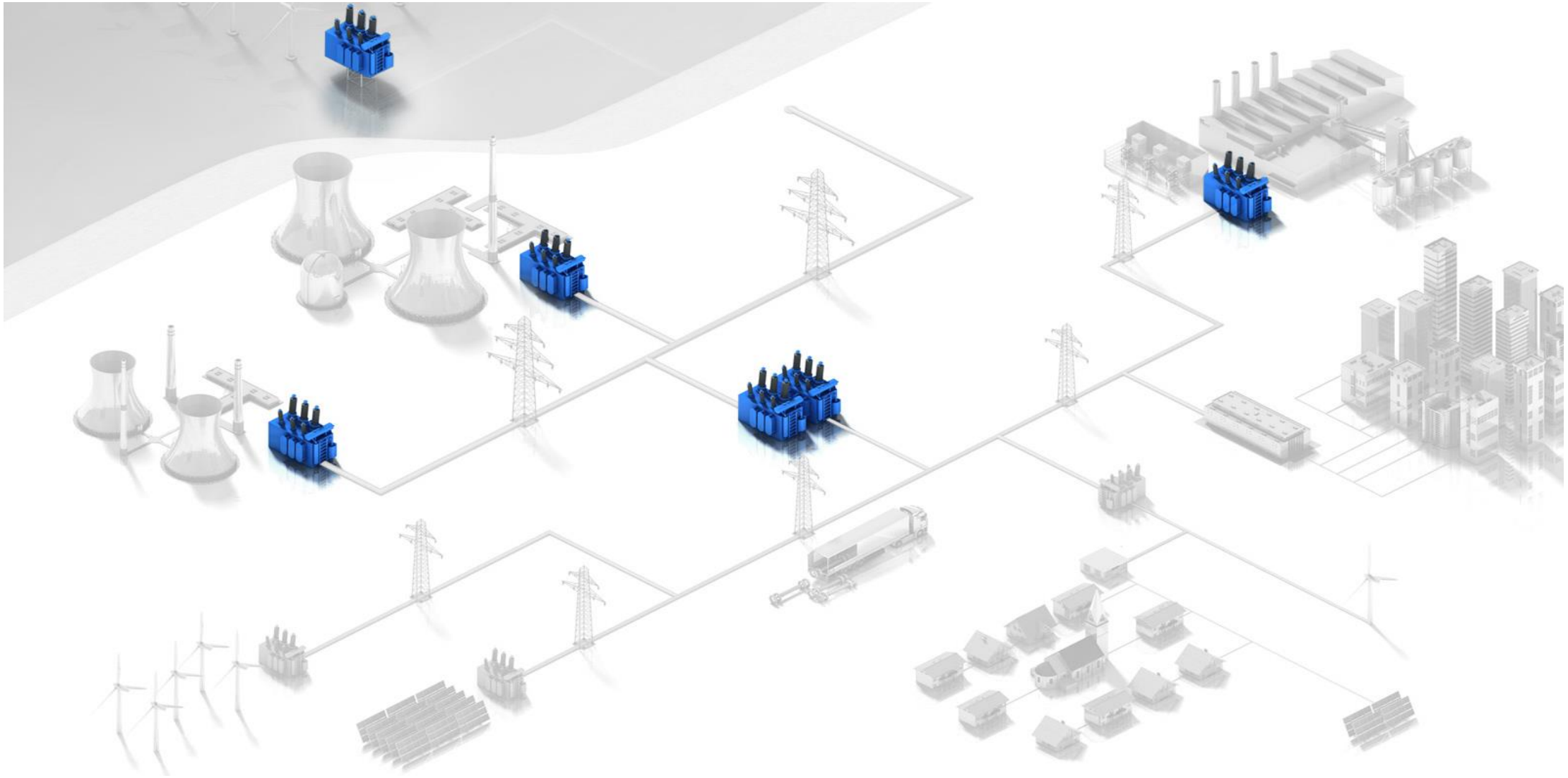
Car drives up a steep hill

Cruise control detects speed decrease

Gearbox shifts down automatically

Constant Speed

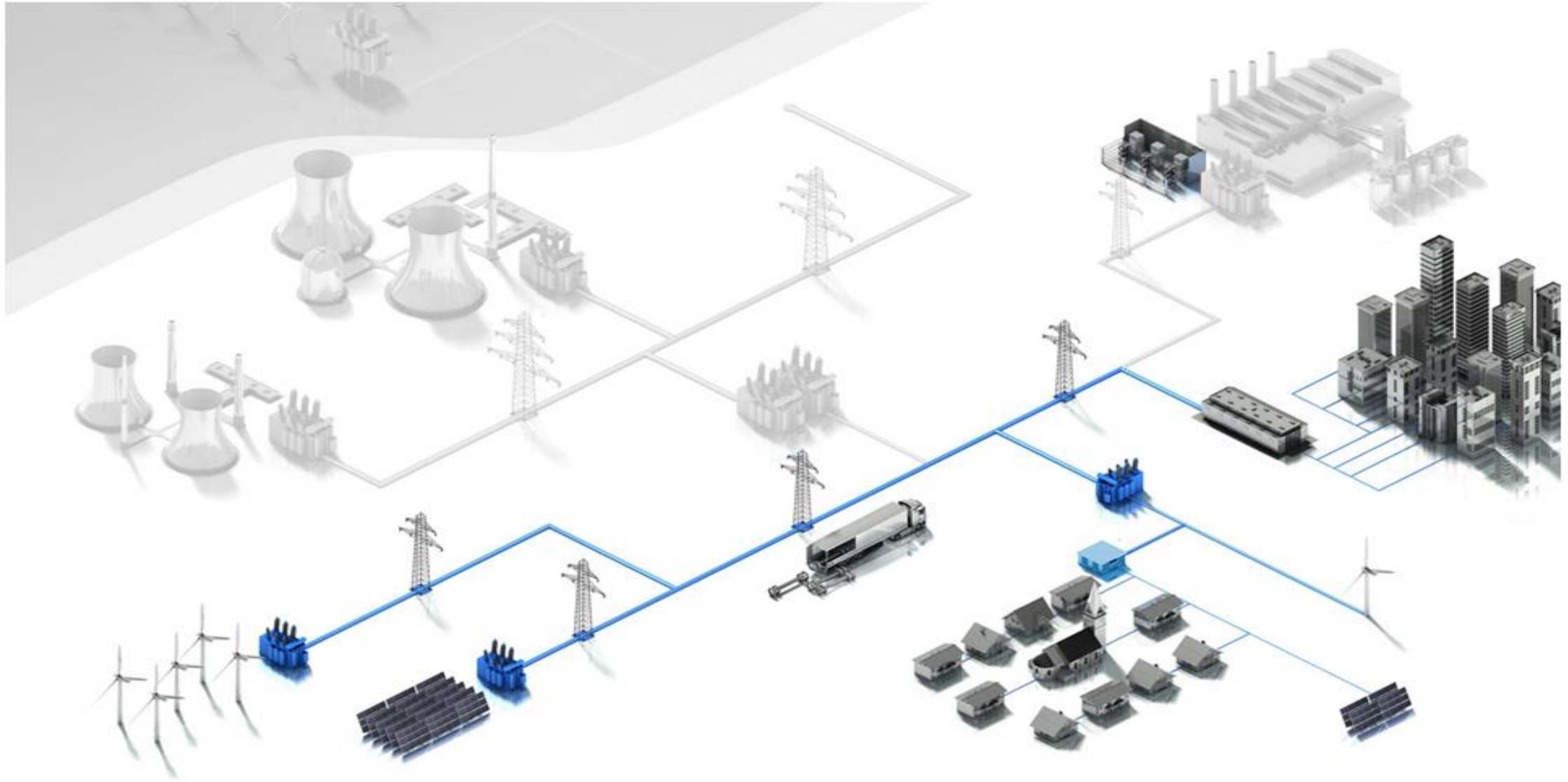
KEY COMPETENCE: REGULATION OF POWER TRANSFORMERS



OLTC WITH TRANSFORMER

575-MVA phase-shifting transformer from Consolidated Edison for New York City with MR OLTCs

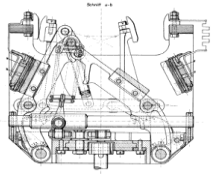
TRANSFERRING OUR VAST EXPERIENCE TO THE DISTRIBUTION NETWORK



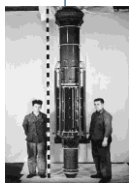
THE FIRST — FOR 90 YEARS TECHNOLOGY MILESTONES

1929 — First on-load tap-changer based on the resistor principle

1933 — First on-load tap-changer in tube design



1938 — First on-load tap-changer with separate advanced retard switch and selector

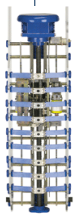


1973 — First series production for the global market

1974 — First semiconductor tap-changer

1990 — First reactor-type tap-changer, beginning of vacuum technology

1995 — First vacuum OLTC for dry-type transformers



2000 — First resistor type vacuum OLTC for oil transformers

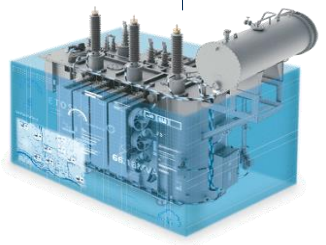
2012 — First series-production solution for local grids

2014 — First full semiconductor tap-changer

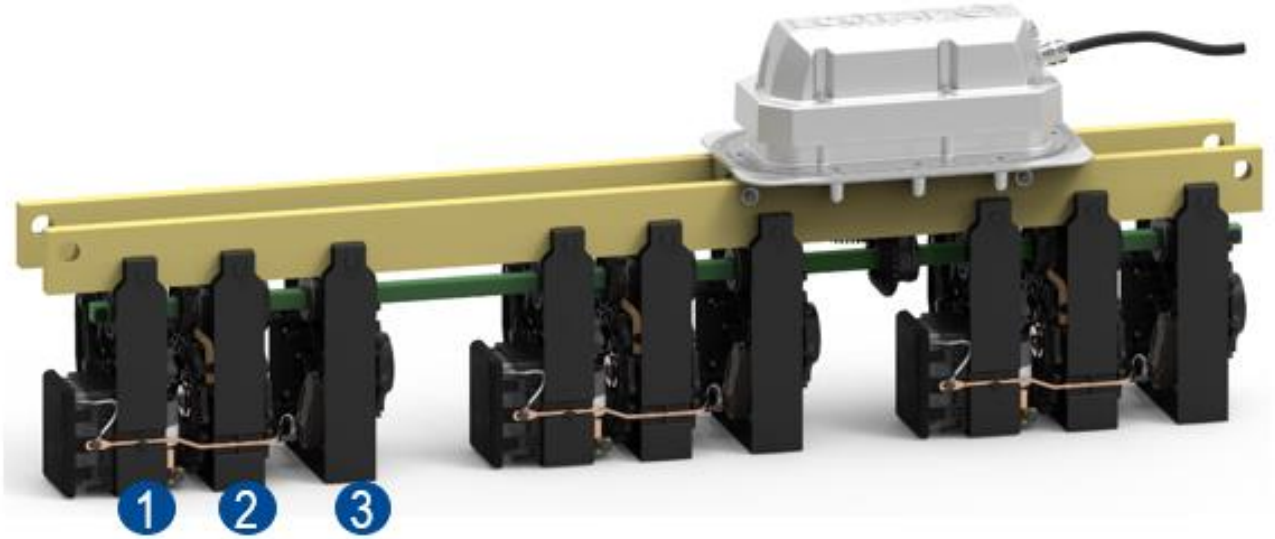
2015 — First top drive with integrated monitoring

2016 — OLTC for distribution transformers with electric control

2018 — First open operating system



ECOTAP® VPD



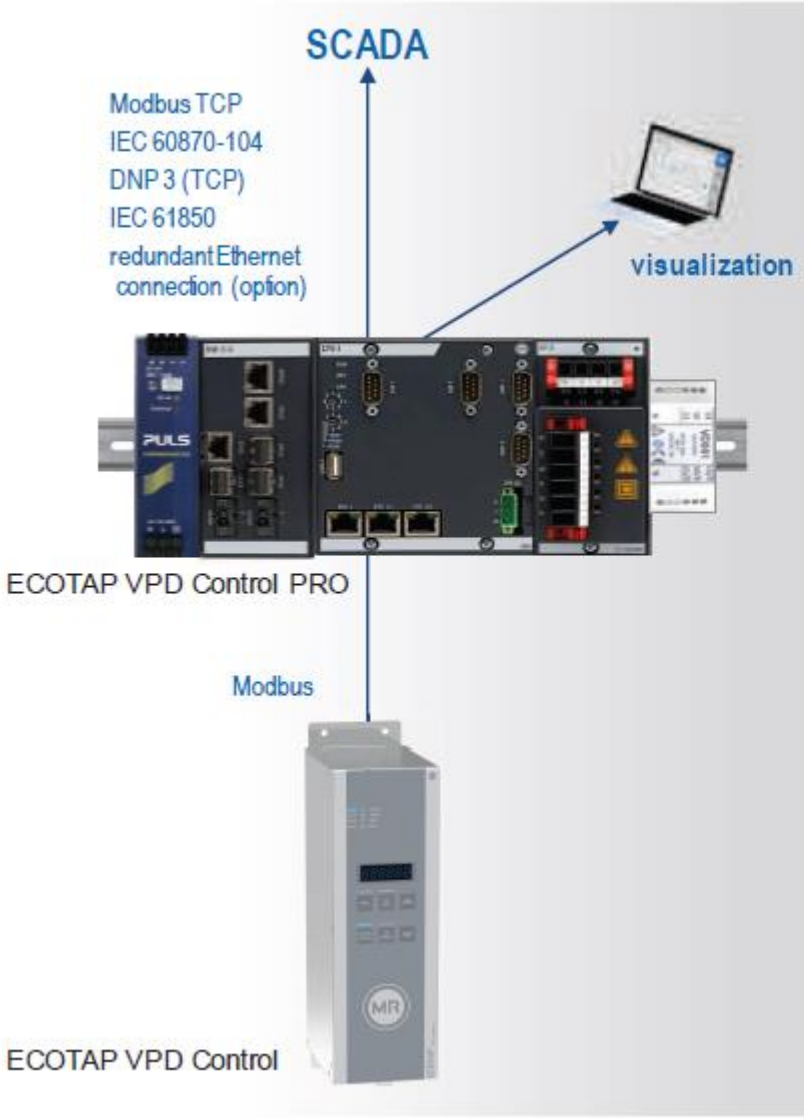
(1) Switching module
(2) Selector module
(3) Change-over selector module*

– With the **change-over selector module** ECOTAP® VPD® reaches up to 17 operating positions. This ensures a **large regulating range** and simultaneous fine steps.

– The **compact dimensions** permit installation in **virtually any power rating class** of distribution transformers without any major changes to the footprint - even for large regulating ranges

TRANSFORMER SIZE WITH ECOTAP® VPD

ECOTAP® VPD CONTROL PRO



Extended Control Functions

- 3 phase voltage control (based on average or single phase measurement)
- linear and integral control algorithm
- individual selectable time delay T1/T2
- up to 3 different desired voltage levels and dynamic set point control TDSC
- line drop compensation (RX or. Z compensation)
- Master-Follower parallel operation

Tap Position Detection

- tap postion via Modbus from Ecotap VPD basic control

Operation Modes

- local / remote
- AVR auto / AVR manual

Monitoring

- symmetry of phases (value and phase angle)
- event log with time stamps
- memory for average measured values

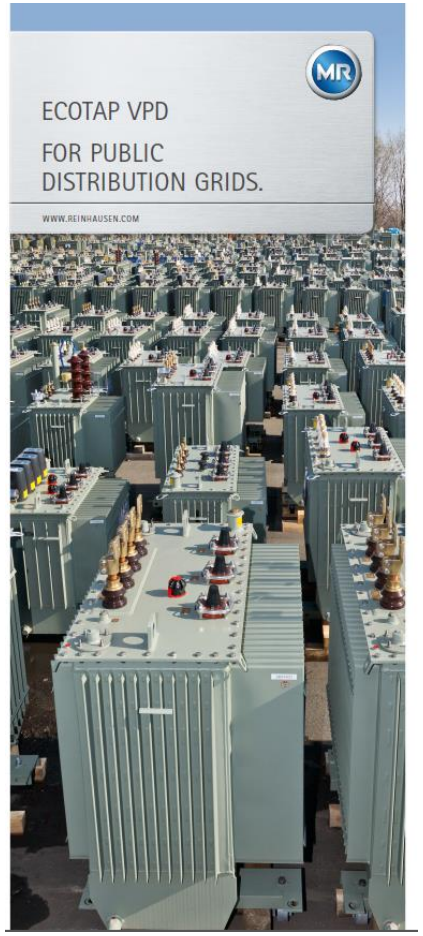
Security

- security log
- rolebased user administration

Visualiziation

- webbased visualization acc. to HTML 5 standard

WIDE RANGE OF APPLICATION OF REGULATED DISTRIBUTION TRANSFORMER



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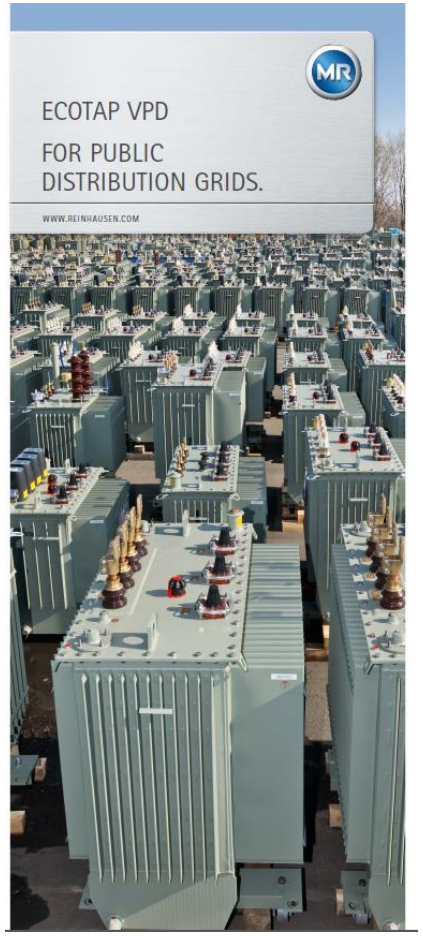
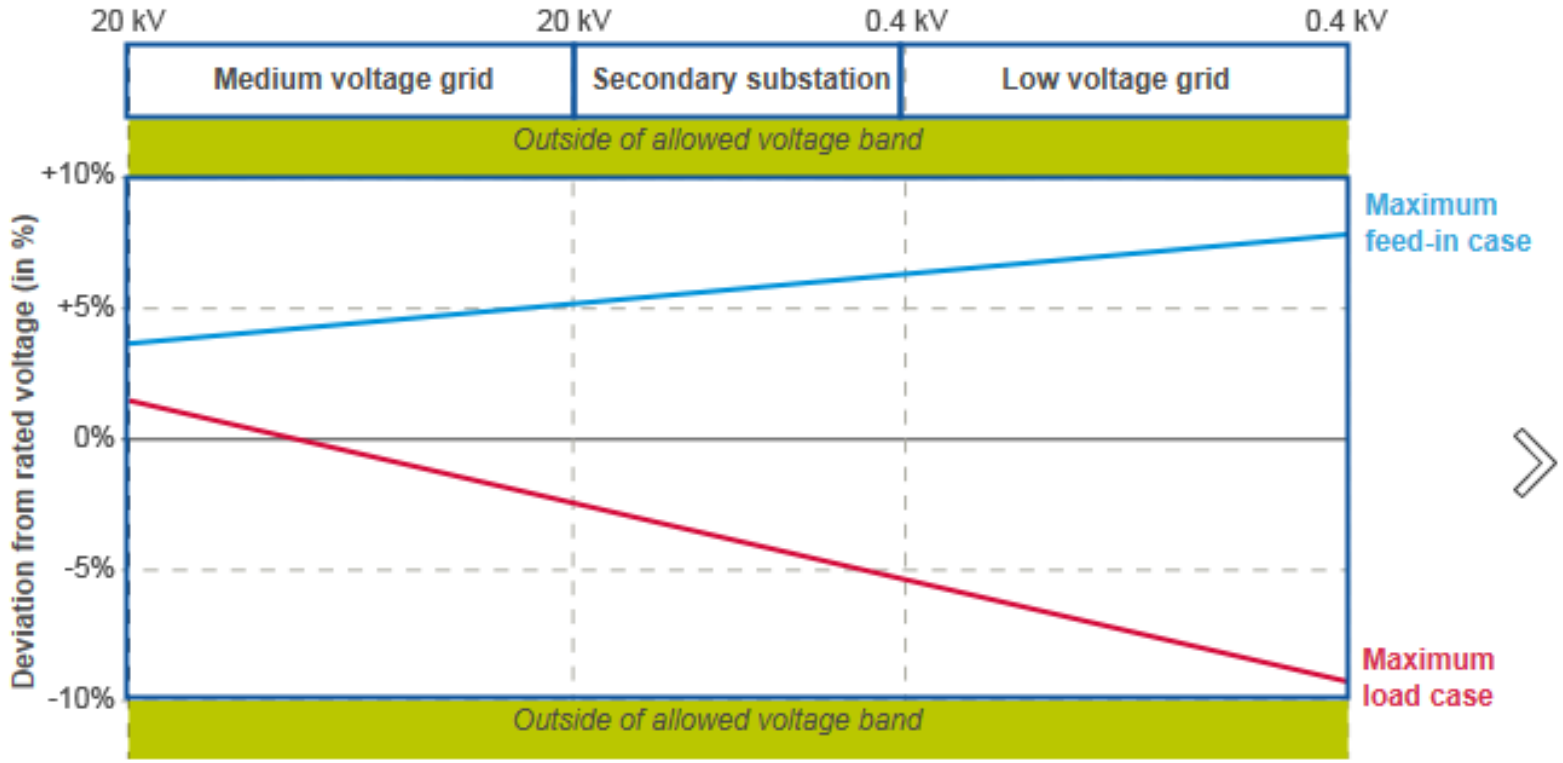


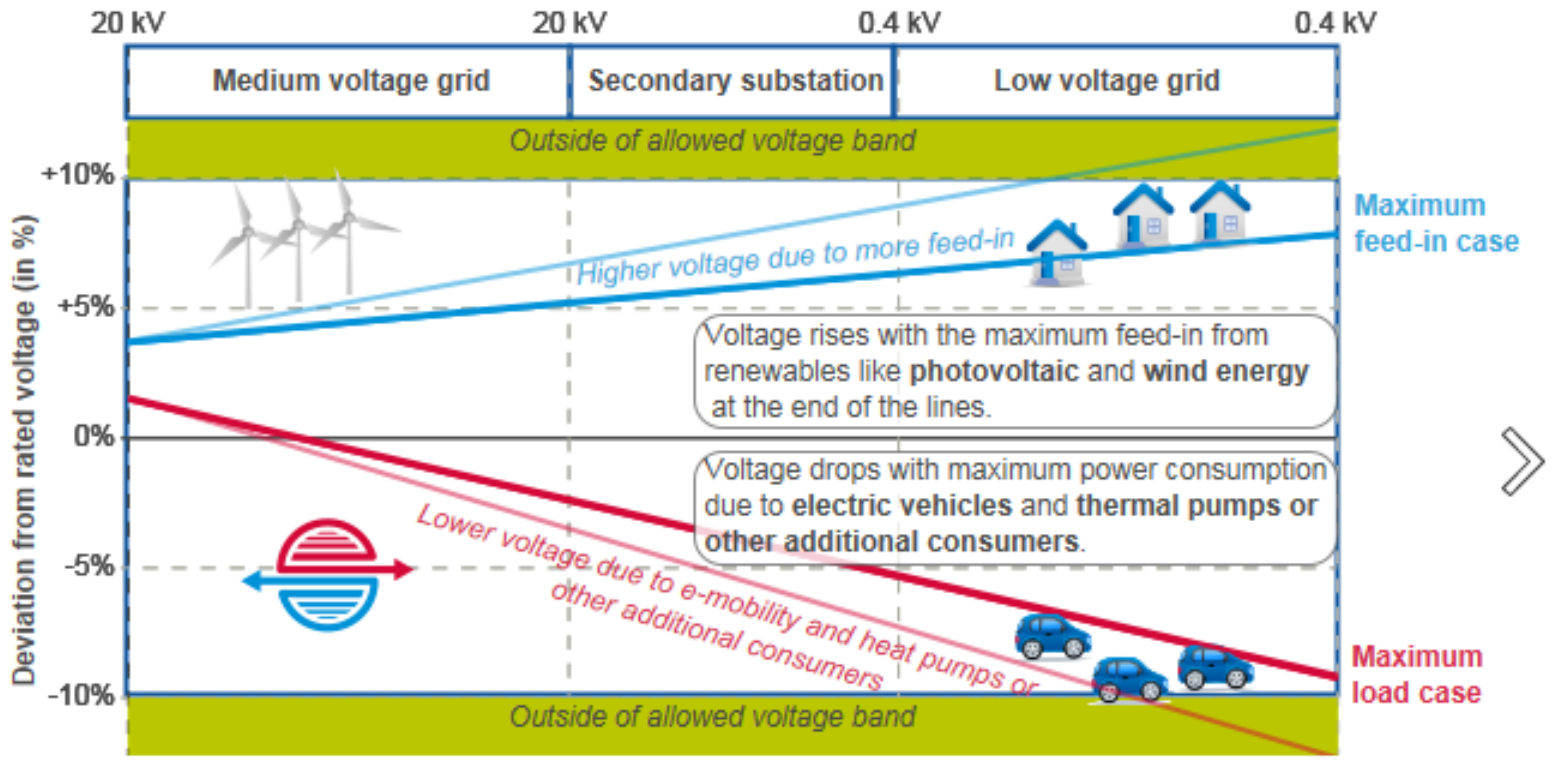
GRID APPLICATION OF REGULATED DISTRIBUTION TRANSFORMER



Grid planner's challenge:

- Maintain voltage level within bandwidth
- Consider future developments in planning process

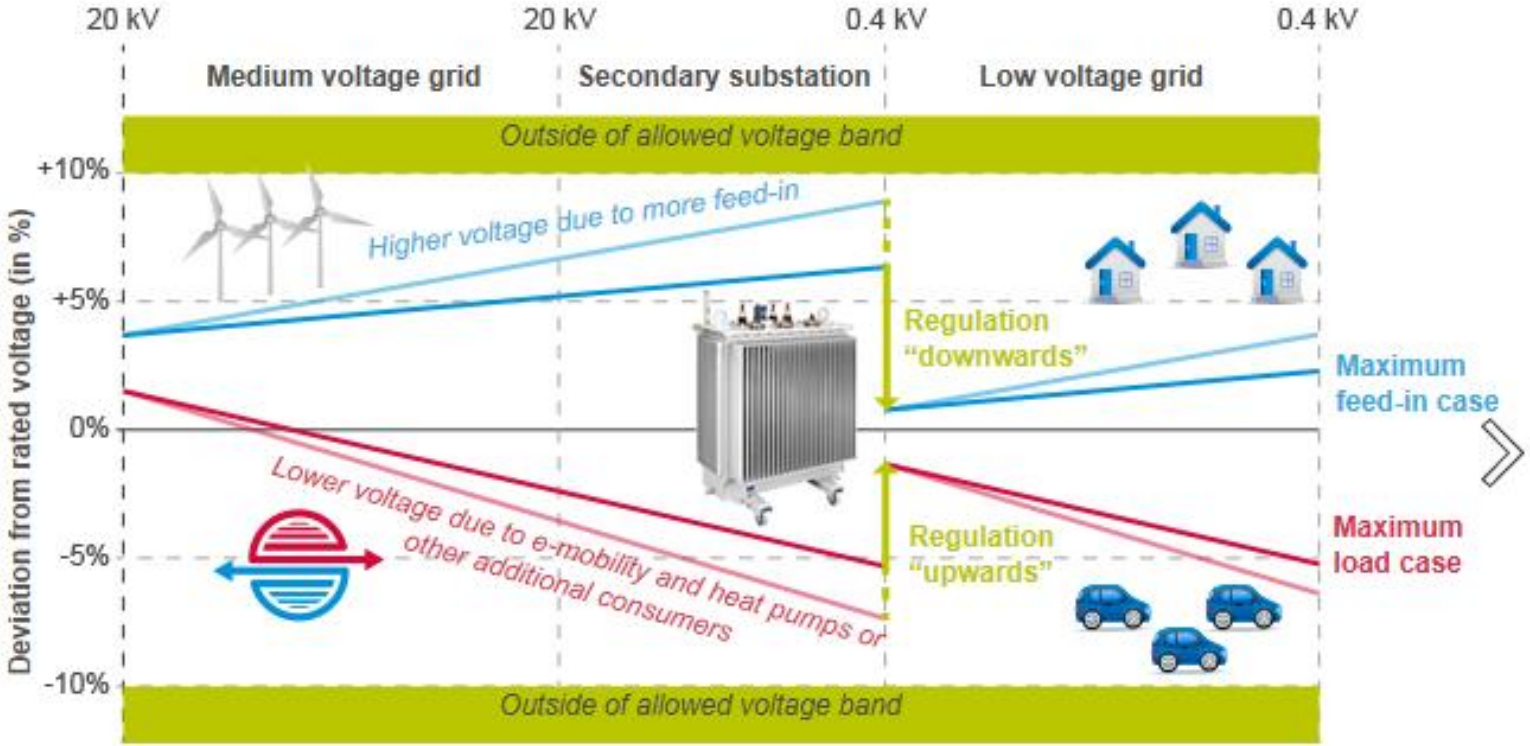
GRID APPLICATION OF REGULATED DISTRIBUTION TRANSFORMER



Changes to the grids

- Energy generation fed into medium voltage grid influences the incoming voltage of the DT
- Generation on the LV side (PV) and increased consumption has significant influence on voltage quality

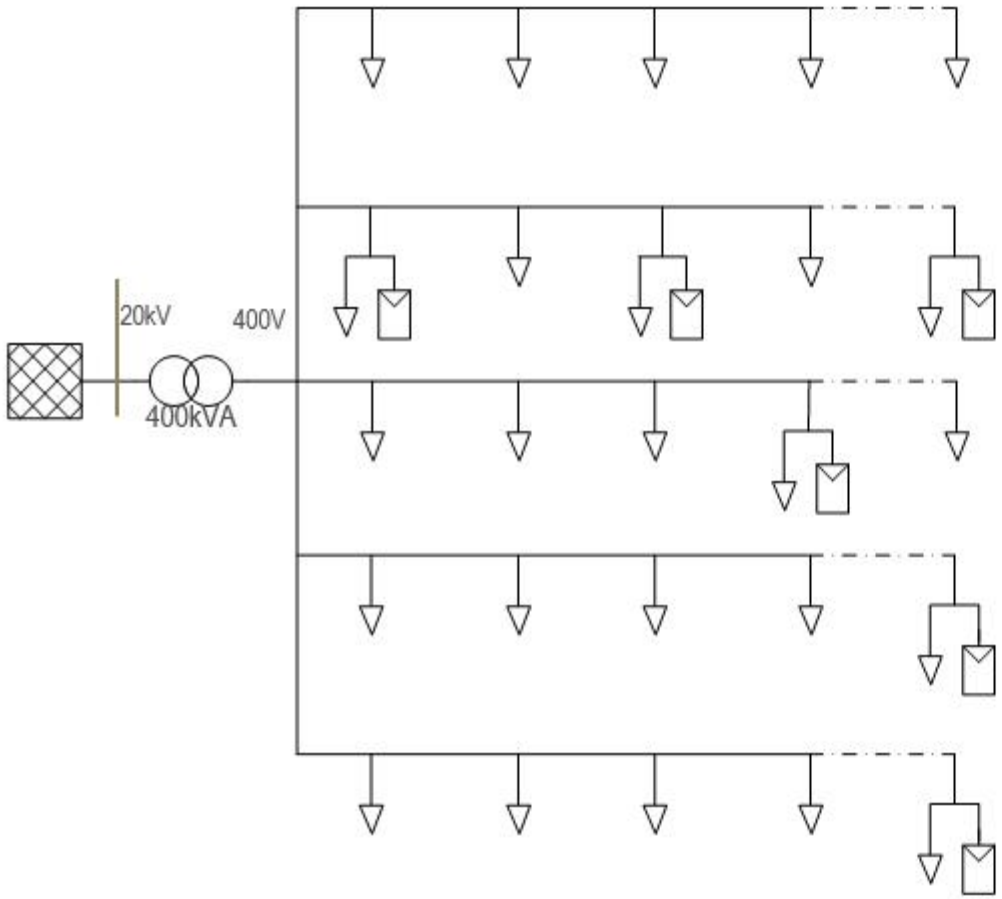
GRID APPLICATION OF REGULATED DISTRIBUTION TRANSFORMER



Cost effective solution for many cases

- Un-coupling MV and LV grid by using a regulated distribution transformer
- Allows increased feed in of renewable energies and increase of load (within the capacity range of equipment)

REFERENCE CASE: INCREASE OF POTENTIAL FOR INTEGRATION OF RENEWABLE ENERGY



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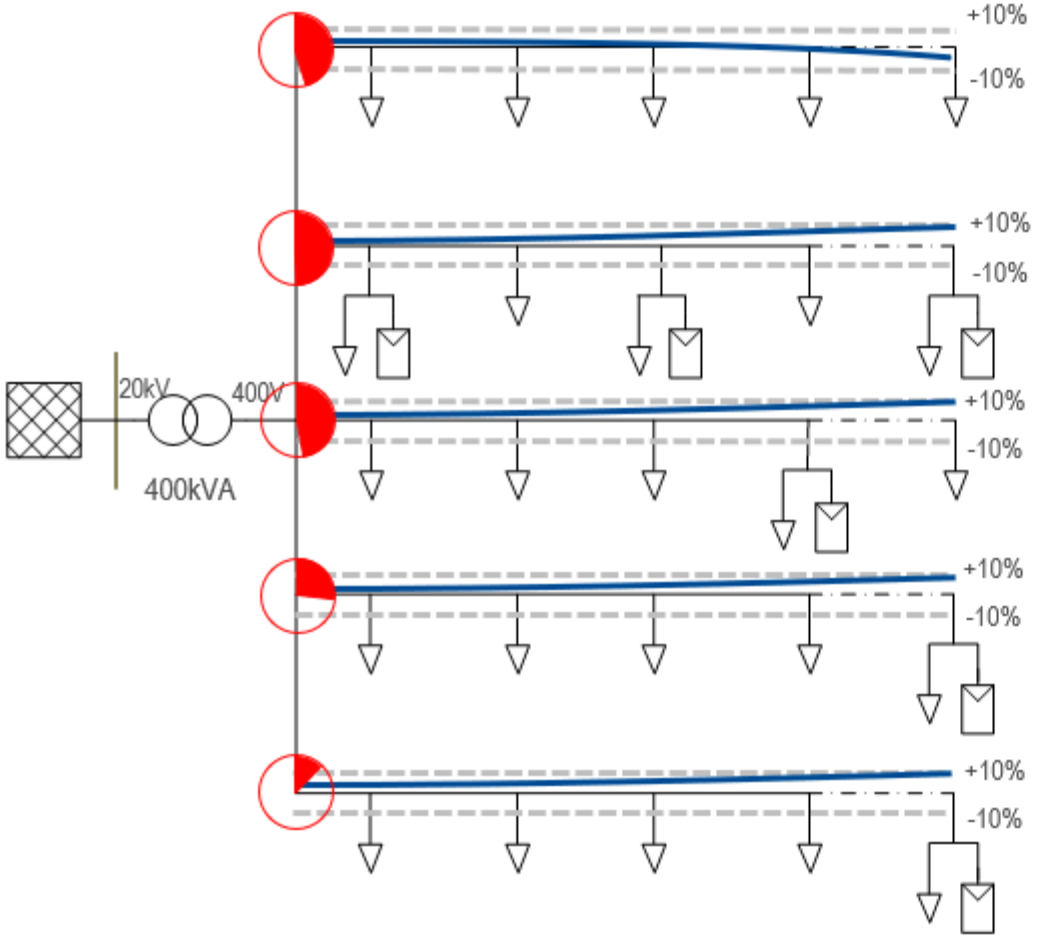
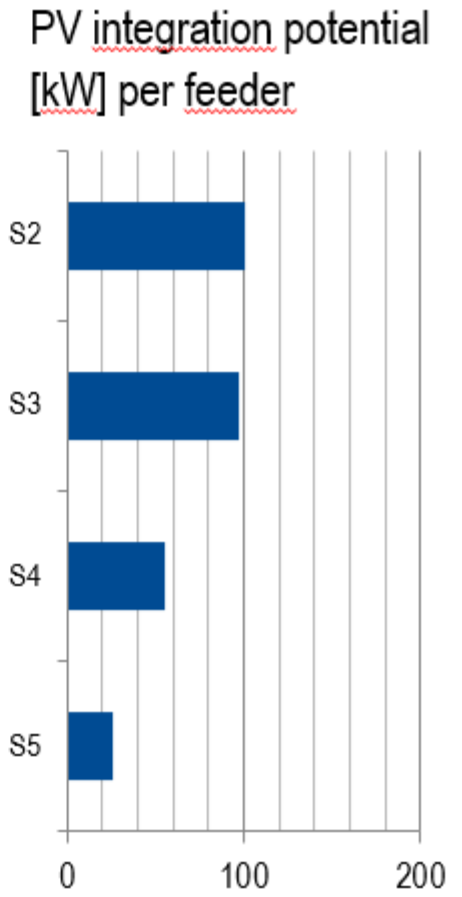
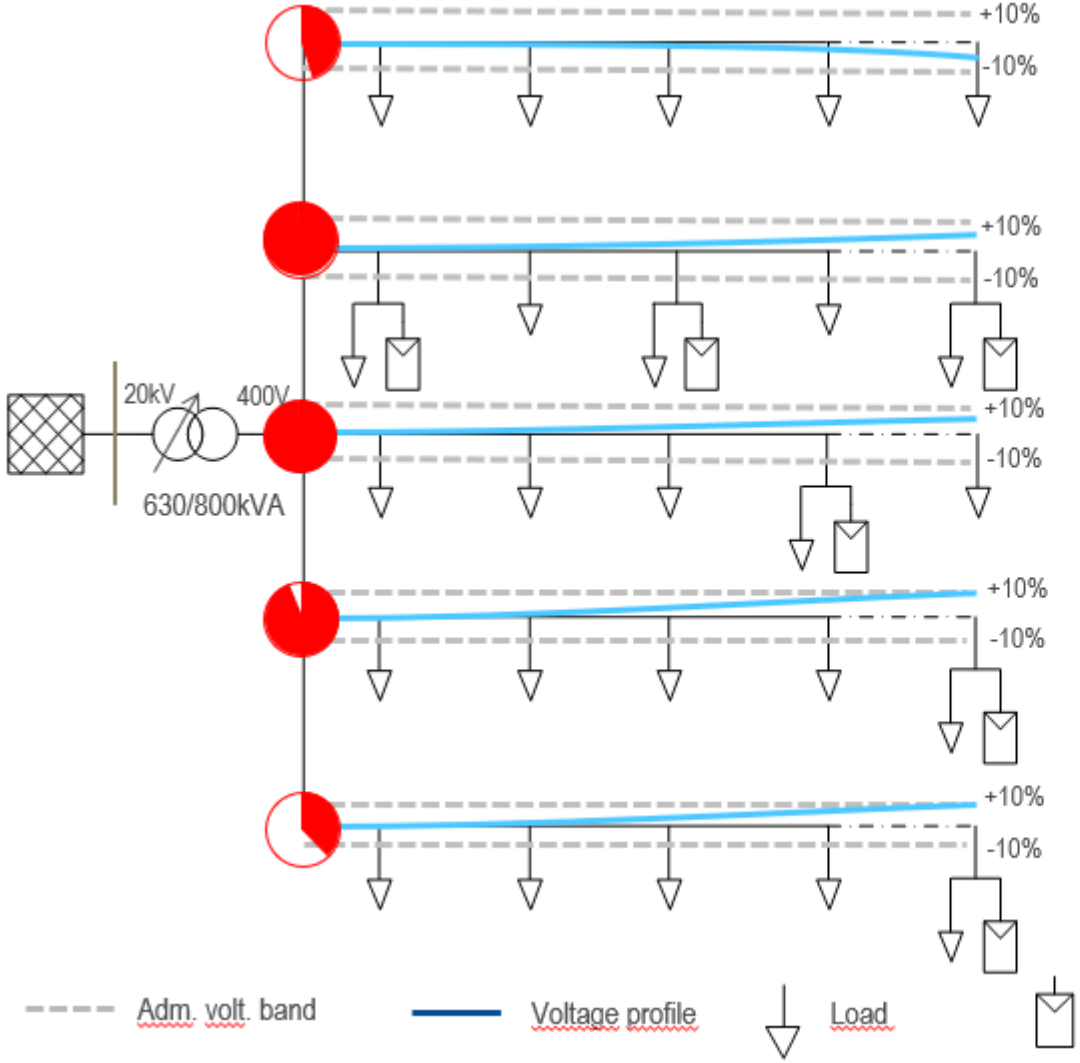
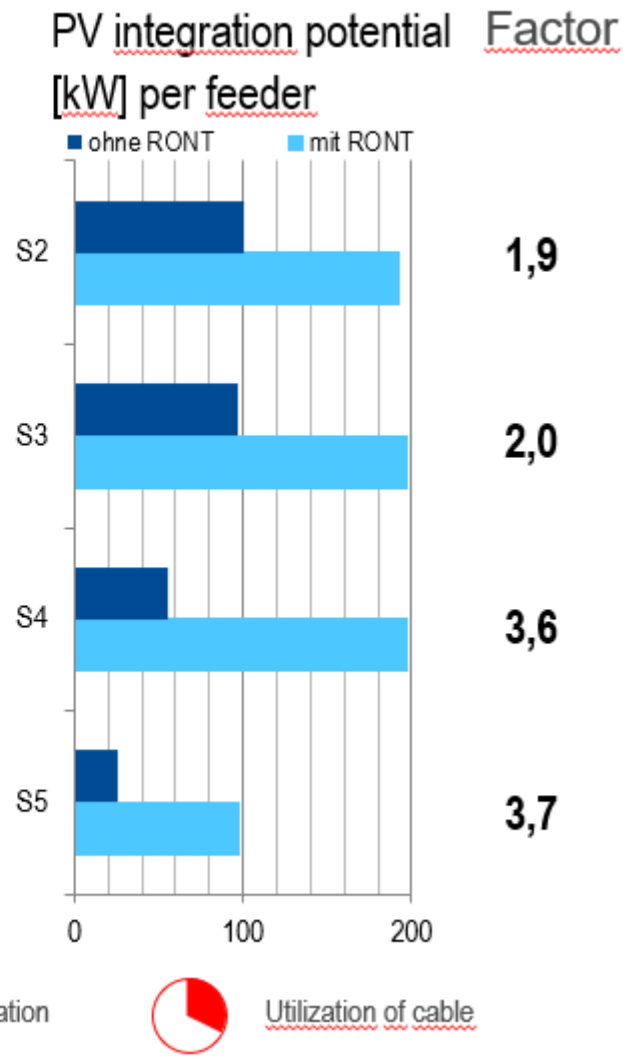




Adm. volt. band Voltage profile Load Generation Utilization of cable

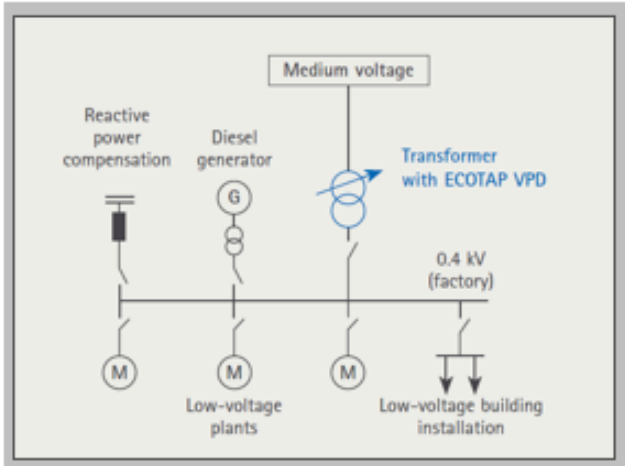
REFERENCE CASE: INCREASE OF POTENTIAL FOR INTEGRATION OF RENEWABLE ENERGY





WIDE RANGE OF APPLICATION OF REGULATED DISTRIBUTION TRANSFORMER

REGULATED DISTRIBUTION TRANSFORMERS IN INDUSTRIAL PLANTS: PROCESS STABILITY

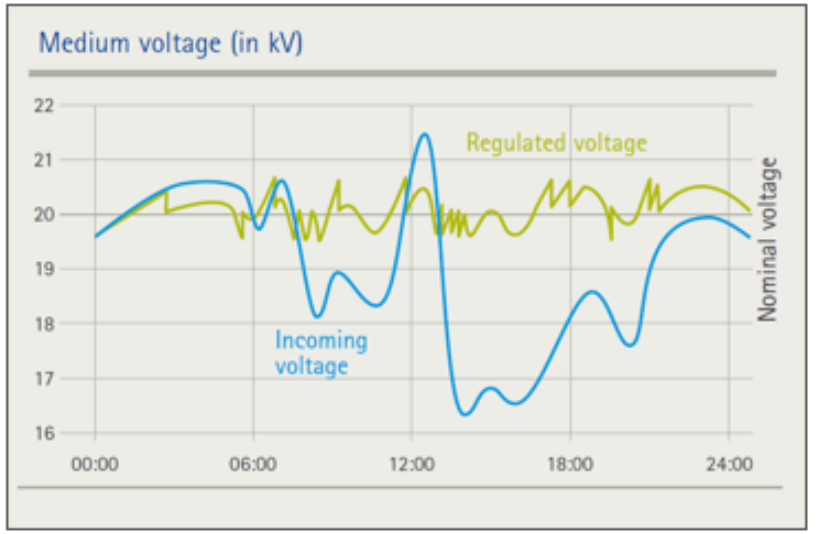


Scope of application: grids with

- limited generator power
- long distances or
- volatile consumers and producers
- sensitive industrial processes

Benefits

- Stable **production cycles**
- Reliable **motor starts**
- Stable **control systems**
- Less **scrap and fewer tooling costs**
- Extended **service life** of equipment



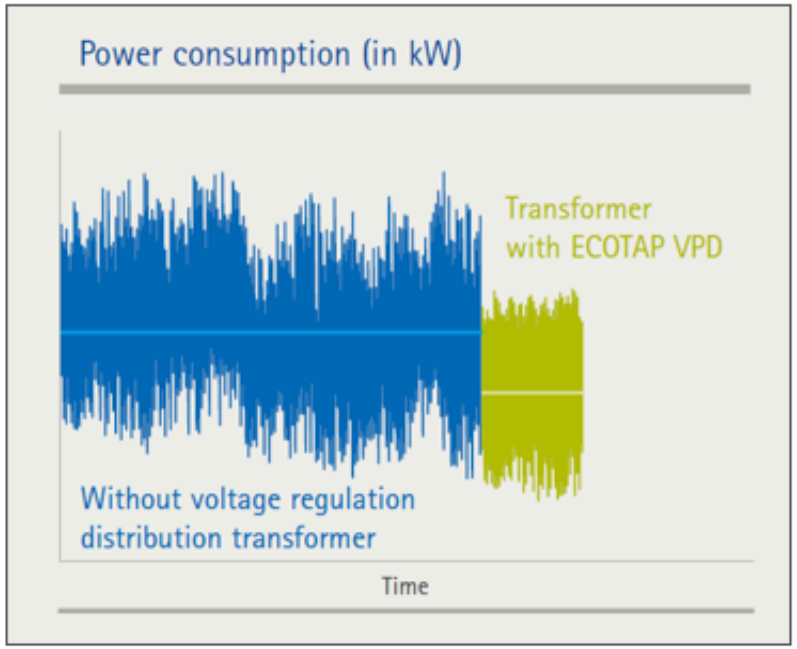
REGULATED DISTRIBUTION TRANSFORMERS IN INDUSTRIAL PLANTS: ENERGY CONSUMPTION

Benefits of regulated distribution transformer with ECOTAP® VPD

- Extensive regulating range with very fine steps allows the **optimum operating point to always be activated and energy costs to thereby be minimized**
- **Best possible returns on investment** thanks to zero maintenance and long life
- **Reduction in energy consumption costs and pay-back of investment**

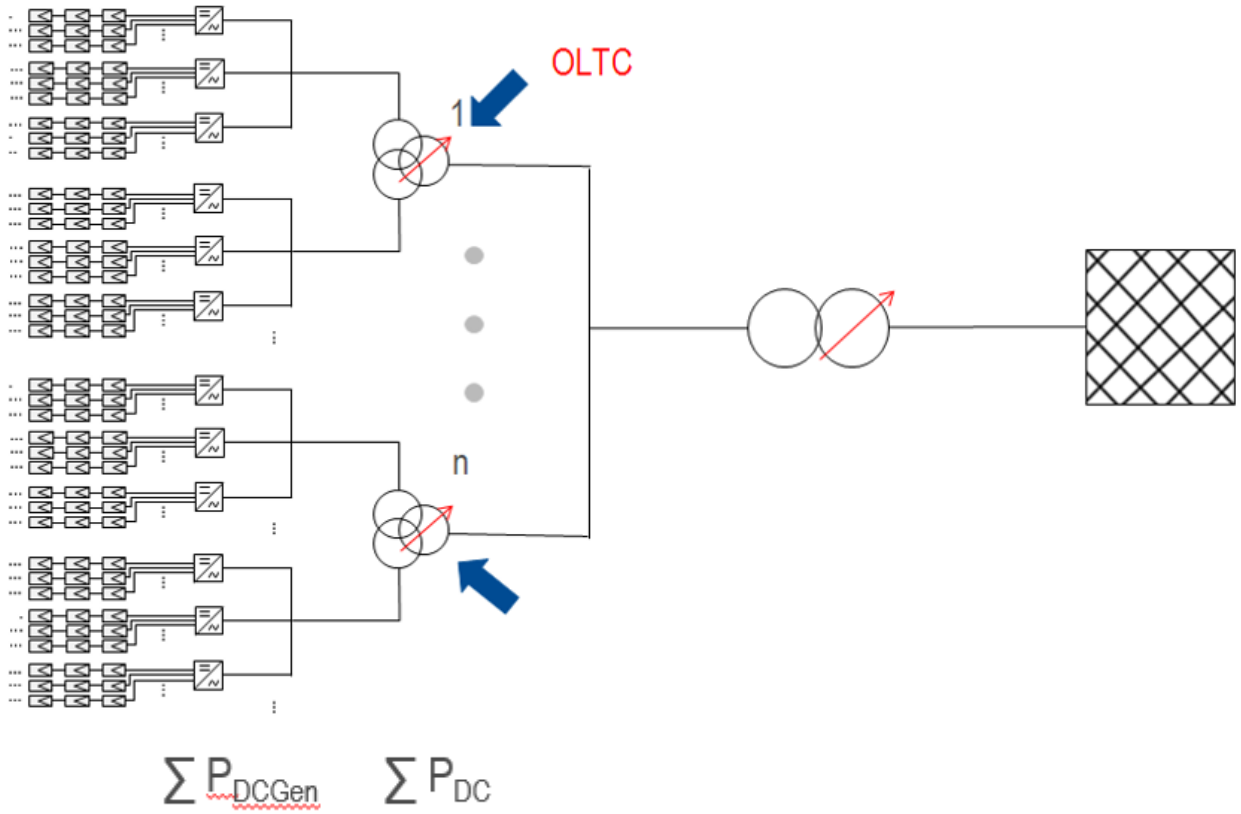
Reducing energy costs by optimizing voltage

By dynamically changing the voltage, regulated distribution transformers with ECOTAP® VPD help to optimize the energy consumption of resistive loads



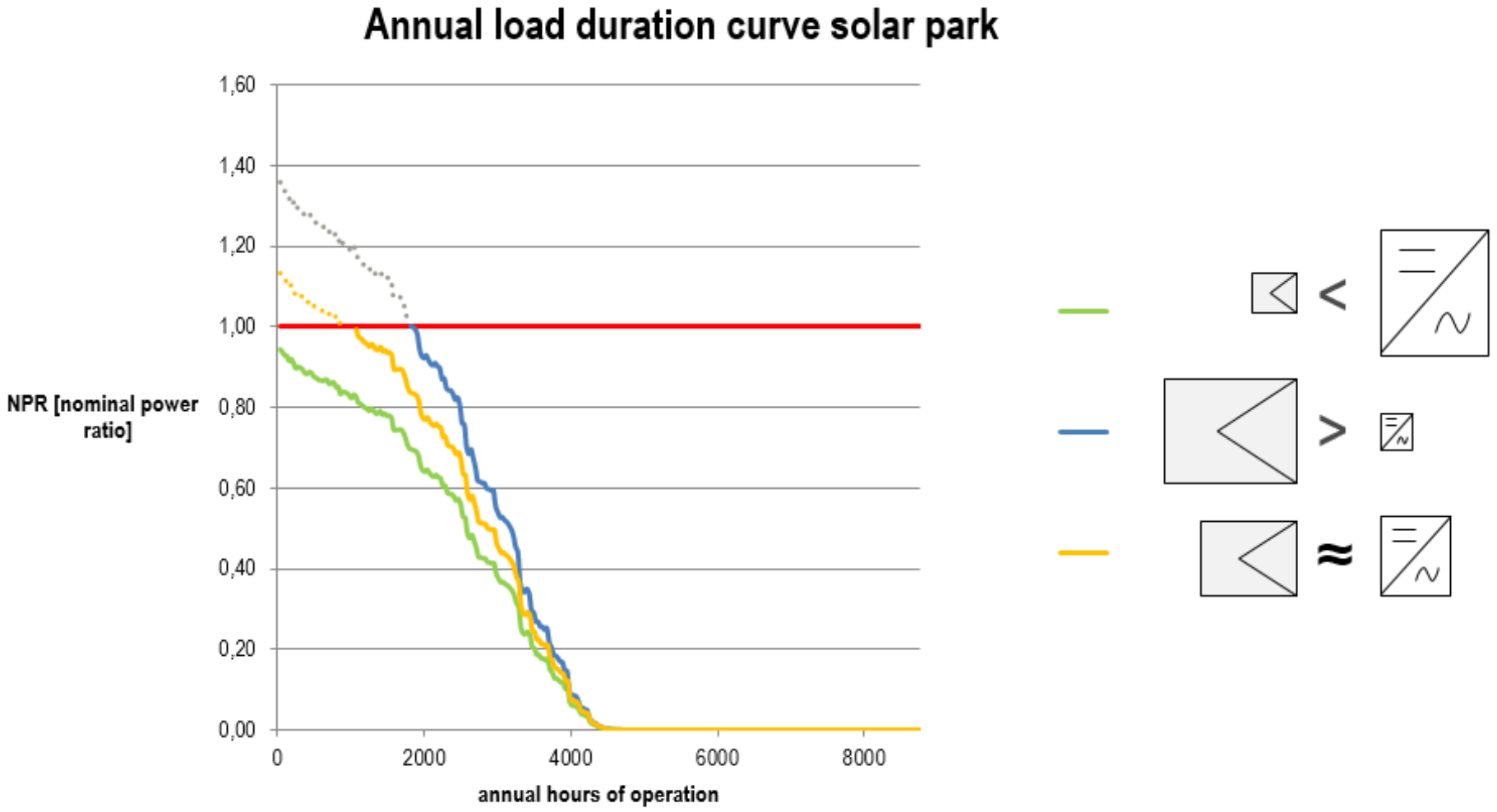
WIDE RANGE OF APPLICATION OF REGULATED DISTRIBUTION TRANSFORMER

REGULATED DISTRIBUTION TRANSFORMERS IN DISPERSED GENERATION PLANTS



- Research project MR and Fraunhofer Institute - for PV parks from 10 to 100 MVA

REGULATED DISTRIBUTION TRANSFORMERS IN DISPERSED GENERATION PLANTS



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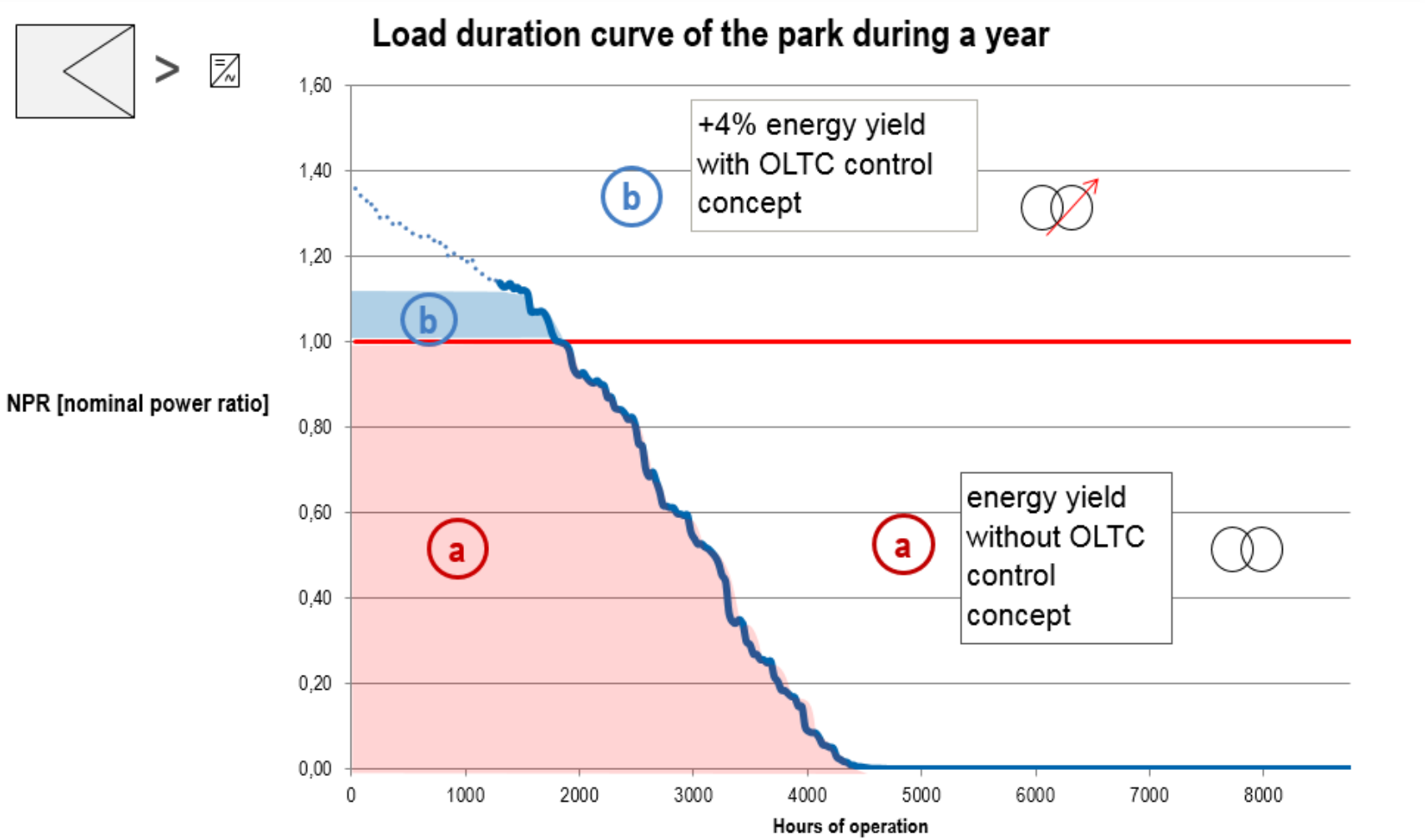


- OLTC regulated transformer increases generation by 4%

ECOTAP® VPD FOR EFFICIENT

The world's **most compact on-load tap-changer** for distribution transformers offering the **largest range of services**

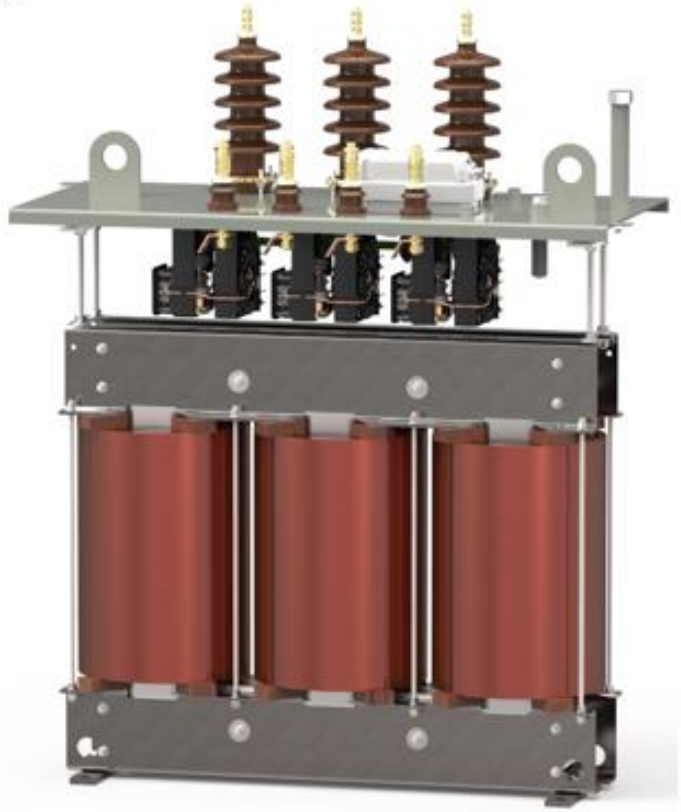
Maintenance-free and long-lasting with proven MR reliability

Maximum economic viability for the entire transformer/on-load tap-changer system

Ready for **future requirements**

Perfect integration into the transformer manufacturer's processes

Easy commissioning – simple operation



THE POWER BEHIND POWER.

reinhausen.com