



**Centre for Industrial
Electronics**

Center for
Industrial
Electronics



Electrical Engineering Centre for Industrial Electronics

A lighthouse for education,
R&D and testing



Ass. Prof. Dr. Thomas Ebel
Head of CIE and EE SDU

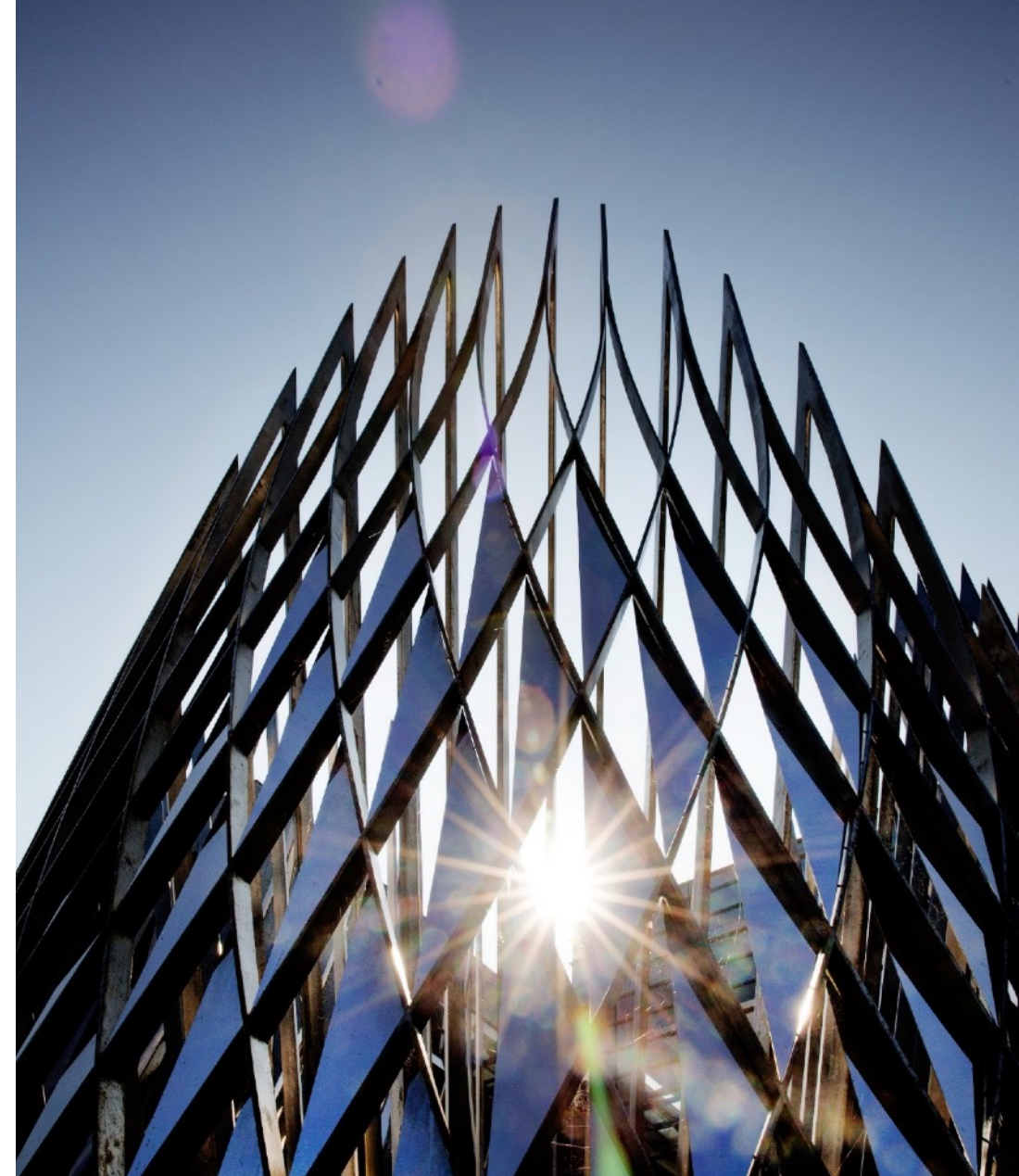
Centre for Industrial Electronics

Mission

- Educate the next generation engineers,
- Conduct world-class research and
- Collaboration with companies within education, research, product development and testing.

Response to the needs of industry for

- SDG17
- Sustainability, Energy efficiency,
- Digitalization and smart systems and
- Cost effectiveness.

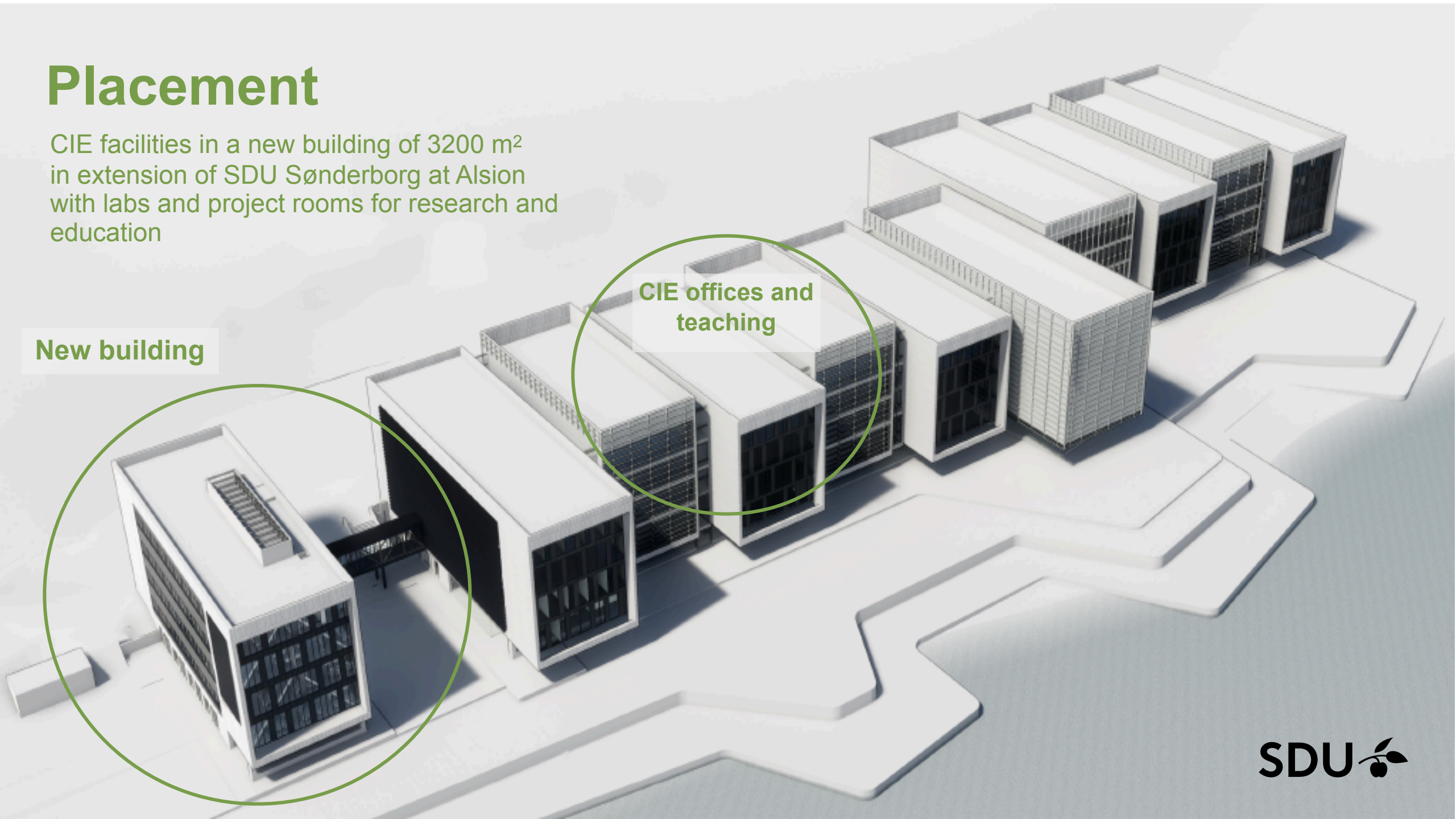


Placement

CIE facilities in a new building of 3200 m² in extension of SDU Sønderborg at Alsion with labs and project rooms for research and education

New building

CIE offices and teaching



Timeline

Establishment
2017-2018

Development
2019-2021

Growth
2022-2024

Consolidation
2025-2030

Scientific staff

Head of CIE
4 associate Professors
2 PhD students
2017-2018

> 10 Professors,
associate Professors,
assistant Professors
as of 2019

SDU Electrical Engineering

The section SDU Electrical Engineering is located in Odense and Sønderborg.

Odense

- 25 members
- 14 Professors/Associate/Assistant
- Electronics teaching and converter research

Sønderborg

- Centre for Industrial Electronics
- 24 member
- 6 Professors/Associate/Assistant

Centre for
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CIE Education

Education of electronics engineers completely taught in English

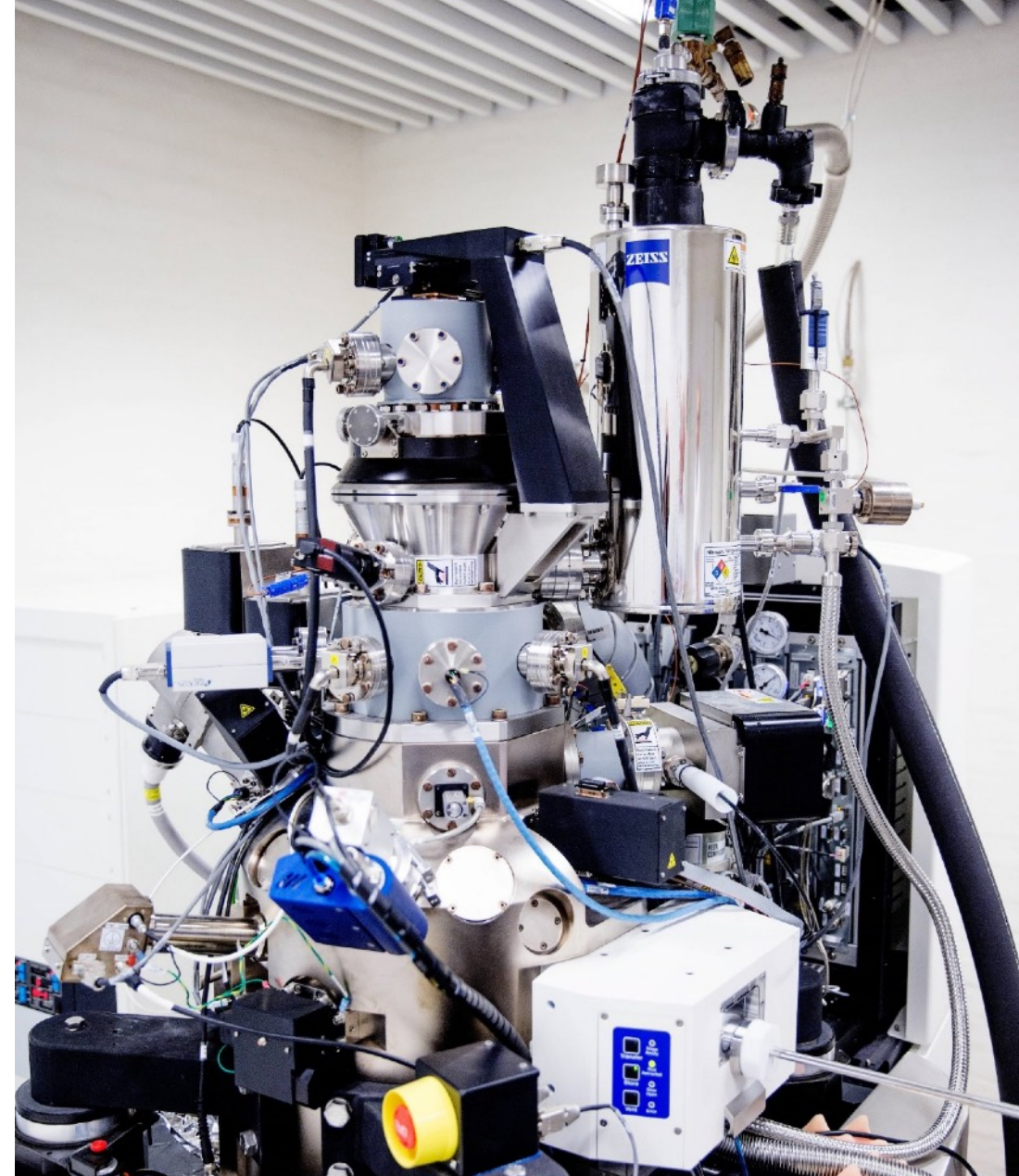
- Bachelor in Electronics (B.Sc., B.Eng) with focus on industrial electronics (started in autumn 2018)
- Master in Electronics (starting in 2020)
 - Power Electronics
 - Embedded Software
 - Industrial Electronics
- Recruitment of international students
- Preparation for employment in the border region
- Collaboration between students and companies
- Candidates: 60–70 electronic engineers per year



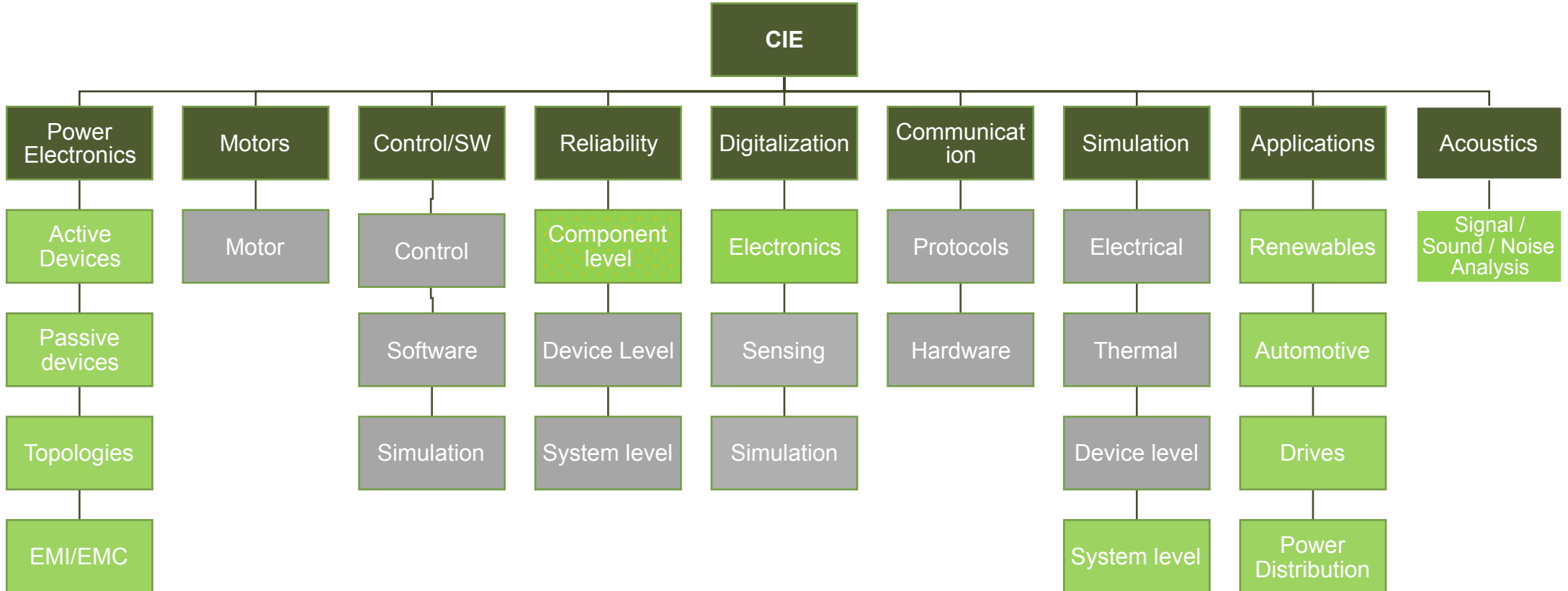
CIE Technology Areas

CIE will cover the following technology areas

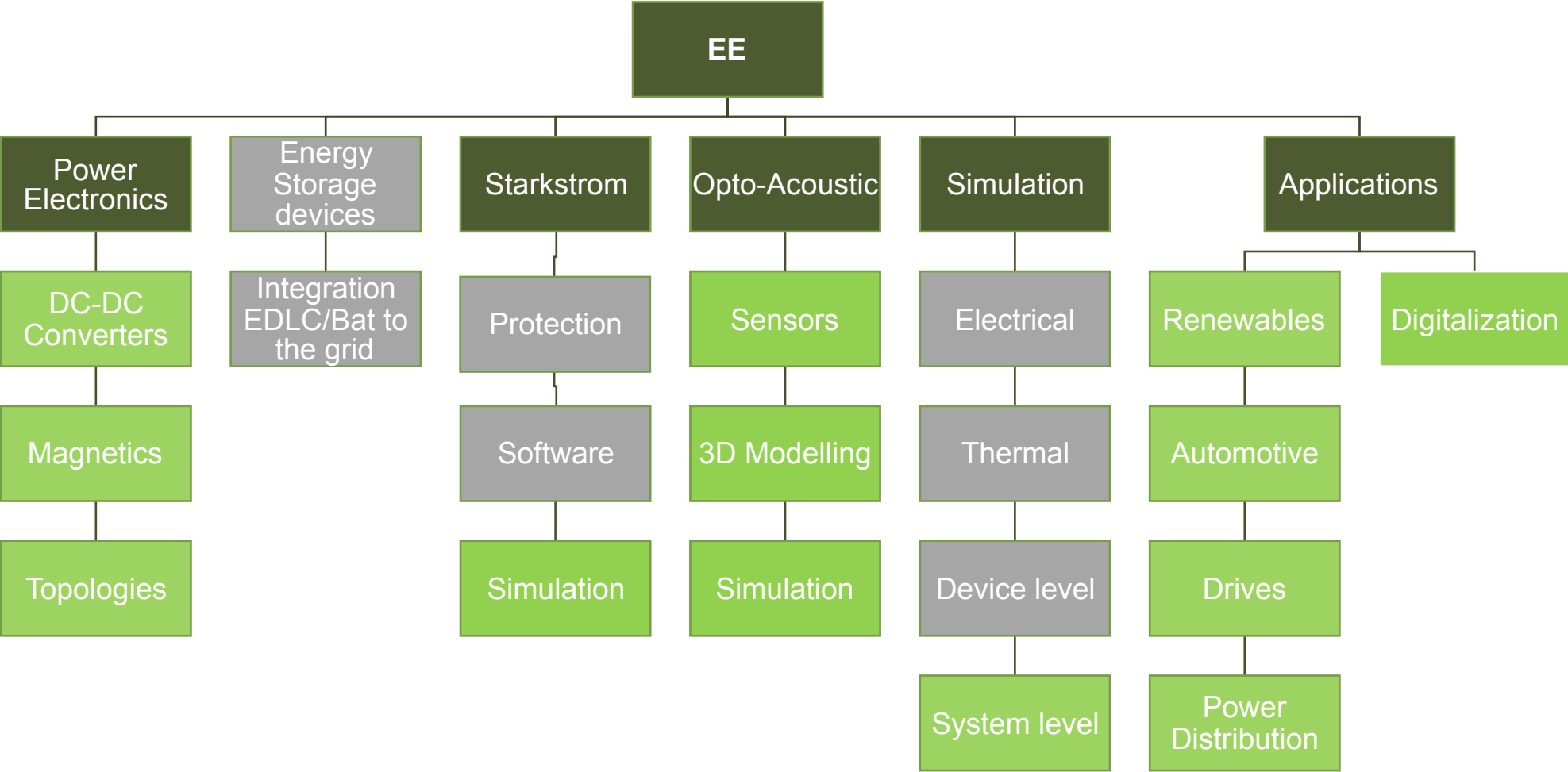
- Passive Components
- Power converters and systems
- Reliability of components and systems
- Motors and Control
- EMI/EMC
- Big data analysis and AI
- Simulation
- Acoustics



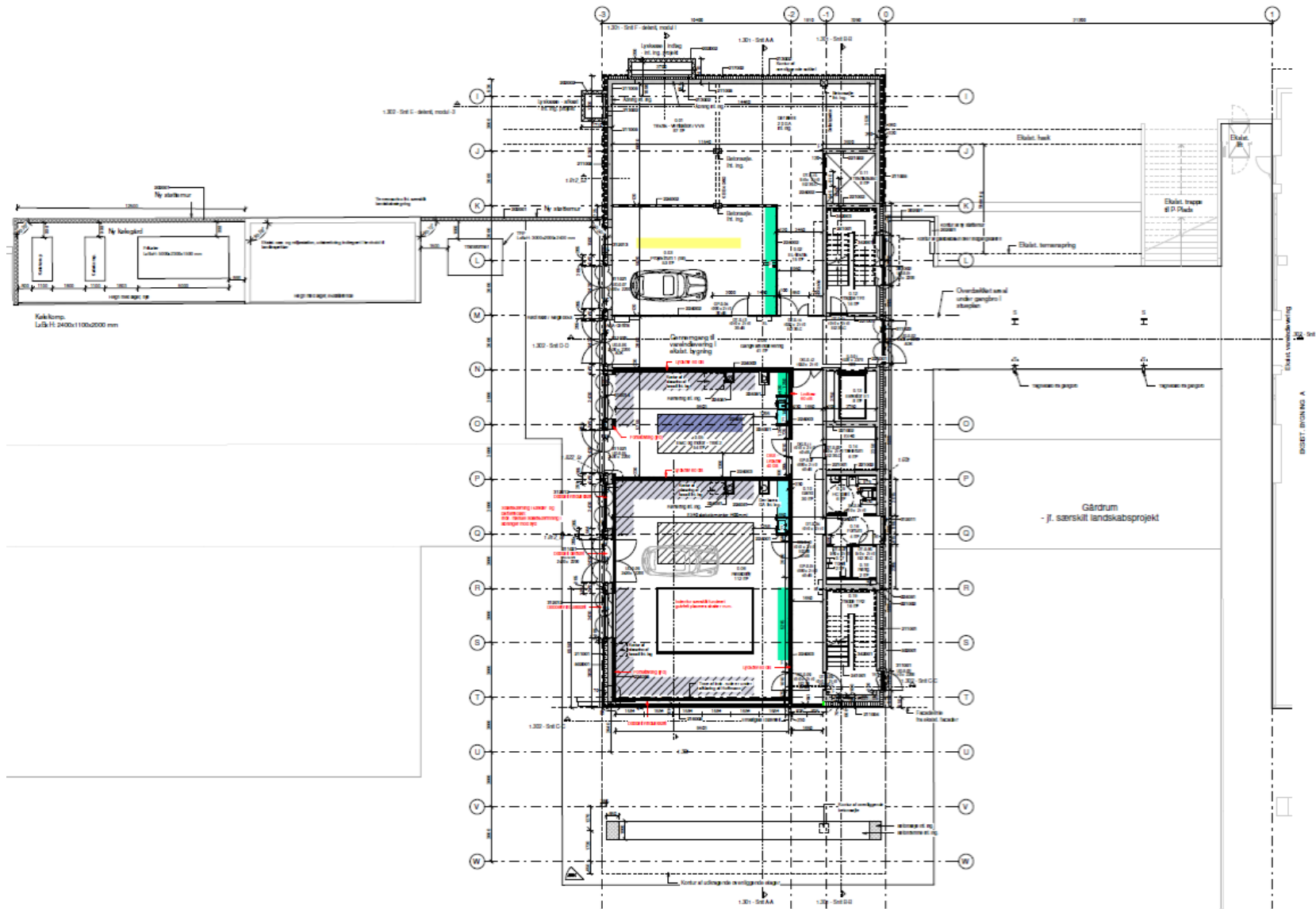
CIE Technology Areas



Electrical Engineering Technology Areas in Odense

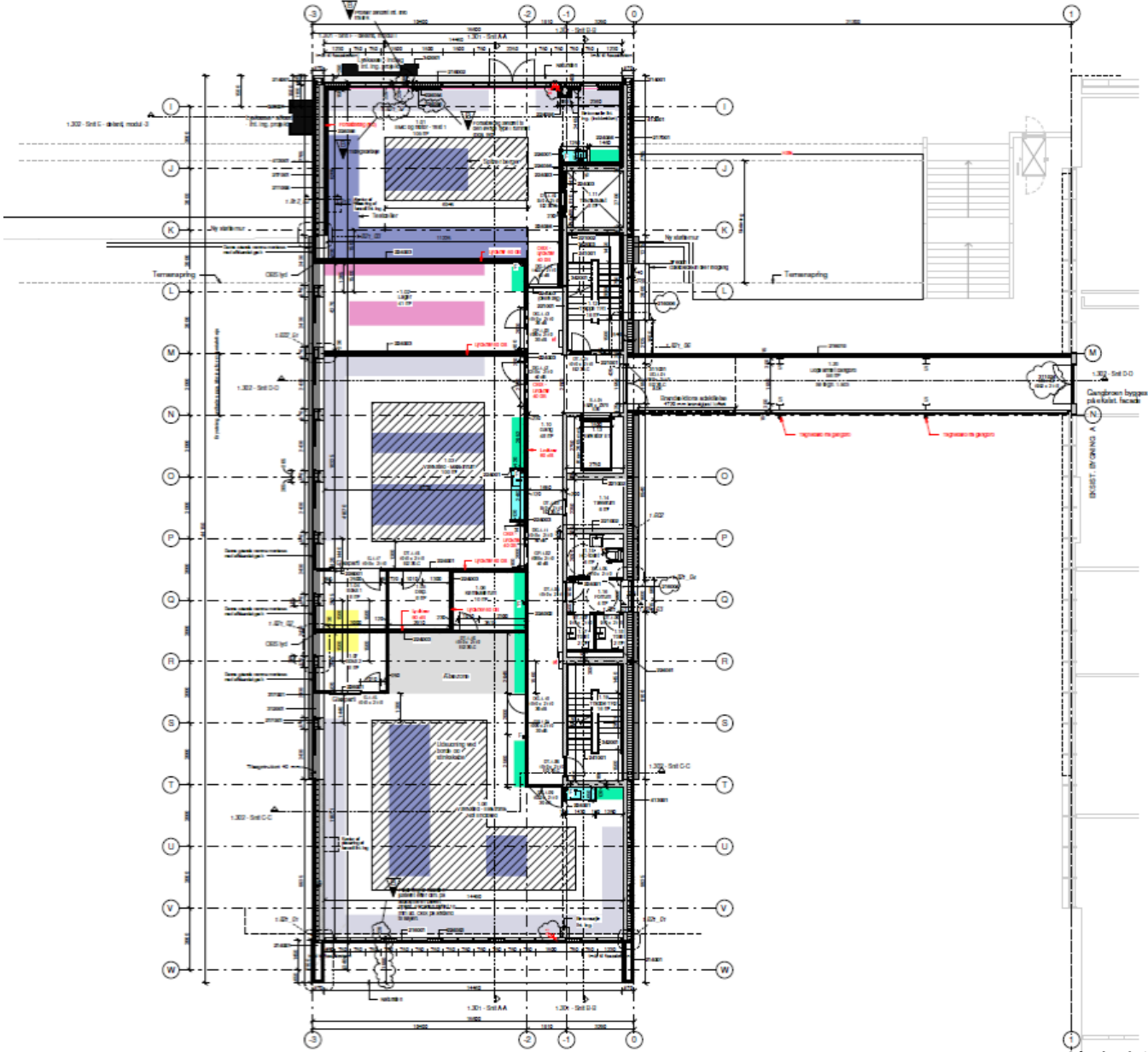


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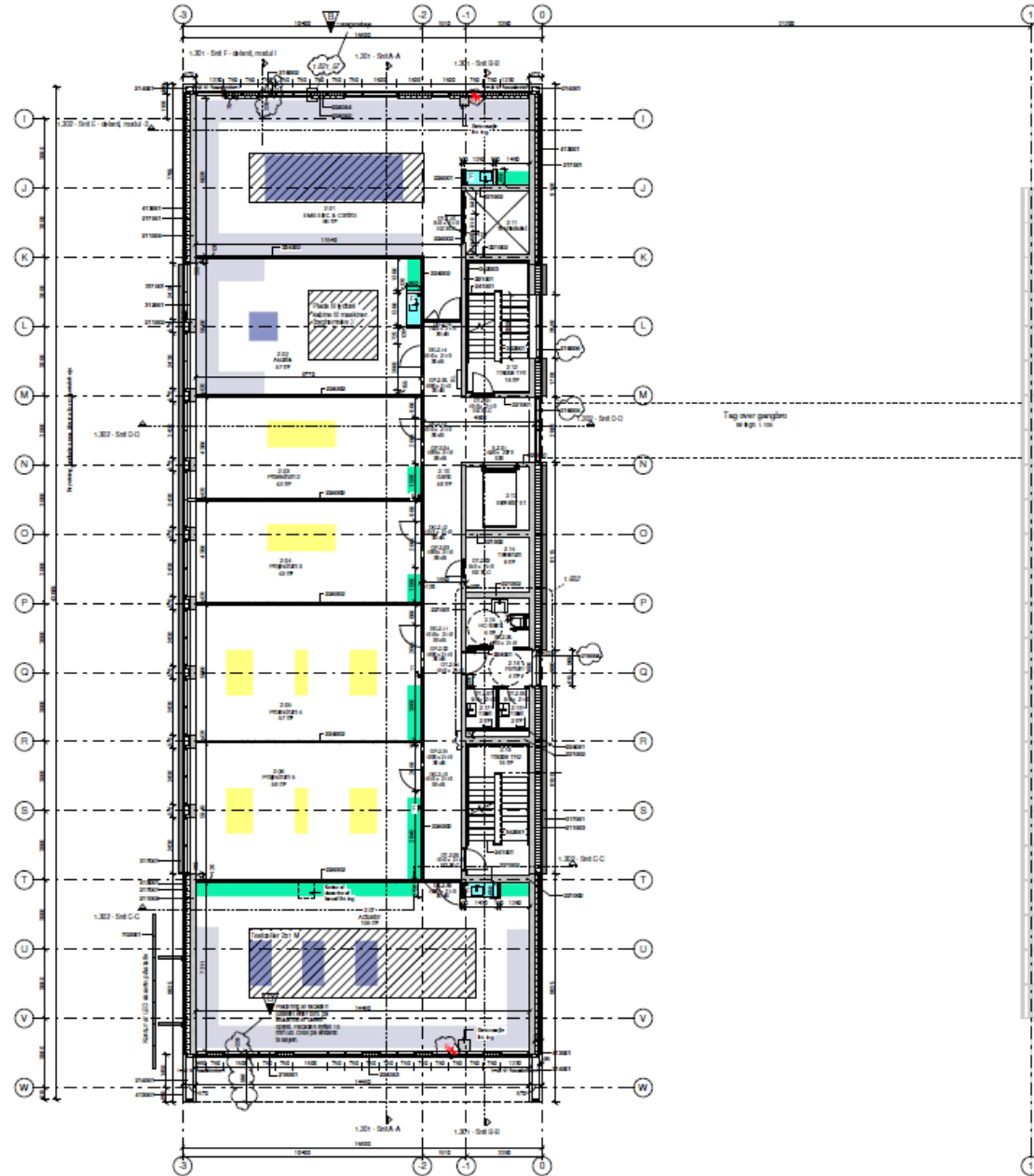
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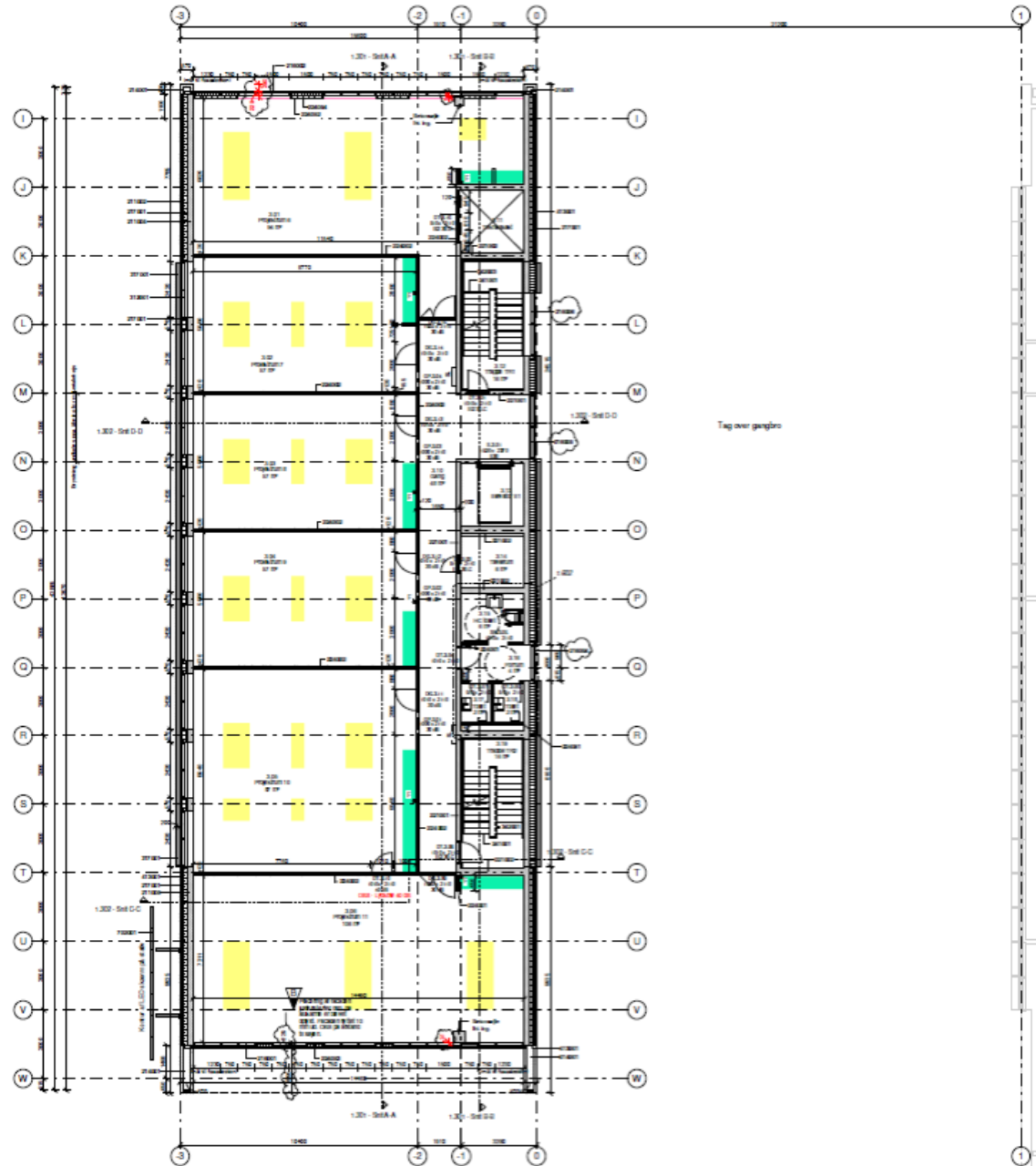
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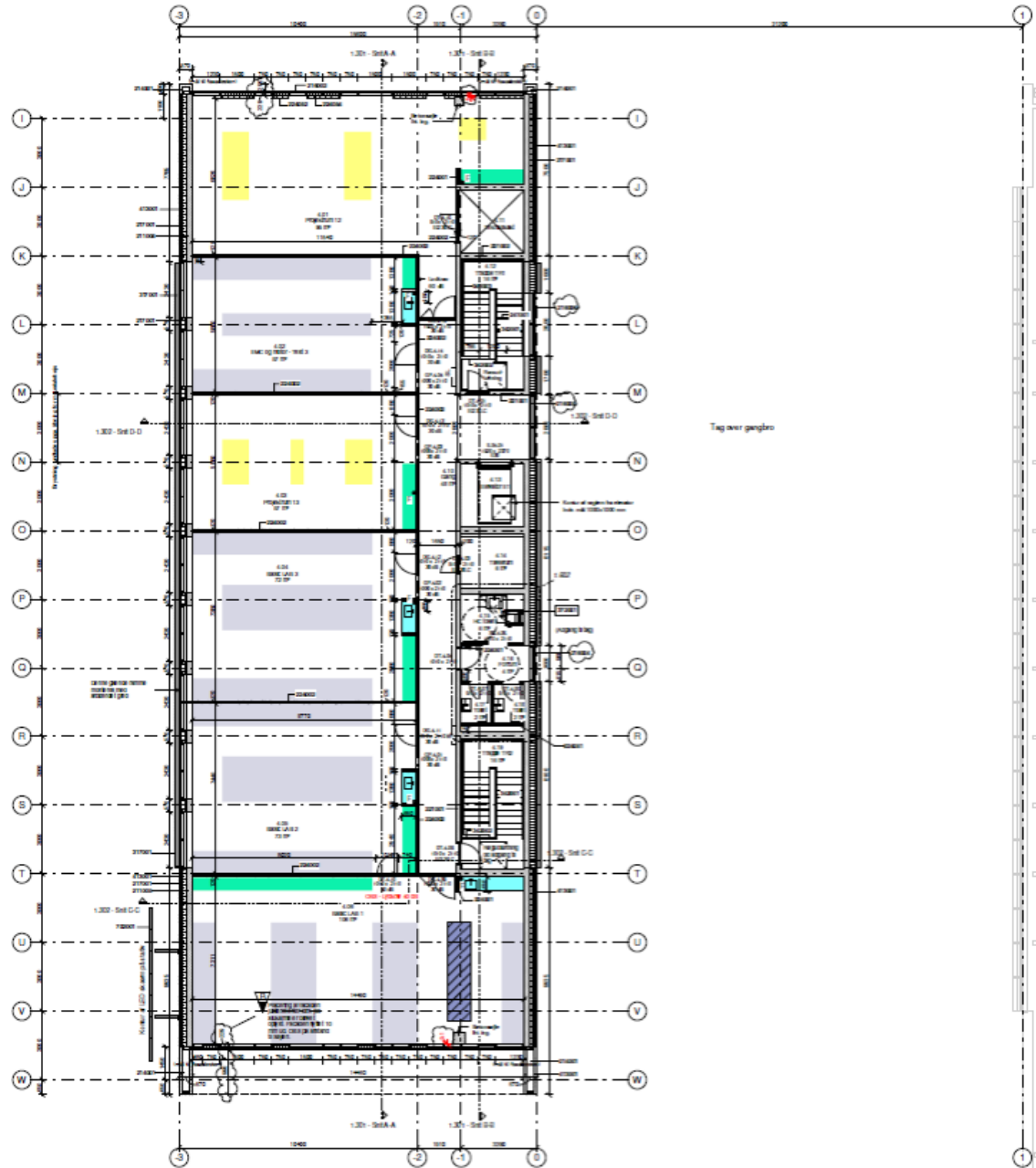
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Etage 3



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Etage 4



21/05/2019

CIE Infrastructure

CIE provides excellent resources to companies for collaboration.

- Internationally known research group of 30+ employees by 2025
- New Building of 3200m² (2019)
- Workshops for
 - Mechanics
 - Electronics
- Laboratories with state-of-the-art analytical equipment
 - Passive Components lab (capacitors - 2020)
 - Power Electronics lab (end 2019)
 - Acoustics lab (end 2019)
 - EMC (2020)
 - Motor, Control and Actuators (end 2019 - mid 2020)
 - Reliability (passive and active components, simulation, 2019/2020)

Passive
Components
lab

Reliability
lab

Motor, Control
and Actuators
lab

Power Electronics
lab

EMC
lab

Acoustics
lab

High-resolution X-ray tomograph
Helium Ion Microscope

CIE Services

Consulting

- Technology radar and clarification

Test & measurement

- Characterisation of power semiconductors
- Characterisation of passive devices
- Reliability of power semiconductors/ passive devices (power cycles)
- EMC

Simulation

- Thermal-mechanical simulations
- Electrical-circuit simulation
- EMC

Demonstrators

Prototyping & product development

Failure analysis (imaging, electrical test)

- Power semiconductors
- Passive devices
- EMC

Reverse engineering

- Topologies
- Devices
- Thermal concept

Acoustics

- 3D sound simulation, sound design
- Acoustic analysis of machines
- Interfacing human-machine

Industrial cooperation - Planning

Potential Cooperation

Automotive

Volkswagen (project start Q4/2019)

BMW (Invitation for initial discussion)

Valeo, Bosch (first contacts)

Continental (Project start 1.1.2020)

Bosch (Invitation for initial discussion)

Industry

Siemens Gamesa (running project)

ABB (Energy storage) Ch/NZ

Wittenstein

SMA (running project)

Danfoss

Linak

Bitzer/Lodam (4 running projects)

OJ

Innocell (running project)

Ballard

Lorc

Potential Cooperation

Passive Components

TDK (Capacitors, Systems e.g. DC-DC converter)

Murata (Invitation for initial discussion)

Vishay/Ecomal

Itelcond (Negotiation of cooperation contract)

Biotronic (HDK materials)

NCC (Invitation for initial discussion)

Glatfelter (operative consulting contract)

Mersen/FTCAP (Invitation for initial discussion)

Birkelbach (Invitation for initial discussion)

Brückner (First contacts)

Wevo (Negotiation of consulting contract)

CIE Network

X-POWER



ZVEI:
Die Elektroindustrie

NETZWERK
**LEISTUNGS
ELEKTRONIK**
LE.SH SCHLESWIG
HOLSTEIN

Interreg 

WT.SH 
Wirtschaftsförderung
und Technologietransfer
Schleswig-Holstein GmbH

 **IEEE**
*Advancing Technology
for Humanity*

 Sønderborg
Vækstråd

EPCIA
.....

European Passive Components Industry Association

 **clean**



SDU is ECPE Competence Center for passive components

THE CENTRE FOR INDUSTRIAL ELECTRONICS

The Centre for Industrial Electronics (CIE) is part of the Mads Clausen Institute at the University of Southern Denmark. CIE was founded in 2017 by an academia-industry-public partnership and specialises on power electronics, motor control, reliability, simulation and acoustics in production. Within power electronics the activities cover power converters and systems, passive devices, simulation and EMC with currently six associate professors and two PhD students. The number of CIE staff will grow over the next years to more than 30 academic employees.

Power converters and systems

CIE has a strong expertise in power electronics with a focus on components and topologies. Furthermore, we are developing our expertise into power electronics systems such as drives and other inverters. On component level we work with the latest active and passive power electronic devices such as GaN and SiC. We combine these new materials in advanced topologies to subsystems for any kind of inverters. Academic and industrial partners benefit from insights into state-of-the-art and future opportunities of advanced power electronics for ensuring reliability and new product.



Passive Devices

CIE has a strong interest in developing the next generation passive components matching the performance levels of new semiconductors. We focus on new electrolytic capacitor systems with low ESR behaviour (Polymer electrolytes), film capacitors with new dielectric materials for high temperature application > 150° grad C and magnetic materials with low losses. Another focus is on thermal, life time and electrical simulation based on the acquisition of physical chemical data.

EMC/EMI

CIE partners with companies to solve EMC and EMI issues early in the design process of electronics components, devices and systems. The aim is to reduce development time and costs. We focus on the simulation of EMC/EMI issues or specific components and PCB.

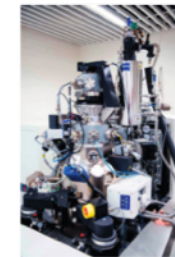
Simulation

CIE will work on the development of holistic system simulation models based on the physics and chemistry of failures

of components. The aim is to improve existing lifetime models of those components and extend it to the system level. At the end the total system level test effort should be reduced.

Labs and equipment

The CIE will establish by end of 2019 following laboratories with state-of-the-art equipment: EMC/EMI, Inverters, Motor, Control and Actuators, Noise lab, Passive Components lab (capacitors and magnetics), Reliability (passive and active components, simulation), High-resolution X-ray tomography, Helium Ion Microscopy.



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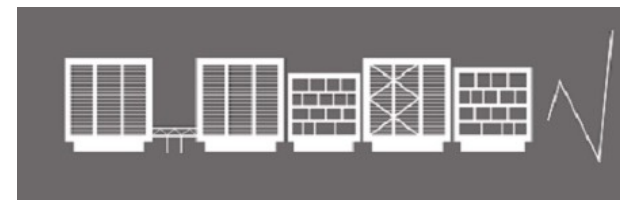
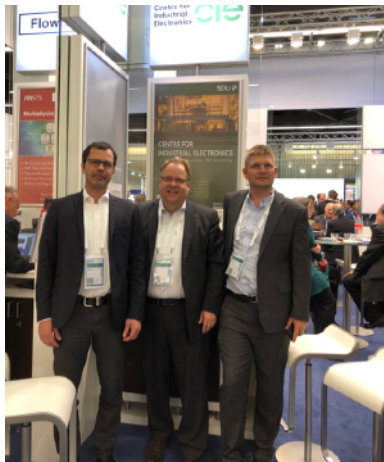
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CIE Conferences



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**Thank you for
your attention**