

# Open DC Alliance ODCA – DC-INDUSTRY

New Energy for Industry conference, 24./25. Oct. 2024, Vienna, AT

Dr. Hartwig Stammberger | Eaton | ODCA



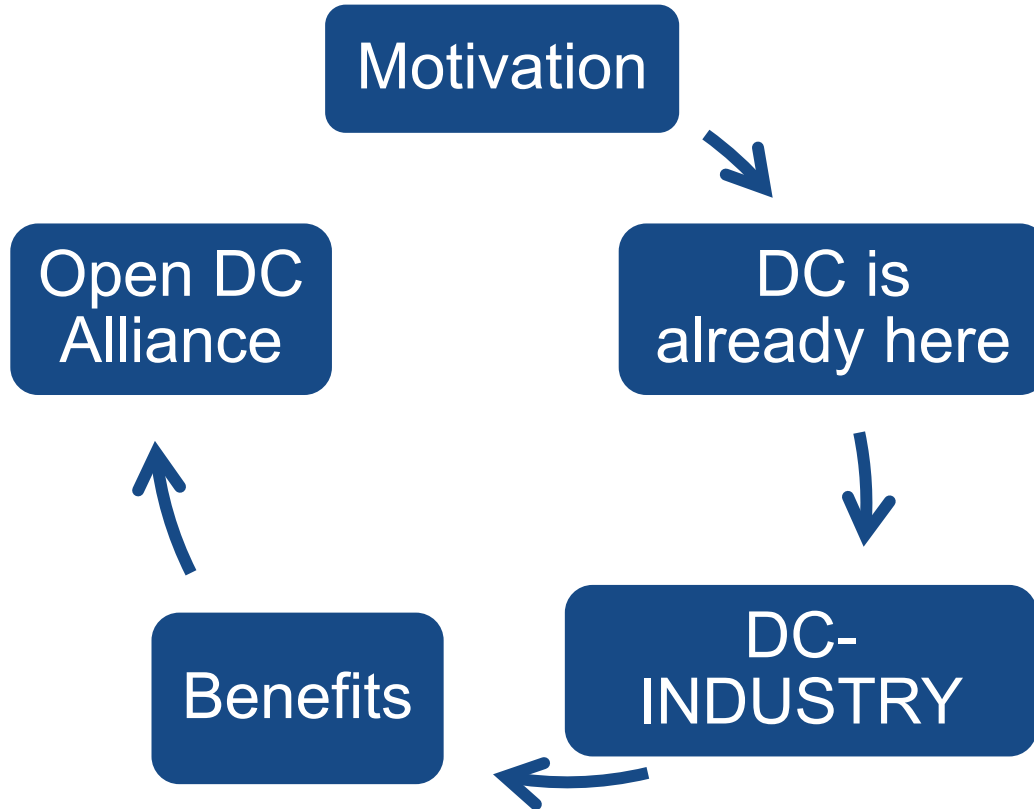
# Dr. Hartwig Stammberger

- **Professional**
  - Eaton, Bonn, Germany
  - Electrical Engineer, Ph. D.
- **Direct current background**
  - 2015: Eaton-lead for DC-INDUSTRIE
  - 2019-2023: Coordinator DC-INDUSTRIE2 (Germany)
    - 39 partners, 150+ experts
    - 10 model applications
    - System description published
  - 2022 – Chair Open DC Alliance ODCA <https://odca.zvei.org>

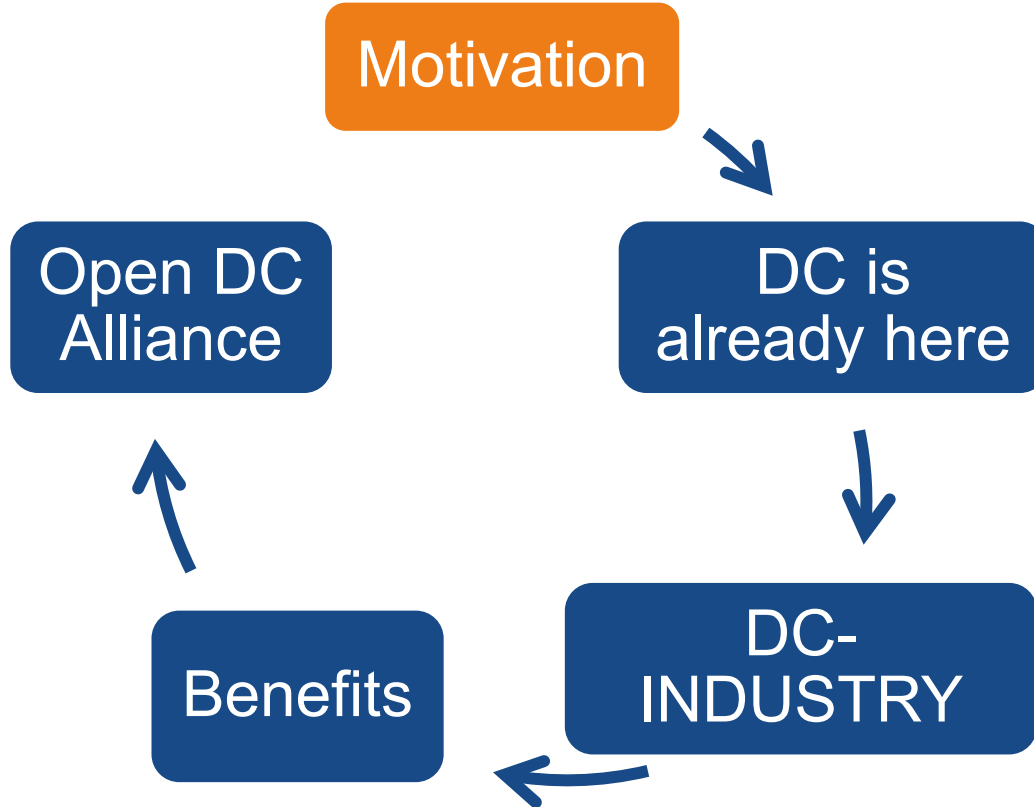


# Why low-voltage DC?

# Content

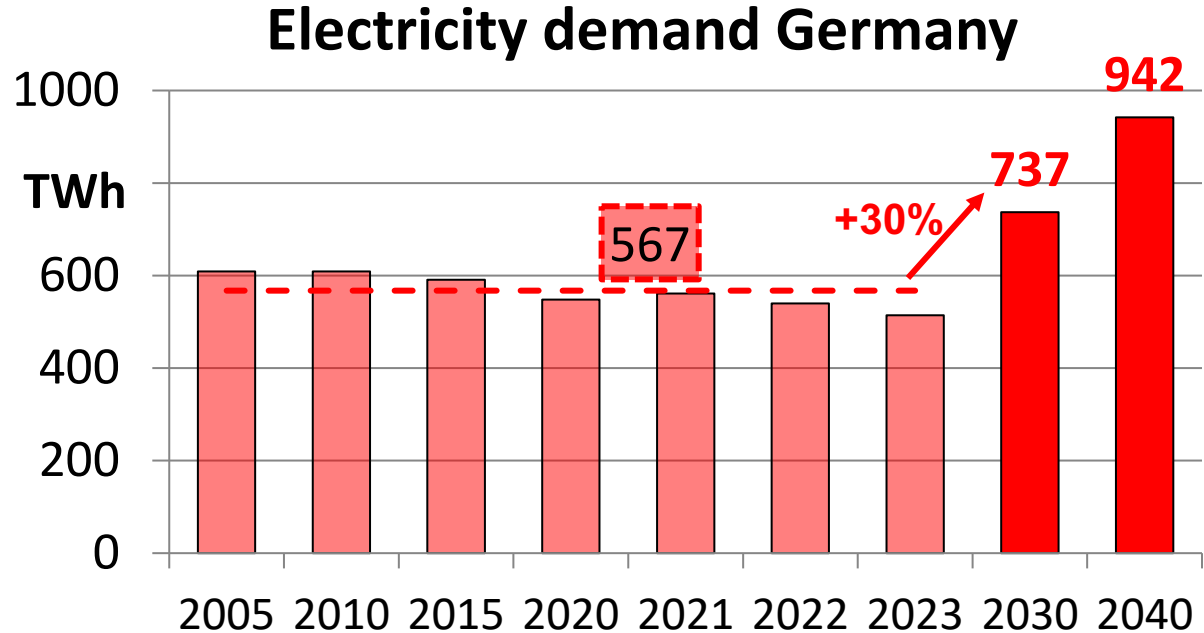


# Content



# Motivation 1 rising energy demand

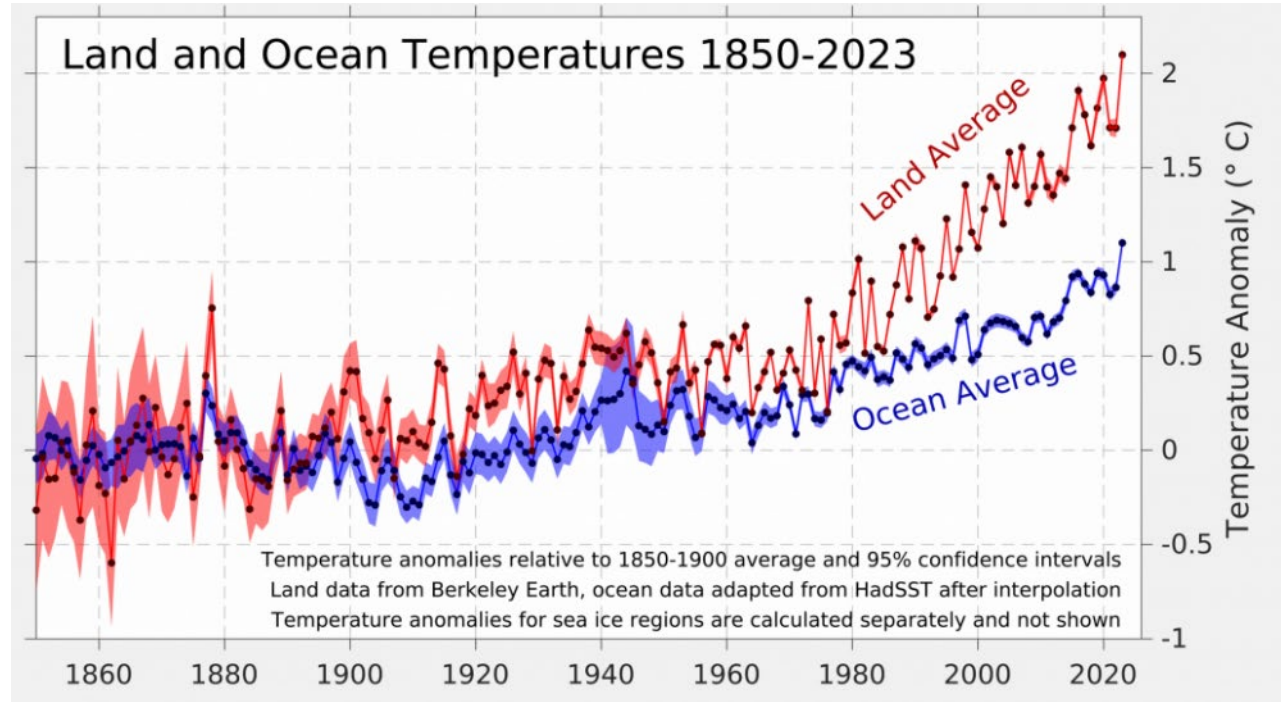
- **Electricity demand is rising**
  - Fossil to electric
  - +30% until 2030
- **Grid reaches / exceeds limitations**
- **New solutions needed**



Sources: <https://ourworldindata.org/energy> (actuals)  
[https://e-vc.org/wp-content/uploads/e.venture\\_Point\\_of\\_View\\_Strommarkt\\_2040.pdf](https://e-vc.org/wp-content/uploads/e.venture_Point_of_View_Strommarkt_2040.pdf) (forecast)

## Motivation 2 Global temperature rise

- Last 9 years have been the 9 warmest years on record (> 100 000 years)
- Land mass warms faster than oceans
- CO<sub>2</sub> emissions are root cause



Source: <https://berkeleyearth.org/global-temperature-report-for-2023/>

# One solution → Energy efficiency

- **IPCC report 2023**
  - Power generation, buildings, industry, and transport are responsible for close to 80% of global emissions
  - One **key solution** is **investment in clean energy & efficiency (2.)**
- **DC is part of the solution**

## 10 key solutions needed to mitigate climate change

1.  RETIRE coal plants
2.  INVEST in clean energy & efficiency
3.  RETROFIT and DECARBONIZE buildings
4.  DECARBONIZE cement, steel & plastics
5.  SHIFT to electric vehicles
6.  INCREASE public transport, biking and walking
7.  DECARBONIZE aviation and shipping
8.  HALT deforestation & RESTORE degraded lands
9.  REDUCE food loss and waste and IMPROVE agricultural practices
10.  EAT more plants & less meat



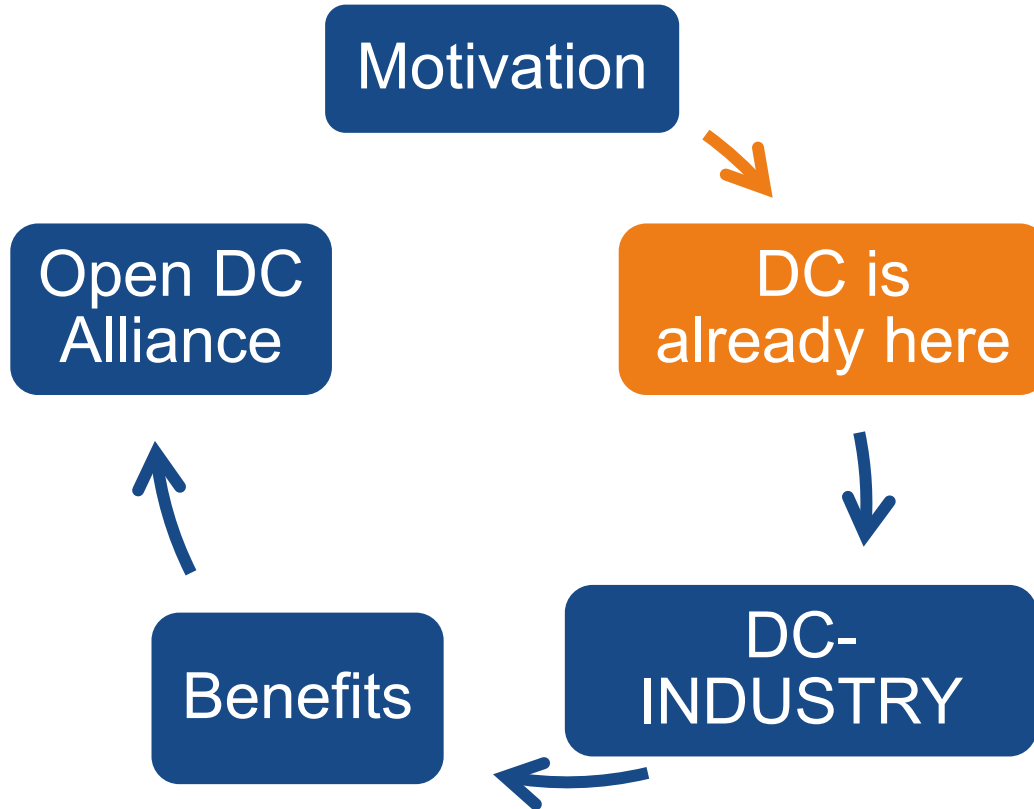
Source: IPCC AR6,  
EQU0855

 WORLD RESOURCES INSTITUTE

Source: <https://www.wri.org/insights/2023-ipcc-ar6-synthesis-report-climate-change-findings> and <https://www.ipcc.ch/report/ar6/syr/>



# Content



# DC is already (almost) everywhere

1 / 2

## 1. Renewable energy uses or generates DC

- Wind power
- Photovoltaic



## 2. Battery storage is DC

- Use of e-cars improves availability and enhances technology



Sources: [https://commons.wikimedia.org/wiki/File:Menkoki\\_Wind\\_Power\\_station.jpg](https://commons.wikimedia.org/wiki/File:Menkoki_Wind_Power_station.jpg),  
[https://commons.wikimedia.org/wiki/File:Solarpark\\_Jännersdorf.jpg](https://commons.wikimedia.org/wiki/File:Solarpark_Jännersdorf.jpg) ,  
<https://commons.wikimedia.org/wiki/File:Battery-Pack-Leaf.jpg>

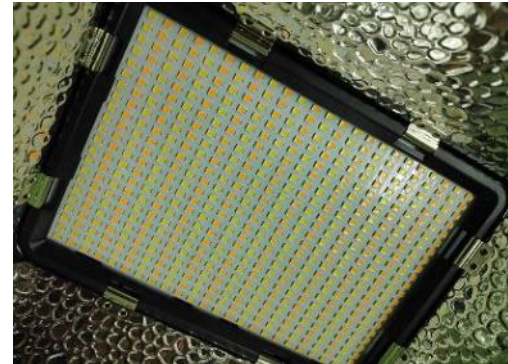
### 3. Drives in industry use frequency converters

- They already have a **DC Link**:  
AC → DC ↔ AC



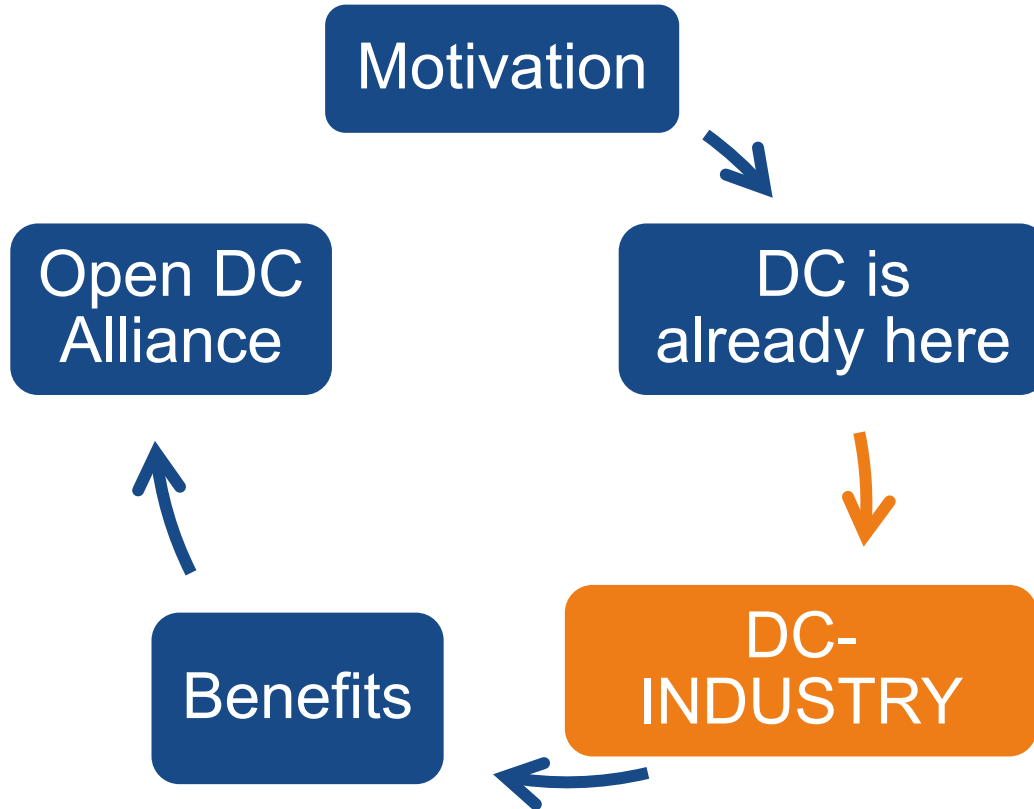
### 4. Many **Applications** have **DC**

- LED lighting
- Office equipment
- Household appliances
- And many more ...



Source: [https://commons.wikimedia.org/wiki/File:Led\\_Lights\\_Panel.jpg](https://commons.wikimedia.org/wiki/File:Led_Lights_Panel.jpg)

# Content

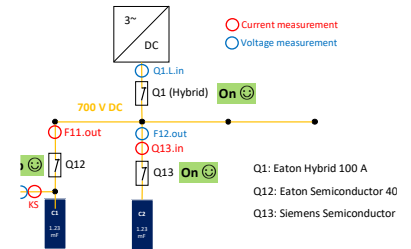


# DC-INDUSTRY projects 2016 – 2023

Supported by:



on the basis of a decision  
by the German Bundestag



Funded by  
German  
federal  
government

Consortium

- 45 partners – industry & research
- 150+ experts

10 model  
applications

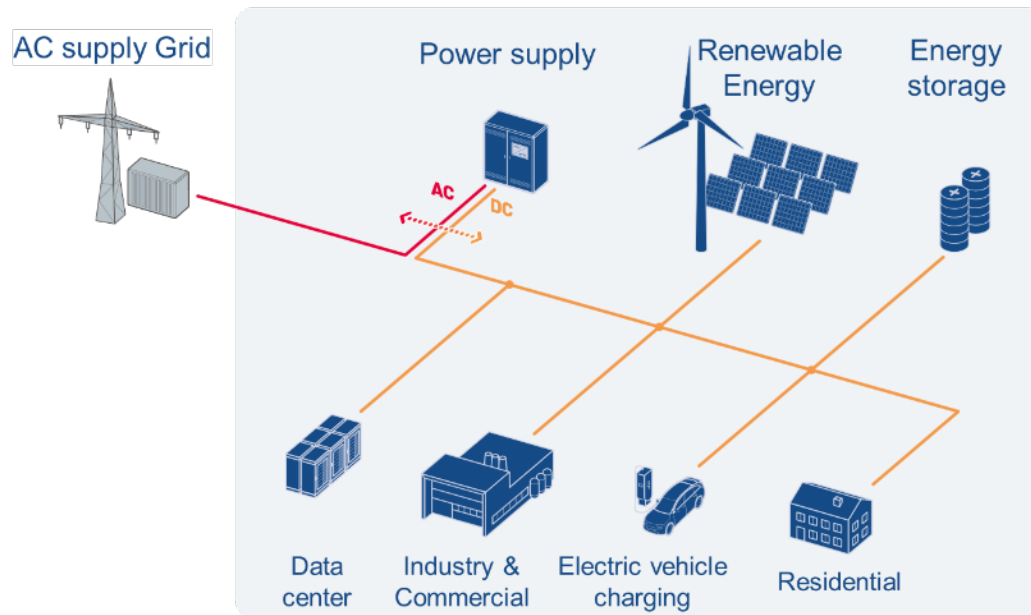
- BMW, Mercedes-Benz, KUKA
  - Homag, KHS
- Fraunhofer IISB, IPA
  - TH OWL

Applicability  
proven

- Technology works
- Comprehensive testing

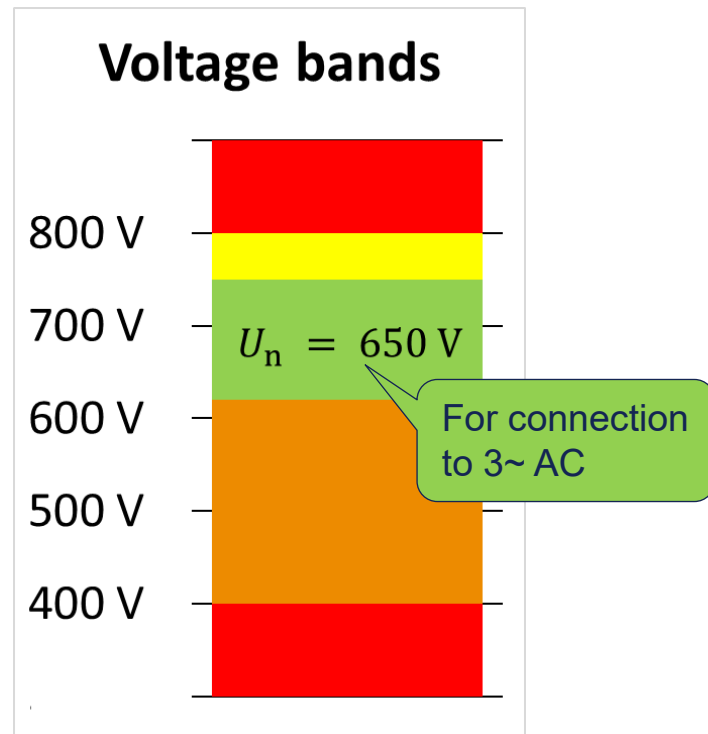
### 3. How LVDC? DC microgrid

- Simply connect “all things DC” with each other
- Fewer conversion steps (AC DC, DC AC)
- Central connection to supply grid



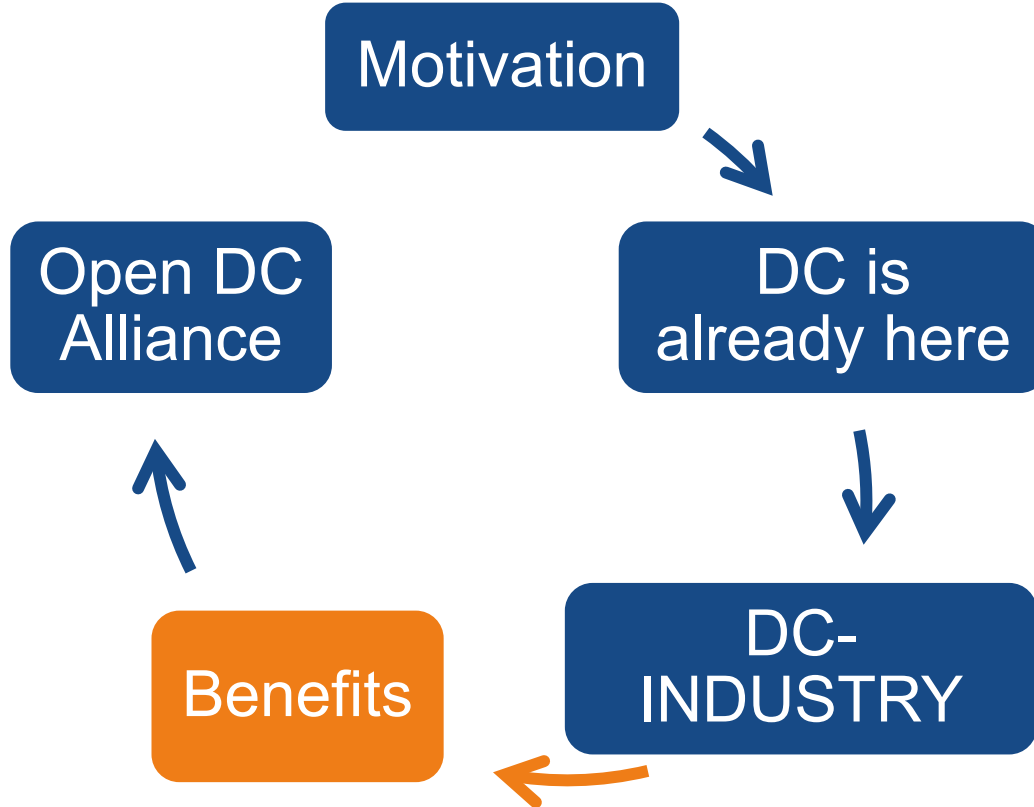
### 3. DC Microgrid Technology

- **Voltage & voltage bands**
  - In line with IEC TR 63282
  - Symmetrical to ground (L+ & L-)
  - Voltage change mirrors power balance
- **Power management**
  - Droop curves ensure stability
  - No extra communication needed
- **Electronic protection**
  - Guarantees continued operation



Source: <https://odca.zvei.org/resources/publications/updated-system-concept-for-dc-industrie2-published>

# Content

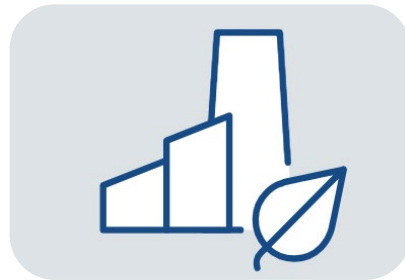




# Benefits



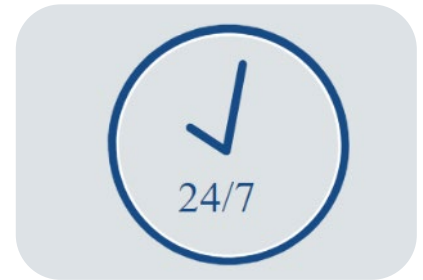
Peak Power  
reduction



Resource  
efficient



Energy  
efficient



Resilient

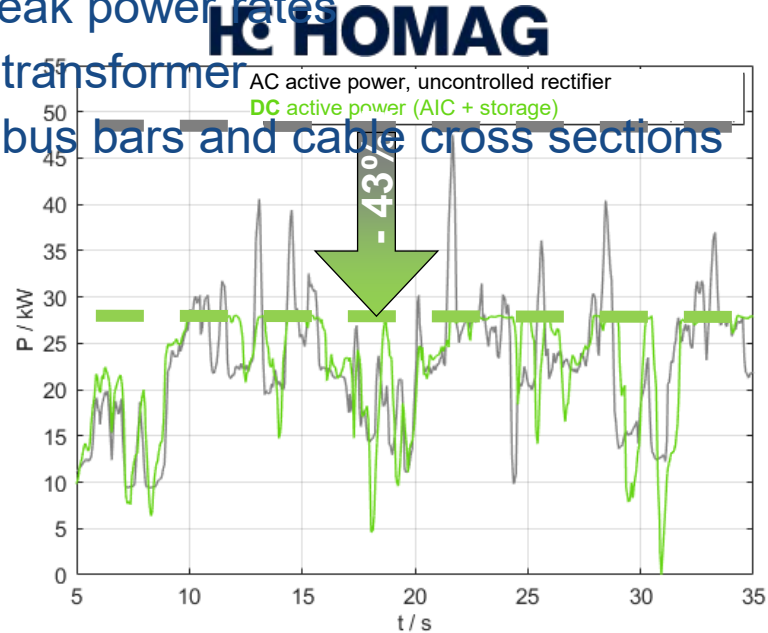
# Benefit: Peak power reduction



Peak Power reduction

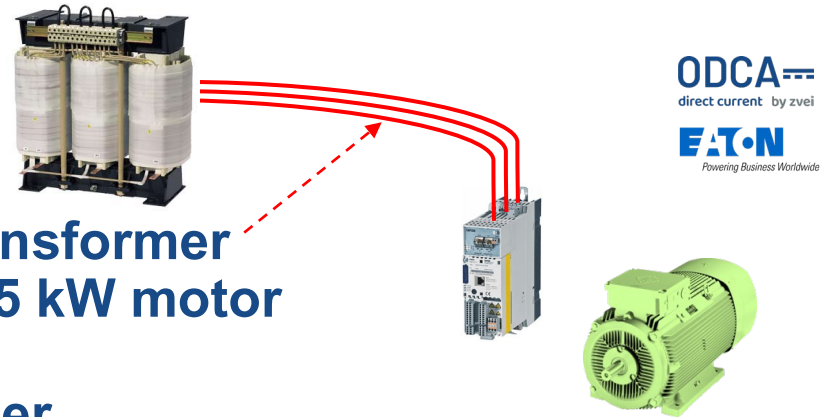
- **Wood working example**

- ✓ Lower peak power rates
- ✓ Smaller transformer
- ✓ Smaller bus bars and cable cross sections



Source: <https://odca.zvei.org/resources/publications/updated-system-concept-for-dc-industrie2-published>

# Benefit: Resource efficient



- **Cabling** from transformer to inverter for 7.5 kW motor driven by frequency inverter



Resource efficient

- ✓ 50 % less copper
- ✓ 50 % lower power loss
- ✓ 2500 € / year savings
  - Per km of cable for 2 shift operation
  - @ 10 ct / kWh

	622'X'CE''	872'X'FE
Current	20 A	14 A
Cable cross section	2.5 mm <sup>2</sup>	1.5 mm <sup>2</sup>
Total copper	10 mm <sup>2</sup>	4.5 mm <sup>2</sup>
Power loss	8.6 W/m	4.3 W/m



Source: <https://odca.zvei.org/resources/publications/dc-industrie2-project-presentation>

# Benefit: Energy efficient



Energy  
efficient

- **Recovery of braking energy**
  - ✓ Not wasted in braking resistors
  - ✓ No extra cooling



# Benefit: Resilient



Resilient

- **Energy storage**

- ✓ Complete the production cycle in case of power outages

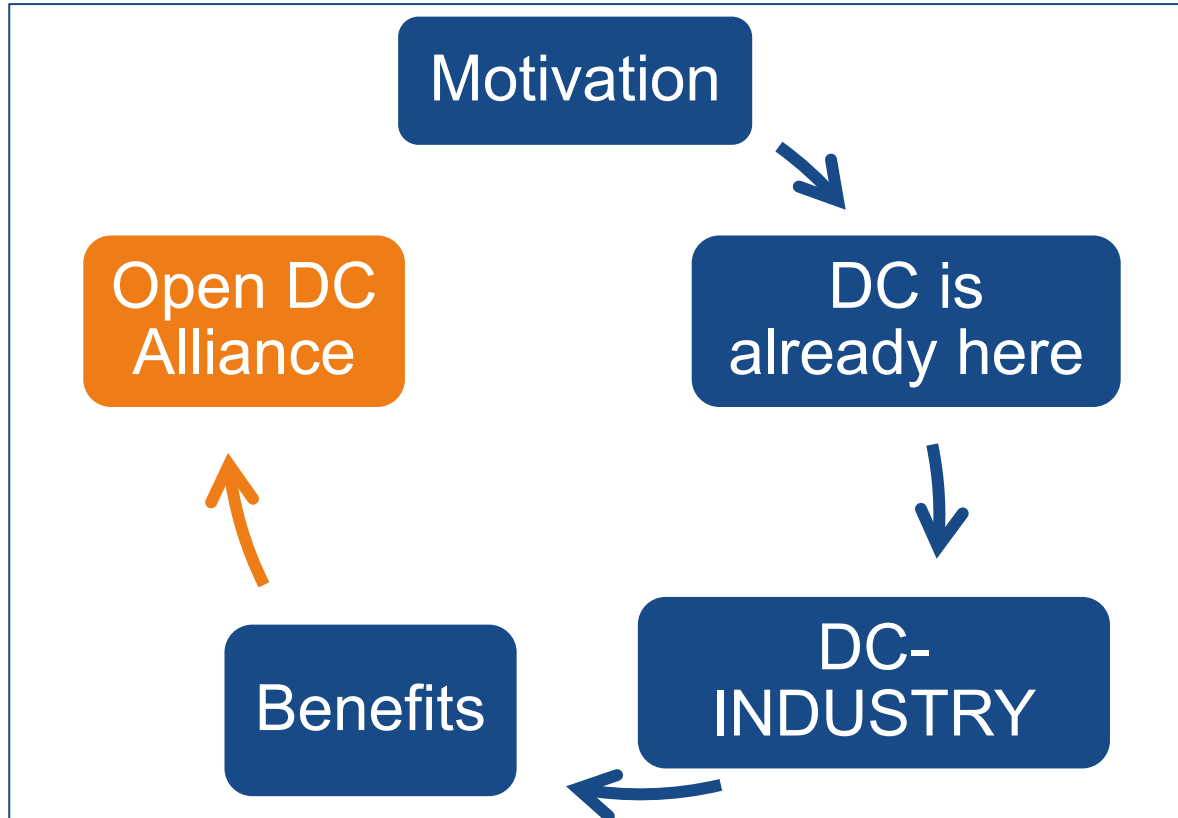


- ✓ Continue operation in island mode

- **Fewer components**

- ✓ Less maintenance, longer lifetime (e.g. LED lighting)

# Content



# From DC-Industrie to Open DC Alliance ODCA

2019 Model application  
@ Daimler: 50 kVA welding



2014/15  
ZVEI study  
about DC

2016-2019  
**DC-INDUSTRIE**

- 25 partners
- 4 Model applications
- ZVEI Group Communication DC-INDUSTRIE

2019-2023  
**DC-INDUSTRIE2**

- 39 partners
- 8 applications

Nov 2022  
**ODCA**

- 33 Founding members

Oct 2024 **ODCA**

- 71 members from 10 countries
- 5 active working groups
- Plenaries with 100+ participants



Plenary @ Zumtobel Oct. 2024

## Vision

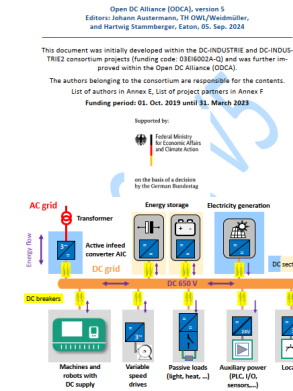
DC contributes to a sustainable world

## Mission

Establish an international DC ecosystem

- **Publications**
  - Comprehensive system description available
    - 7 years, 100+ experts
  - Many conference contributions

### System Description



Source: <https://odca.zvei.org/resources/publications/updated-system-concept-for-dc-industrie2-published>



# ODCA structure

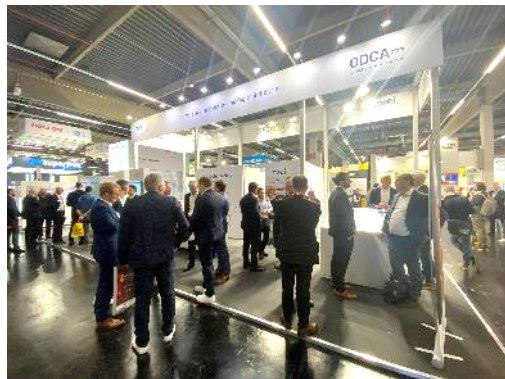


# ODCA meeting impressions

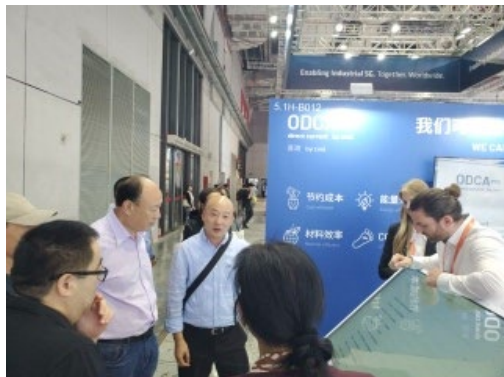




# ODCA fair presence – Hannover 2023 & 2024, SPS 2023



# ODCA: Industrial Automation Show in Shanghai, Sep. 2024



# WE CAN DO BETTER – WITH DC!



Cost-  
efficient



Energy-  
efficient



Material-  
efficient



CO<sub>2</sub>-  
efficient

Scan for more  
information:



# Appetite for DC?

## Dr. Hartwig Stammberger

Eaton Industries GmbH  
Bonn, Germany

Chair of Open DC Alliance ODCA  
Manager Strategic Associations DC  
@Eaton

<https://www.linkedin.com/in/hartwig-stammberger>



<https://openDCalliance.org>

**ODCA**  
**Open Direct Current Alliance**  
Lyoner Straße 9, 60528 Frankfurt / Main, Germany

**EATON**

*Powering Business Worldwide*



**ODCA**   
direct current by zvei

---