PROPOSAL ABSTRACT

Bidirectional electrical conversion: the first step towards smart residential energy gates

Proposed theme (one choice)	Network integration, control concepts and operations	Date	15-12-2017

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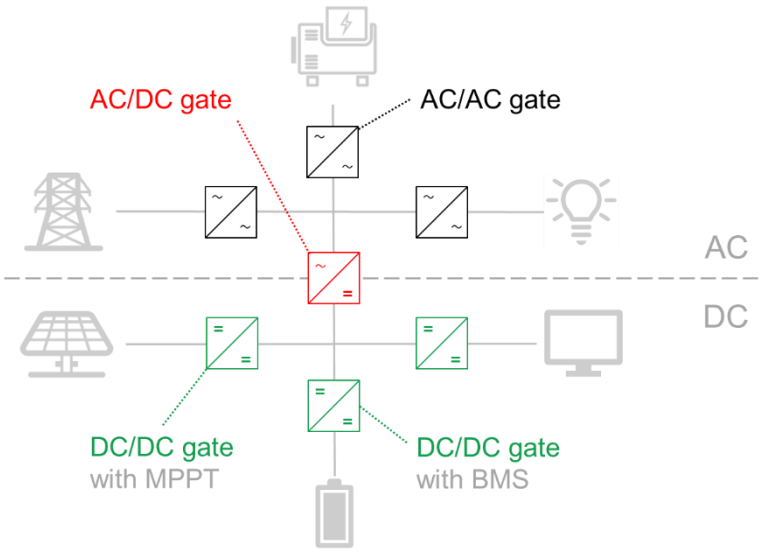
SUMMARY

Residential electricity management historically required only little power electronics equipment. Indeed, most electrical loads needed AC power supplied via the grid from a centralized production. Still back-up applications relied on unidirectional converters, a first DC/AC to supply loads from a battery in case of grid outage, and a second AC/DC to charge the battery. Nowadays battery applications extend far beyond the back-up scope as batteries become more and more affordable and complement local energy production. This production, mainly renewable and solar, occasioned the first real breakthrough of residential power electronics. However, it has been deployed on top of existing infrastructures and not really integrated into local energy systems including, e.g., more and more DC loads. Hence, rethinking electrical converters as building blocks of energy management systems – a challenge CE+T has decided to tackle – appears mandatory to shape future residential electricity management. In particular, such management involves smart energy gates consisting of bidirectional electrical converters.



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As a first step, several dedicated concepts, e.g., a patented isolated DC/DC topology, have been investigated during the development of a new technology called Enhanced Conversion Innovation (ECI) featuring bidirectionality. These concepts – which will be described in the proposed paper – have been demonstrated by means of the first member of the ECI family, the SIERRA bidirectional AC/DC converter. This 3-kVA converter is currently available in 120 Vac or 230 Vac and 48 Vdc or 380 Vdc flavors. Among others, it enables storage/restitution or peak shaving. It offers a scalable power capacity thanks to its modularity and its proprietary and non-proprietary communication capabilities. It already served several times as a basis for demonstrators of the next members of its family, e.g., embedding Maximum Power Point Tracking (MPPT) or operated as DC/DC converter. Thanks to the interoperability of its different members, this family will enable distributed energy storage for residential producers and a more effective power system.