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SYSTEMS REFERENCE DELIVERABLE

Architecture and use-cases for EVs to provide grid support functions

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The text of this System Reference Document is based on the following documents:

Draft	Report on voting
SyCSmartEnergy/287/DTS	SyCSmartEnergy/288/RVDTS

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this System Reference Document is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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- reconfirmed,
- withdrawn, or
- revised.

INTRODUCTION

0.1 Objective

When electric vehicles (EVs) are interconnected to the electric power system, they are capable of providing grid support functions similar to other distributed energy resources (DER), particularly energy storage units, while still not impacting any more than necessary their primary purpose of charging their batteries in a timely manner. In aggregate, such as in fleets, in community aggregations, or in microgrids, EVs can not only benefit grid operations, but, if not managed well, cause grid problems.

This document provides various use cases as examples of how EVs might be used as DERs. Since regulations, EVs, charging stations, and power systems are vastly different across the world, this document does not attempt to define any specific mechanism for EVs to provide DER grid support functions, but rather draws on IEC 61850-7-420 that defines the data models for most of the DER grid support functions, including those described in electric power requirements in IEEE Std 1547™-2018 and EN 50549.

It is expected that IEC 61850-7-420 will utilize these use cases to develop EV specific data models for "EV as DER" as needed, and that other standards such as the IEC 63110, ISO 15118, and the IEC 63382 series[1] will be revised or will otherwise accommodate the results of these "EV as DER" requirements.

Clearly contractual arrangements will need to be made with all relevant stakeholders on which EVs, under what conditions, with which functions, and when permitted. However, those contractual arrangements are outside the scope of this document, which addresses only the technical aspects of EVs as DER.

Cybersecurity for EVs as DER is important but is not in the scope of this document.

0.2 EVs, utilities, and charging

Utilities everywhere are concerned that the charging load for electric vehicles (EVs) will greatly increase the load on the power grids. In many places, the charging load could exceed the existing demand during peak hours from residential consumers. As more electric vehicle charging points are deployed it becomes increasingly important to manage flexibility of both the power levels and the times of charging.

The concept adopted in the past has been that EV charging would be managed by charging stations similar to gas stations, but today it is clear that EV drivers often charge at home and use phone applications, cloud-based systems, and remote service providers to manage their charging. Although charging stations are still important, they are no longer the only way EVs are charged. This shift is also complicating the design of the EV standards.

In addition, the idea that EVs could be used to support the power grid used to be regarded as strange, technically difficult, and not likely to be supported by EV owners. That idea, too, has been overtaken by events, as more and more EV manufacturers are including the ability to discharge and many pilot projects have shown that "vehicle-to-home" would be very desirable by customers, and "vehicle-to-grid" would be very popular with EV fleets and charging stations if they want to take part in market operations. In some regions, such as California, if the EVs are capable of discharging, they are included in the definition of Distributed Energy Resources.

[1] Under preparation.