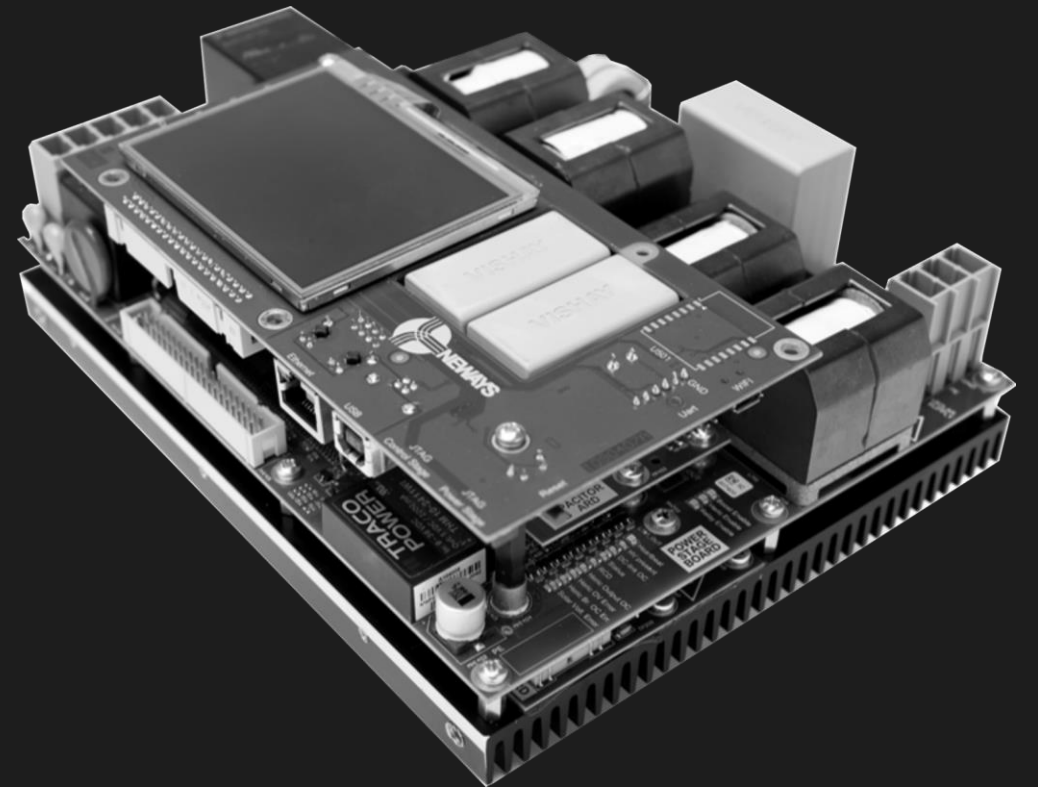


neways



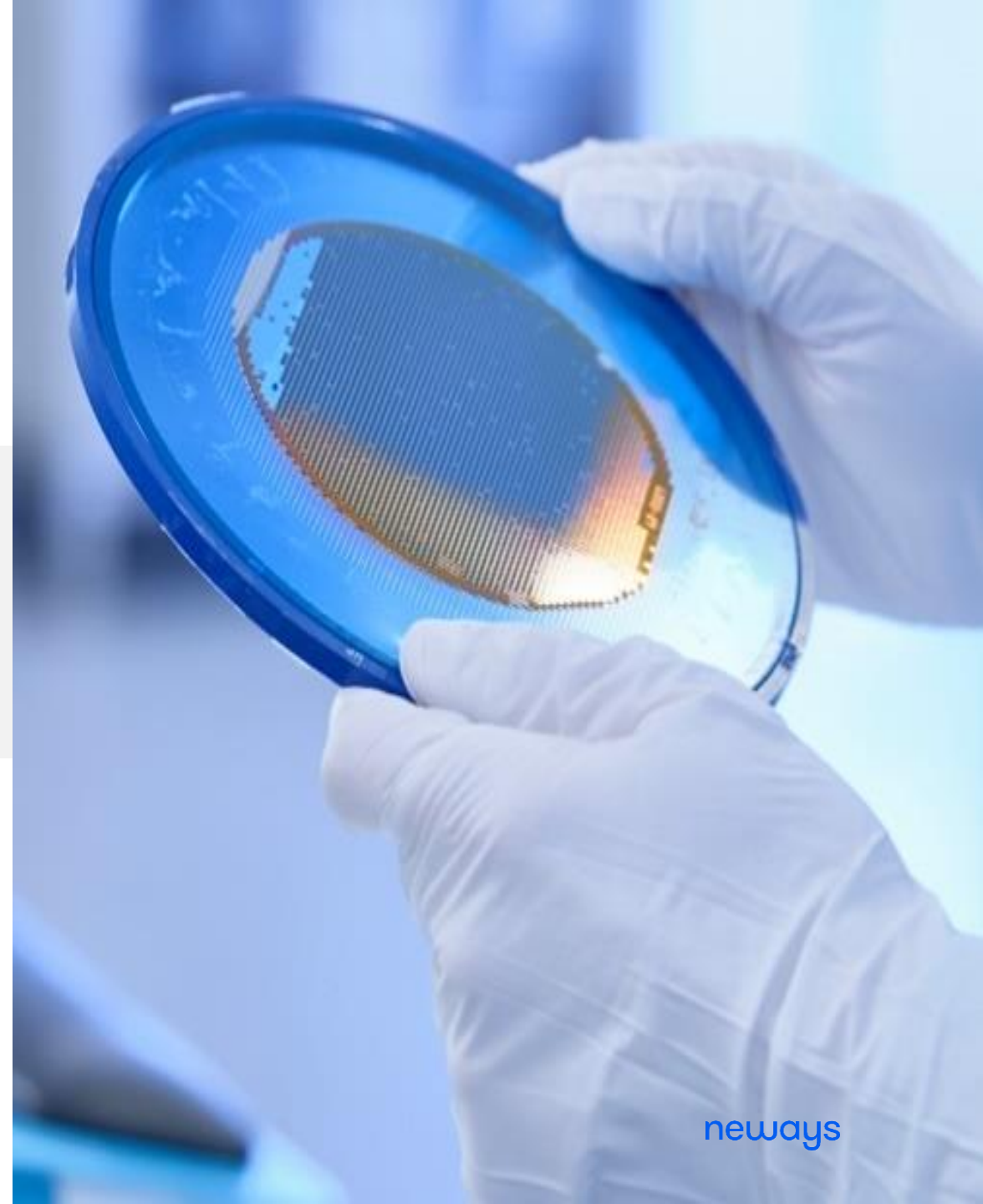
Technology development @ Neways -  
Use case: GaN PV inverter

February 29<sup>th</sup>, 2024



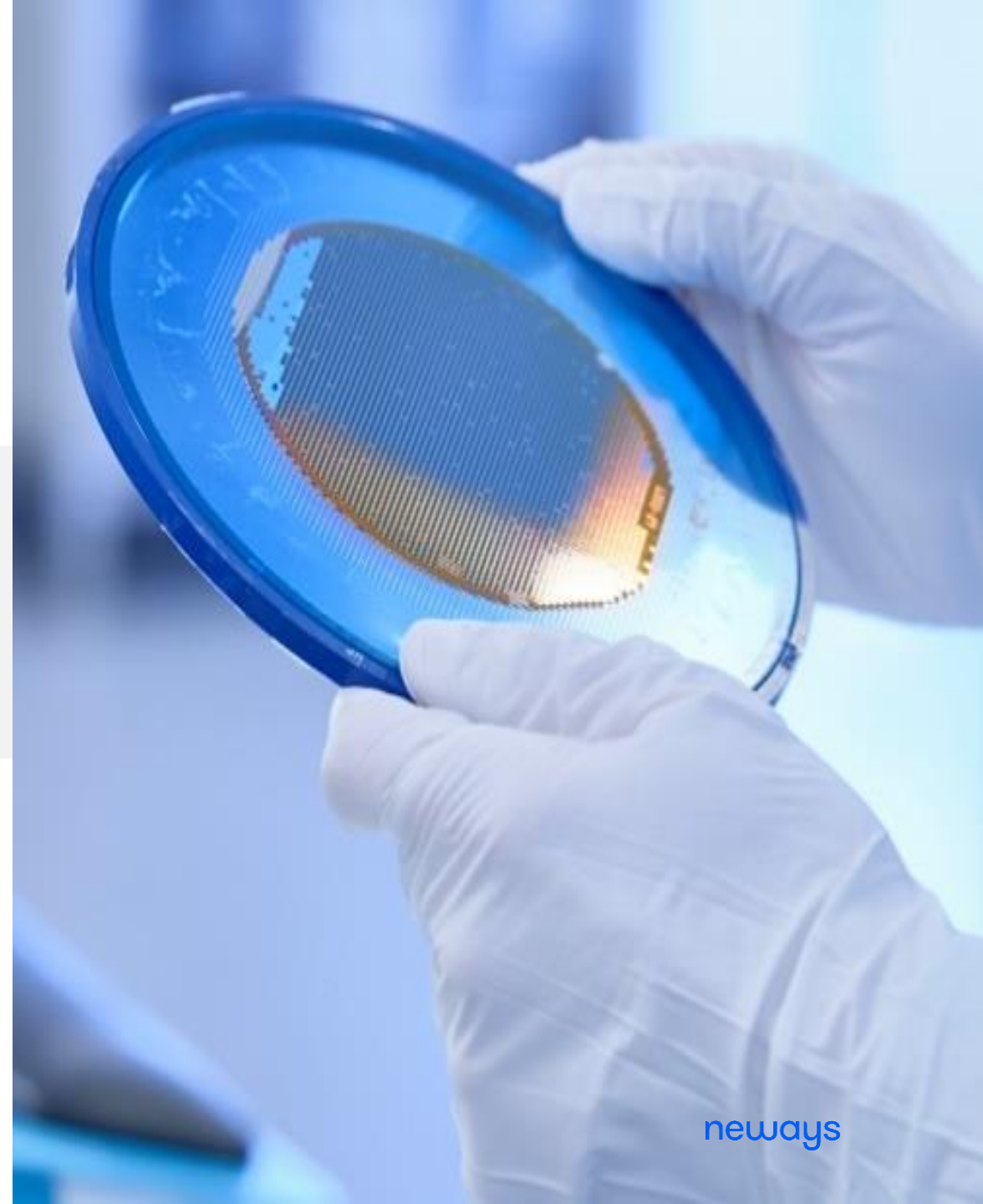
# Agenda

- ▶ Neways at a glance
- ▶ Development and engineering
- ▶ Use case: GaN PV inverter



# Agenda

- ▶ **Neways at a glance**
- ▶ Development and engineering
- ▶ Use case: GaN PV inverter



# Neways as international innovator

## International technology partner

With more than **50 years'** **experience** combined with **world-class engineering** power, Neways **develops** and **produces** electronics, facilitating disruptive technological innovations in high growth industries

## Driving innovation in high-growth industries



**Smart mobility**



**Semicon solutions**



**Connectivity**

**€470m**

2021 revenue

**>2,600**

Employees

**18%**

Engineers in workforce

Leading in electronics for a sustainable future, and serving the most demanding customers

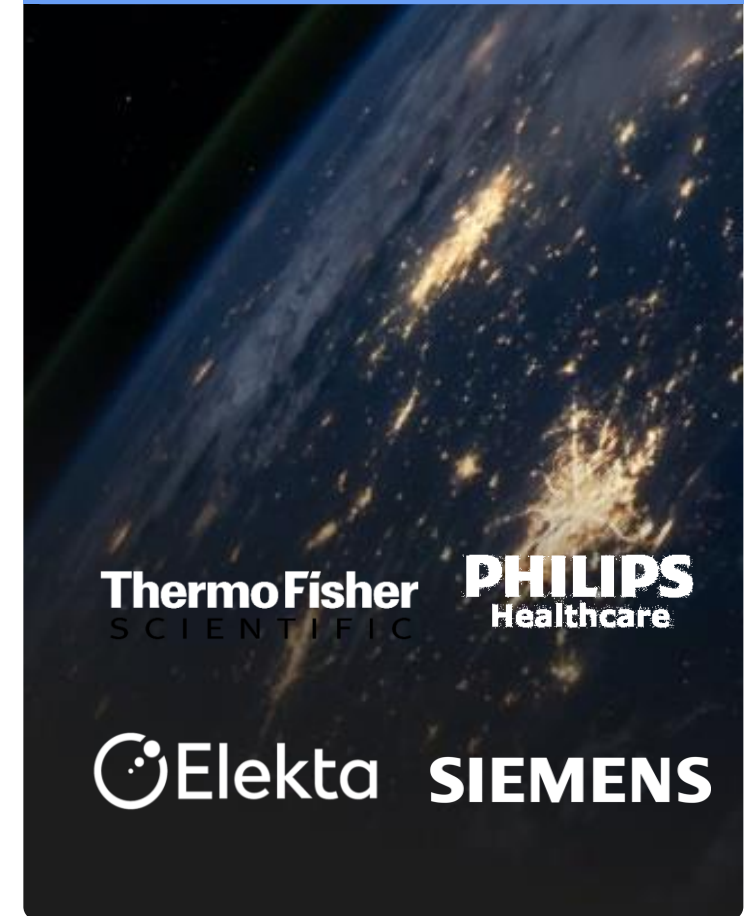
### Smart mobility















### Semicon solutions



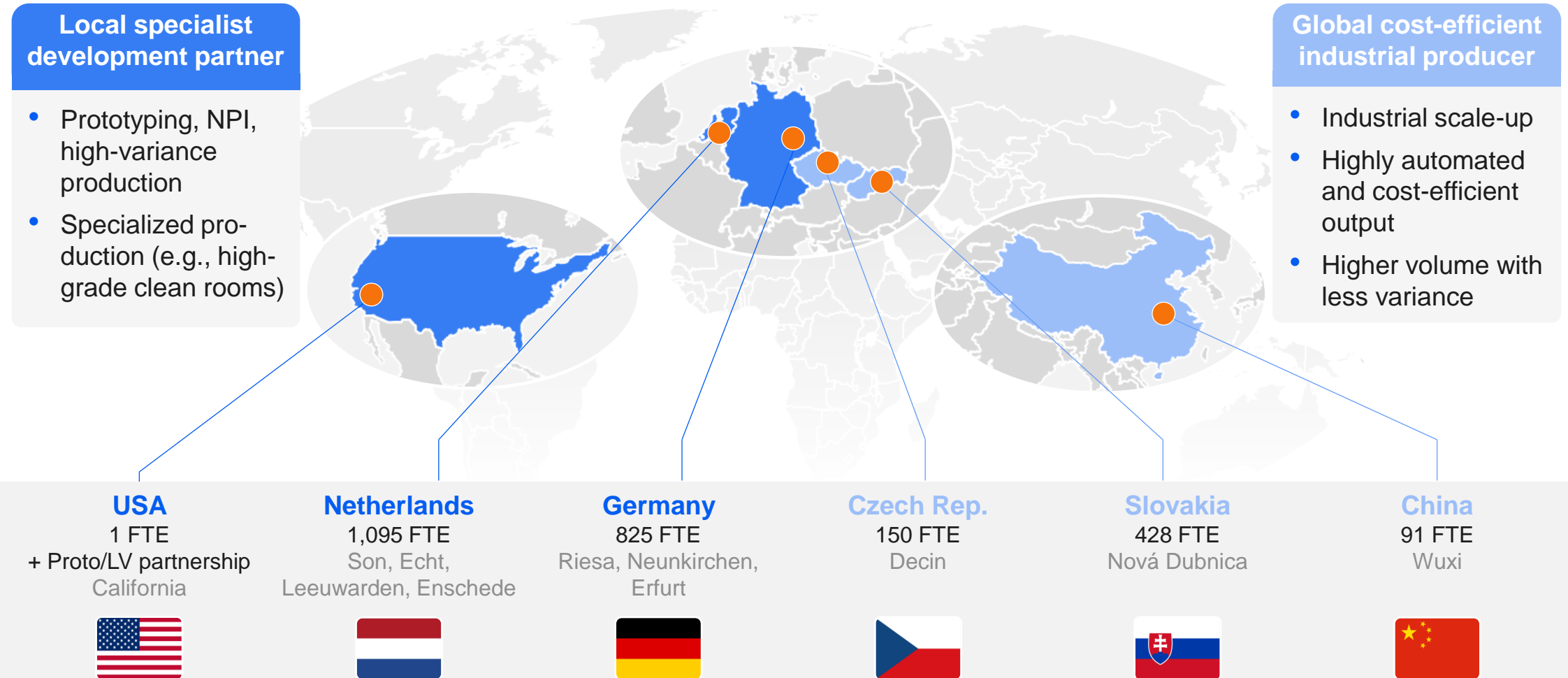
### Connectivity



## Firmly positioned across our three business lines

Smart mobility	Semicon solutions	Connectivity
 <p><b>Transforming motion</b></p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">   <b>Electrification</b> </div> <div style="text-align: center;">   <b>Digitization</b> </div> <div style="text-align: center;">   <b>Autonomous driving</b> </div> </div>	 <p><b>Enabling smart technologies</b></p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">   <b>Lithography innovation</b> </div> <div style="text-align: center;">   <b>Front-end innovation</b> </div> <div style="text-align: center;">   <b>System integration</b> </div> </div>	 <p><b>Connecting life</b></p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">   <b>Robotics &amp; automation</b> </div> <div style="text-align: center;">   <b>IoT applications</b> </div> <div style="text-align: center;">   <b>MedTech</b> </div> </div>
<ul style="list-style-type: none"> <li>● <b>Pioneer role</b> in charging and inverter technology with &gt;10 years experience</li> <li>● <b>Expert in interoperability</b> between different IoT and Smart Mobility solutions</li> <li>● Vast experience with <b>automotive quality standards</b></li> </ul>	<ul style="list-style-type: none"> <li>● <b>Top supplier to semiconductor lithography</b> (such as ASML), including delivery of “Grade 2” cleanroom functional tested cabinets</li> <li>● Expertise in <b>re-use and re-manufacturing services</b> to prolong the lifetime of existing systems</li> </ul>	<ul style="list-style-type: none"> <li>● Experts in technologies underpinning the future of <b>healthcare, agriculture and industrial automation</b></li> <li>● Lifecycle services for electronics in demanding “<b>high durable</b>” environments</li> </ul>

# Footprint to optimally cater to our customers' local needs and enable cost-efficient industrial scale-up globally



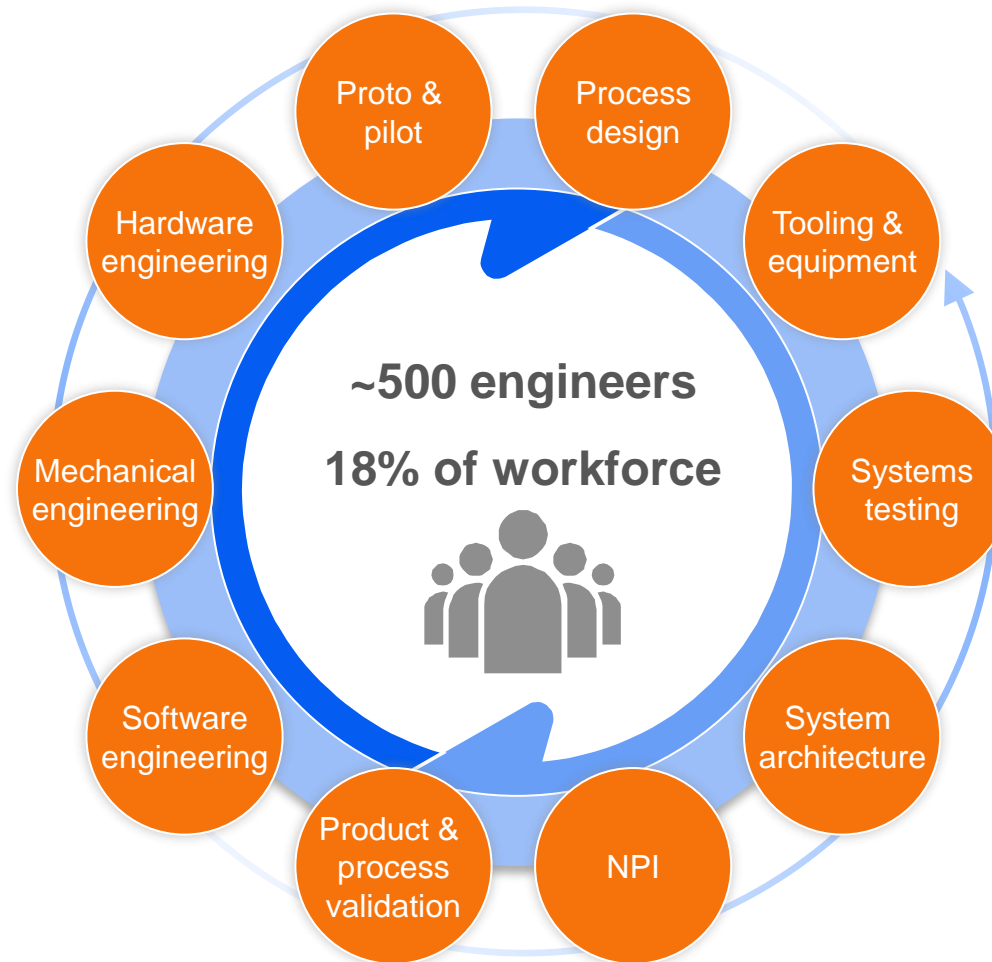
Our skilled engineers enable our value-adding technology proposition...

We integrate your requirements as you need it with close connection to production

### New technology development

Developing **new technologies** addressing **future trends**, optimizing for **availability** and **circularity** with ability to quickly respond to **market dynamics** and **cross-industry innovation**

**Based in our innovation centers** in the Netherlands (Son, Echt and Enschede) and Germany (Erfurt) –setting up innovation hub in Romania



### Process & production engineering

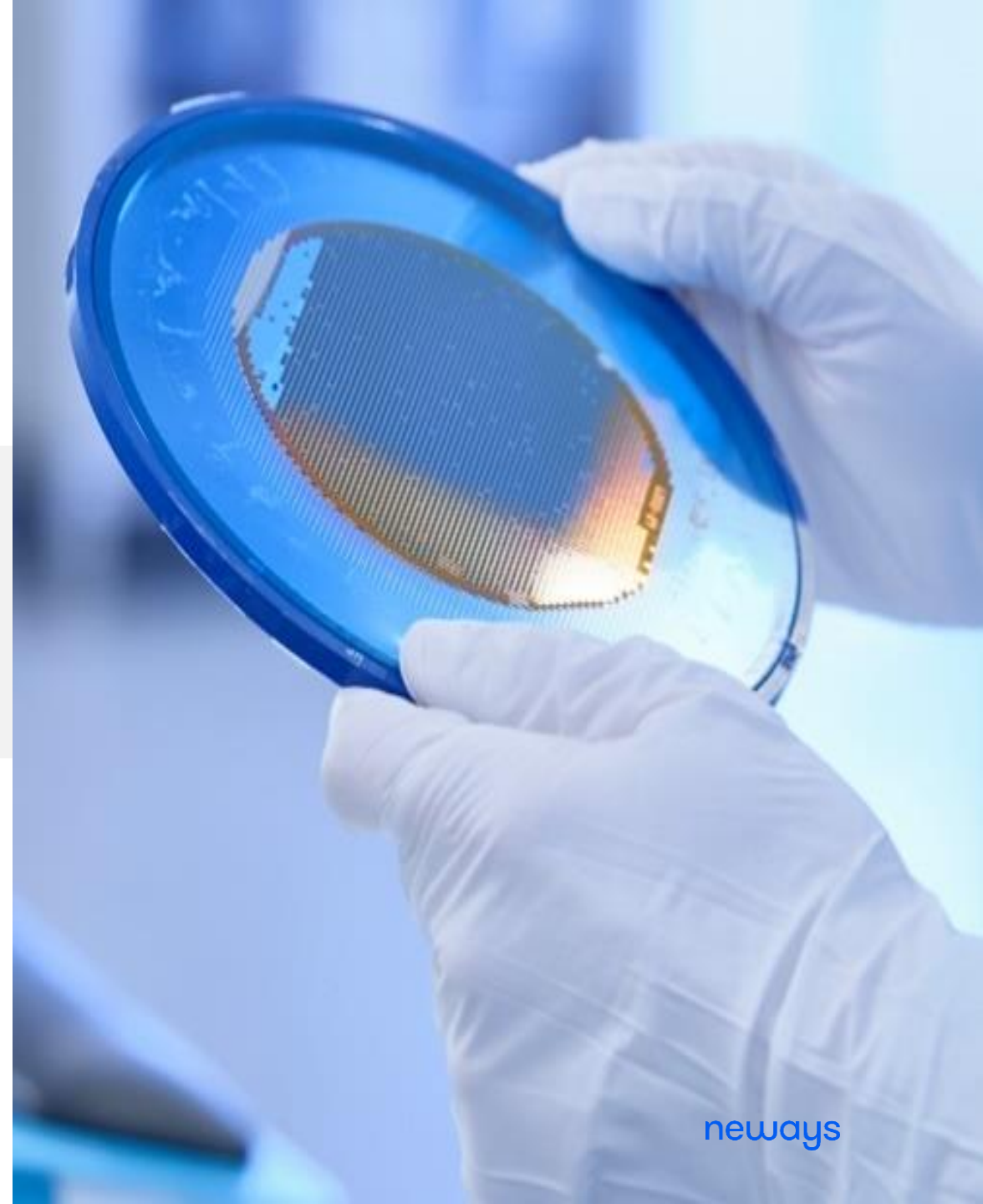
Optimizing **design and production processes**, for example for **new product introductions**, **industrial scale-up** and **designing products for circularity**

**Integrated in our various production locations** across the Netherlands, Germany, the Czech Republic, Slovakia, and China



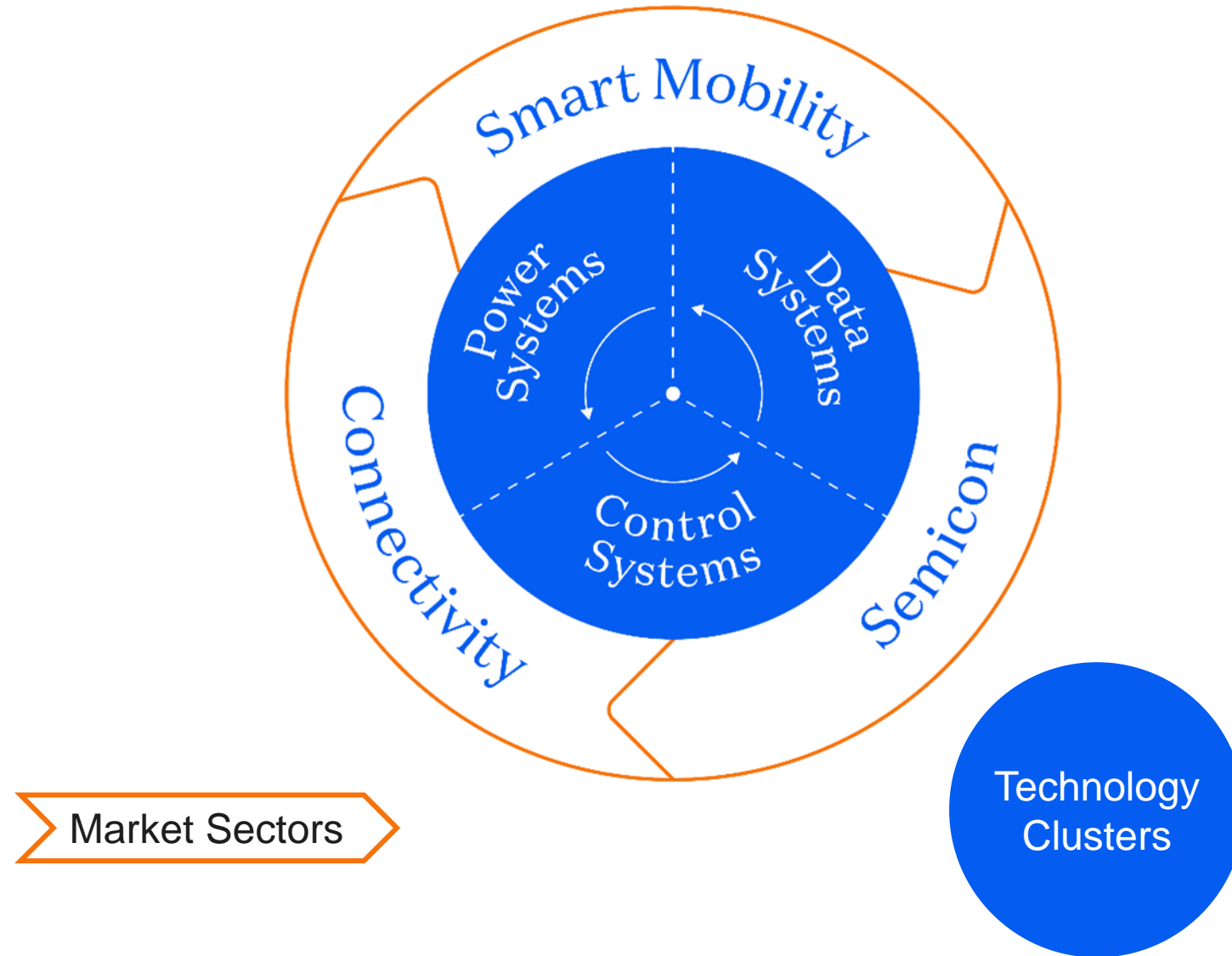
# Agenda

- ▶ Neways at a glance
- ▶ **Development and engineering**
- ▶ Use case: GaN PV inverter



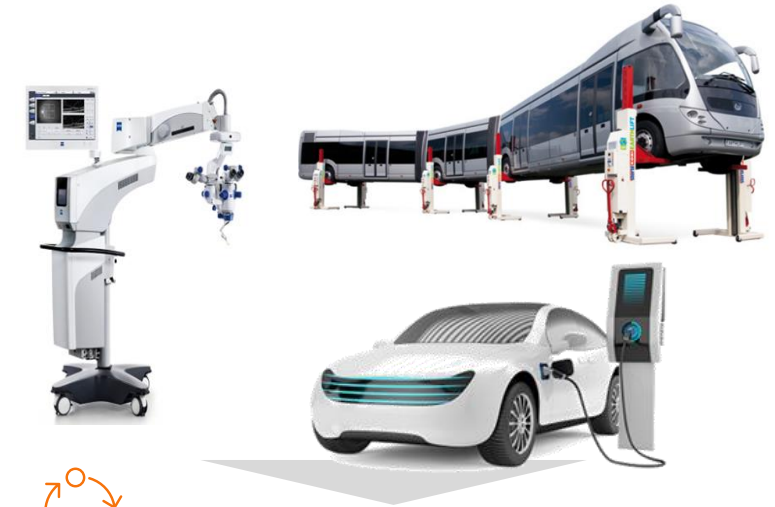
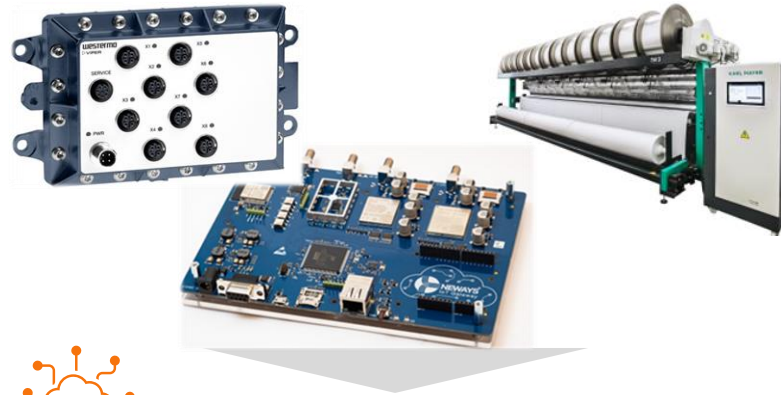
# Neways Technologies (NT) –

Three technology clusters connected with all 3 Market Sectors



# Technology clusters, for which Neways is recognized for

APPLICATIONS



## Power Electronics & Systems

- High-power, high-voltage conversion
- Motor drives
- Power supplies: DC-DC, AC-DC
- Low-power circuits & energy harvesting
- SiC / GaN technology
- Thermal management
- PCBA design
- Housing design & cooling
- System-in-package technologies



## Data Systems

- Sensing, SPI, I2C, UART
- Wired communication: fieldbuses, USB, RSxxx, CAN, Profinet, Modbus, Profibus, PCIe
- Wireless communication
- High-speed communication (HSDD)
- Cabling, harnesses & connectors
- Miniaturization
- Data security
- AI / ML



## Control Systems & Technology

- Algorithms motion control
- Open / closed control loops
- Actuators control
- System on Chip, FPGA
- Digital signal processing
- System dynamics mechatronics
- Safety control
- HIL & modelling
- Simulation tools (Simulink, 20sim)

TECHNOLOGIES



Design for Sustainability



Design for Manufacturing



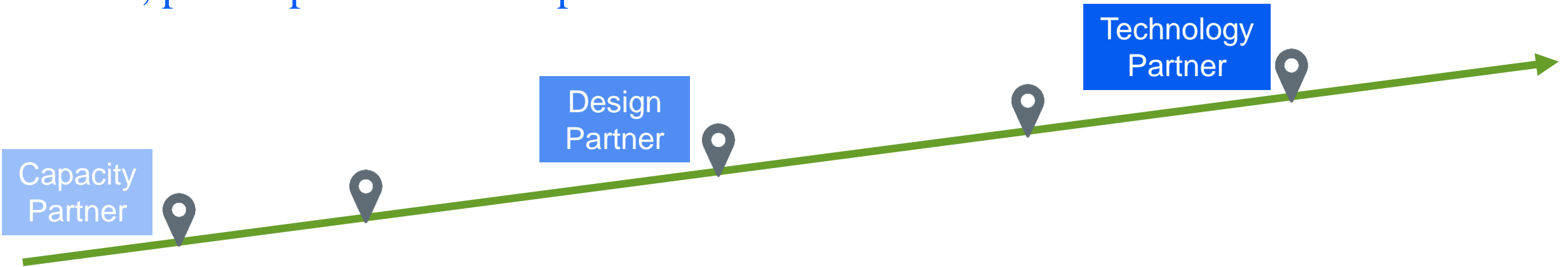
Systems & Reliability Engineering



Functional Safety, Regulations

FOUNDATION

# NT, past to present: development



**PCBA designs**  
*PCB designs*

**Electronic Cabinets**  
*EM design of electronic cabinets*

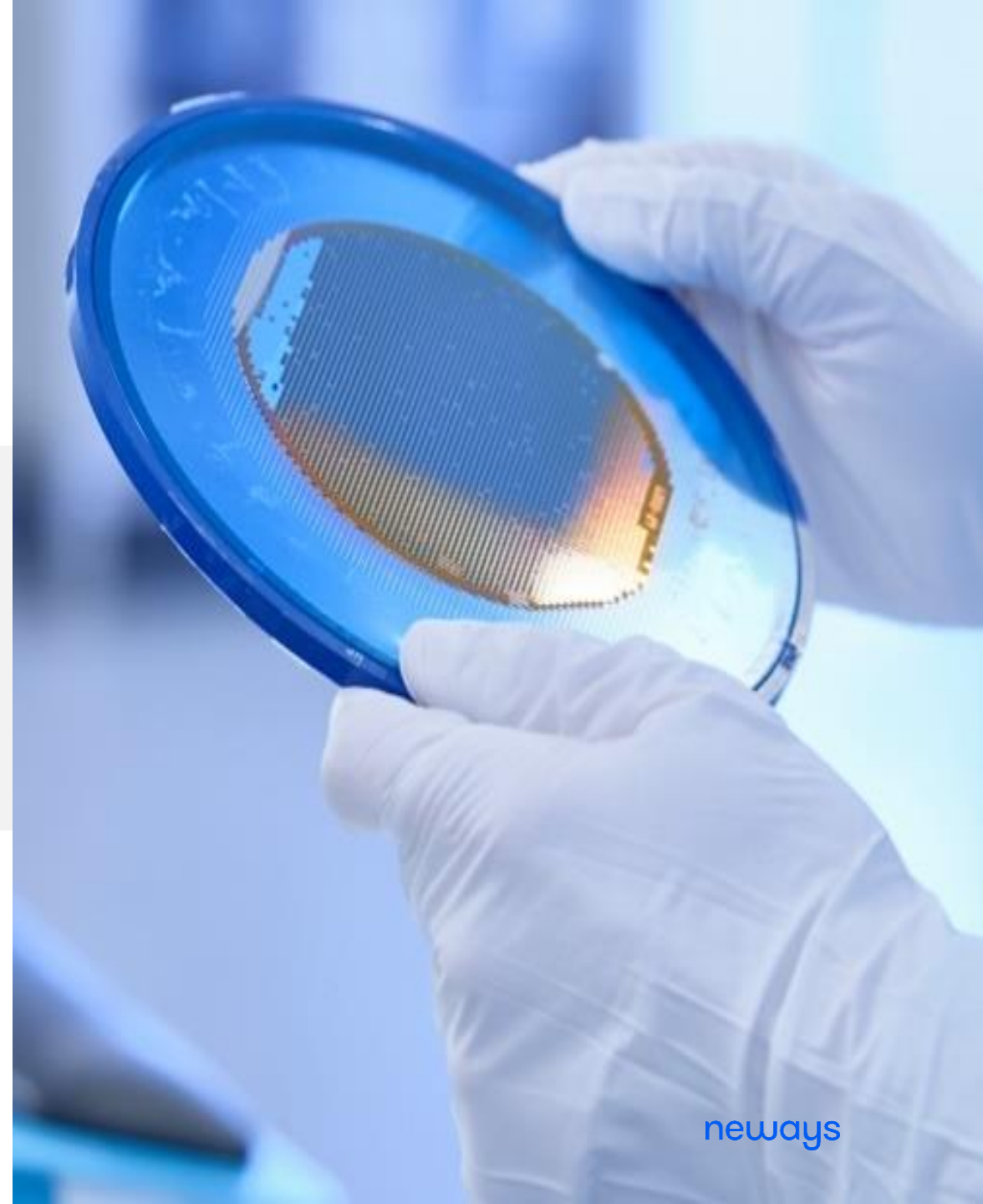
**Motor Control**  
*HW/SW design & realization*

**Automotive developments**  
*Mode 2 charging solutions*

**Technology platforms**  
*GaN, IoT, Charging*

# Agenda

- ▶ Neways at a glance
- ▶ Development and engineering
- ▶ **Use case: GaN PV inverter  
(technology demonstrator)**



# Neways as sustainable development partner

Design for sustainability topic examples:

- Serviceability
- Predictive maintenance
- Reuse of materials
- Increase efficiency
- Use less materials
- ...

# GaN

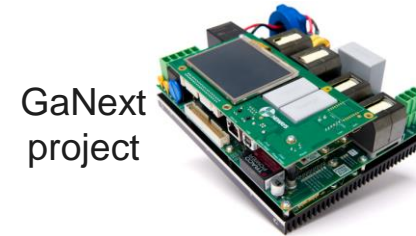


# Introduction: GaN and GaNext

- Gallium Nitride (GaN) in power applications
  - Wide-bandgap semiconductor
  - Faster switching speeds (compared to Si)
  - Higher conversion efficiencies and power densities
  - Disadvantages: cost, reliability, EMC, implementation effort
- GaNext project
  - Remove barriers to adoption of GaN
  - Demonstrate higher efficiency and power density for power applications
  - Develop intelligent GaN power module
  - Integrate/co-package power device with drive, voltage control, and protection circuits



# Transitioning from <0.1kW/<100V into 3kW/650V → opening new application areas in automotive and industrial



GaNNext project

1950

2020

Si

GaN

<0.1kW or <100V

<3kW or <650V

<6kW or <1250V

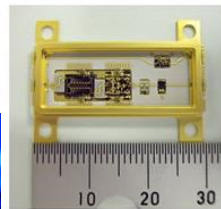
Common usage



Radar drives



LED-technology



Consumer charging



High-End audio



Future applications

5G-Systems

Motor Drives

Traction Inverters

PV-Inverters

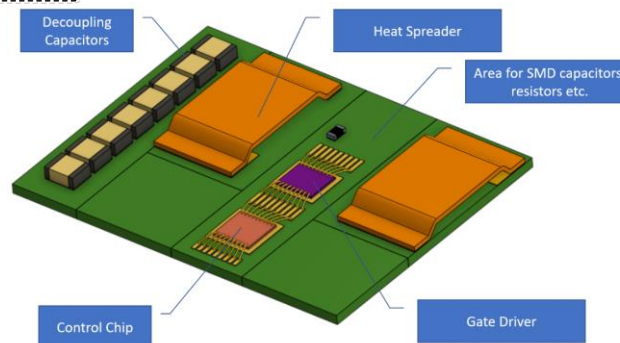
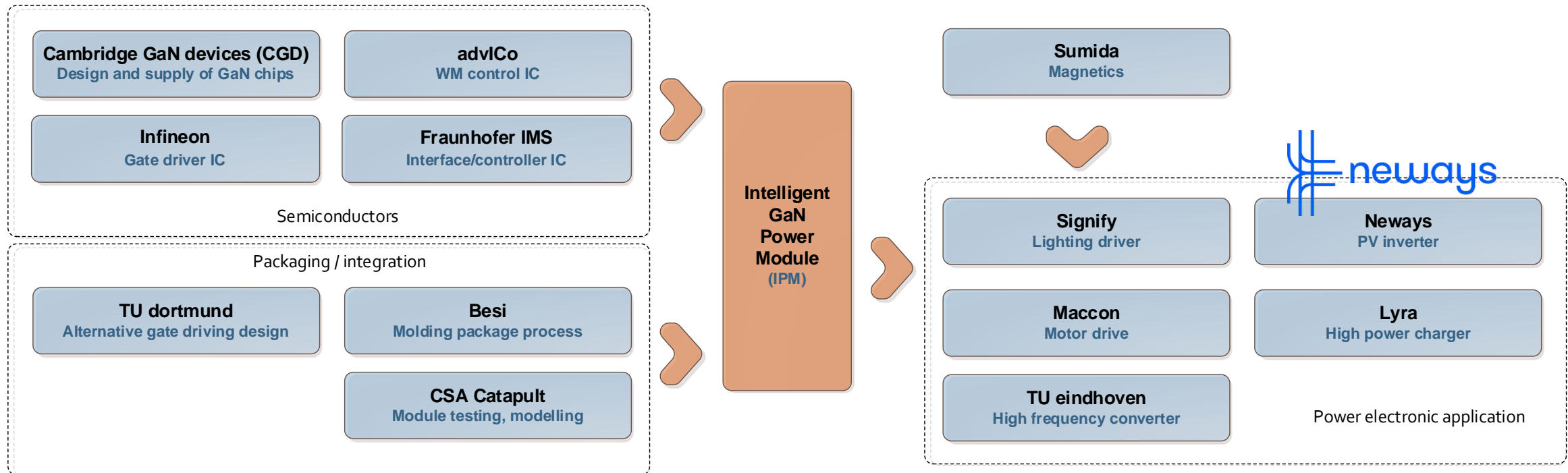
Power Supply

And many more...





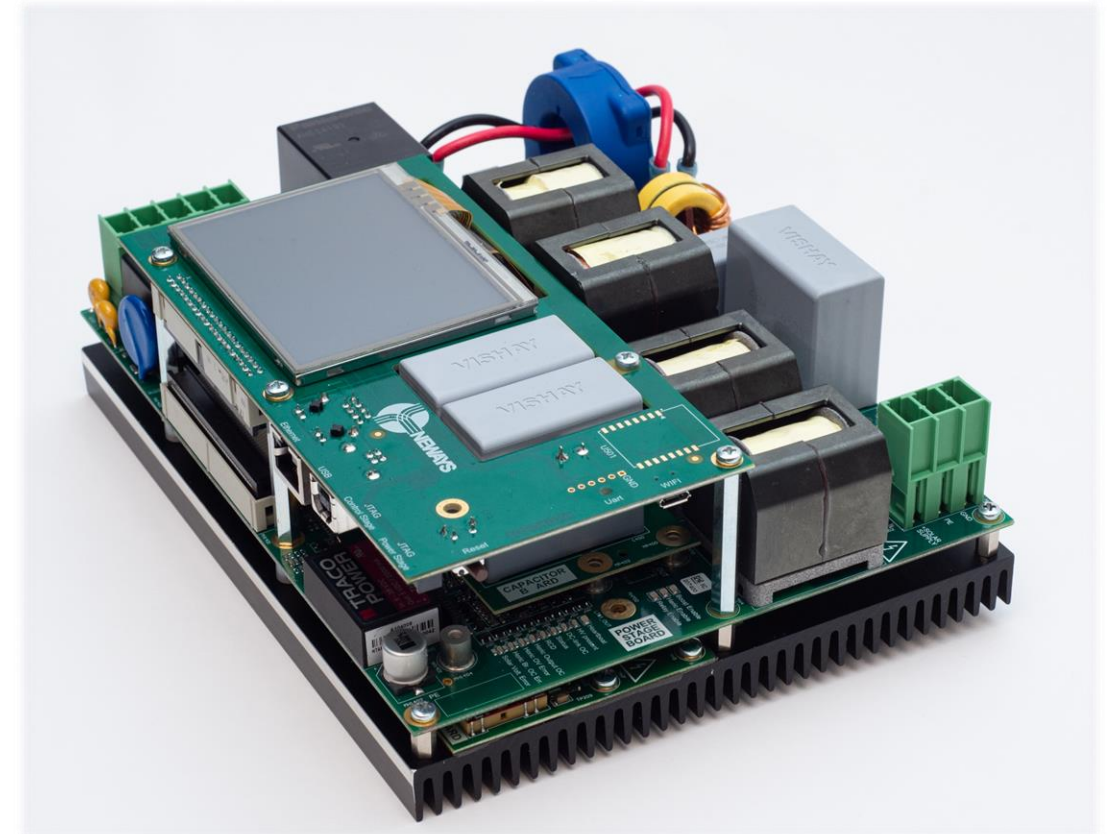
# GaNext: project and positioning of Neways



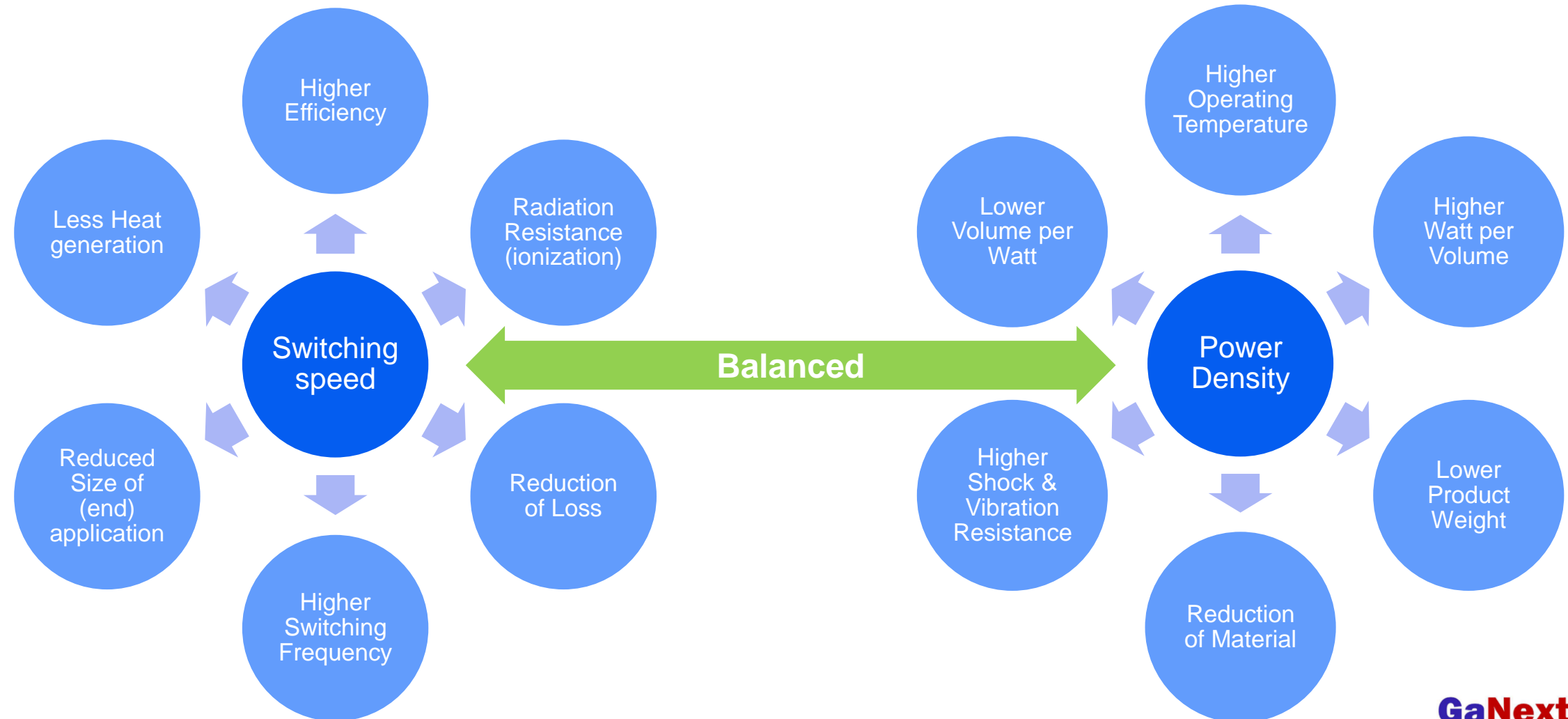
13 partners / 3 countries

# Neways GaNext PV inverter

- Vin 150-350VDC, Vout 230VAC
- Maximum output power: 3kW
- Switching frequency selected for optimum size vs. efficiency
- Transformer-less design
- Power density target: 1kW/L including housing
- Switching frequency: 350kHz
- Uses CGD GaN HEMTs in:
  - Boost converter stage
  - Output stage
- GaNext Intelligent Power Modules (IPM) used in output stage of improved power inverter



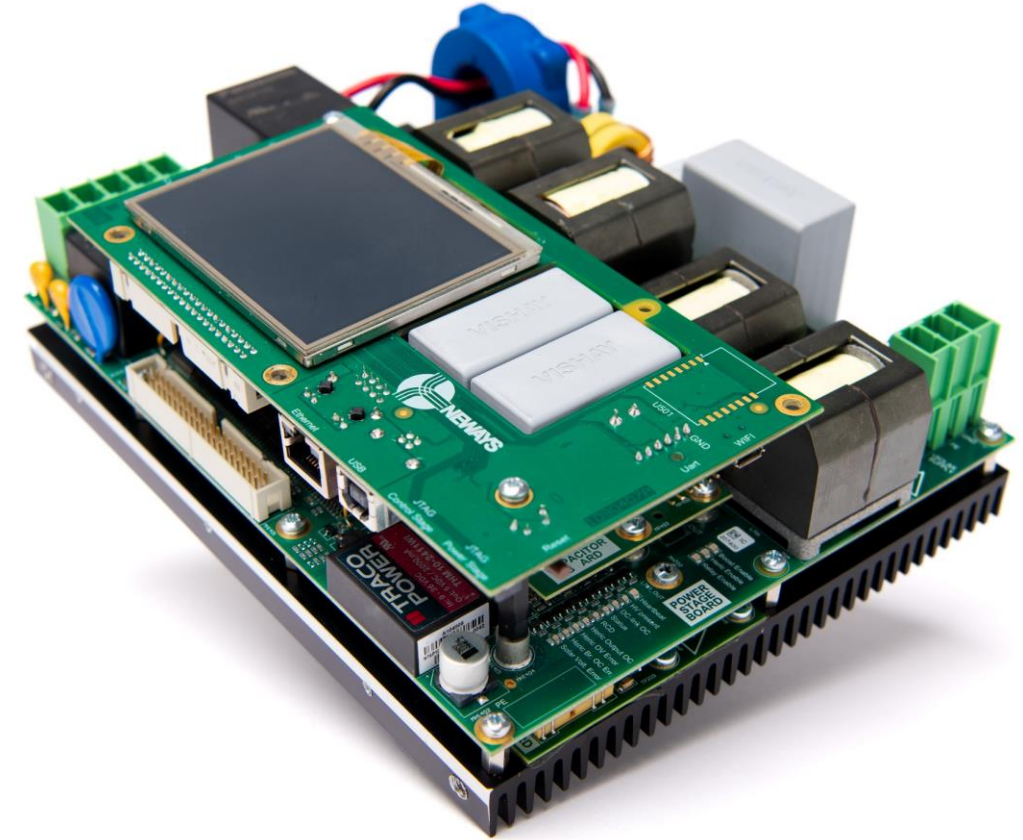
# Advantages of using GaN. What is important to you?



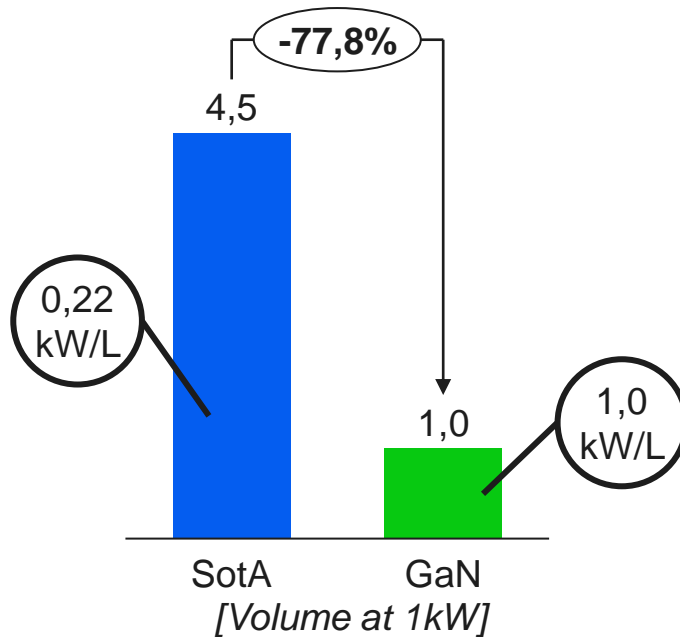
# GaNext: GaN-based PV inverter with optimized efficiency and reduced size

## Key Achievements:

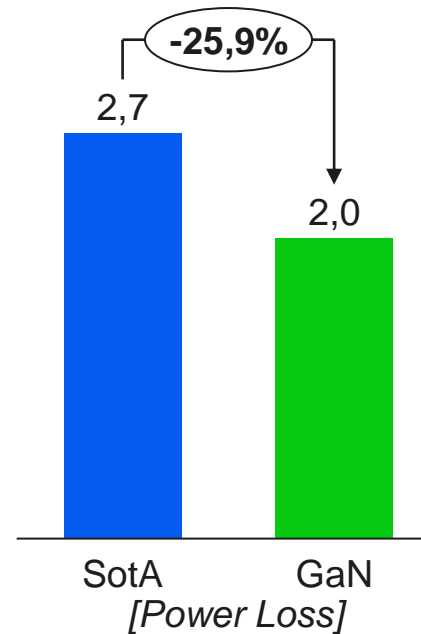
- Successful deployment of GaN-technology
- Optimized Size vs Efficiency
- Achieved Power density: 1kW/L including housing
- Realized transformer-less design



## Volume:



## Losses:



Neways has the expertise and knowledge to successfully implement improved GaN-technologies, enabling great advantages in high-power and high-voltage applications

The GaN technology sets the bar in power conversion with:

- **Higher efficiency**
  - Reduced heat dissipation
  - Smaller cooling measures
- **Smaller product/module dimensions**
  - Re-think system architectures
    - Deployment of power inverters in narrow spaces
    - Integrate power inverters into product enclosures
  - Improve sustainability
    - Less material needed
    - Smaller logistical impact

### GaN challenges = Neways Key Expertise

- **Thermal Management**
  - GaN device
  - Driver circuitry
  - Bootstrap circuitry
- **Gate Control**
- **Voltage derating**
- **EMI**
- **VDS 100-650V**

