Influential Article Review - Roadmap Application For Smart Electric Vehicles To Grid (V2g)

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This paper examines technology. We present insights from a highly influential paper. Here are the highlights from this paper: Smart grid is defined as the overlaying of a unified communications and control system onto the existing power delivery infrastructure to provide the right information and the right entity at the right time. It helps even out demand spikes and uses resource mix more efficiently. It is a better integration, or "system balancing," of variable resources, like wind power. Many of the advanced applications of smart grid are expected to develop in an evolutionary manner based on current technologies available and the needs of the market, for example, electric vehicles (EVs) or plug-in hybrid electric vehicles (PHEVs). It is likely that we will see a simpler associated application (i.e., smart battery charger) before the market matures to support a more complex form of the application vehicle-to-grid (V2G). The objective of this paper is to develop a technology road mapping (TRM) process for smart electric V2G technologies in Oregon and the Pacific Northwest (PNW). The research focuses on the application of V2G in the residential chargers. It introduces the market drivers, products, and technology analysis and provides research on the necessary resources needed within R&D in the coming years (next 10 years). For our overseas readers, we then present the insights from this paper in Spanish, French, Portuguese, and German.

SUMMARY

- In developing our roadmap, we analyzed market drivers as they are indicators of the basic criteria to meet a potential buyer's needs. In the recent decade, car buyers have inclined using EVs due to several drivers in the US environment.
- Rapid growth in the number of EVs in use would have a significant impact on the need for investment in electricity network capacity and smart grid technologies.
- The most important role for V2G may ultimately be in emerging power markets to support renewable energy. The two largest renewable sources likely to be widely used soon, photovoltaic and wind turbines, are both intermittent.
- Range anxiety in EVs refers to « continual concern and fear of becoming stranded with a discharged battery in a limited range vehicle».
- Ease of use is a major factor and can include the physical hardware, software programming, and integration of communications systems, V2G program administration, standardization of programs across utilities, and other issues.

- An EV or PHEV uses its excess rechargeable battery capacity to provide power to the electric grid in response to peak load demands.
- The results of the study show that V2G, in addition to providing valuable grid services, could also prove to be a prominent application in the global transition to the emerging green and sustainable energy economy.
- Most cities have embarked on policies to encourage the development and spread of electric-drive and low-pollution vehicles.
- Developing V2G technology of residential chargers will help to reduce the environmental risks.
- The V2G system can provide the operating reserve.
- The value of a product reflects the owner/buyer desire to retain or obtain a product. The best product value propositions focus on the key benefits—not features or attributes—that matter most to buyers in the target market. Moreover, the best value propositions specifically document the worth/superiority of the seller's offering, relative both to competitors and to customer needs.
- It is important to perform intelligent scheduling for charging and discharging of EVs. Intelligent scheduling for EV charging and discharging has become a vital step towards smart grid implementation.
- Unlike other communications networks, the V2G communication has its own characteristics that the vehicular network differs in size and vehicular speed, as well as relevance of their geographic positions.
- In most areas of the USA, the Independent System Operator provides an electronic signal to request frequency regulation, reserves, and other forms of fast-response, high-value power.
- After integrating technology road mapping processes, the three main levels of the roadmap, which are market driver, product feature, and technology, also require extra factors to increase market opportunity and approach the development of new technologies. Technology resources are addressed as significant sources because they have potential to fill the technology gaps and deliver good roadmaps.
- V2G is in an early stage, which means companies such as auto, smart grid technology integrators and telematic manufacturers can prepare themselves for market entry by closely monitoring government legislation, standards, smart grid and charging station rollouts, and security.
- For the next 5 years, the market for residential charging stations will provide a greater opportunity than commercial charging stations.
- More and more automobile companies are committed to research and develop V2G technology for EVs.
- The method of road mapping consists of time usage in connection with dimension gathering for a technology strategy structure.

HIGHLY INFLUENTIAL ARTICLE

We used the following article as a basis of our evaluation:

Daim, T. U., Wang, X., Cowan, K., & Shott, T. (2016). Technology roadmap for smart electric vehicle-to-grid (V2G) of residential chargers. Journal of Innovation and Entrepreneurship, 5(1), 1–13.

This is the link to the publisher's website:
https://innovation-entrepreneurship.springeropen.com/articles/10.1186/s13731-016-0043-y

INTRODUCTION

One million electric vehicles (EVs) and plug-in hybrid electric vehicles (PHEVs) are expected to be in use by individuals and fleets by 2015 (United States Department of Energy 2011). Unmanaged EV charging will add to peak grid load and would require additional generation capacity (Kiviluoma & Meibom 2011;

Kintner-Meyer et al. 2007). Charging must be scheduled intelligently to avoid overloading the grid at peak hours and to take advantage of off-peak charging benefits. EVs can also serve as an energy resource through vehicle-to-grid (V2G) operation by sending electricity back into the grid, thereby preventing or postponing load shedding (Kempton & Tomić 2005; Guille & Gross 2009a). Charging and V2G services must be optimized for grid load while guaranteeing owner schedule and range requirements are met. A system encompassing EV owner input via a mobile application, an aggregation middleware, a charge scheduling, and V2G operation algorithm, and radio-frequency identification (RFID) reader, is proposed (Ferreira et al. 2011).

Recent technological advances in electricity distribution and load management, referred to as "smart grids," promise to facilitate the integration of EVs into electricity load and to lower costs. Electric utilities have already begun to deploy smart grid technologies to better manage commercial and household load using intelligent metering and communications systems to save energy, cut emissions, and reduce peak loads. More widespread deployment would enable EV charging to be scheduled intelligently. In addition, it could—at least in principle—enable the storage capacity of the batteries in EVs to be used as a supplementary source of power at times of peak load; the residual charge in those batteries could be fed back into the network during the evening peak and the battery recharged at night. There may also be scope for exploiting this storage potential to compensate for the variability of electricity supply from variable renewable energy sources such as wind and solar. In this way, smart grids and EVs could be mutually beneficial: EVs could both benefit from and help to drive forward investment in smart grids (Trevor 2012).

In this paper is presented the technology road mapping of a smart battery charger for EVs or PHEVs, aiming their integration in smart grids. The battery charging process is controlled by an appropriate control algorithm, aiming to preserve the battery lifespan. The main features of the equipment are the mitigation of the power quality degradation and the bidirectional operation, as grid-to-vehicle (G2V) and as V2G. The V2G mode of operation will be one of the main features of the smart grids, both to collaborate with the electrical power grid to increase stability and to function as a distributed Energy Storage System (ESS) (Vítor et al. 2012).

Therefore, EVs could play a central role in decarbonizing road transport soon. To establish the appropriate strategies for research and development (R&D) is required. According to Phaal et al., technology road mapping is a proper tool to build up strategic and long-term planning by assessing potentially disruptive technologies and market changes (Phaal et al. 2004). Accordingly, the objective of this paper is to develop a technology roadmap for smart grid technology. This research focuses on the application of smart grids in the EV charging for the residence.

CONCLUSION

Electric-drive vehicles can become an important resource for the electric utility system, with consequent air pollution, system reliability, and economic benefits. Both consumers and utilities will benefit from efficient V2G. The V2G features meet both consumer and utility requirements. The technical requirements are needed to realize the most value from vehicle power. There are some gaps that exist in all three key technology areas: computing, communication, and residential V2G components. V2G technology development needs to progress from labs to commercialization to deployment. To set up some standards for the V2G technology is necessary because the smart grid will touch so many aspects of life in the twenty-first century and the development of standards involves a wide range of stakeholders—national and international, private, and public, large and small. Also, early development of standards is the key to not delaying deployment. Preparing for rapid growth in electric vehicle use is necessary since new and upgraded supporting infrastructure, whether charging stations, generating capacity, or enhanced transmission systems, require time for deployment.

As stated in the beginning, the objective of this report is to develop a roadmap for the smart electric V2G of residential chargers. The research met the goal by collecting, analyzing, and presenting the research data in the form of a technology roadmap. The paper presents the current state of V2G technology in the automotive industry and where the industry should and will be heading in the next 5 years. Factors like

V2G technology and the related research by industry and government-industry-academia partnership are well accounted for.

APPENDIX

TABLE 1
MARKET DRIVERS

Info. object catalog	Market drivers
Environment	Electric cars
	Renewable (intermittent) generation resources online
	Differential cost of peak vs. off-peak power
Consumers	Prevent "empty battery" range anxiety
	Ease of use
	Lowest cost ownership
	Be green
Utility	Reliability
	Risk reduction
	Lowest operating cost

TABLE 2
PRODUCT FEATURES

Product features	Factors
Customer features	Scheduling: dumb (L1/L2)
	Scheduling: smart (L1/L2)
	Scheduling: aware (L2)
	Scheduling: green
	Pricing: dumb time of use (TOU)
	Pricing: smart time of use (TOU)
	Pricing: R/T (real time)
	Pricing: feed-in
Utility features	Demand management: limited load control
	Demand management: R/T (real time)
	Demand management: green
	System control: feed-in
	Pricing: time of use (TOU)
	Pricing: R/T (real time)

TABLE 3
PRODUCT AND NEEDS

Product	Features	Factors	Requirements
Smart residential EV charging	Customer	Scheduling	Anxiety, ease, cost, green
		Pricing	Cost
	Utility	Demand management	Reliability, cost, risk
		System control	
		Pricing	

TABLE 4
TECHNOLOGY ANALYSIS

Technology features		Technologies
Charger/car (consumer)	Schedule	1.0, 2.0, third party API
	Feed-in	Standard connector
Communication (both)	Speed	1-way, 2-way; minutes, seconds
	Information	Usage, demand requirements, TOU rate, R/T price, demand shedding, green, system control
Computing (utility)	Data	Data warehouse, R/T availability
	Management	Demand management
	Market	Local rate market, regional imbalance market

TABLE 5
RESOURCES ANALYSIS

Resources		Requirements
Labs	Government and university labs	Demand management/data
		Demand control
		Feed-in charger
		Feed-in car
		Imbalance/power market
Third party S/W	Independent S/W company	R/T data collection
		Demand management
		Demand control
		Imbalance/power market
Standards	Standards organizations: IEEE, ITU, NIST, ANSI	Demand management
		Demand control
		Feed-in charger
		Feed-in car
		Imbalance/power market
		Third party API
Utility	Local utility company	R/T data collection
		Demand ,management
		Demand control
		Imbalance/power market
Charger	Residential charger companies	Charger schedule S/W 1.0
		Demand data
		Feed-in charger
		Feed-in car
Car	Auto companies	Car schedule S/W 1.0
		Car schedule S/W 2.0
		Third party API
		Demand data
		Feed-in car

FIGURE 1
ANNUAL GLOBAL EV AND PHEV SALES IN BLUE MAP SCENARIO

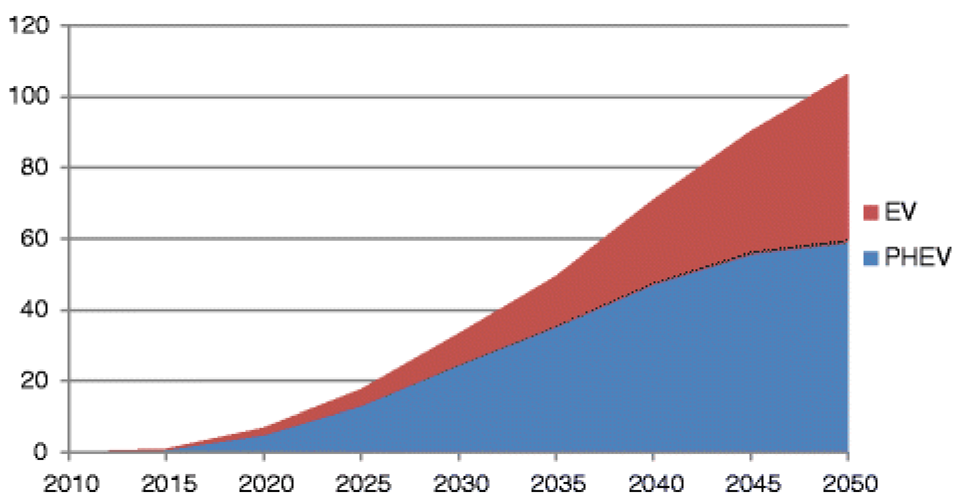
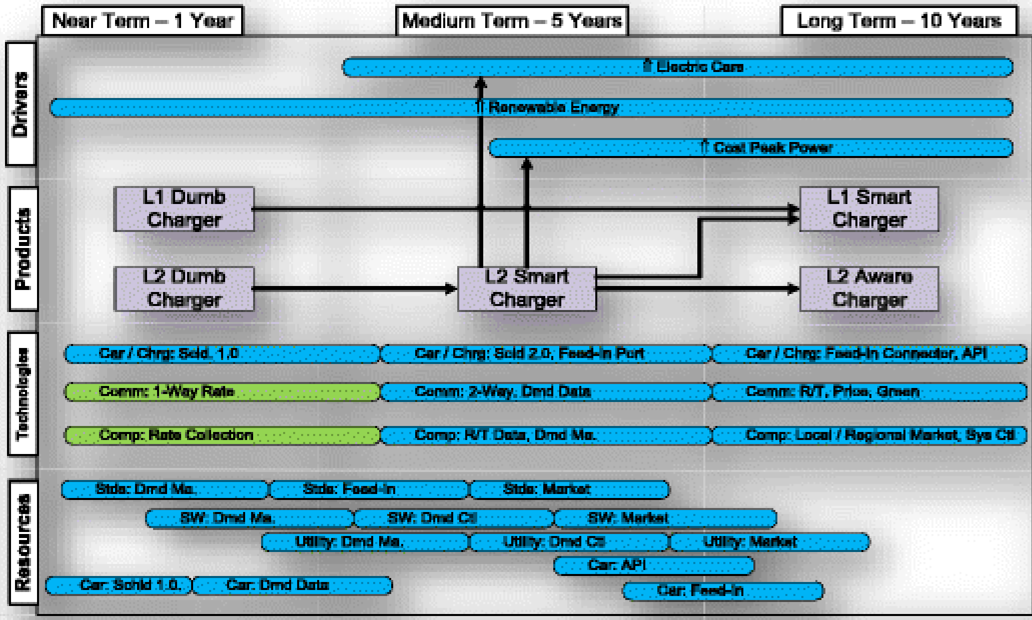


FIGURE 2
SMART ELECTRIC V2G OF RESIDENTIAL CHARGER TECHNOLOGY ROADMAPPING



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TRANSLATED VERSION: SPANISH

Below is a rough translation of the insights presented above. This was done to give a general understanding of the ideas presented in the paper. Please excuse any grammatical mistakes and do not hold the original authors responsible for these mistakes.

VERSION TRADUCIDA: ESPAÑOL

A continuación se muestra una traducción aproximada de las ideas presentadas anteriormente. Esto se hizo para dar una comprensión general de las ideas presentadas en el documento. Por favor, disculpe cualquier error gramatical y no responsabilite a los autores originales de estos errores.

INTRODUCCIÓN

Se espera que un millón de vehículos eléctricos (VE) y vehículos eléctricos híbridos enchufables (PHEV) sean en uso por individuos y flotas para 2015 (Departamento de Energía de los Estados Unidos 2011). La carga EV no administrada se sumará a la carga máxima de la red y requeriría capacidad de generación adicional (Kiviluoma & Meibom 2011; 2007). La carga debe programarse de forma inteligente para evitar sobrecargar la red en las horas pico y aprovechar las ventajas de carga fuera de las horas pico.

Los vehículos eléctricos también pueden servir como un recurso energético a través de la operación de vehículo a red (V2G) enviando electricidad de vuelta a la red, evitando así o posponiendo el desprendimiento de carga (Kempton & Tomi 2005; Guille & Gross 2009a). Los servicios de carga y V2G deben optimizarse para la carga de la red, garantizando al mismo tiempo que se cumplen los requisitos de horario y rango del propietario. Se propone un sistema que abarca la entrada del propietario de EV a través de una aplicación móvil, un middleware de agregación, una programación de cargos y un algoritmo de operación V2G, y un lector de identificación por radiofrecuencia (RFID) (Ferreira et al. 2011).

Los recientes avances tecnológicos en la distribución de electricidad y la gestión de la carga, denominados "redes inteligentes", prometen facilitar la integración de los vehículos eléctricos en la carga eléctrica y reducir los costes. Las empresas eléctricas ya han comenzado a implementar tecnologías de redes inteligentes para gestionar mejor la carga comercial y doméstica mediante sistemas inteligentes de medición y comunicaciones para ahorrar energía, reducir las emisiones y reducir las cargas máximas. Una implementación más amplia permitiría programar la carga de EV de forma inteligente. Además, podría, al menos en principio, permitir que la capacidad de almacenamiento de las baterías en los vehículos eléctricos se utilice como fuente suplementaria de energía en momentos de carga máxima; la carga residual en esas baterías podría ser alimentada de nuevo en la red durante el pico de la noche y la batería recargada por la noche. También puede haber margen para explotar este potencial de almacenamiento para compensar la variabilidad del suministro de electricidad a partir de fuentes de energía renovables variables como la eólica y la solar. De esta manera, las redes inteligentes y los vehículos eléctricos podrían ser mutuamente beneficiosos: los vehículos eléctricos podrían beneficiarse y ayudar a impulsar la inversión en redes inteligentes (Trevor 2012).

En este documento se presenta la tecnología de mapeo de carreteras de un cargador de batería inteligente para vehículos eléctricos o phevs, apuntando a su integración en redes inteligentes. El proceso de carga de la batería se controla mediante un algoritmo de control adecuado, con el objetivo de preservar la vida útil de la batería. Las principales características del equipo son la mitigación de la degradación de la calidad de la energía y el funcionamiento bidireccional, como red a vehículo (G2V) y como V2G. El modo de funcionamiento V2G será una de las principales características de las redes inteligentes, tanto para colaborar con la red eléctrica para aumentar la estabilidad y funcionar como un sistema de almacenamiento de energía distribuido (ESS) (Vítor et al. 2012).

Por lo tanto, los vehículos eléctricos podrían desempeñar pronto un papel central en la descarbonización del transporte por carretera. Es necesario establecer las estrategias adecuadas para la investigación y el desarrollo (I+D). Según Phaal et al., la cartografía de carreteras tecnológicas es una herramienta adecuada para construir una planificación estratégica y a largo plazo mediante la evaluación de tecnologías potencialmente disruptivas y cambios en el mercado (Phaal et al. 2004). En consecuencia, el objetivo de este documento es desarrollar una hoja de ruta tecnológica para la tecnología de redes inteligentes. Esta investigación se centra en la aplicación de redes inteligentes en la carga EV para la residencia.

CONCLUSIÓN

Los vehículos de accionamiento eléctrico pueden convertirse en un recurso importante para el sistema de servicios eléctricos, con la consiguiente contaminación del aire, fiabilidad del sistema y beneficios económicos. Tanto los consumidores como los servicios públicos se beneficiarán de un V2G eficiente. Las características de V2G cumplen con los requisitos de consumo y servicios públicos. Los requisitos técnicos son necesarios para obtener el mayor valor de la potencia del vehículo. Existen algunas lagunas en las tres áreas tecnológicas clave: informática, comunicación y componentes V2G residenciales. El desarrollo de tecnología V2G debe progresar de los laboratorios a la comercialización y la implementación. Para establecer algunos estándares para la tecnología V2G es necesario porque la red inteligente tocará tantos aspectos de la vida en el siglo XXI y el desarrollo de estándares implica una amplia gama de partes interesadas: nacionales e internacionales, privadas y públicas, grandes y pequeñas. Además, el desarrollo temprano de los estándares es la clave para no retrasar la implementación. Es necesario preparar el rápido crecimiento del uso de vehículos eléctricos, ya que la infraestructura de soporte nueva y mejorada ya sea estaciones de carga, capacidad de generación o sistemas de transmisión mejorados, requiere tiempo para su despliegue.

Como se indicó al principio, el objetivo de este informe es desarrollar una hoja de ruta para el V2G eléctrico inteligente de cargadores residenciales. La investigación cumplió el objetivo al recopilar, analizar y presentar los datos de investigación en forma de una hoja de ruta tecnológica. El documento presenta el estado actual de la tecnología V2G en la industria automotriz y hacia dónde la industria debería y se dirigirá en los próximos 5 años. Factores como la tecnología V2G y la investigación relacionada por la industria y la asociación entre el gobierno y la industria y la academia están bien contabilizados.

TRANSLATED VERSION: FRENCH

Below is a rough translation of the insights presented above. This was done to give a general understanding of the ideas presented in the paper. Please excuse any grammatical mistakes and do not hold the original authors responsible for these mistakes.

VERSION TRADUITE: FRANÇAIS

Voici une traduction approximative des idées présentées ci-dessus. Cela a été fait pour donner une compréhension générale des idées présentées dans le document. Veuillez excuser toutes les erreurs grammaticales et ne pas tenir les auteurs originaux responsables de ces erreurs.

INTRODUCTION

Un million de véhicules électriques (VE) et de véhicules électriques hybrides rechargeables (VEE) devraient être utilisés par les particuliers et les flottes d'ici 2015 (Département de l'énergie des États-Unis, 2011). La recharge non ingérative des VE ajoutera à la charge maximale du réseau et nécessiterait une capacité de production supplémentaire (Kiviluoma et Meibom, 2011 ; Kintner-Meyer et coll. 2007). La recharge doit être planifiée intelligemment afin d'éviter de surcharger le réseau aux heures de pointe et de profiter des avantages de charge hors pointe. Les VE peuvent également servir de ressource énergétique par le biais de l'exploitation du véhicule au réseau (V2G) en renvoyant l'électricité dans le réseau, empêchant ainsi ou reportant l'excrétion de la charge (Kempton et Tomić, 2005 ; Guille & Brut 2009a). Les services de recharge et de V2G doivent être optimisés pour la charge du réseau tout en garantissant que les exigences relatives à l'horaire et à la portée des propriétaires sont respectées. Un système comprenant l'entrée du propriétaire d'ev via une application mobile, un middleware d'agrégation, une planification des frais et un algorithme d'exploitation V2G, et un lecteur d'identification par radiofréquence (RFID), est proposé (Ferreira et al., 2011).

Les progrès technologiques récents dans la distribution et la gestion de la charge d'électricité, appelés « réseaux intelligents », promettent de faciliter l'intégration des VE dans la charge électrique et de réduire les coûts. Les services publics d'électricité ont déjà commencé à déployer des technologies de réseau intelligent pour mieux gérer la charge commerciale et domestique à l'aide de systèmes intelligents de mesure et de communication afin d'économiser l'énergie, de réduire les émissions et de réduire les charges de pointe. Un déploiement plus étendu permettrait de programmé intelligemment la recharge ev. En outre, il pourrait, du moins en principe, permettre l'utilisation de la capacité de stockage des batteries dans les VE comme source supplémentaire d'énergie en période de pointe; la charge résiduelle de ces batteries pourrait être ramenée dans le réseau pendant le pic du soir et la batterie rechargée la nuit. Il peut également être possible d'exploiter ce potentiel de stockage pour compenser la variabilité de l'approvisionnement en électricité à partir de sources d'énergie renouvelables variables telles que l'énergie éolienne et solaire. De cette façon, les réseaux intelligents et les VE pourraient être mutuellement avantageux : les VE pourraient à la fois bénéficier et contribuer à faire avancer les investissements dans les réseaux intelligents (Trevor, 2012).

Dans cet article est présenté la cartographie routière de la technologie d'un chargeur de batterie intelligent pour les VE ou les VEE, visant leur intégration dans les réseaux intelligents. Le processus de charge de la batterie est contrôlé par un algorithme de contrôle approprié, visant à préserver la durée de vie de la batterie. Les principales caractéristiques de l'équipement sont l'atténuation de la dégradation de la qualité de l'énergie et le fonctionnement bidirectionnel, comme le réseau-à-véhicule (G2V) et comme V2G. Le mode de fonctionnement V2G sera l'une des principales caractéristiques des réseaux intelligents, à la fois pour collaborer avec le réseau électrique afin d'accroître la stabilité et de fonctionner comme un système de stockage d'énergie distribué (ESS) (Vítor et al., 2012).

Par conséquent, les VE pourraient jouer un rôle central dans la décarbonisation prochaine du transport routier. Pour établir les stratégies appropriées pour la recherche et le développement (R&D) est nécessaire. Selon Phaal et coll., la cartographie routière technologique est un outil approprié pour établir une planification stratégique et à long terme en évaluant les technologies potentiellement perturbatrices et les changements du marché (Phaal et al., 2004). Par conséquent, l'objectif de ce document est d'élaborer une feuille de route technologique pour la technologie des réseaux intelligents. Cette recherche se concentre sur l'application de réseaux intelligents dans la recharge EV pour la résidence.

CONCLUSION

Les véhicules à propulsion électrique peuvent devenir une ressource importante pour le réseau de services publics d'électricité, avec une pollution atmosphérique conséquente, la fiabilité du système et des avantages économiques. Les consommateurs et les services publics bénéficieront d'un V2G efficace. Les caractéristiques V2G répondent aux exigences des consommateurs et des services publics. Les exigences techniques sont nécessaires pour réaliser le plus de valeur de la puissance du véhicule. Il existe certaines lacunes dans les trois domaines technologiques clés : l'informatique, la communication et les composants V2G résidentiels. Le développement de la technologie V2G doit passer des laboratoires à la commercialisation en passe d'être déployé. Il est nécessaire d'établir certaines normes pour la technologie V2G parce que le réseau intelligent touchera tant d'aspects de la vie au xxie siècle et que l'élaboration de normes implique un large éventail d'intervenants — nationaux et internationaux, privés et publics, petits et grands. De plus, l'élaboration précoce de normes est la clé pour ne pas retarder le déploiement. Il est nécessaire de se préparer à une croissance rapide de l'utilisation des véhicules électriques, car les infrastructures de soutien nouvelles et améliorées, qu'il s'agisse de bornes de recharge, de capacité de production ou de systèmes de transmission améliorés, nécessitent du temps pour le déploiement.

Comme indiqué au début, l'objectif de ce rapport est d'élaborer une feuille de route pour le V2G électrique intelligent des chargeurs résidentiels. La recherche a atteint cet objectif en recueillant, en analysant et en présentant les données de recherche sous la forme d'une feuille de route technologique. Le document présente l'état actuel de la technologie V2G dans l'industrie automobile et où l'industrie devrait et se dirigera dans les 5 prochaines années. Des facteurs comme la technologie V2G et les recherches connexes menées par l'industrie et le partenariat entre l'industrie et le milieu universitaire sont bien pris en compte.

TRANSLATED VERSION: GERMAN

Below is a rough translation of the insights presented above. This was done to give a general understanding of the ideas presented in the paper. Please excuse any grammatical mistakes and do not hold the original authors responsible for these mistakes.

ÜBERSETZTE VERSION: DEUTSCH

Hier ist eine ungefähre Übersetzung der oben vorgestellten Ideen. Dies wurde getan, um ein allgemeines Verständnis der in dem Dokument vorgestellten Ideen zu vermitteln. Bitte entschuldigen Sie alle grammatikalischen Fehler und machen Sie die ursprünglichen Autoren nicht für diese Fehler verantwortlich.

EINLEITUNG

Eine Million Elektrofahrzeuge (evs) und Plug-in-Hybrid-Elektrofahrzeuge (phevs) werden voraussichtlich bis 2015 von Einzelpersonen und Flotten genutzt (United States Department of Energy 2011). Nicht verwaltete EV-Gebühren erhöhen die Spitzennetzlast und erfordern zusätzliche Erzeugungskapazität (Kiviluoma & Meibom 2011; Kintner-Meyer et al. 2007). Das Laden muss intelligent geplant werden, um eine Überlastung des Netzes zu Spitzenzeiten zu vermeiden und die Vorteile der Ladenaußerhalb der Spitzenzeiten zu nutzen. Elektrofahrzeuge können auch als Energieressource durch den Fahrzeug-zu-Netz-Betrieb (V2G) dienen, indem sie Strom zurück ins Netz schicken und dadurch Lastabwurf verhindern oder aufschieben (Kempton & Tomié 2005; Guille & Gross 2009a). Lade- und V2G-Dienste müssen für die Netzlast optimiert werden, wobei die Anforderungen des Eigentümerplans und der Reichweite n. Chr. Erfüllt werden müssen. Vorgeschlagen wird ein System, das die Eingabe von EV-Eigentümern über eine mobile Anwendung, eine Aggregations-Middleware, einen Ladungsplanungs- und V2G-Betriebsalgorithmus sowie einen RFID-Lesegerät (Radio Frequency Identification) umfasst (Ferreira et al. 2011).

Die jüngsten technologischen Fortschritte bei der Stromverteilung und dem Lastmanagement, die als "intelligente Netze" bezeichnet werden, versprechen, die Integration von Elektrofahrzeugen in die Stromlast zu erleichtern und die Kosten zu senken. Stromversorger haben bereits damit begonnen, intelligente Netztechnologien einzusetzen, um die Kommerzielle und Haushaltslast mithilfe intelligenter Mess- und Kommunikationssysteme besser zu verwalten, um Energie zu sparen, Emissionen zu reduzieren und Spitzenlasten zu reduzieren. Eine breitere Bereitstellung würde es ermöglichen, das Laden von Elektrofahrzeugen intelligent zu planen. Darüber hinaus könnte sie – zumindest im Prinzip – die Verwendung der Speicherkapazität der Batterien in Elektrofahrzeugen als zusätzliche Stromquelle in Zeiten der Spitzenlast ermöglichen; die Restladung in diesen Batterien könnte während der Abendspitze wieder ins Netz eingespeist und die Batterie nachts wieder aufgeladen werden. Es kann auch Möglichheit sein, dieses Speicherpotenzial auszuschöpfen, um die Variabilität der Stromversorgung aus variablen erneuerbaren Energiequellen wie Wind und Sonne auszugleichen. Auf diese Weise könnten smarte Netze und Elektrofahrzeuge für beide Seiten von Vorteil sein: Elektrofahrzeuge könnten sowohl von den Investitionen in intelligente Netze profitieren als auch dazu beitragen, Investitionen in intelligente Netze voranzutreiben (Trevor 2012).

In diesem Beitrag wird die Technologie Straßenkartierung eines intelligenten Batterieladegeräts für Elektrofahrzeuge oder phevs vorgestellt, deren Integration in intelligente Netze angestrebt wird. Der Batterieladevorgang wird durch einen geeigneten Steuerungsalgorithmus gesteuert, der darauf abzielt, die Lebensdauer der Batterie zu erhalten. Die Hauptmerkmale der Ausrüstung sind die Abschwächung der Leistungsminderung und des bidirektionalen Betriebs, als Grid-to-Vehicle (G2V) und als V2G. Die V2G-Betriebsart wird eines der Hauptmerkmale der intelligenten Netze sein, sowohl um mit dem Stromnetz zusammenzuarbeiten, um die Stabilität zu erhöhen, als auch um als verteiltes Energiespeichersystem (ESS) zu funktionieren (Vétor et al. 2012).

Daher könnten Elektrofahrzeuge bald eine zentrale Rolle bei der Dekarbonisierung des Straßenverkehrs spielen. Um geeignete Strategien für Forschung und Entwicklung (F&E) zu entwickeln, ist es erforderlich, geeignete Strategien für Forschung und Entwicklung zu entwickeln. Laut Phaal et al. Ist die technische Straßenkartierung ein geeignetes Instrument, um strategische und langfristige Planungen durch die Bewertung potenziell disruptiver Technologien und Marktveränderungen aufzubauen (Phaal et al. 2004). Dementsprechend besteht das Ziel dieses Papiers darin, eine Technologie-Roadmap für smart grid-Technologie zu entwickeln. Diese Forschung konzentriert sich auf die Anwendung von Smart Grids in der EV-Maut für die Residenz.

SCHLUSSFOLGERUNG

Fahrzeuge mit Elektroantrieb können zu einer wichtigen Ressource für das elektrische Versorgungssystem werden, was zu Luftverschmutzung, Systemzuverlässigkeit und wirtschaftlichen Vorteilen führen kann. Sowohl Verbraucher als auch Versorgungsunternehmen werden von einem effizienten V2G profitieren. Die V2G-Funktionen erfüllen sowohl die Anforderungen an Verbraucher als auch an Versorgungsunternehmen. Die technischen Anforderungen werden benötigt, um den größten Nutzen aus der Fahrzeugleistung zu ziehen. Es gibt einige Lücken, die in allen drei Schlüsselbereichen der Technologie bestehen: Computer, Kommunikation und V2G-Komponenten für Wohnzwecke. Die V2G-Technologieentwicklung muss von Laboren über die Kommerzialisierung bis hin zur Bereitstellung voranschreiten. Die Einrichtung einiger Standards für die V2G-Technologie ist notwendig, da das intelligente Netz so viele Aspekte des Lebens im 21. Jahrhundert berühren wird und die Entwicklung von Standards eine breite Palette von Stakeholdern einbezieht – nationale und internationale, private und öffentliche, große und kleine. Außerdem ist die frühzeitige Entwicklung von Standards der Schlüssel, um die Bereitstellung nicht zu verzögern. Die Vorbereitung auf ein rasches Wachstum der Nutzung von Elektrofahrzeugen ist notwendig, da neue und verbesserte unterstützende Infrastrukturen, ob Ladestationen, Erzeugungskapazitäten oder erweiterte Übertragungssysteme, Zeit für den Einsatz benötigen.

Wie eingangs erwähnt, besteht das Ziel dieses Berichts darin, eine Roadmap für den intelligenten elektrischen V2G von Ladegeräten für Wohnladegeräte zu entwickeln. Die Forschung erfüllte das Ziel, indem sie die Forschungsdaten in Form einer Technologie-Roadmap sammelte, analysierte und präsentierte. Das Papier stellt den aktuellen Stand der V2G-Technologie in der Automobilindustrie vor und wo die Branche in den nächsten fünf Jahren hingehen soll und wird. Faktoren wie die V2G-Technologie und die damit verbundene Forschung durch Industrie und Partnerschaft zwischen Der Industrie und Industrie sind gut berücksichtigt.

TRANSLATED VERSION: PORTUGUESE

Below is a rough translation of the insights presented above. This was done to give a general understanding of the ideas presented in the paper. Please excuse any grammatical mistakes and do not hold the original authors responsible for these mistakes.

VERSÃO TRADUZIDA: PORTUGUÊS

Aqui está uma tradução aproximada das ideias acima apresentadas. Isto foi feito para dar uma compreensão geral das ideias apresentadas no documento. Por favor, desculpe todos os erros gramaticais e não responsacule os autores originais responsáveis por estes erros.

INTRODUÇÃO

Espera-se que um milhão de veículos elétricos (evs) e veículos elétricos híbridos plug-in (phevs) estejam em uso por indivíduos e frotas até 2015 (Departamento de Energia dos Estados Unidos 2011). O carregamento de EV não gerenciado adicionará à carga de grade máxima e exigirá capacidade de geração adicional (Kiviluoma & Meibom 2011; Kintner-Meyer et al. 2007). O carregamento deve ser programado de forma inteligente para evitar sobrecarregar a rede nos horários de pico e aproveitar os benefícios de carregamento fora do pico. Os evs também podem servir como um recurso energético através da operação veículo-para-grade (V2G) enviando eletricidade de volta para a rede, impedindo ou adiando o derramamento de carga (Kempton & Tomić 2005; Guille & Gross 2009a). Os serviços de carregamento e V2G devem ser otimizados para a carga da rede, garantindo que os requisitos de horário e alcance do proprietário sejam atendidos. Um sistema que engloba a entrada do proprietário de EV através de um aplicativo móvel, um middleware de agregação, um cronograma de carga e algoritmo de operação V2G e leitor de identificação por radiofrequência (RFID) é proposto (Ferreira et al. 2011).

Os recentes avanços tecnológicos na distribuição de energia elétrica e na gestão de cargas, chamados de "redes inteligentes", prometem facilitar a integração dos evs na carga elétrica e reduzir custos. As concessionárias de energia elétrica já começaram a implantar tecnologias de smart grid para gerenciar melhor a carga comercial e doméstica usando sistemas inteligentes de medição e comunicação para economizar energia, reduzir as emissões e reduzir as cargas máximas. Uma implantação mais difundida permitiria que o carregamento de EV fosse programado de forma inteligente. Além disso, poderia, pelo menos em princípio, permitir que a capacidade de armazenamento das baterias em evs fosse usada como fonte suplementar de energia em momentos de carga máxima; a carga residual nessas baterias poderia ser alimentada de volta à rede durante o pico da noite e a bateria recarregada à noite. Também pode haver espaço para explorar esse potencial de armazenamento para compensar a variabilidade do fornecimento de eletricidade a partir de fontes de energia renovável variáveis, como eólica e solar. Desta forma, redes inteligentes e evs podem ser mutuamente benéficos: os evs podem se beneficiar e ajudar a impulsionar o investimento em redes inteligentes (Trevor 2012).

Neste artigo é apresentado o mapeamento rodoviário tecnológico de um carregador de bateria inteligente para evs ou phevs, visando sua integração em smart grids. O processo de carregamento da bateria é controlado por um algoritmo de controle adequado, com o objetivo de preservar a vida útil da bateria. As principais características do equipamento são a mitigação da degradação da qualidade de energia e da operação bidirecional, como grid-to-vehicle (G2V) e como V2G. O modo de operação V2G será uma das principais características das redes inteligentes, tanto para colaborar com a rede elétrica para aumentar a estabilidade quanto para funcionar como um Sistema de Armazenamento de Energia Distribuído (ESS) (Vítor et al. 2012).

Portanto, os evs poderiam desempenhar um papel central na descarbonização do transporte rodoviário em breve. Para estabelecer as estratégias adequadas para pesquisa e desenvolvimento (P&D) é necessário. De acordo com Phaal et al., o mapeamento de estradas tecnológicas é uma ferramenta adequada para construir um planejamento estratégico e de longo prazo, avaliando tecnologias potencialmente disruptivas e mudanças de mercado (Phaal et al. 2004). Assim, o objetivo deste artigo é desenvolver um roteiro tecnológico para a tecnologia de smart grid. Esta pesquisa se concentra na aplicação de redes inteligentes no carregamento de EV para a residência.

CONCLUSÃO

Os veículos movidos a eletricidade podem se tornar um recurso importante para o sistema de energia elétrica, com consequente poluição do ar, confiabilidade do sistema e benefícios econômicos. Tanto os consumidores quanto os utilitários se beneficiarão de um V2G eficiente. Os recursos V2G atendem tanto aos requisitos do consumidor quanto do utilitário. Os requisitos técnicos são necessários para perceber o maior valor da potência do veículo. Existem algumas lacunas que existem nas três principais áreas de tecnologia: computação, comunicação e componentes V2G residenciais. O desenvolvimento de tecnologia V2G precisa progredir de laboratórios para comercialização até implantação. Para estabelecer alguns padrões para a tecnologia V2G é necessário porque a rede inteligente tocará tantos aspectos da vida no século XXI e o desenvolvimento de padrões envolve uma ampla gama de stakeholders — nacionais e internacionais, privados e públicos, grandes e pequenos. Além disso, o desenvolvimento precoce de normas é a chave para não atrasar a implantação. A preparação para um rápido crescimento no uso de veículos elétricos é necessária, uma vez que uma infraestrutura de suporte nova e atualizada, seja estações de carregamento, capacidade de geração ou sistemas de transmissão aprimorados, requerem tempo para implantação.

Como dito no início, o objetivo deste relatório é desenvolver um roteiro para o V2G elétrico inteligente dos carregadores residenciais. A pesquisa atingiu a meta coletando, analisando e apresentando os dados da pesquisa na forma de um roteiro tecnológico. O documento apresenta o estado atual da tecnologia V2G na indústria automotiva e para onde a indústria deve e irá nos próximos 5 anos. Fatores como a tecnologia V2G e a pesquisa relacionada pela indústria e parceria governo-indústria-academia são bem contabilizados.