SCU Mobility and Energy Researh Group

Contact

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The Team

3 Professor

5 Postdoc

12 Master and PhD

in Electrical Engineering, Computer Engineering, Mechanical Engineering, Logistic and Chemistry

5 key Technical Expertise

Power Electronics

- Multilevel modeling
- Low-level control
- Thermal design and Management
- Prototyping
- BMS
- Powertrain

Electric Machine

- Multilevel modeling
- Advanced control systems (DTC, IFOC, AI, etc.)
- Thermal design and Management
- Co-design optimization incl. FEM modeling

Renewable Energy

- Modeling and simulation
- Wind Turbine
- PV Farm
- Energy management & co-design optimization

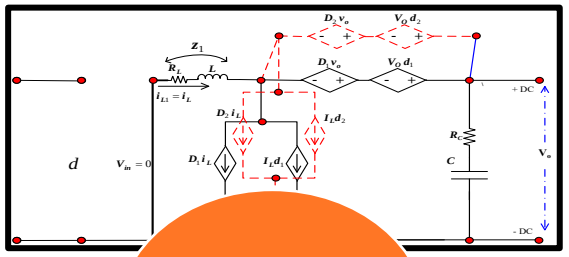
Urban Mobility

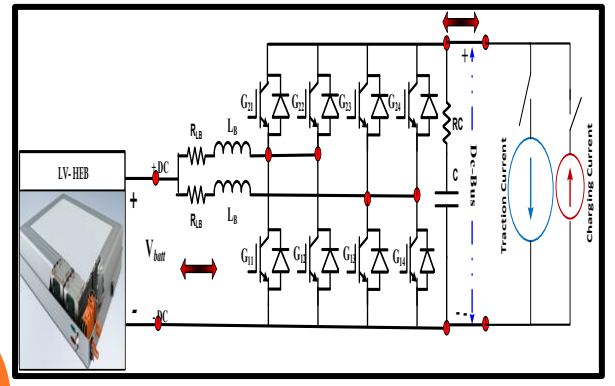
- B2B, B2C, C2B and C2C
- Pooling
- Smart algorithms
- System Engineering
- Planning and optimization

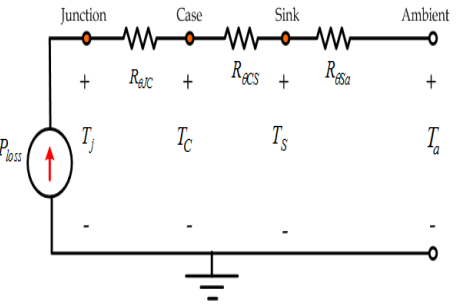
Software

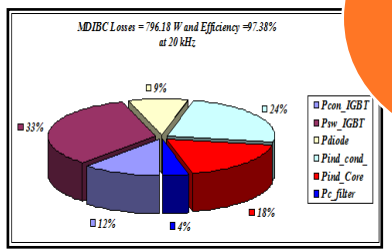
- Deep learning/machine learning
- Artificial intelligence methods
- Front-end and back-end
- Embedded system programming

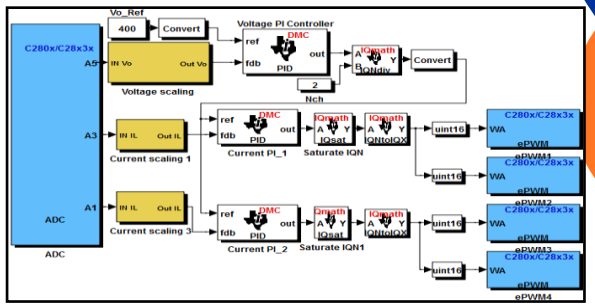
Power Electronics (Sub)Systems & Control Systems

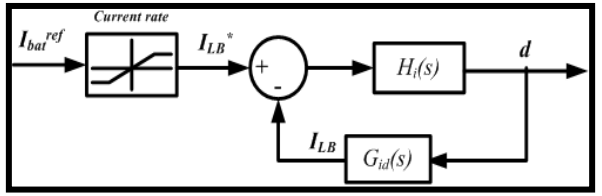


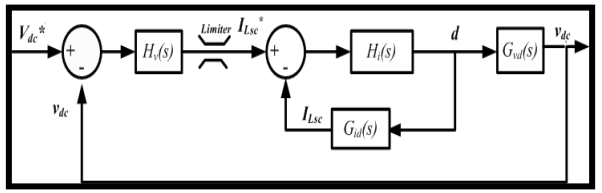












Switch/ Component modelling

Converter-inverter modelling

PE Control Systems

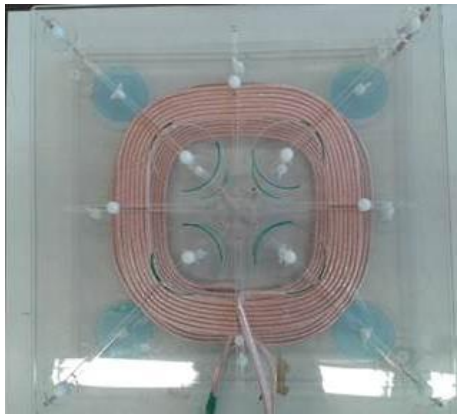
Real-Time Implementation RTW & SiL

Prototyping & PE loss Modeling & Thermal Modeling and management

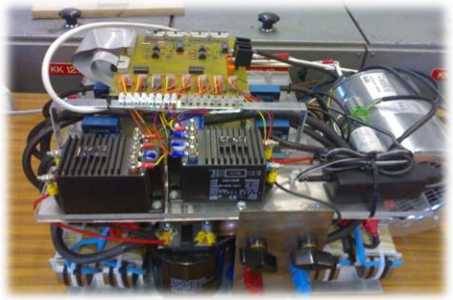
High Efficiency & Accuracy

Power Electronics (Sub)Systems & Control Systems

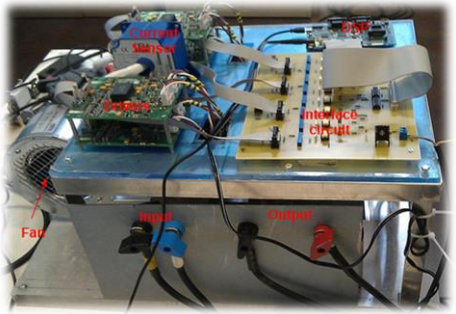
- ✓ Multilevel Models and control systems;
- ✓ Thermal modeling and cooling systems design for PECs
- ✓ Low/ high-power DC/DC Converters;
- ✓ Low/high-power DC/AC inverters; Multilevel topologies
- ✓ On/Off Board Battery Chargers <Conductive and Inductive systems> & <V2G &G2V);
- ✓ Battery Management Systems (BMS) <Passive and active systems> light power electronics



Inductive systems



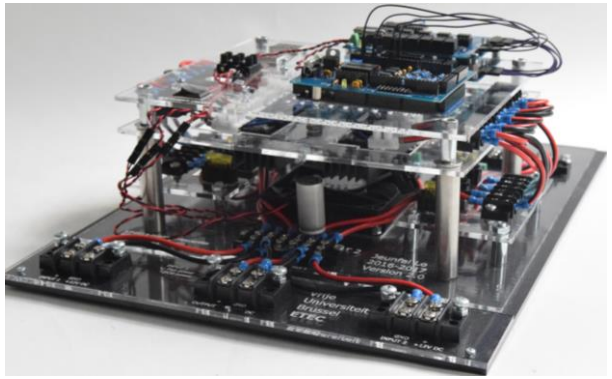
Interleaved DC/DC Converters



Resonant DC/DC Converters

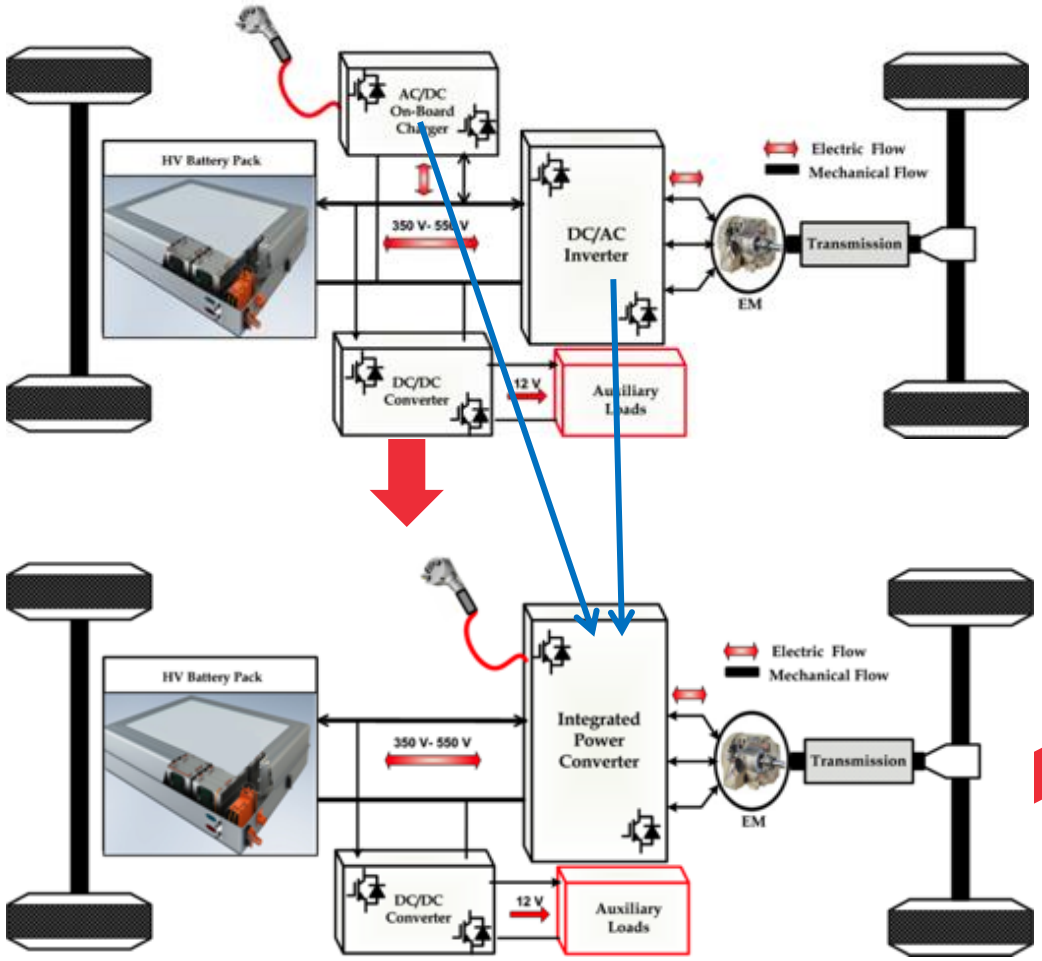
Integrated Power Converters (incl. Inverter and Charger)

Z Source Inverters



Multiport converter

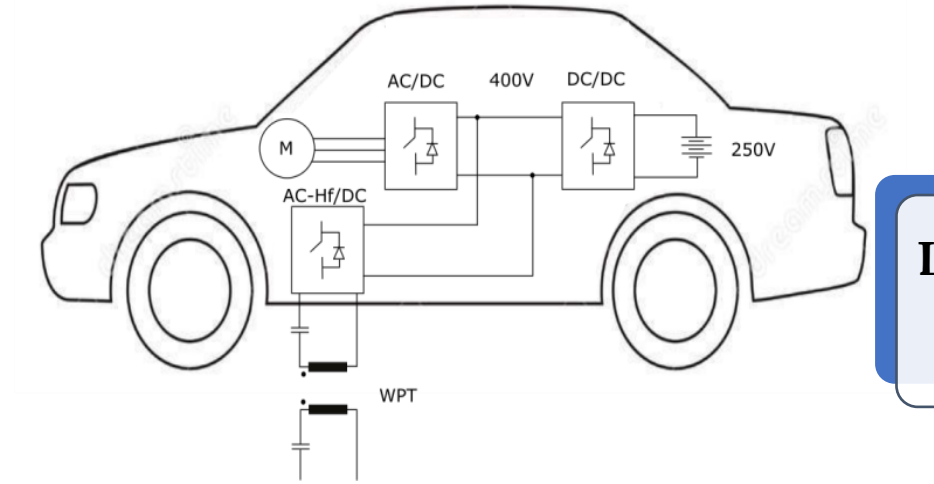
Power Electronics (Sub)Systems & Control Systems

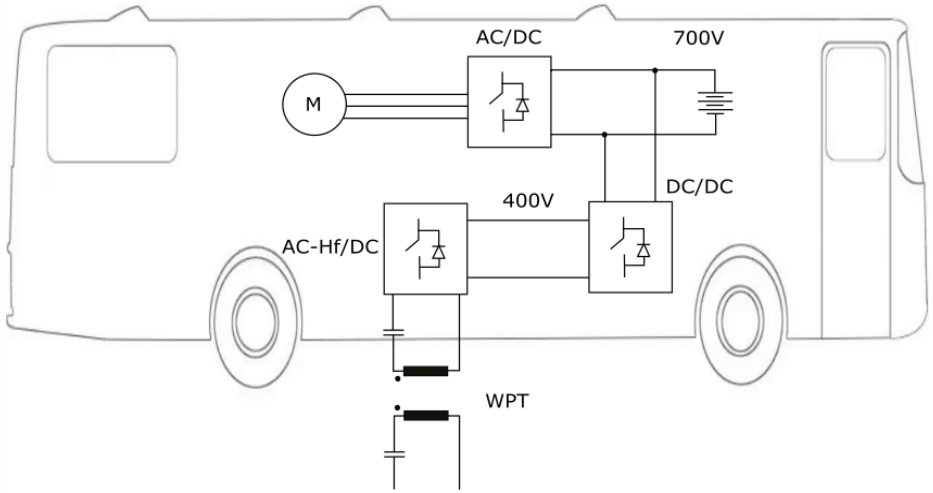


- ✓ Compact Size
- ✓ Low Weight
- ✓ Less component account
- ✓ Low Cost
- ✓ High Performance

Integrated PE Converter

Power Electronics (Sub)Systems & Control Systems



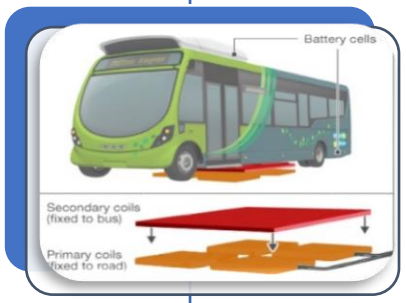


Inductive Chargers

LP (slow, passenger car)
3.7 kW/ 7.7 kW

Wide-Bandgap
(SiC & GaN)

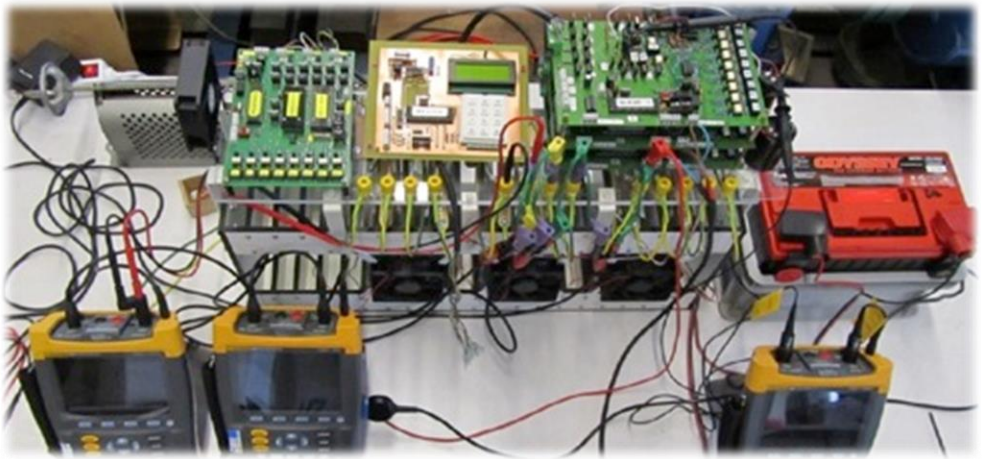
HP (fast, bus, opportunity)
22kW/ 50 kW



IGBT
(G1/G4)

Power Electronics (Sub)Systems & Control Systems

Unbalanced battery cells

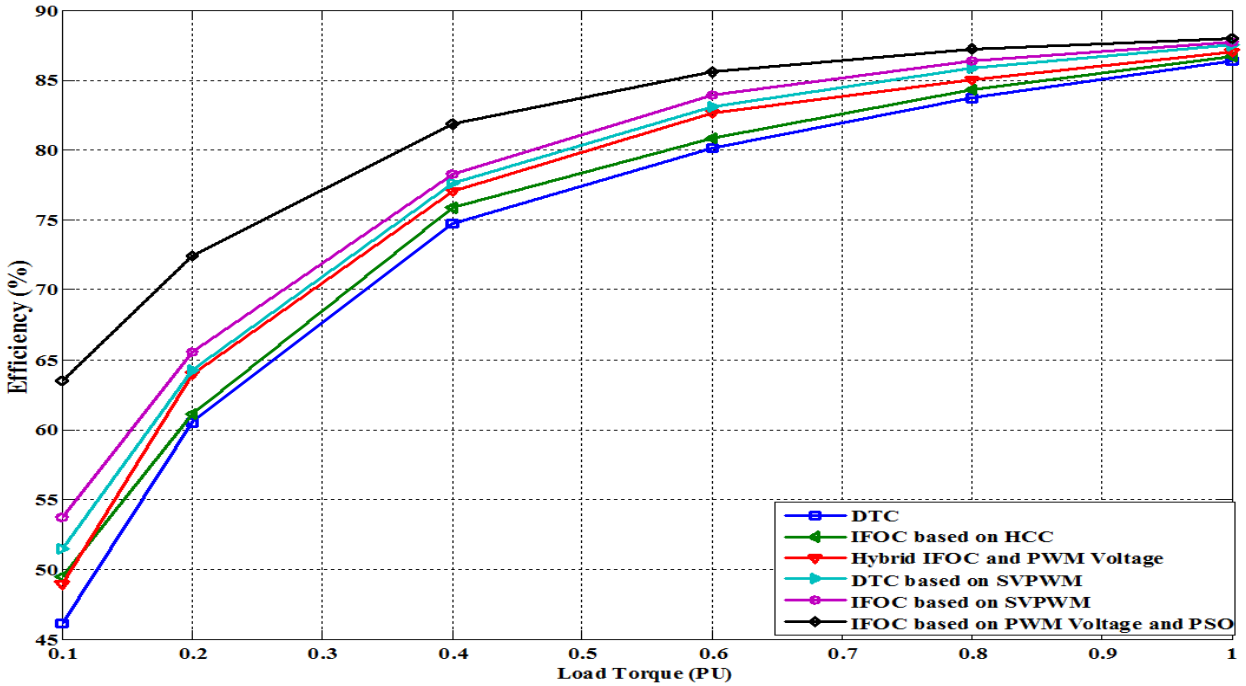


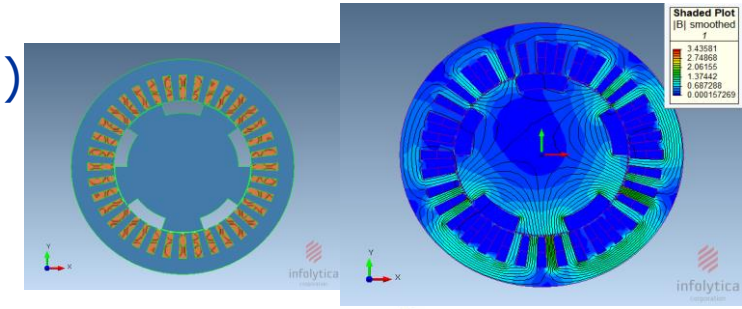
- ✓ Active BMS for Li-ion Battery Pack
- ✓ Second life battery
- ✓ SuperCapacitor
- ✓ Min. Voltage difference between Cells
- ✓ Fast balancing time
- ✓ High Accuracy

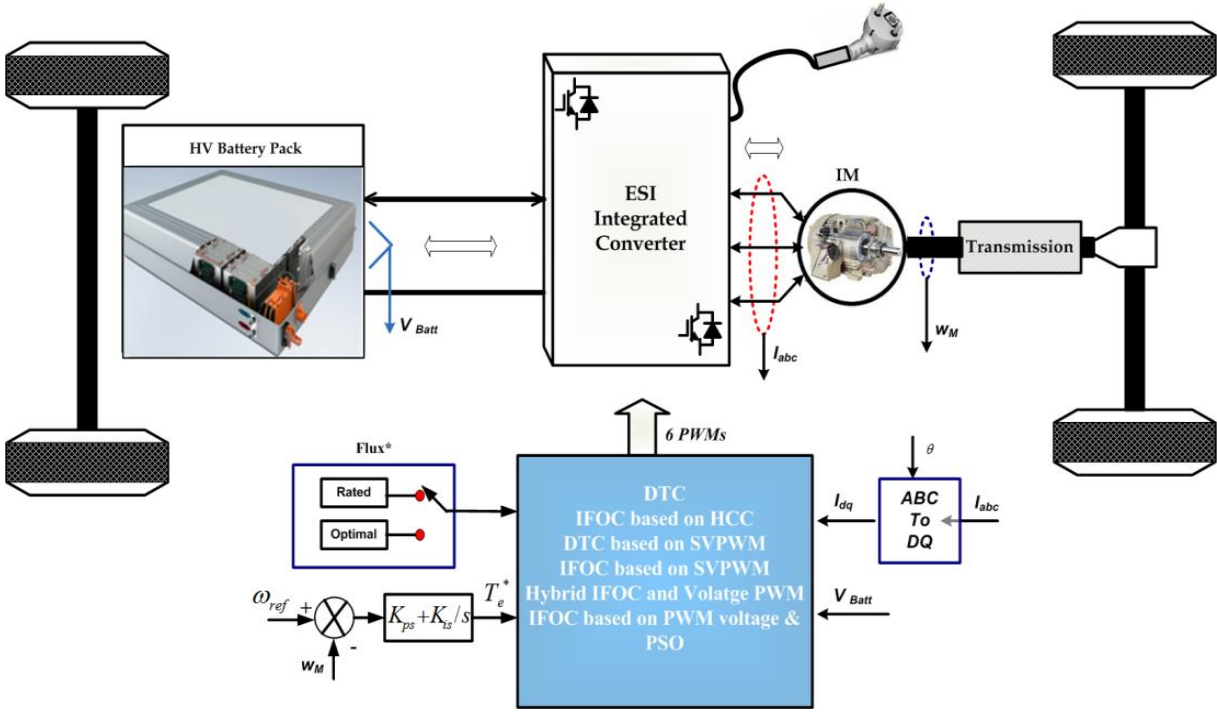
Balanced battery cells

Electric Machines

- ✓ Multilevel Models (electro-magnetic modeling): DQ, FEM modeling
- ✓ Efficient control systems (SVC, FOC, IFOC, DTC, PSO, DP,etc.)
- ✓ Co-design optimization (topology, technology and control optimization)
- ✓ Testing and validation

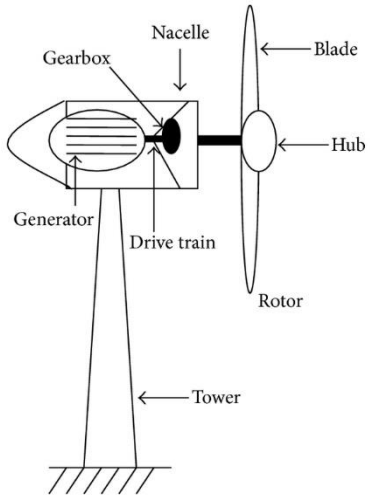


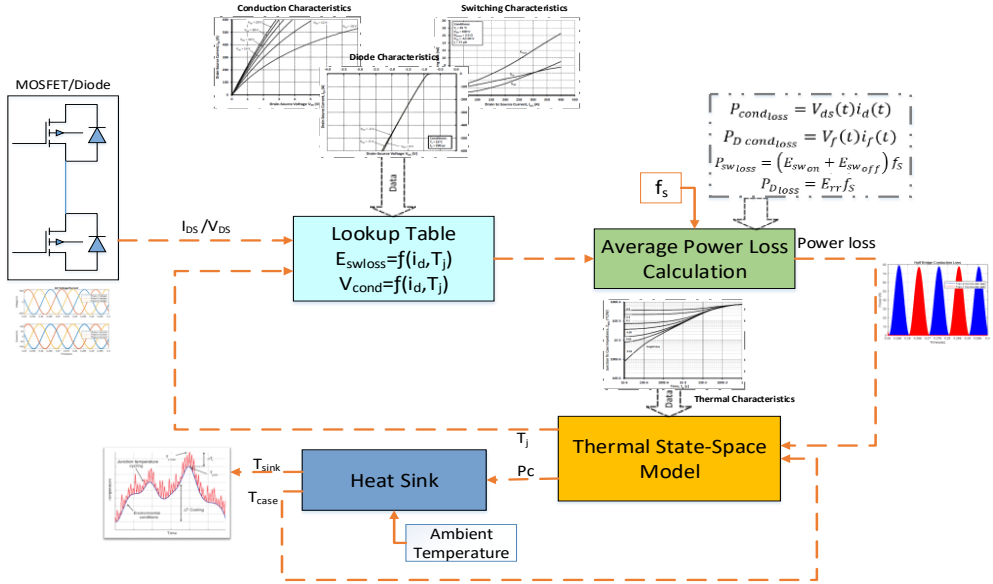


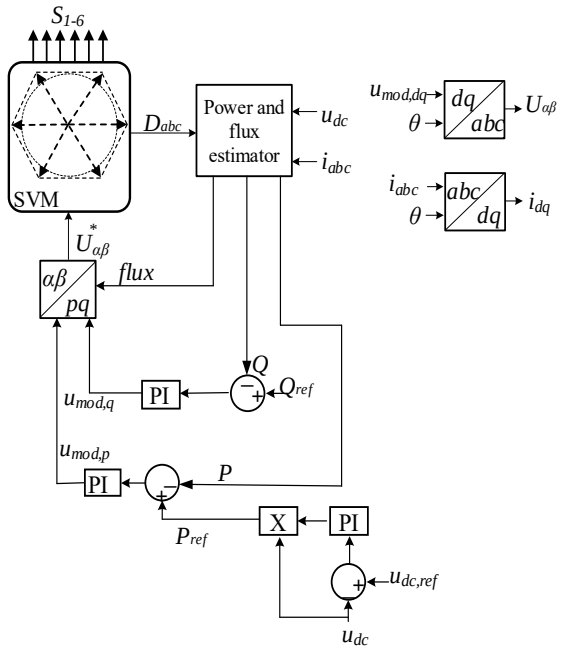


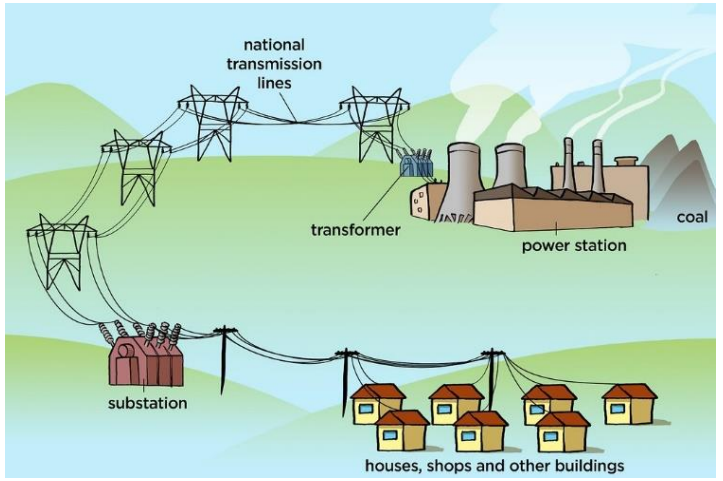
Renewable Energy and Smart Grid

- ✓ Realistic simulation and digital twin
- ✓ Field experiences
- ✓ Co-design optimization
- ✓ Testing and validation
- ✓ Communication



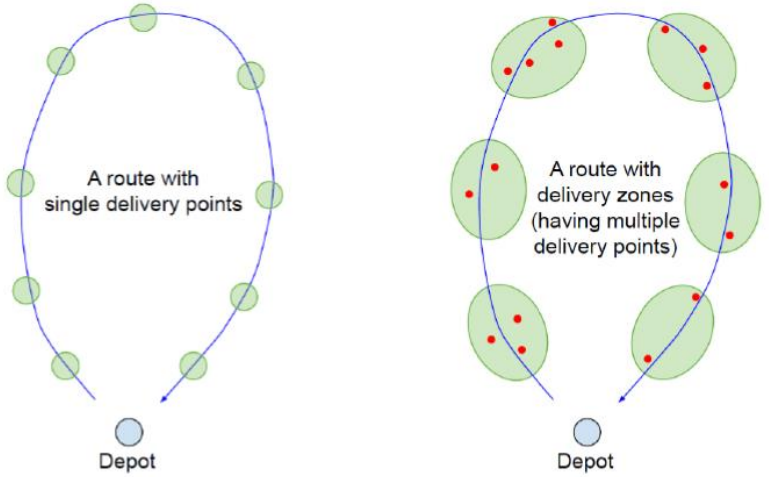


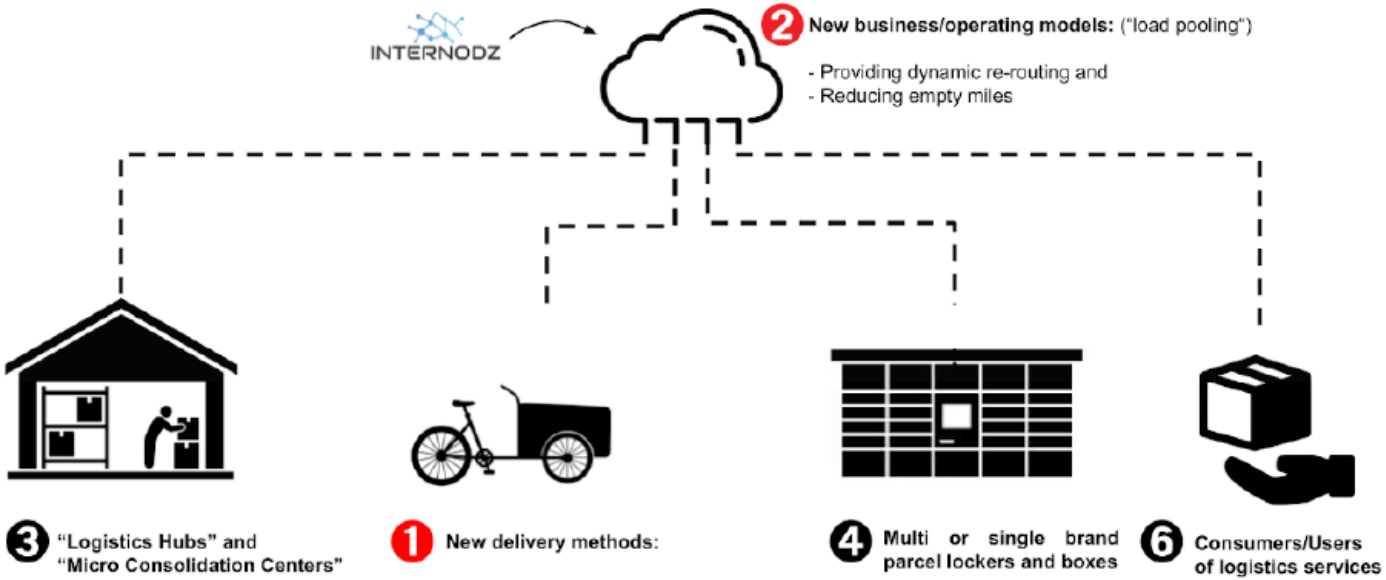


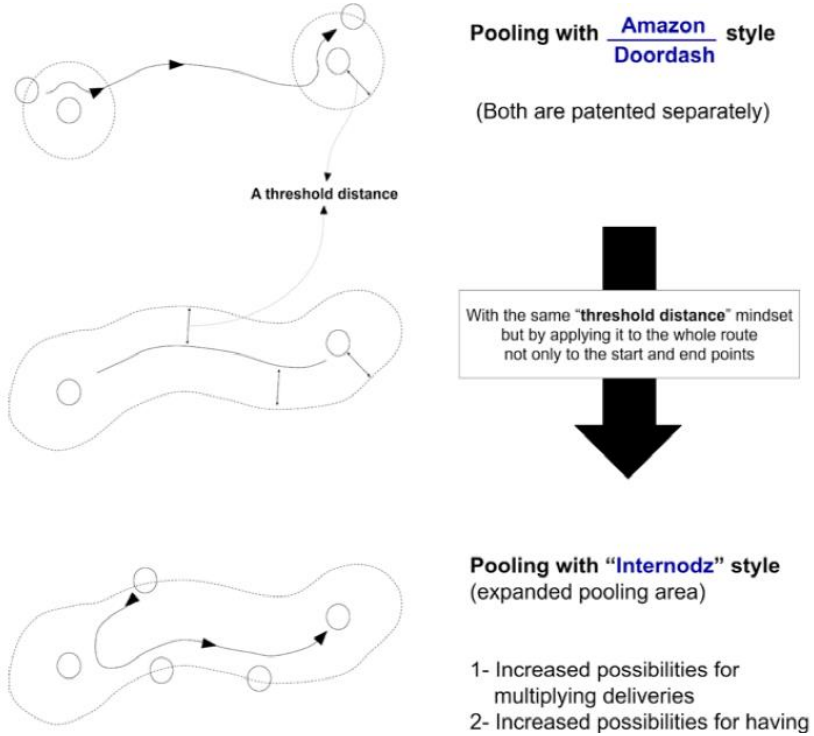


Urban Mobility and Logistic

- ✓ Urban solutions
- ✓ Sub-urban modelling
- ✓ Decarbonization
- ✓ Smart software and demonstration
- ✓ Pooling approaches







Projeleriniz ve konsorsiyum yapıları hakkında kısa bilgi

✓ BLOW

- 16 partner
- 9 ülke

✓ FLEXSHIP

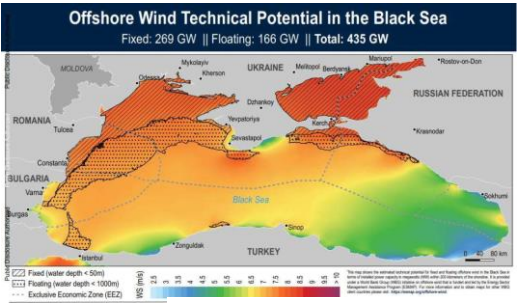
- 16 partner
- 9 ülke

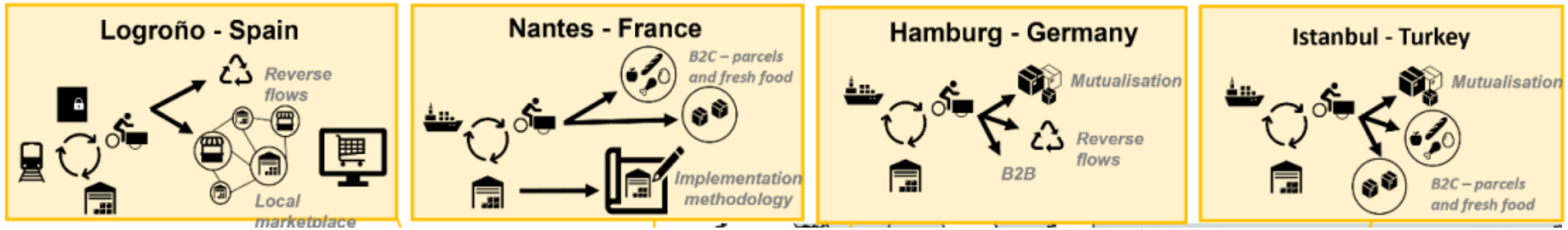
✓ DECARBOMOBILE

- 31 partner
- 11 ülke

✓ EXTENDED

- 20 partner
- 10 ülke





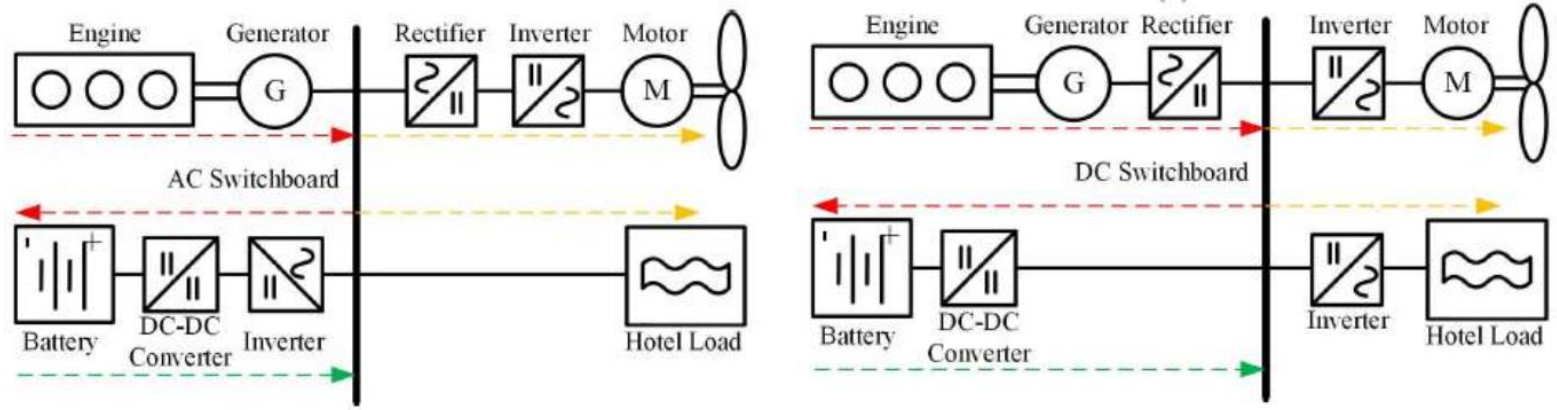


Figure 1.5 Hybrid marine vessel grid architectures (a) AC grid and (b) DC grid

Figure 1.2 - Wireless BMS and wireless sensor concept for solid state batteries

Proje konsorsiyumlarına nasıl dahil olunur?

- ✓ Yurt dışı tecrübeler ve iletişim
- ✓ Ağlara üyelikler
- ✓ Proje pazarları
- ✓ Geçmiş proje üyeleri

TURKEY in HORIZON 2020

European Commission

Funding & tender opportunities

Single Electronic Data Interchange Area (SEDIA)

Konsorsiyum toplantıları ne sıklıkla yapılır?

- ✓ Endüstriyel partnerler, araştırma kurumları, devlet organizasyonları ve STK lar

- ✓ Genel toplantılar
- ✓ Teknik toplantılar
- ✓ İş paketi toplantıları
- ✓ Ortaklardan neler beklenir
- ✓ Karşılaşılan zorluklar ve çözüm önerileri

Proje hazirlanirken dikkat edilmesi gereken hususlar

- ✓ Proje fikrinin konu ile uyumu
- ✓ Ufuk Avrupa'da "etki" bolumunun daha ön plana cikmasi
- ✓ TRL seviyesi
- ✓ Konsorsiyum gücü
- ✓ Partner rollerinin sağlıklı dağılması
- ✓ KPI gerçekleştirilebilirliği

European Commission

Technology Readiness Levels

TRL 0: **Idea**. Unproven concept, no testing has been performed.

TRL 1: **Basic research.** Principles postulated and observed but no experimental proof available.

TRL 2: **Technology formulation**. Concept and application have been formulated.

TRL 3: **Applied research**. First laboratory tests completed; proof of concept.

TRL 4: **Small scale prototype** built in a laboratory environment ("ugly" prototype).

TRL 5: **Large scale prototype** tested in intended environment.

TRL 6: **Prototype system** tested in intended environment close to expected performance.

TRL 7: **Demonstration system** operating in operational environment at pre-commercial scale.

TRL 8: **First of a kind commercial system**. Manufacturing issues solved.

TRL 9: **Full commercial application**, technology available for consumers.

İlgilendiğiniz 2023-2024 çağrıları

- Küme 5 Hedef 3, Hedef 6 ve Hedef 5
  - **HORIZON-CL5-2023-D2-02-02**: New Approaches to Develop Enhanced Safety Materials for Gen 3 Li-Ion Batteries for Mobility Applications
  - **HORIZON-CL5-2023-D2-02-01**: Advanced materials and cells development enabling large-scale production of Gen4 solid-state batteries for mobility applications
  - **HORIZON-CL5-2023-D2-01-04**: Battery management system (BMS) and battery system design for stationary energy storage systems (ESS) to improve interoperability and facilitate the integration of second life batteries
  - **HORIZON-CL5-2023-D2-01-03**: Advanced digital twins for battery cell production lines
  - **HORIZON-CL5-2024-D3-01-10:** Next generation of renewable energy technologies
  - **All 2ZERO calls (CCAM)**

Are you ready to work with us to benefit from the latest technologies in the most efficient way and to get maximum service while protecting the health of nature ?

MOBILITY
AND ENERGY RESEARH GROUP

Thank you for your attention
SCU MOBILERS