Certification challenges and energy metering for V2G VEHICLE TO GRID systems on AC

Jonas Van De Vijver - Portfoliomanager
Simon Lammens - Teamlead Electrical and Electronics

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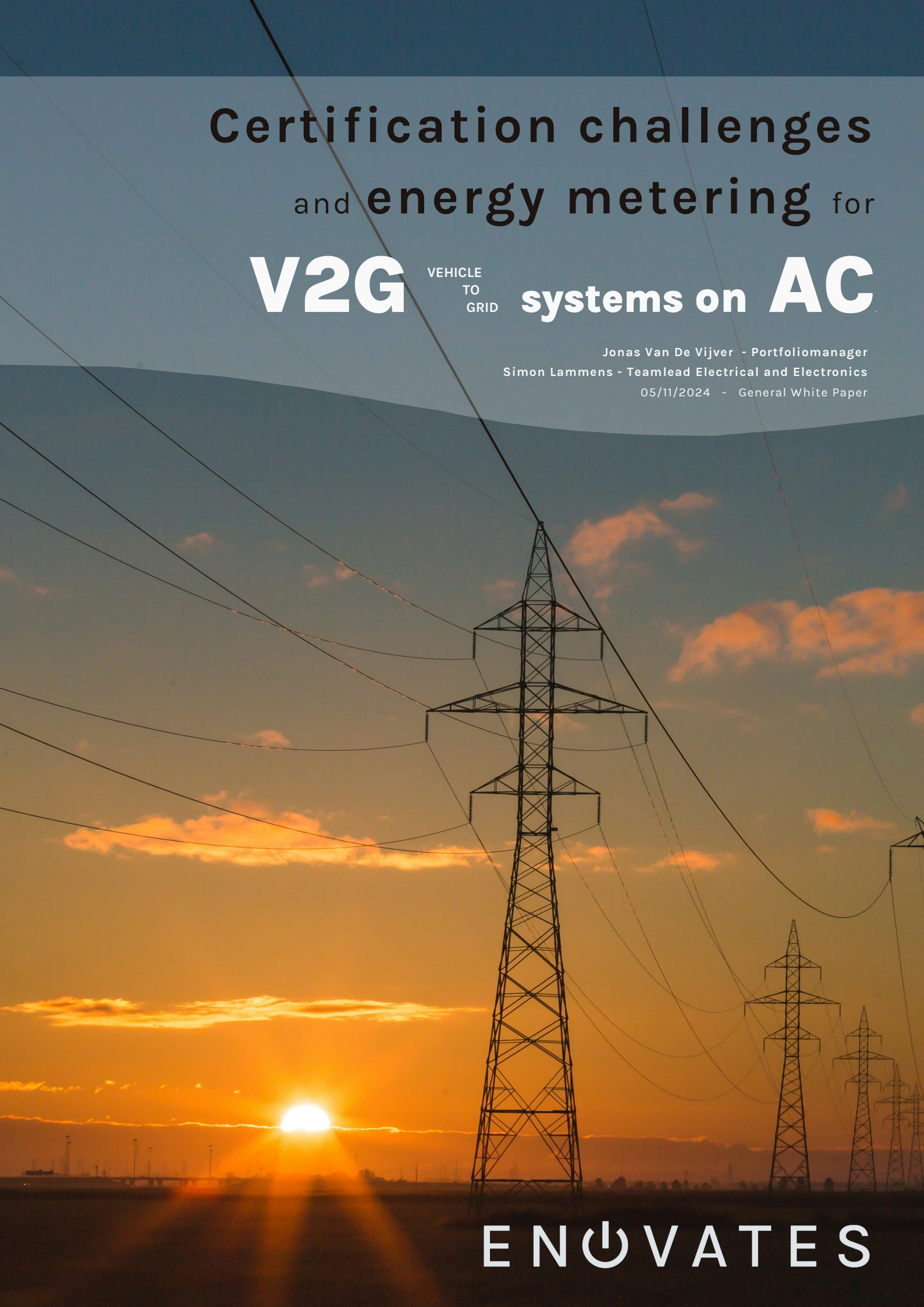

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Introduction

Vehicle-to-Grid (V2G) technology on **Alternating Current (AC)** is revolutionizing how electric vehicles (EVs) interact with the grid. V2G enables EVs to act as both energy consumers and providers, to stabilize grids and promote renewable energy integration. However, implementing V2G on AC involves significant **certification challenges**, particularly around **grid codes** and **regulatory compliance**.

Beyond the **ISO 15118** communication standard, the real challenge lies in complying with **country-specific grid codes**, these vary widely, even across European countries. V2G systems must meet **local grid norms** to ensure safe integration and stable operations. Furthermore, today, certification of both the **Electric Vehicle (EV) and the Electric Vehicle Supply Equipment (EVSE) together** is required since each plays a specific role in managing **energy flow**, **grid protection measures**, and regulating functions essential for **grid stability**.

This whitepaper explores the **certification process for V2G on AC**, highlighting the complexities of **grid code compliance** and the importance of **MID-compliant energy meters** in effectively managing **bidirectional energy flows**.

Certification challenges

Grid code compliance and ISO 15118-20

While **ISO 15118-20** establishes the communication protocol between the EV and the EVSE, the larger challenge is compliance with **local grid codes**. These codes dictate how V2G systems must operate to maintain grid stability, and they differ from country to country. Each country's unique requirements complicate the certification process, making it necessary for V2G systems to undergo individual qualification tests for each market.

Moreover, **EVs and EVSEs must be certified as a unit** since both components play integral roles in **protection and regulation**. For AC-based V2G, the **inverter** responsible for energy conversion is inside the EV, not the EVSE, which differs from DC-based systems. This means both the EV and EVSE must work together to comply with grid standards for **bidirectional power flow**, adding another layer of complexity to the certification process. This is particularly critical in **European countries**, where grid interconnection requirements are governed by national grid codes. For example, **Germany's VDE-AR-N 4105 standards** and some other countries who adopt the European suggestion EN 50549-1 (-10) all regulate the integration of distributed energy resources like V2G capable EVs.

In the **UK**, **G98/99 grid codes** mandate compliance for systems like V2G to operate safely within the national grid. **Enovates**, in collaboration with **Nissan**, successfully completed the certification for **G99 compliance**, a key requirement for connecting generating equipment to the **UK distribution network**. This certification process was conducted at **TÜV Rheinland** in Italy, ensuring the V2G system met **UK grid stability** and **bidirectional energy flow** requirements.

Field Operating Test (FOT)
A Real-World Showcase

After successfully obtaining **G99 certification**, Enovates, alongside partners **Nissan**, **Dreev**, and **EDF**, conducted a **Field Operating Test (FOT)** to showcase the V2G system's capabilities in a real-world scenario. This FOT, performed after certification, served as a **live demonstration** of how the system would manage **grid balancing**, **frequency regulation**, and overall **grid support**.

The **FOT** highlighted the seamless interaction between **Nissan EVs** and the UK grid, validating the V2G system's ability to provide critical grid services under real operating conditions. This test demonstrated the **effectiveness** of the V2G system in handling **bidirectional energy transfer** in a dynamic grid environment, further reinforcing its readiness for broader deployment across the UK.

The success of this collaborative effort underscores the importance of field testing in validating V2G solutions after certification. It also emphasizes how **cross-industry partnerships** between technology providers, automakers, and energy companies can help accelerate the adoption of V2G technology while ensuring regulatory and operational compliance with **UK grid stability** and **bidirectional energy flow** requirements.

Importance of a full integrated MID meter

For V2G to function effectively, **accurate metering** is crucial. **MID-compliant meters** are responsible for measuring the energy consumed by EVs and the energy discharged back into the grid. To ensure compliance with **grid norms**, two key factors must be present: 1) **communication speed** and 2) **measurement accuracy**. Both are essential for performing the protection and regulation functions required to maintain grid stability during **bidirectional energy flow**.

At **Enovates**, we have developed a fully integrated MID energy meter within the EVSE to address these requirements. This **integrated solution** allows for fast response times between grid events and stabilisation/protection actions, enabling rapid response to **grid demands**. Furthermore, by maintaining precise measurement accuracy, the system can manage energy flow efficiently, reducing the risk of grid instability during peak usage periods or fluctuations in **renewable energy supply**.

Real-time data collection is especially critical during **peak energy usage periods**, where the risk of **grid overloads** is higher. By controlling both the **hardware and software** of the MID meter, we ensure that our systems can continuously gather accurate data and respond promptly to dynamic grid needs. This also enables **over-the-air (OTA) updates**, allowing the system to adapt seamlessly to new grid regulations and standards as they emerge, making our solution future-proof and flexible.

Future Outlook
RfG Requirements and ISO 15118

Looking ahead, the **Requirements for Generators (RfG)** regulation is expected to play a crucial role in the future of V2G. The **European Union** is currently reviewing RfG requirements, which could mandate that **all grid compliance technologies be integrated into vehicles**. This would simplify certification for V2G systems, as both the EV and the EVSE would have standardized roles and functions. While the **UK** operates outside of EU regulations, it is expected that similar guidelines will be adopted.

The **ISO 15118** standard is also being updated to accommodate these changes, offering an option where **grid compliance functionalities** could be handled almost entirely within the EV. As this transition unfolds, firmware updates to **ISO 15118 modules in chargers** will likely be necessary to meet these evolving standards.

Currently, **V2G systems** require separate EMC testing for the combination of **EV** and **EVSE**. However, since both EV and EVSE are already certified as separate CE -labeled components, future standards are expected to streamline this process, removing the need for re-certification of the combined system. This change would simplify approval, as no new EMC testing would be required for the V2G system once individual components are certified. Until then, all EV and EVSE combinations must still undergo EMC certification together. As the V2G landscape matures, adoption by **notified bodies** and **standardization organizations** is anticipated.

Over the next five years, V2G systems will continue to operate under the current dual-certification model for both EV and EVSE. However, as the **RfG regulations** take effect and ISO 15118 evolves, the certification process may become more streamlined, creating a more transparant split between EV and EVSE responsibilities.

The certification process for **V2G systems on AC** requires navigating complex **grid code requirements** that vary by country, making widespread adoption challenging. Beyond **ISO 15118-20** compliance, certifying both the **EV** and **EVSE** as a single unit presents challenges due to their interdependent roles in managing **bidirectional power flow**. This requirement to certify each **EV-EVSE combination** for both various grid codes and **EMC compliance** leads to substantial costs, limiting the accessibility and scalability of **V2G technology**.

The use of **MID-compliant meters** for precise energy flow measurement is also critical, and maintaining full control over both hardware and software is essential to ensure **real-time grid responsiveness**. As **RfG regulations** and **ISO 15118 standards** evolve, V2G certification is likely to shift towards integrating more functionality within the EV itself, simplifying the certification process and reducing costs.

At **Enovates**, we are committed to addressing these challenges head-on, prioritizing adaptability through **Over-The-Air (OTA) updates** and deploying **robust MID-compliant solutions** to remain at the forefront of **V2G technology**.

Conclusion