

TPEG COMPETENCES

# FOR HYDROGEN & POWER TO X MARKET



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## OVERVIEW

- HOW IT WORKS
- WHAT IS USED
- WHAT IS SPECIAL
- HOW WE CAN HELP
- OUR SOLUTIONS IN DETAIL





# HOW IT WORKS

## HOW DOES THE PRODUCTION OF HYDROGEN WORK?



Hydrogen is produced during electrolysis process, where flow of electrical potentials into stacks with Proton Exchange Membrans (PEM). The electrical power applied to electrolyzers must come from a renewable source, such as photovoltaics, wind or biomass power, in order for the hydrogen to be considered green.

- 1. Cleaning process.** The water/amoniac used for electrolysis must be cleaned to prevent damages of electrolyser stacks. The water is cleaned and demineralized using a variety of methods, such as reverse osmosis and filtration. Amoniac must be dried in addition.
- 2. Electrolysis.** Flowing water into PEM system, the hydrogen can pass the ion conducting membrane surface of the electric powered electrolyzer to be separated from oxygen. Depends on method of water injection (fluid or steam) a natural pressure of 40Bar for hydrogen is possible.
- 3. Drying.** After electrolysis process hydrogen need to be prepared for transportation or storage and cleaned from water particles (moisture), which still can be in hydrogen gas available.
- 4. Compression & Storage.** Dried hydrogen can be directly stored in 40Bar storage tank-banks or pumped into hydrogen or industry-gas pipeline (up to 15%). On demand hydrogen can be compressed up to 1000Bar and stored in special high-pressure tanks.



# COMPONENTS OF A FUEL CELL SYSTEM

## WHICH INDUCTIVE COMPONENTS ARE USED IN THE PRODUCTION OF HYDROGEN?



### Inductive components for Power to X market:

- **Power supply for Electrolyzers or Fuel Cells:** Rectifiers, AC/DC, DC/AC and DC/DC power converters are used to run electrolyser stacks and the whole Power to X system
- **Power supply for Compressors and Cooling Systems:** Compressors and cooling systems require system relevant power supply as well as regulation systems.
- **Power supply for H2 flow control:** Hydrogen Flow meter systems need to be supplied from different energy source as devices working directly with electrolysis process..
- **Power supply for Safety and Monitoring Systems:** Safety systems: Those systems are with safety regulations. They are checking and react by all incidental or non-incidental issues (lack of energy, internal and external disturbance, device failure, etc.) and are redundant.

### Here are some specific examples of inductive components that are used in Power to X and Hydrogen market:

- **Power Transformers** – connect Power to X system to electrical Grid.
- **Power DC chokes and AC inductors** – used rectifier systems for PEM stacks in large Power to X systems (Utility Scale) as well as Hydrogen Power Plants.
- **AC/DC and DC/DC Power converters** – are used in off-grid power to grid in small and medium size Power to X systems (Residential up to C&I scale)
- **Printing boards transformers, low power transformers** – are used in all possible power supply constructions and at all electronic devices where galvanic separation is required
- **PFC Chokes, Common Mode Chokes, EMI Chokes, Flyback transformers** are used in all electrical designs of switching mode power supplies (low power), filters and regulation as well as monitoring systems.
- **Current transformers** are responsible to measure current flow in electrical systems. This value is required for efficient work of Power to X electronics.



# WHAT IS SPECIAL?

## WHAT ARE THE SPECIAL REQUIREMENTS FOR THESE COMPONENTS?

Inductive components used in power electronics for hydrogen production must meet a number of special requirements, including:

- **Durability:** Hydrogen & Power to X Systems must characterize with long-possible lifetime, so inductive components must be constructed using special HQ materials and advanced techniques. A long-life usage and reduce material aging phenomena is highly required.
- **Linearity & Efficiency:** Inductive components used into Power to X systems must be as efficient as possible to minimize energy losses. Their characteristic must be highly linear and fine-tuned into power electronics.
- **Reliability:** Inductive components must be highly reliable to ensure the smooth operation of the hydrogen, storage and utilization.
- **Cost:** Renewable market required extremely low OPEX costs. Design and production quality of inductive components reduce CAPEX, but especially reduce maintenance costs of Hydrogen&Power to X systems to make green energy production& storage economically viable.



# HOW WE CAN HELP

We have extensive expertise and many years of experience in the development and production of inductive components in Power to X applicable systems.



## POWER CONVERTERS:

DC/DC Power Converters, Air or Water Cooled. All Industrial Communication Standards Available. Customized MPT tracker optional.

## PRODUCT PARAMETERS:

- Input Voltage (150-850V)
- Output Voltage - customized
- 10Years warranty option
- Customer Regulation Option
- GUI Optional
- 19" Standard optional

## POWER TRANSFORMERS:

1-Phase or 3-Phase design  
50/60Hz – AN/AF3 construction  
Horizontal or Vertical mounting system; IP00-IP67 possible

## PRODUCT PARAMETERS:

- Power: up to 500kVA
- Grid Voltage Standard: 230V/400V/690V
- Secondary Voltage customized
- Number of Sec. Outputs customized
- Connectors customized
- Low Losses design
- UKCA/UL on request

## CHOKES/INDUCTORS:

DC/1-Phase or 3-Phase design  
AN/AF3 construction  
Horizontal or Vertical mounting system; Cabined ready construction

## PRODUCT PARAMETERS:

- Inductance customized
- Current and THD<sub>i</sub> customizerd
- Custom linearity range
- Low loss design
- Up to 500kg weight
- Copper coils
- UKCA/UL on request

## POWER ELECTRONIC MAGNETIC COMPONENTS:

Chokes, Printboard Transformers, Switching Mode Transformers. THT&SMD Designs, Automatic assembly packing systems ready

## PRODUCT PARAMETERS:

- Electrical Parameters Customized
- Standard Component Programm
- Mounting System Customized
- ATEX on request
- UKCA/UL on request





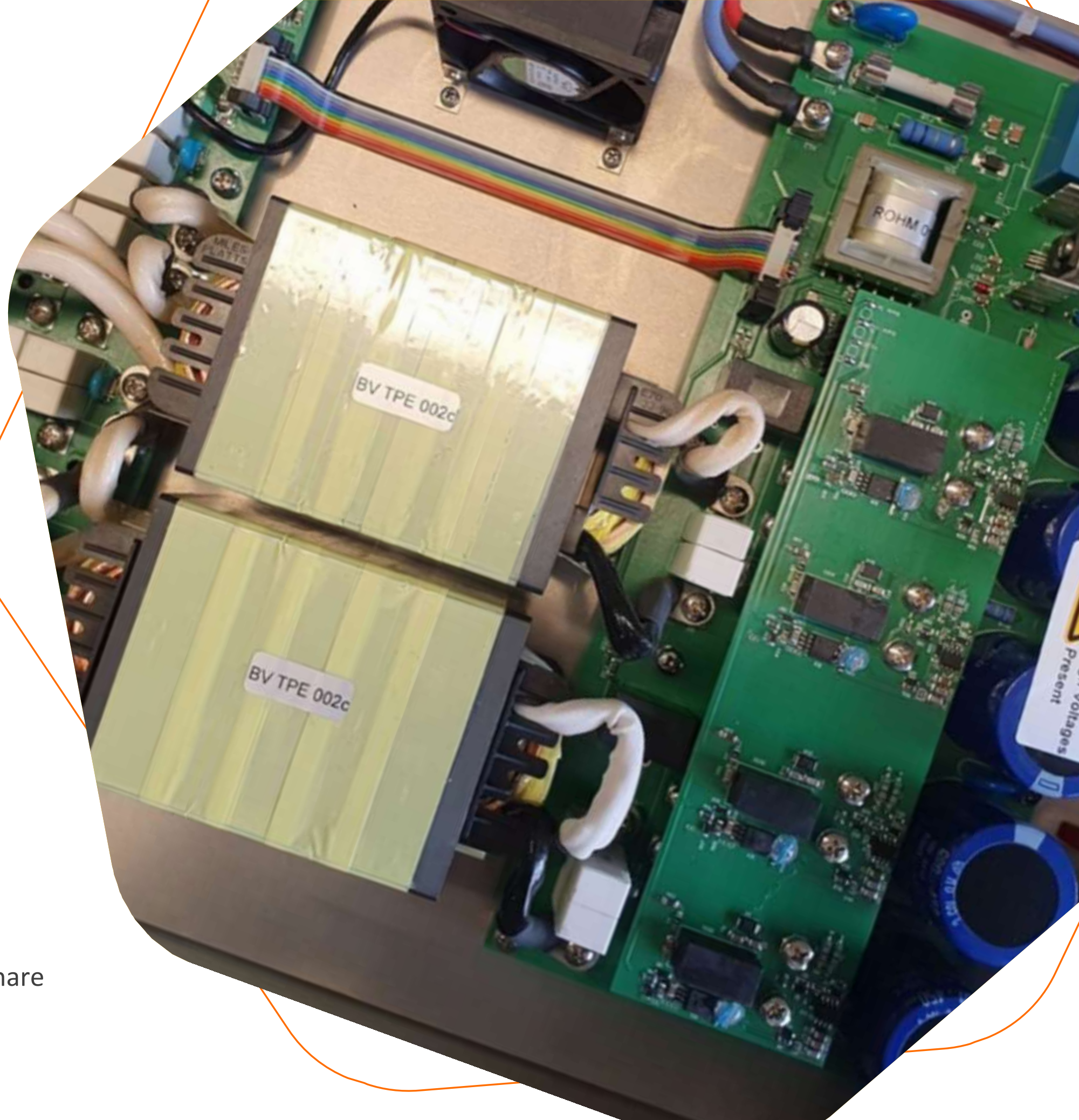
# TPEG POWER DC/DC CONVERTER

## DC/DC CONVERTER

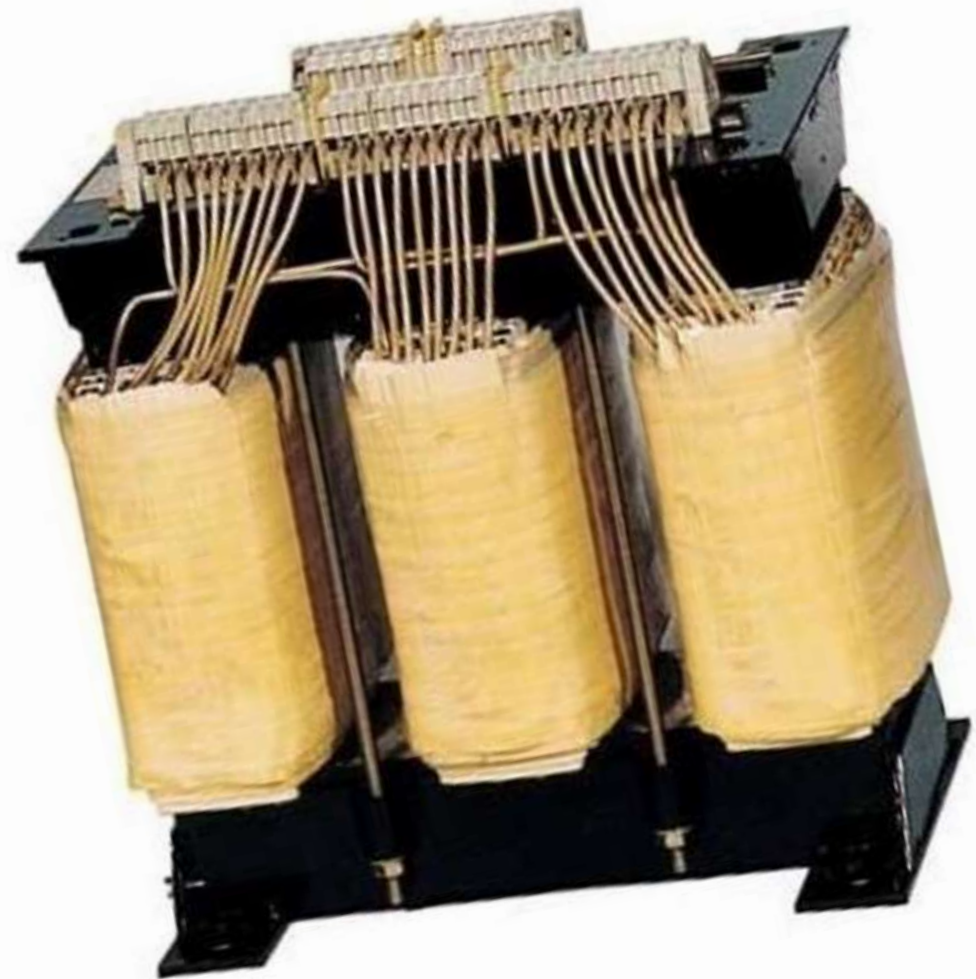
TPEG DC/DC Power converter transforms electrical power coming from renewable energy sources into DC Energy levels usable for energy storage in Hydrogen.

### 10-50kW DCDC Converter Parameters

- Input voltage 600-860V
- Output Voltage 24-140V
- Ripple/Noise: 1%
- Power 50kW
- EMI Standard EN55011A
- Size: 19" 3-6HE
- Parallel work: 3-6x with Power share







## POWER TRANSFORMERS CHOKES AND INDUCTORS

### PRODUCT DESCRIPTION

Green hydrogen production relies on transformers to step up or step down electrical energy voltage for the electrolysis process. The use of high-efficiency transformers and optimized chokes and design can optimize and ensure safe operation of Hydrogen Market related power systems

### Transformers and Chokes:

- 1-, 3- Phase Inductors, transformers
- DC Chokes
- up to 250kVA single-unit systems
- On-, Off-Grid application
- Cooling: AN, AF, indirect Water-Cooled

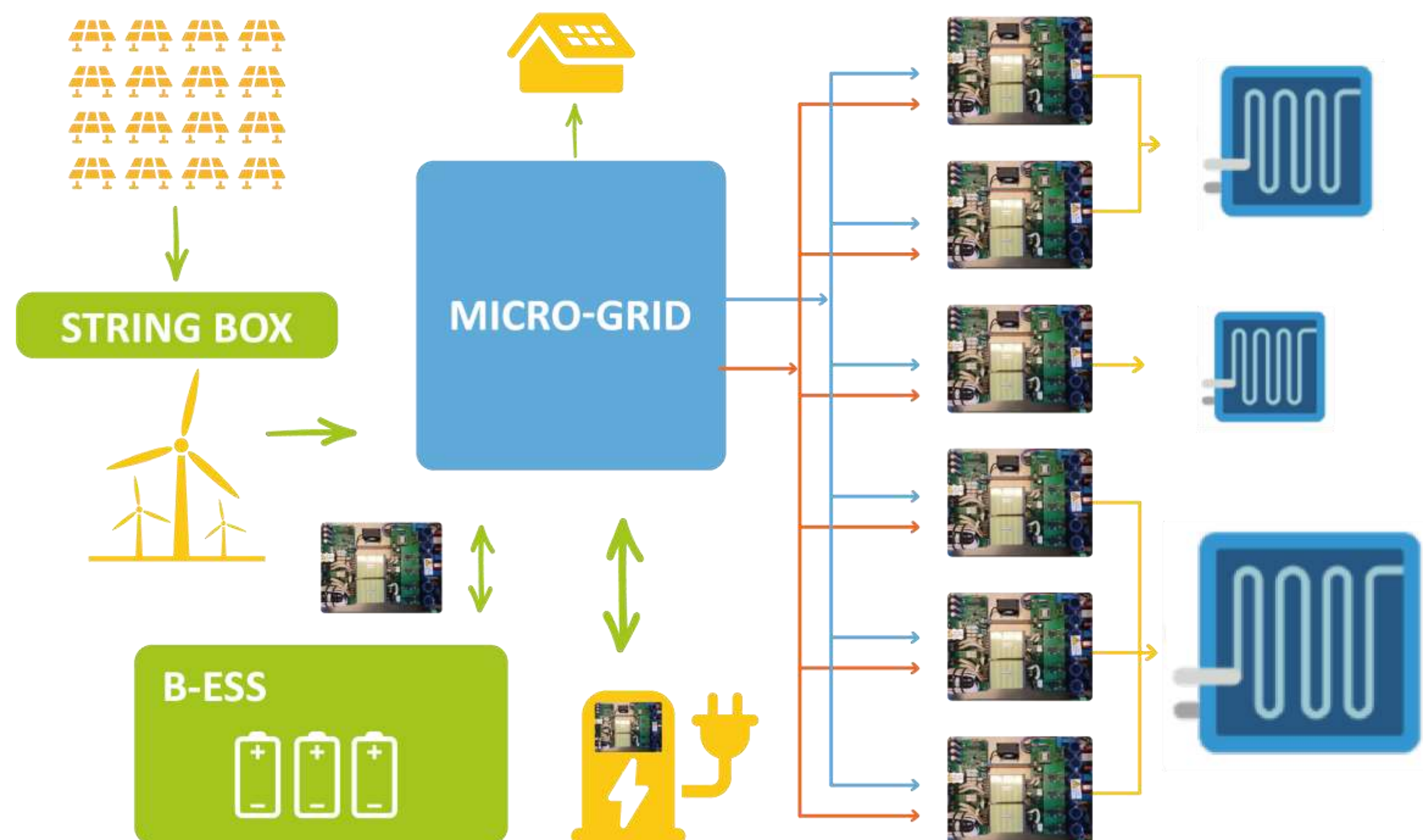




# EXAMPLE APPLICATION OF TPEG PRODUCTS IN POWER TO X



## TPEG PRODUCTS





## POWER ELECTRONIC MAGNETIC COMPONENTS



- **OUTPUT CHOKES**
  - **50 HZ LINE CHOKES**
  - **COMMON MODE CHOKES (THT & SMD)**
  - **PFC CHOKES**
  - **STORAGE CHOKES**
  - **POWER CHOKES WITH UPRIGHT COILS**
  - **POT CORE CHOKES**
- 
- **SMPS TRANSFORMERS**
  - **FLYBACK TRANSFORMERS**
  - **FORWARD TRANSFORMERS**
  - **PUSH-PULL TRANSFORMERS**



# THANK YOU MERCI | DANKE



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