

15 PhD positions in the Horizon Europe Marie-Curie Doctoral Network



MSCA Doctoral Network on Bidirectional Wireless Power Transfer for Next-Generation Electric Mobility

Applications are invited for 15 PhD positions (“Doctoral Candidates”, DCs) to be funded by the Marie-Sklodowska-Curie Doctoral Network “**BiWPT – MSCA Doctoral Network on Bidirectional Wireless Power Transfer for Next-Generation Electric Mobility**” within the Horizon Europe programme of the European Commission.

Charging your electric vehicle should be as effortless as connecting to Wi-Fi. This vision captures a key ambition of the energy transition: making electrified mobility not only clean and efficient, but also seamless, intelligent, and integrated into the broader energy ecosystem. Europe’s transition to sustainable mobility depends on integrating electric vehicles (EVs) with renewable energy systems. EV batteries could act as a vast distributed energy storage network through vehicle-to-grid (V2G) operation, helping balance supply and demand and reducing costly grid upgrades. However, widespread V2G adoption is hindered by the inconvenience of repeatedly plugging and unplugging vehicles. Wireless power transfer (WPT) addresses this challenge by enabling automatic, contactless charging and discharging, even while vehicles are parked or in motion. Yet current WPT systems are largely unidirectional and struggle with misalignment, dynamic operation, and bidirectional power flow. BiWPT addresses these challenges, enabling efficient, safe, and cost-effective bidirectional wireless charging.

The **BiWPT Doctoral Network on Bidirectional Wireless Power Transfer for Next-Generation Electric Mobility** has a clear mission: to train a new generation of experts who possess the skills and fundamental knowledge required to effectively address the challenges of bidirectional WPT systems for electric mobility, enabling vehicle-grid integration in support of Europe’s energy transition. The network will advance fundamental understanding and practical implementation of efficient, compact, and misalignment-tolerant bidirectional WPT technologies. Expected innovations include novel electromagnetic coupling and converter designs, integrated shielding concepts, and real-world demonstrators that enable seamless, efficient, and high-power electric vehicle charging and discharging.

The BiWPT beneficiaries are 8 universities: University of Antwerp (UAntwerp, Belgium), University of Aveiro (UAveiro, Portugal), University of Southern Denmark (SDU, Denmark), University of Bologna (UniBo, Italy), Chalmers University of Technology (Chalmers, Sweden), University of Stuttgart (USTUTT, Germany), KU Leuven (KUL, Belgium) and LUT University (LUT, Finland). They are supported by 7 leading European companies within the wireless power transfer sector: Multipower (MPW, Belgium), HFA (Portugal), Converdán (CON, Denmark), RFI (Italy), ENRX (Germany), ETRIXA (Sweden) and Kempower (KEM, Finland).

The (final) deadline for the online application is 1 October 2026.
However, candidates are encouraged to apply as soon as possible

Key background info

EU FUNDING



Number of positions available

15 PhD Positions¹

Research Fields

Electrical Engineering – Modelling – Materials Engineering – Wireless Communication – System Engineering – Electromagnetic Compatibility – Embedded Systems – Control Engineering – Sustainable Design

Keywords

Electrical and electronic engineering - Control engineering - Embedded systems - Simulation engineering and modelling - Industrial design - Energy systems - Materials engineering - Wireless communications

Career Stage

Doctoral Candidate (DC)

Benefits and salary

The successful candidates will receive an attractive salary in accordance with the MSCA regulations for DCs. The gross salary includes a **living allowance** (approximately € 4000 per month²), a **mobility allowance** of approximately € 700 per month and, if applicable, a **family allowance** of approximately € 495 per month. **These amounts are nominal (gross) amounts and certain deductions will apply for social security contributions and/or taxes according to the applicable national laws of the country where the recruiting beneficiary is located.** The exact (net) salary will be confirmed upon appointment and is dependent on local tax regulations and on the country correction factor (to allow for the difference in cost of living in different EU Member States).

Funding duration and training

The guaranteed PhD funding is for 36 months (i.e. EC funding, additional funding is possible, depending on the local Supervisor, and in accordance with the regular PhD time in the country of origin). In countries where PhDs typically last longer than 36 months, beneficiaries aim at providing additional funding for the required time to finish the PhD if the DC fulfils all technical requirements at the end of the 36 months. In addition to their individual scientific projects, all fellows will benefit from further continuing education, which includes internships and secondments, a variety of training modules as well as active participation in workshops and conferences. The DC will participate in two planned secondments as part of the doctoral

training programme: an academic secondment at the co-supervising university abroad and an industrial secondment at the mentor's company.

Online Recruitment Procedure

All applications proceed through the online recruitment portal on the <https://www.biwpt.eu/> website. Candidates may apply electronically for between **one to maximum three DC positions** and indicate their preference. Candidates provide all requested information including a detailed CV (Europass format³ obligatory), a motivation letter and transcripts of bachelor and master degree⁴. During the registration, applicants will need to prove that they are eligible (cf. DC definition, mobility criteria, and English language proficiency). For some positions, candidates must be eligible with respect to national and international regulations for knowledge transfer and export control.

The final deadline for online applications is 1 October 2026.

However, candidates are encouraged to apply as early as possible, as online pre-interviews may be organized with candidates who meet the profile requirements and have expressed mutual interest in an exploratory conversation. All applications received before the deadline will be considered in the formal evaluation procedure.

After the application deadline (1 October 2026), the selection procedure will be carried out through online interviews (recruitment event) in the period 2–13 November 2026. The selected candidates provide a 10-minute presentation and are interviewed by the Recruitment Committee. Candidates will be given a small scientific task (prior to the online interviews) by their prioritized Supervisor and will be asked questions about this task during the interview to check if the candidate has the right background/profile for and a good view on the DC position. The selected DCs are to start their research as quickly as possible (target period: 1 Jan. – 1 Sept. 2027).

Applicants need to fully respect three eligibility criteria (to be demonstrated in the Europass CV):

1. **Doctoral Candidates (DCs)** are those who are, at the time of recruitment by the host, **not already in possession of a doctoral degree**. Researchers who have successfully defended their doctoral thesis but have not yet formally been awarded the doctoral degree will not be considered eligible.
2. **Conditions of international mobility of researchers:** Researchers are required to undertake transnational mobility (i.e. move from one country to another) when taking up the appointment. **At the time of selection by the host organisation, researchers must not have resided or carried out their main activity (work, studies, etc.) in the country of the recruiting beneficiary for more than 12 months in the 3 years immediately prior to their recruitment.** Short stays, such as holidays, are not considered.
3. **English language:** Doctoral Candidates (DCs) must demonstrate that their ability to understand and express themselves in both written and spoken English is sufficiently high for them to derive the full benefit from the network training.

¹ Disclaimer: These offers are subject to the signature of grant agreement nr° 101310414, expected by mid-July 2026.

² Dependent on the applicable EU Country Coefficient

³ <https://europass.cedefop.europa.eu/documents/curriculum-vitae>

⁴ Master students who will graduate in the next coming months are welcome to apply. In that case, please provide an overview of the transcripts that are already available.

The 15 available PhD positions

DC1: Parity-time symmetry for dynamic bidirectional WPT

Host: UAntwerp (Belgium)

Main supervisor: B. Minnaert (UAntwerp, BE)

(ben.minnaert@uantwerpen.be)

Co-supervisors/mentors: A. Babaki & R. Maheshwari (SDU, DK), C. Lecluyse (MPW, BE)

Duration: 36 months

Required profile: Electrical Engineering, Physics or equivalent.

Desirable skills/interests: Simulation engineering and modelling; Energy systems; Electrical and electronic engineering; Mathematical physics; Embedded systems; Systems engineering.

Objectives: Extending the concept of parity-time symmetry to bidirectional and dynamic capacitive WPT systems. The DC will develop an equivalent circuit model of the PT-symmetric capacitive WPT system enabling bidirectional energy flow. Analytical criteria will be derived to maintain exact PT symmetry under varying alignment and load conditions, ensuring constant power and high efficiency. Adaptive control strategies exploiting the self-tuning behaviour of parity-time symmetry will be designed and simulated to eliminate active impedance matching. The concept will be experimentally validated.

DC2: Combining magnetic and electric field coupling for bidirectional WPT

Host: UAntwerp (Belgium)

Main supervisor: B. Minnaert (UAntwerp, BE)

(ben.minnaert@uantwerpen.be)

Co-supervisors/mentors: V. Cirimele & A. Costanzo (UniBo, IT), C. Lecluyse (MPW, BE)

Duration: 36 months

Required profile: Electrical Engineering, Physics or equivalent.

Desirable skills/interests: Simulation engineering and modelling; Energy systems; Electrical and electronic engineering; Mathematical physics; Embedded systems; Systems engineering.

Objectives: Developing an integrated coupler that simultaneously exploits magnetic and electric field coupling mechanisms in bidirectional WPT systems. The DC will derive analytical expressions for hybrid magnetic-electric coupling coefficients and energy transfer characteristics, including efficiency, stability, and misalignment tolerance, resulting in compact lumped equivalent circuit models. The model will be validated through circuit-level simulations in LTspice and full-wave electromagnetic simulations in CST Studio. Finally, an integrated magnetic-electric coupler will be realized and experimentally evaluated against conventional WPT systems in terms of compactness, component reduction, and misalignment tolerance.

DC3: Metamaterial design using high-power-handling materials for increasing power transfer efficiency

Host: UAveiro (Portugal)

Main supervisor: N.B. Carvalho (UAveiro, PT) (nbc Carvalho@ua.pt)

Co-supervisors/mentors: A.K. Baghel (UAveiro, PT), B. Minnaert (UAntwerp, BE), C. Alves (HFA, PT)

Duration: 36 months

Required profile: Electrical Engineering, Physics or equivalent.

Desirable skills/interests: Metamaterials; Simulation engineering and modelling; Energy systems; Electrical and electronic engineering; Mathematical physics; Materials engineering; Systems engineering.

Objectives: Design, modelling, and validation of metamaterial structures using high-power-handling dielectric and composite materials to enhance wireless power transfer efficiency. The DC will design and analyse artificial metamaterials (i.e., artificial magnetic conductors, metasurfaces, and frequency-selective surfaces) to confine electromagnetic fields and reduce leakage. The focus will be on identifying dielectric and composite materials with superior power handling, low dielectric losses, and strong thermal stability. Using full-wave electromagnetic simulations in the software program CST Studio, the most promising solutions will be integrated into practical WPT coils and systems. Experimental validation on a WPT prototype will demonstrate the efficiency and safety benefits of the metamaterial-enhanced system.

DC4: Misalignment-tolerant magnetic coupler for dynamic WPT

Host: SDU (Denmark)

Main Supervisor: A. Babaki (SDU, DK) (amirbabaki@sdu.dk)

Co-supervisors/mentors: R. Maheshwari (SDU, DK), B. Minnaert (UAntwerp, BE), C. Kjeldsen (CON, DK)

Duration: 36 months

Required profile: Electrical Engineering or equivalent.

Desirable skills/interests: Simulation engineering and modelling; Electrical and electronic engineering; Embedded systems; Control engineering.

Objectives: Designing, modelling, and prototyping an integrated magnetic coupler that maintains high efficiency and constant output characteristics under significant lateral and longitudinal misalignments. The DC will develop hybrid compensation topologies that ensure passive stability without active control. A digital twin will be built to simulate electromagnetic, circuit, and thermal behavior, combining simulation programs as CST Studio and circuit simulator LTspice. The optimized coupler will be fabricated and experimentally validated in a bidirectional EV wireless charging demonstrator, proving >90% efficiency under realistic misalignment conditions.

DC5: Single and multi-phase PCB coil-based bidirectional WPT systems

Host: UniBo (Italy)

Main supervisor: V. Cirimele (UniBo, IT)

(vincenzo.cirimele@unibo.it)

Co-supervisors/mentors: A. Costanzo (UniBo, IT), B. Minnaert (UAntwerp, BE), S. Amorelli (ENRX, DE)

Duration: 36 months

Required profile: Electrical engineering or equivalent

Desirable skills/interests: Simulation engineering and modelling; Electrical and electronic engineering; Embedded systems; Control engineering; Mathematical physics.

Objectives: Developing and validating single- and multi-phase PCB-based coils for bidirectional WPT systems. The DC will identify suitable materials, geometries, and thermal management strategies to achieve current densities above 15 A/mm² while maintaining high efficiency. Using analytical and numerical modelling tools, the DC will design self-resonant PCB coils that minimize or eliminate external compensation capacitors. Experimental validation will be performed on a prototype compliant with SAE J2954 standards to benchmark performance against conventional litz-wire coils.

DC6: Design and control of bidirectional high-power and robust WPT converters

Host: Chalmers (Sweden)

Main supervisor: Y. Liu (Chalmers, SE) (yujing.liu@chalmers.se)

Co-supervisors/mentors: N. Parspour (USTUTT, DE), B. Jiang (ETRIXA, SE)

Duration: 36 months

Required profile: Electrical engineering or equivalent

Desirable skills/interests: Embedded systems; Materials engineering; Electrical and electronic engineering; Control engineering; Sustainable design; Simulation engineering and modelling; Systems engineering; Industrial design; Computer aided design.

Objectives: Design, implementation, and control of compact and cost-effective wireless power transfer converters capable of robust bidirectional operation. The DC will investigate suitable topologies, materials, and components to achieve high efficiency and scalability up to 500 kW. Advanced control algorithms will be developed to ensure stable power flow under varying coupling conditions and battery states. The designed system will be experimentally validated to assess efficiency, reliability, and fault tolerance.

DC7: Development and validation of bidirectional converter and hybrid compensation topologies

Host: SDU (Denmark)

Main supervisor: A. Babaki (SDU, DK) (amirbabaki@sdu.dk)

Co-supervisors/mentors: R. Maheshwari (SDU, DK), A. Costanzo & V. Cirimele (UniBo, IT), C. Kjeldsen (CON,DK)

Duration: 36 months

Required profile: Electrical Engineering or equivalent

Desirable skills/interests: Simulation engineering and modelling; Electrical and electronic engineering; Embedded systems; Control engineering.

Objectives: Design innovative hybrid compensation and converter topologies that minimize magnetic material usage and component count while ensuring high efficiency and robustness. The DC will realize the development and experimental validation of a hybrid compensated, bidirectional wireless charging system capable of stable, load-independent current and voltage transfer in both charging and discharging modes. Experimental validation through hardware prototypes will demonstrate >95% efficiency and strong misalignment tolerance.

DC8: Nonlinear design and optimization of bidirectional circuits capable of operating both as power oscillators and as rectifiers

Host: UniBo (Italy)

Main supervisor: A. Costanzo (UniBo, IT)

(alessandra.costanzo@unibo.it)

Co-supervisors/mentors: V. Cirimele (UniBo, IT), A. Babaki & R. Maheshwari (SDU, DK), N.C. Sebastian (RFI, IT)

Duration: 36 months

Required profile: Electrical Engineering, Physics or equivalent

Desirable skills/interests: Simulation engineering and modelling; Electrical and electronic engineering; Embedded systems; Control engineering; Mathematical physics.

Objectives: Design of GaN-HEMT-based circuits acting as power sources and power rectifiers up to the MHz range. The DC will extract accurate empirical models of the nonlinear FET-like devices in the third quadrant of the DC characteristics for nonlinear operation with negative drain-source voltages. Design guidelines for bidirectional WPT systems will be designed, adopting analytical and

numerical tools in the MHz range. Realization and experimental validation of the most promising topologies in the MHz range and assessment of the main performance indexes (such as the conversion efficiency in both operating regimes) will be performed.

DC9: Near-field communication for wireless power transfer

Host: USTUTT (Germany)

Main supervisor: N. Parspour (USTUTT, DE)

(nejila.parspour@iew.uni-stuttgart.de)

Co-supervisors/mentors: Y. Liu (Chalmers, SE), M. Böttigheimer (ENRX, DE)

Duration: 36 months

Required profile: Electrical engineering, communication engineering, computer science or equivalent

Desirable skills/interests: Wireless communications; Embedded systems; Electrical and electronic engineering; Control engineering; Signal processing.

Objectives: Development and experimental validation of a near-field communication system that is seamlessly integrated into a bidirectional WPT system. The DC will realize the electrical and magnetic design of coupled communication channels, the development of duplex communication hardware and filtering circuits, and the implementation of synchronization and control algorithms. System-level experiments will demonstrate closed-loop control in both static and dynamic conditions, achieving low latency, high reliability, and enhanced overall efficiency.

DC10: Identifying, measuring, and mitigating electromagnetic interference in dynamic EV applications

Host: KUL (Belgium)

Main supervisor: D. Pissoort (KUL, BE)

(davy.pissoort@kuleuven.be)

Co-supervisors/mentors: N.B. Carvalho & A.K. Baghel (UAveiro, PT), C. Lecluyse (MPW, BE)

Duration: 36 months

Required profile: Electrical Engineering or equivalent

Desirable skills/interests: Electrical and electronic engineering; Systems engineering; EMC; Electromagnetism.

Objectives: Identification, characterization, and mitigation of electromagnetic interference (EMI) in dynamic electric vehicle wireless charging applications. The DC will systematically analyse the sources and propagation paths of EMI in time-varying coupling environments, where both vehicle motion and surrounding infrastructure influence electromagnetic interactions. Advanced near-field scanning, spectral analysis, and electromagnetic co-simulation tools will be employed to quantify key disturbance parameters, including coil misalignment, conductive chassis effects, and switching transients from power converters. Full-wave simulations will be performed. Based on these insights, mitigation strategies such as shielding layer optimization, grounding schemes, and spatial field confinement will be developed and validated experimentally.

DC11: High-power-handling materials and electromagnetic decoupling strategies

Host: UAveiro (Portugal)

Main supervisor: N.B. Carvalho (UAveiro, PT) (nbcarvalho@ua.pt)

Co-supervisors/mentors: A.K. Baghel (UAveiro, PT), D. Pissoort (KUL, BE), C. Alves (HFA, PT)

Duration: 36 months

Required profile: Electrical Engineering, Physics, or equivalent.

Desirable skills/interests: Simulation engineering and modelling; Energy systems; Electrical and electronic engineering; Mathematical physics; Materials engineering; Systems engineering.

Objectives: This topic focuses on novel high-power-handling materials (ceramics, composites, and engineered dielectrics) for high-power bidirectional WPT systems. The DC will characterize breakdown strength, thermal stability, and dielectric losses at high RF levels, and develop electromagnetic decoupling strategies to minimize coupling with surrounding metallic or biological structures and nearby electronic devices. The optimized materials and shielding designs will be integrated into WPT demonstrators to evaluate the reduction in unwanted electromagnetic coupling.

DC12: Efficient shielding through novel electric topology structures

Host: UAntwerp (Belgium)

Main supervisor: B. Minnaert (UAntwerp, BE)

(ben.minnaert@uantwerpen.be)

Co-supervisors/mentors: N.B. Carvalho & A.K. Baghel (UAveiro, PT), C. Lecluyse (MPW, BE)

Duration: 36 months

Required profile: Electrical Engineering, Physics or equivalent.

Desirable skills/interests: Simulation engineering and modelling; Energy systems; Electrical and electronic engineering; Mathematical physics; Embedded systems; Systems engineering.

Objectives: Developing novel compact structures that integrate electric coupling and electromagnetic shielding within a single design. The DC will analyse and compare different electrode topologies, with the four-plate configuration as a reference. Both existing concepts (e.g., three-plate and six-plate designs) and newly proposed structures (such as multi- and matrix-topologies) will be modelled. Full-wave electromagnetic simulations will be performed in CST Studio, considering shielding effectiveness, compactness, and cost-efficiency. A bidirectional WPT demonstrator will be experimentally validated with electromagnetic measurements.

DC13: Optimizing efficiency and misalignment tolerance in bidirectional wireless charging systems for electric vehicles

Host: LUT (Finland)

Main supervisor: P. Lindh (LUT, FI) (Pia.Lindh@lut.fi)

Co-supervisors/mentors: L. Aarniovuori (LUT, FI), Y. Liu (Chalmers, SE), V. Naumanen (KEM, FI)

Duration: 36 months

Required profile: Electrical Engineering or equivalent

Desirable skills/interests: Simulation engineering and modelling; Systems engineering; Control engineering; Industrial design; Mechanical and manufacturing engineering; Automation; Computer aided design.

Objectives: Design and experimental validation of bidirectional wireless charging systems optimized for high efficiency and misalignment tolerance under real-world EV parking conditions. The DC will integrate electromagnetic design, adaptive impedance matching, and converter control to maintain $\geq 90\%$ efficiency at

± 100 mm misalignment. Using multi-objective optimization and hardware prototyping aligned with SAE J2954 standards, the work will deliver validated designs and control strategies, contributing to IEEE P2030.1.1 and IEC 61980 standardization.

DC14: Application-driven, system-level analysis of high-power wireless charging architectures

Host: LUT (Finland)

Main supervisor: L. Aarniovuori (LUT, FI) (lassi.aarniovuori@lut.fi)

Co-supervisors/mentors: P. Lindh (LUT, FI), Y. Liu (Chalmers, SE), P. Korhonen (KEM, FI)

Duration: 36 months

Required profile: Electrical Engineering or equivalent.

Desirable skills/interests: Simulation engineering and modelling; Systems engineering; Control engineering; Industrial design; Mechanical and manufacturing engineering; Automation; Computer aided design.

Objectives: This topic involves a system-level, application-driven analysis of wireless charging architectures for distributed DC systems in heavy-duty electric fleets. The DC will benchmark performance, identify key technological bottlenecks, and develop targeted improvements in thermal management, power electronics, control, and automation. The outcomes will include optimized subsystem designs. A prototype will be constructed demonstrating enhanced efficiency, safety, and scalability for commercial heavy fleet bidirectional charging.

DC15: Integration and deployment strategies of high-power WPT converters for heavy-duty vehicles

Host: Chalmers (Sweden)

Main supervisor: Y. Liu (Chalmers, SE) (yujing.liu@chalmers.se)

Co-supervisors/mentors: P. Lindh & L. Aarniovuori (LUT, FI), B. Jiang (ETRIXA, SE)

Duration: 36 months

Required profile: Electrical Engineering or equivalent

Desirable skills/interests: Embedded systems; Materials engineering; Electrical and electronic engineering; Control engineering; Sustainable design; Simulation engineering and modelling; Systems engineering; Industrial design; Computer aided design.

Objectives: Development of integration and deployment strategies for high-power WPT systems in heavy-duty vehicles, addressing cost, safety, and sustainability barriers. The DC will study architectures for system integration to vehicles, design high-power WPT systems including mechanical interfaces, and implement digital-twin models for real-time validation of the effectiveness of bidirectional WPT. An important aspect of this task is that sustainability and recyclability assessments of system components will guide the design optimization.

BiWPT project abstract and key project information

Charging your electric vehicle should be as effortless as connecting to Wi-Fi. This vision captures a key ambition of the energy transition: making electrified mobility not only clean and efficient, but also seamless, intelligent, and integrated into the broader energy ecosystem.

The European Union's Green Deal and Fit-for-55 package place electrification at the heart of Europe's decarbonization strategy. The rapid growth of **electric vehicles (EVs)** is a crucial pillar of this transformation. Yet, this electrification trend introduces new technical and systemic challenges. As more electricity is generated from renewable sources such as solar panels and wind turbines, the power grid becomes more dependent on weather conditions and therefore less predictable. To keep the grid stable, very large investments in grid reinforcement and expansion are required: we need ways to store energy when there is too much (for example, on a sunny or windy day) and release it again when there is too little. EVs can play an important role in significantly reducing these costly grid upgrades. Each EV contains a large battery that is often parked and unused for most of the day. If these batteries could temporarily give electricity back to the grid when needed, and charge again when energy is plentiful, they would act as a huge, distributed energy storage network. This idea, called **vehicle-to-grid (V2G)**, turns EVs into flexible energy assets that help balance supply and demand, reduce pressure on the grid, and make it easier to use renewable energy efficiently.

However, despite its great potential, the large-scale adoption of V2G remains limited. One of the main obstacles is convenience. Most users find it impractical to plug and unplug their vehicles every day, especially in contexts such as shared mobility, fleet operations, or autonomous driving. Even when users are willing to plug in their EVs, they often choose not to do so when the battery is already sufficiently charged and typically disconnect them once the battery is full, making the stored energy unavailable for grid support. This repeated manual connection and disconnection creates a barrier to continuous and reliable V2G participation.

Wireless power transfer (WPT) offers a promising solution to this challenge. Using magnetic or electric fields, WPT enables energy transfer without physical cables or connectors. Vehicles can charge or discharge automatically simply by parking over a charging pad, or even while moving in traffic (called, dynamic WPT). Crucially, even when the battery is full, an EV could remain parked over a WPT pad at home or at work, staying connected to the grid and providing electricity back when needed. By eliminating the need for manual plugging, WPT makes energy exchange seamless, autonomous, and highly compatible with the future of shared and automated mobility. This evolution mirrors the paradigm shift seen in wireless communication technologies, which enabled the rise of mobile and connected applications such as smartphones.

While conventional WPT technologies have matured rapidly over the past decade, they are still predominantly unidirectional, designed only to charge the vehicle battery.

However, achieving the full benefits of V2G and grid flexibility requires bidirectional WPT, where power can flow both from the grid to the vehicle and from the vehicle back to the grid without any physical connection. **Bidirectional WPT** combines the challenges of high-efficiency resonant power transfer, real-time control, electromagnetic compatibility, and safety in a single system. Current unidirectional systems achieve efficiencies above 90% at tens of kilowatts under static conditions, but performance drops sharply when misalignment, dynamic motion, or bidirectional operation is introduced. Moreover, compact and affordable designs that can meet industrial standards (SAE J2954, IEC 61980) and operate safely in dense urban environments are still lacking. Research is therefore needed to develop new coupling mechanisms, hybrid circuit topologies, and integrated shielding concepts that can support efficient, safe, and cost-effective bidirectional operation. Achieving this will not only enable fully automated, contactless charging and discharging but also unlock the large-scale use of EVs as distributed storage, accelerating the integration of renewable energy and the transition toward a flexible, sustainable, and user-friendly energy ecosystem.

The BiWPT Doctoral Network on Bidirectional Wireless Power Transfer for Next-Generation Electric Mobility has a clear mission: to train a new generation of experts who possess the skills and fundamental knowledge required to effectively address the challenges of bidirectional WPT systems for electric mobility, enabling vehicle-grid integration in support of Europe's energy transition. The network will advance fundamental understanding and practical implementation of efficient, compact, and misalignment-tolerant bidirectional WPT technologies. Expected innovations include novel electromagnetic coupling and converter designs, integrated shielding concepts, and real-world demonstrators that enable seamless, efficient, and high-power electric vehicle charging and discharging.

Achieving BiWPT's ambitious mission demands a highly interdisciplinary approach that exceeds the capacity of any single organization. Therefore, a large, integrated training network has been established, bringing together Europe's flagship companies and leading academic institutions. This collaboration provides the ideal framework to address the complex scientific and technological (S/T) challenges outlined below, which form the focus of the project's four S/T work packages (WPs):

Challenge 1: Coupling (WP1): This WP focuses on the wireless coupling itself as the core of the bidirectional power link. Advanced electromagnetic coupling structures will be designed to enhance field confinement, transfer efficiency, compactness, and safety. The goal is to achieve scalable, misalignment-tolerant operation, establishing the physical and design principles for next-generation high-efficiency WPT systems.

Challenge 2: Bidirectionality (WP2): This work package investigates the design, control, and implementation of high-power bidirectional WPT converters that enable V2G functionality. It focuses on the remote electronics outside of the coupler that make bidirectionality possible. The goal is to realize bidirectional converters that respond to changes in load, coupling, and battery states, featuring adaptive control and near-field communication for stable bidirectional energy flow.

Challenge 3: Integration (WP3): This work package focuses on the integration of WPT technology into EVs. It addresses challenges related to electromagnetic interference (EMI), unwanted radiation, and safe system integration. By developing advanced magnetic and dielectric materials, compact shielding structures, and intrinsic interference mitigation techniques, it enables low-loss, high-power, and

environmentally robust WPT systems suitable for safe deployment in EVs.

Challenge 4: Deployment (WP4): This work package focuses on translating the knowledge gained in the previous challenges into practical implementations and case studies. It addresses safety, standardization, and environmental impact considerations to ensure practical and sustainable deployment for real-world EV applications. By combining multidisciplinary modelling and hands-on testing, this WP aims to bridge the gap between fundamental research and real-world applications. It also provides guidelines and platforms to support future standardization and industry adoption of bidirectional WPT systems.

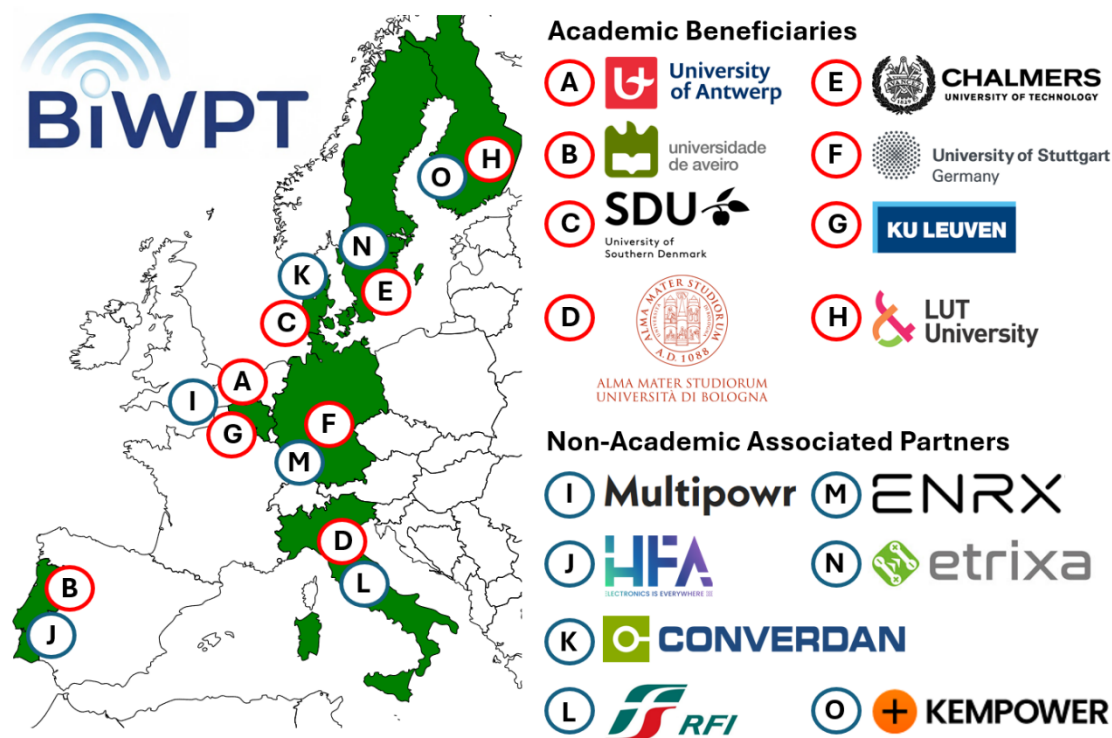


Figure 1: BiWPT Consortium overview

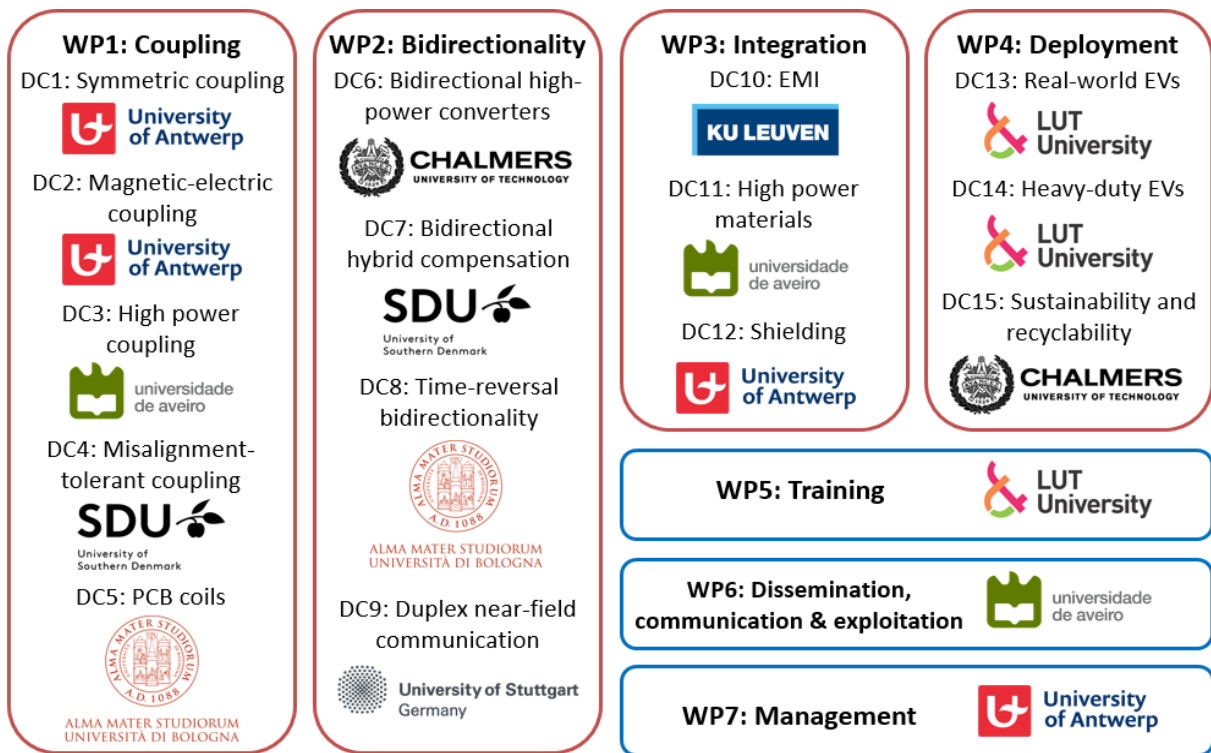


Figure 2: BiWPT WP structure

Coordinators for MSCA DN BiWPT:

Prof. Ben Minnaert (University of Antwerp) – Program Coordinator

ben.minnaert@uantwerpen.be

David Ceulemans, PhD (University of Antwerp) – Project Manager

david.ceulemans@uantwerpen.be

Any questions on the application procedure can be directed to David Ceulemans, project manager.

DN BiWPT WEBSITE: www.biwpt.eu