RESEARCH CAMPUS
Public-Private Partnership for Innovation

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FLEXIBLE ELEKTRISCHE NETZE







Research Campus Flexible Electrical Networks FEN

October 12, 2021

Concept 2.0

- BMBF Research Campus concept
- Structure of concept 2.0
- Partnership models

FEN Research Campus in a nutshell

- It is long-term research institution
- It focuses on a topic of high societal and economical relevance and high scientific challange
- It has a potential for leap-frog innovation
- It implements an inter- and transdisciplinary approach
- It integrates stakeholders along the entire value chain at a common location
- It implements a balanced scientific community with equal rights and obligations

Requirements from BMBF towards Partners in Forschungscampus

- University and Companies are required to take an **active** role in the partnership
- Research activities are required to be executed mainly at a **single location**
- Commitment to a minimum of 5 years partnership starting at government funding and to a commitment to financing the industry share to the FEN Research Campus (including staff at FEN Research Campus)
- Medium- to long-term work on a specific and societally relevant research topic
- Mandatory public-private partnership, with financial contributions of the involved partners (independent from BMBF-support)

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FEN Research Campus in a nutshell – it …

…combines the interest of academia and industry from energy sector

… accelerates innovation of DC technology and its integration in grids

… offers a joint communication and cooperation platform for academia and industry

… is the only German Research Campus with the focus on DC distribution grids

… is broader than just technology

… fosters the national and international visibility of all partners

… informs all shareholders with the relevant energy related news

… initializes and coordinates activities public funded projects

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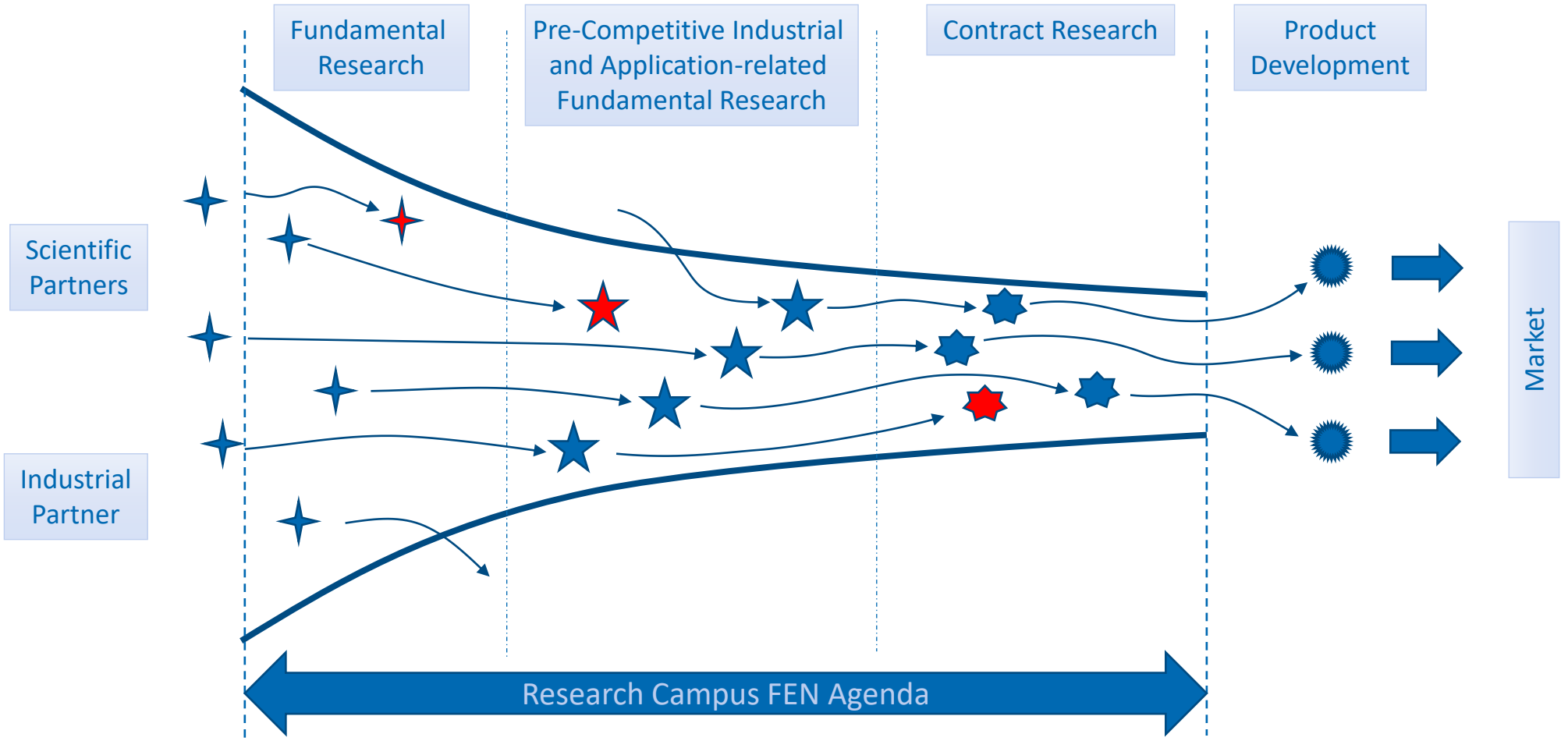
Continuous Innovation Concept



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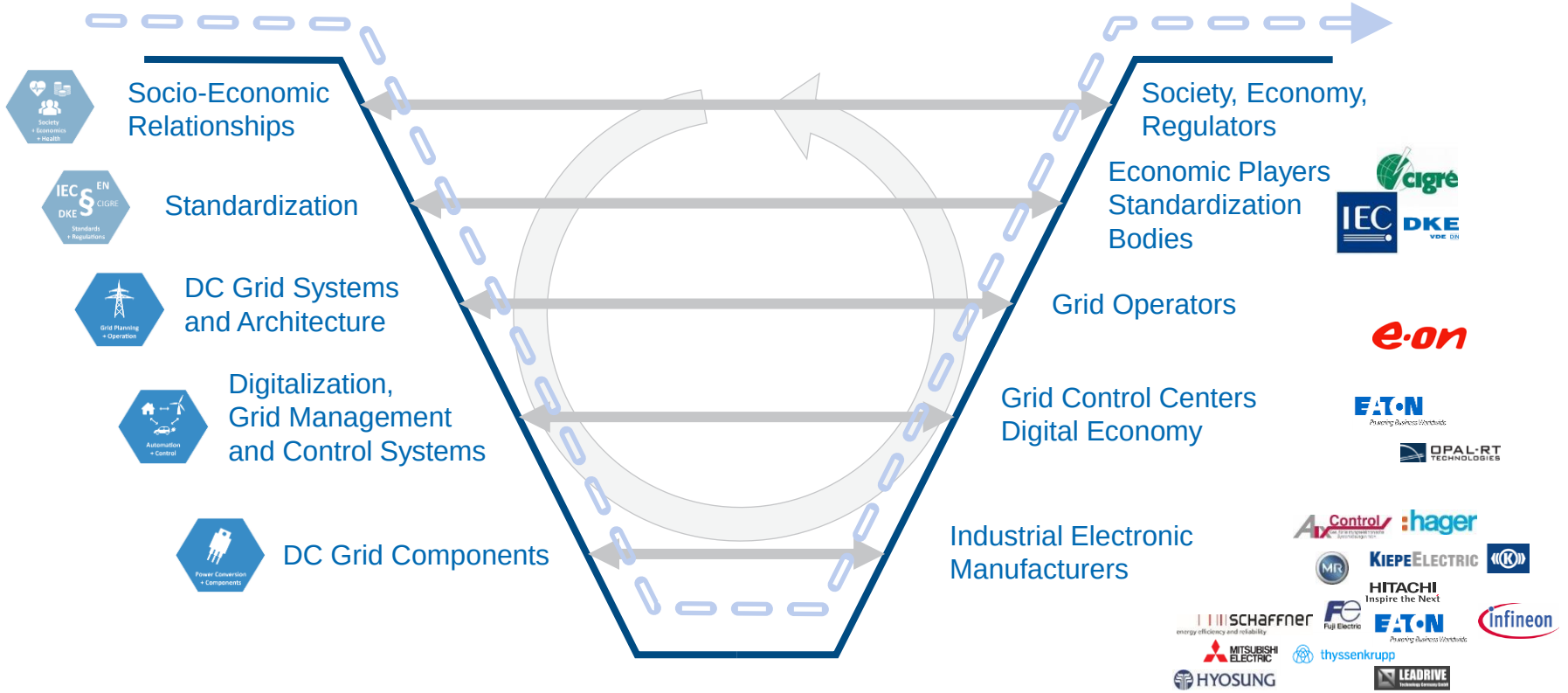
Innovation und Implementation Layers

(According to aV-Model)



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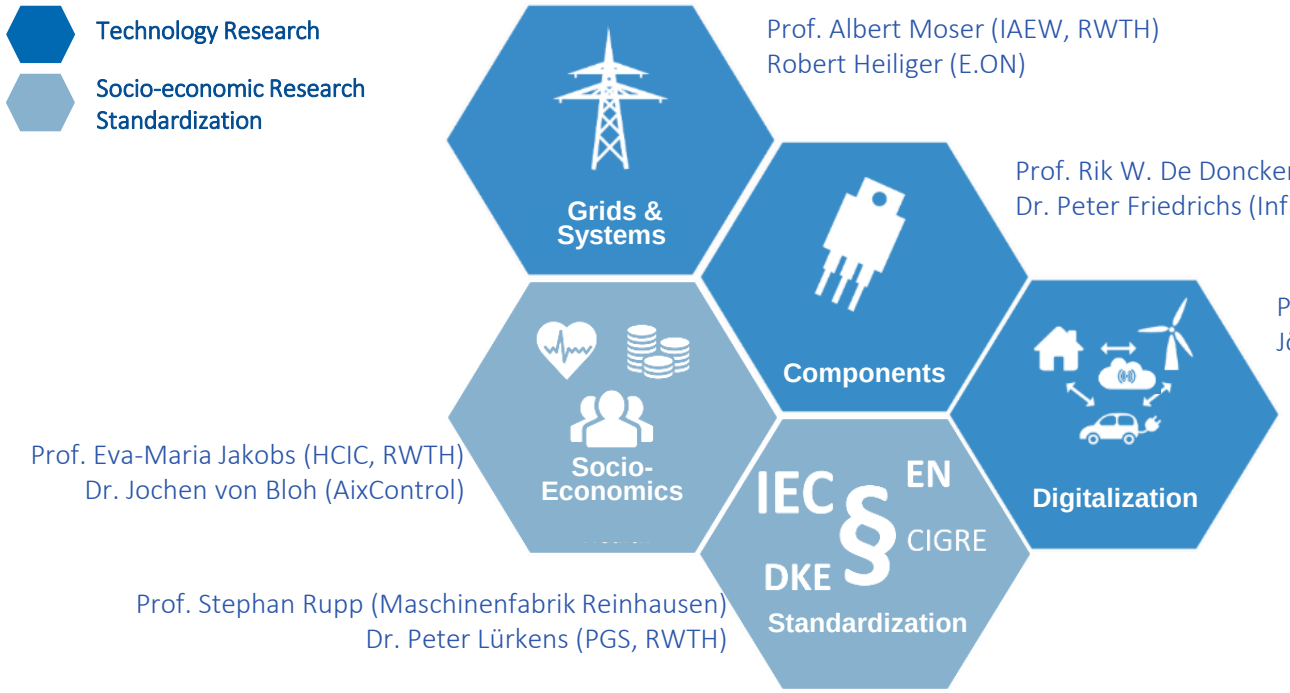
FEN Divisions Integrate Technical with Social, Economical and Environmental Research Approaches



Prof. Albert Moser (IAEW, RWTH)
Robert Heiliger (E.ON)

Prof. Rik W. De Doncker (PGS, RWTH)
Dr. Peter Friedrichs (Infineon)

Prof. Antonello Monti (ACS, RWTH)
Jörgen von Bodenhausen (Eaton)

Prof. Eva-Maria Jakobs (HCIC, RWTH)
Dr. Jochen von Bloh (AixControl)

Prof. Stephan Rupp (Maschinenfabrik Reinhausen)
Dr. Peter Lürkens (PGS, RWTH)

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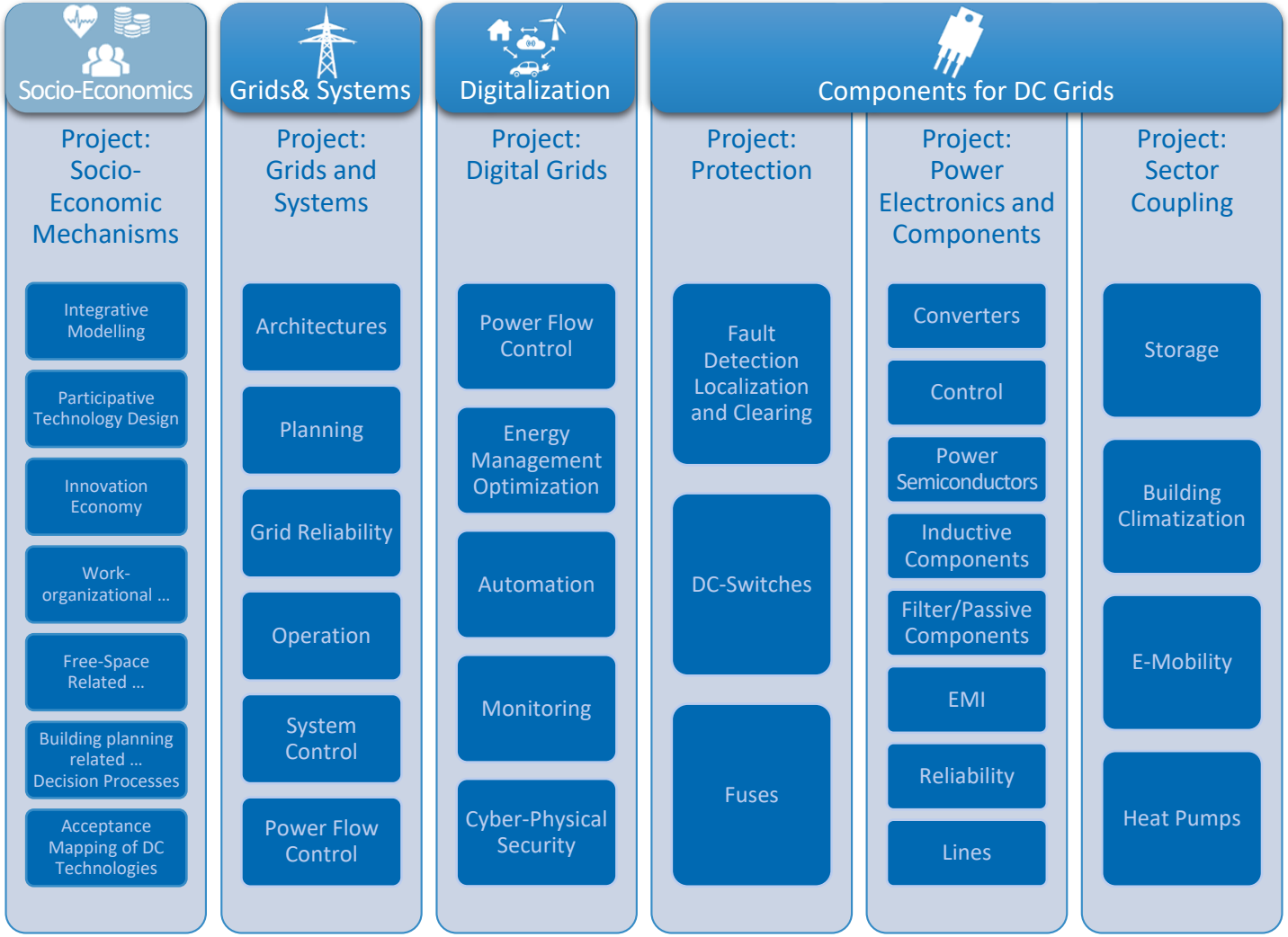
Agenda of Technological and Socio-Economic Research Divisions



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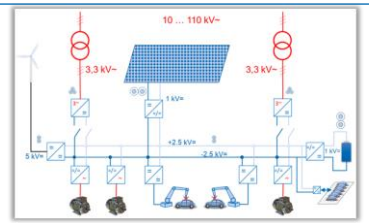
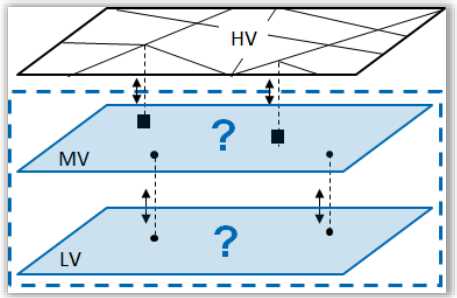
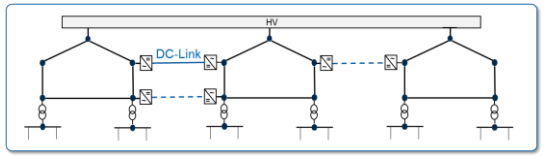
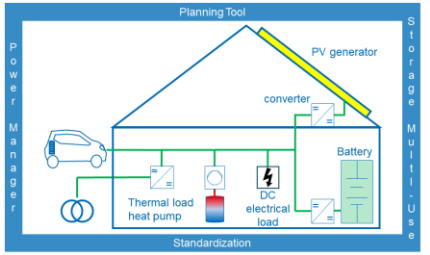
Mid-Term Realistic Use Cases

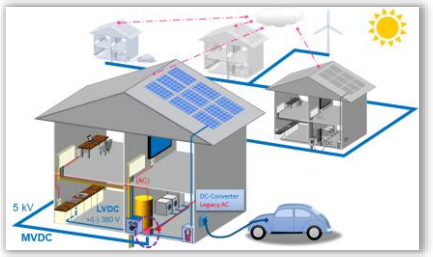
- LVDC and MVDC Industrial Grids
- Storage Integration
- Commercial DC Buildings
- DC Quarter
- MVDC and LVDC grids for a real region and comparison with AC
- Charging Infrastructure
- DC P2P Links in Distribution Grids
- DC Collector Grids

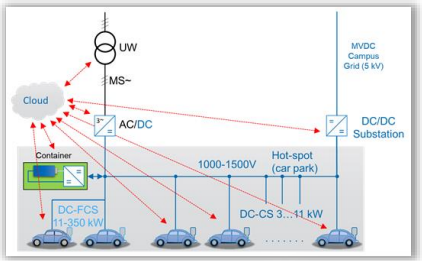


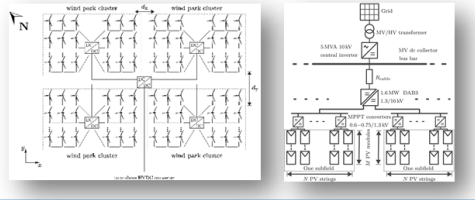












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Divisions Link Use-Cases to Science and Technology

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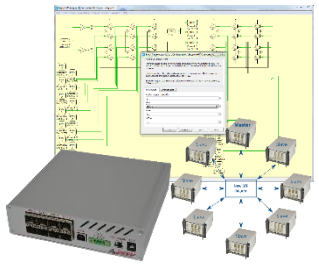
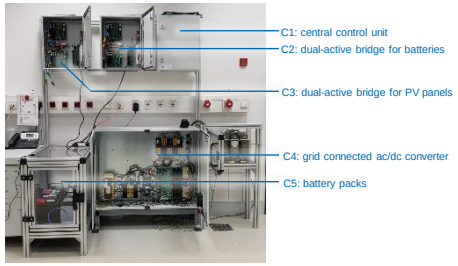
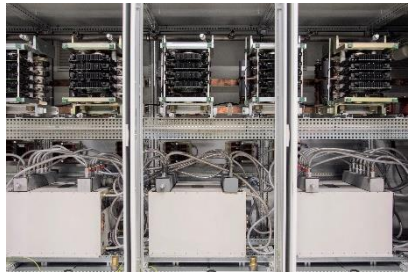
Selected Highlights from 1st Funding Phase



Development system PLECS
→ Multi-node control platform

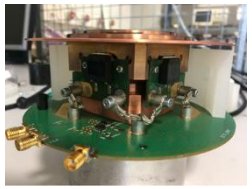


Small-scale lab model
of MVDC Campus Grid

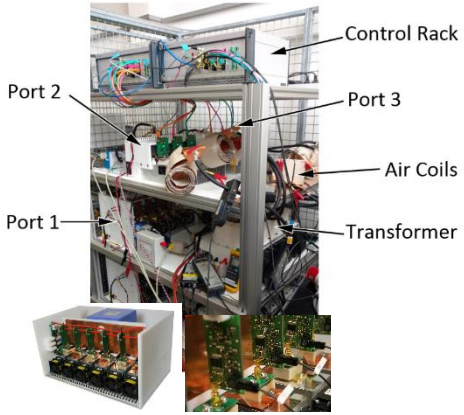


7 MW DC-DC converter (5kV, 1 kHz)
3-phase DAB with ARCP

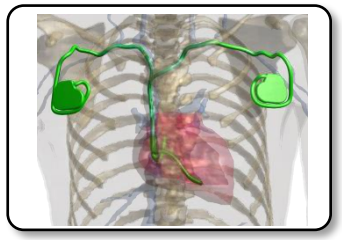
Exhibition Energeticon
„Mission Energiewende“



Final IETO2 package



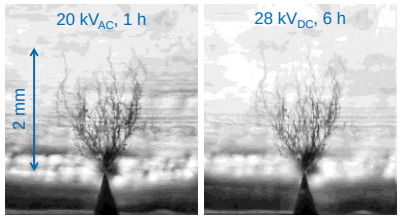
Tri-port DC-DC converter with SiC
150 kW, 5kV⇔720/360V, 20 kHz



Implants in Body Model

2nd highest score
at BMBF Science Slam

5 MVA-MF-Transformer
from Schaffner

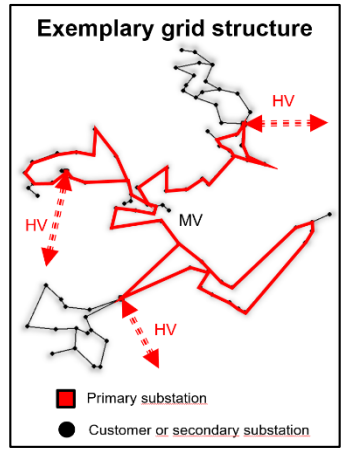


No further cable-aging after
switching to DC operation

Installation of access shafts
for MVDC Campus grid

Marx-Generator for testing
insulation materials
36 kV$_{pp}$ < 1.6 µs (!)

Aerial photo MVDC Campus
Grid and planned buildings



Planning methods for optimized
MVDC grids (Diss.)

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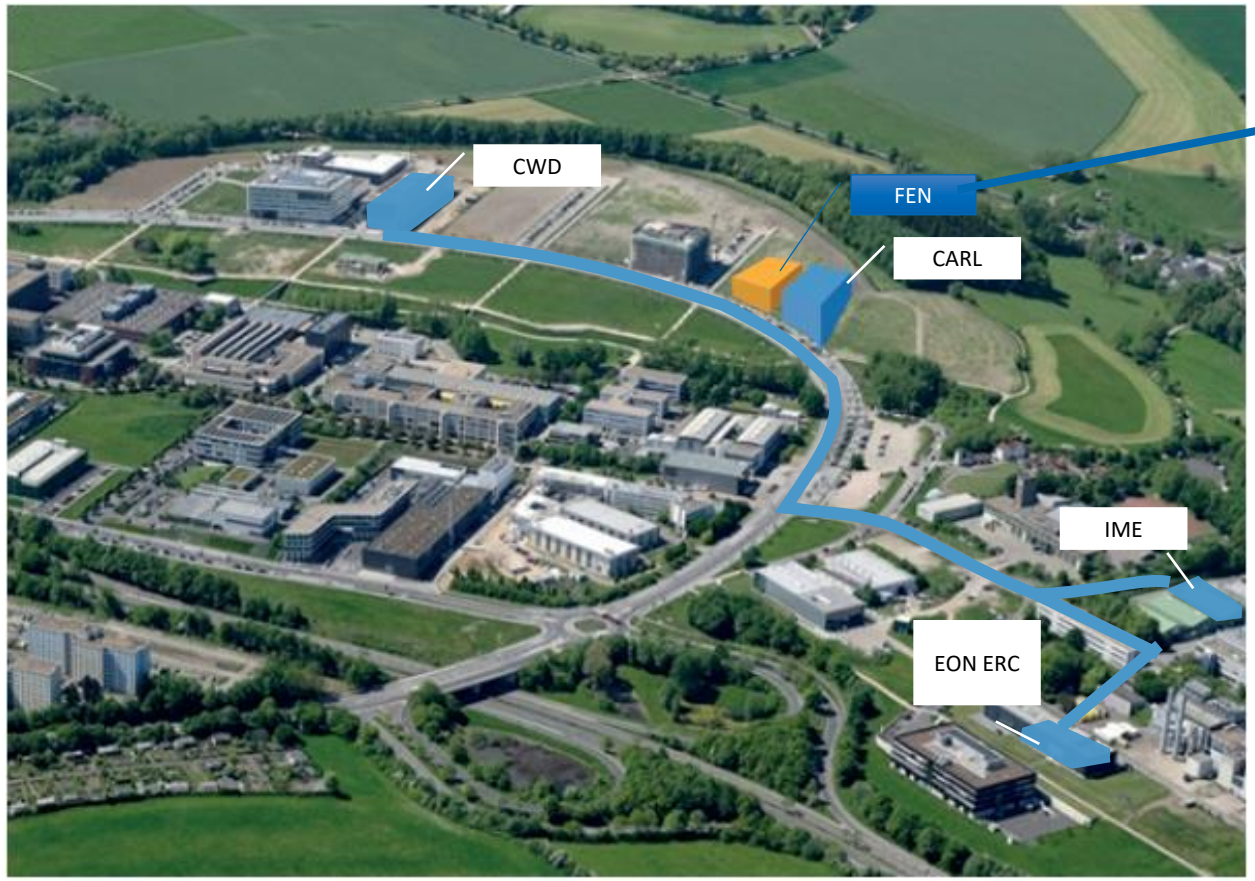
Structural visibility of the FEN Research Campus and its MVDC research grid (CWD, CARL & IME & EON ERC)



Description of FEN-building

- Planning of an own building incl. office and lab space
- Available for FEN Research Campus partners and FEN GmbH
- Demo-floors for DC-application and test scenarios
- Interconnection of different DC- & hybrid AC/DC-components
- DC eV Fast Charging in front of the building
- Roof-top PV
- Close proximity and connection to the future MVDC research grid

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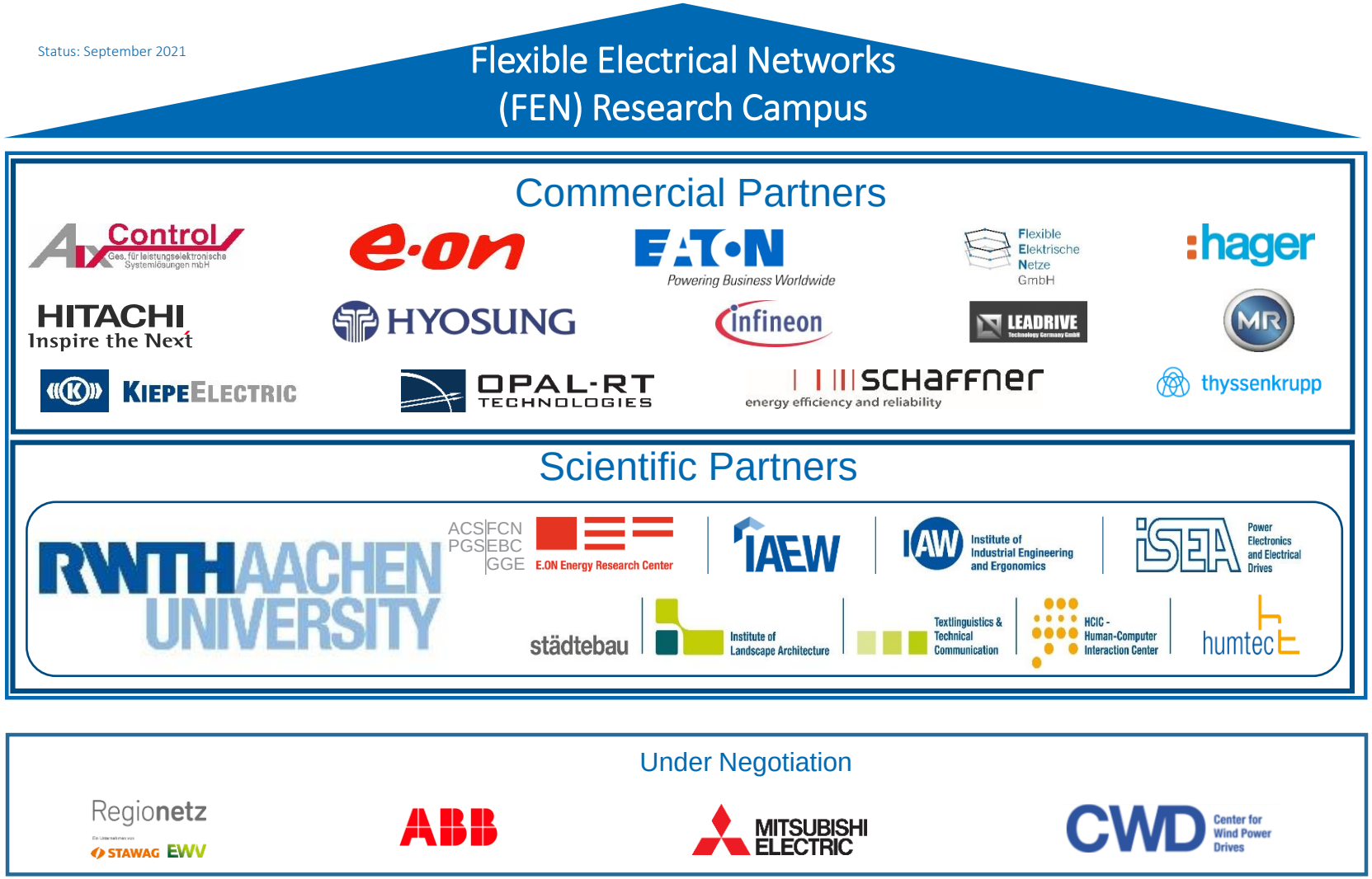
FEN Partners – Comprise the Entire Value Chain

Status: September 2021



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Established international collaborations to optimize the visibility and awareness of DC and its partners

All partners of the FEN Research Campus benefit from the knowledge and staff exchange.

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Benefits for all FEN Partners

Community

- Transdisciplinary team of experts
- Joint research and direct exchange of knowledge between science and industry in “FEN Think Tank”
- Corporate meetings: Steering Committees
- Access to new Start-Ups
- Access to junior researchers
- Online platform „meinFEN“ (wiki, overview test benches, internal documents etc.)

Research

- Application-oriented, pre-competitive and transdisciplinary research
- Publicly funded projects (BMBF, BMWi, etc.) and projects based on the partners‘ ideas
- Administrative support for publicly funded projects
- Access to studies as well as theses and further professional publications
- Use of registered patents

Training

- Training opportunities at favorable conditions, for example at RWTH Aachen International Academy
- PhD lectures at RWTH Aachen University
- Internal workshops and colloquia
- International exchange programs for students

Infrastructure

- Office space at “FEN Think Tank” in one of the largest technology-oriented research landscapes in Europe: RWTH Aachen Campus Melaten
- Access to the laboratory infrastructure of the RWTH institutes
- DC experimental building
- MVDC research grid

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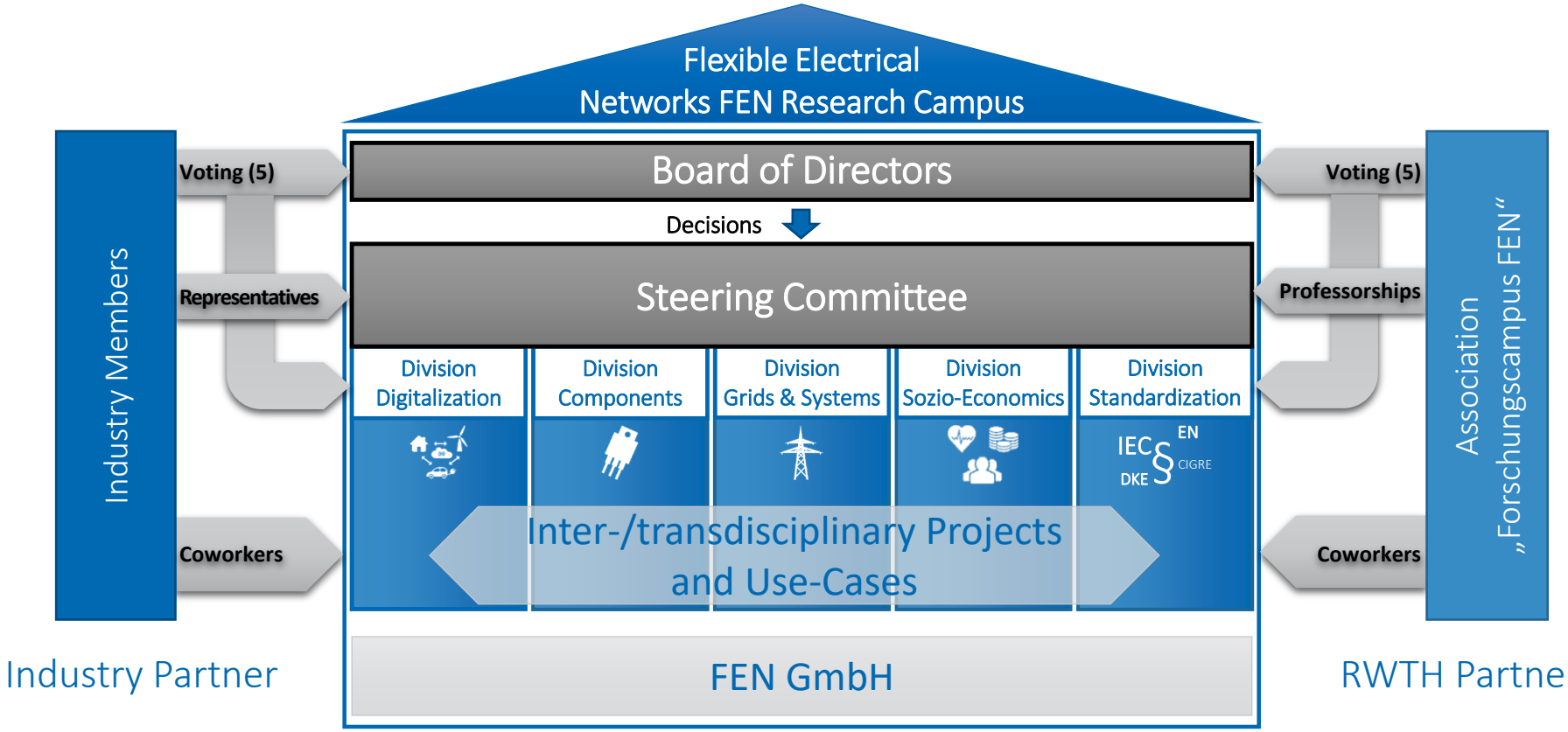
FEN-Governance



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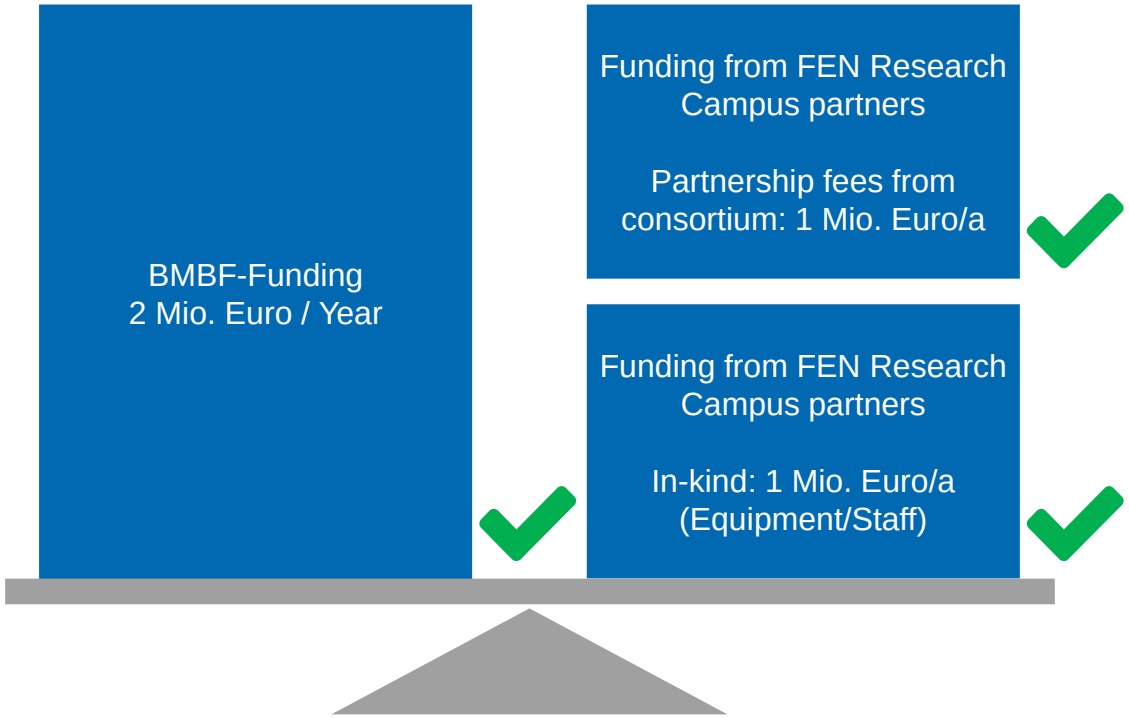
Funding from BMBF as well as from FEN Research Campus partners



The funding scheme requires a match between funding from BMBF und partners.

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Details of partnership model elements

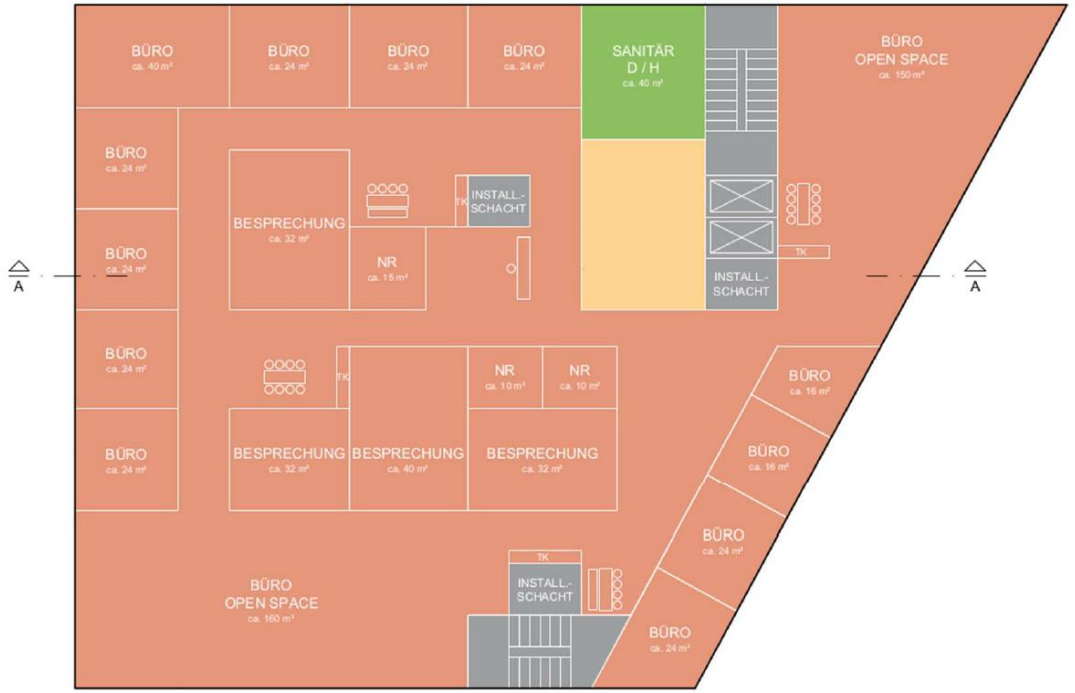
	Explanation
Content-driven participation in FEN Research Campus	The FEN partnership requires a content (= energy sector)-related compatibility either on the research or industrial side.
Access to BMBF-funding with own share in subsidies	The partnership with FEN allows the partners to apply for government-funded joint projects together with other partners of the Research Campus and receive funding from BMBF (Federal Ministry of Education and Research).
Access to FEN-community and additional results from other public-funded projects	Partners become members of the FEN community and have access to studies, theses and results from publicly funded projects as well as further professional publications.
One-time in-kind donation (cash/equipment) (no yearly fee)	Partners give one-time donation, which can be either money or equipment, at an unspecified time during their partnership.
Individual budget of Industry partner (incl. in partnership fee)	40% of the partnership fee can be used on the individual partners own discretion for taking out services from the Research Campus (e.g. PhD support, or office space, issuing and participating in consortium projects).
Number of votes for decisions concerning new projects, partners and IPR	Depending on the individual partner model, the partners have one or two votes when it comes to making decision within FEN and its activities.
Contract duration	The duration of the contract between FEN and the individual industry partner is split into 2 sections. The contract starts with an initial period of 2 years. (When/if) the BMBF FEN Research Campus funding starts, a main phase of a duration of 5 years will automatically come into effect immediately, abandoning the remainder of the initial phase.
Yearly partnership fee	The fee that every FEN partner pays each year for the duration of their partnership.

Details of partnership services

	Explanation
Office space at FEN Think Tank	Equipped with an universal docking station connected to two displays, mouse and keyboard, internet, scanner and a printer. Access to a kitchen with dish washer, coffe-maker, electric grill, sink
Workshop at industry partner premises	FEN carries out a workshop at the premises of your company. The workshop can include brainstorming for new products, development of new business models, design thinking or world cafe workshops.
Research funding support	FEN supports you as a company with the organizational and administrative tasks to acquire public subsidies.
PhD support	FEN supports your company in finding and hosting a PhD candidate.
IPR Services	FEN supports patent application processes and can provide maintenance and licensing of FEN community patents
Studies (aka. seed fund projects)	If you have an idea for a research project within the range of 3 to 6 months, either alone or in cooperation with other FEN partners, FEN will support you in finding the right institutes for fulfilling the task.
Test benches	RWTH Aachen University has a huge variety of test benches. FEN will inform you which ones are available and grant you access to those test benches.
Career services	Use the career services of RWTH Aachen University for personal guidance.

Site Development (exemplary, 2. BA)

BGF	=	ca.	1.350 m²
MFG	=	ca.	1.040 m²
NUF	=	ca.	840 m²



12 separate office rooms
Approx. 70 work places (inkl. open-space)

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Time Line

2013 2014 2019/2020 2025 2029 →

Pre-phase

- Pre-studies
- FEN Concept development

1st Funding Phase

- P1/5 - Grid Modeling, Design, Evaluation
- P2 - Equipment and Technologies
- P3 - Automation, Control, Operation
- P4 - MVDC-Research Grid

2nd Funding Phase

- DC-SE - DC-Socio-Economics
- FlexGrids - Grid Planning
- DC-Sek - Automation and Cybersecurity
- ESCape - DC Protection and Switching
- ScaLE - Converter Optimization
- InEEd-DC - Sector Coupling

3rd Funding Phase

Open Funding

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Thank you for your attention.

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