Technology Planning for Emerging Business Model and Regulatory Integration: The Case of Electric Vehicle Smart Charging

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***Abstract*--Smart grid has been described as the Energy Internet: Where Energy Technology meets Information Technology. The incorporation of such technology into vast existing utility infrastructures offers many advantages, including possibilities for new smart appliances, energy management systems, better integration of renewable energy, value added services, and new business models, both for supply- and demand-side management. This paper proposes to build upon existing roadmapping processes by considering an integrated set of factors, including policy issues, that are specifically tuned to the needs of smart grid and have not generally been considered in other types of roadmapping efforts. It will also incorporate expert judgment quantification to prioritize factors, show the pathways for overcoming barriers and achieving benefits, as well as discussing the most promising strategies for achieving these goals.**

I. LITERATURE REVIEW

Literature from several key literature streams has been reviewed and research gaps were identified. The first key area analyzed was the Technology Roadmapping literature. The following research gaps are summarized on the table 1 below.

The second key area discussed was the Smart Grid and Electric Vehicle literature. The following research gaps are summarized on the table 2 below.

The third key area discussed was the Resource Planning literature. The following research gaps are summarized on the table 3.

The following sections summarizes the Research Gaps, Research Goals and Research Questions determined after performing all the analysis up to this point in this study.

FIGURE 1 TECHNOLOGY ROADMAPPING LITERATURE GAPS

Research Concept	References	Research Gaps
Various processes developed for applying TRM in current and emerging industries	[1-5], [6-15], [16-25]	Method is needed to integrate business modeling, policy, and regulatory factors into TRM for the utility industry
Several methods integrate aspects of business modeling with TRM	[18, 19], [21, 22], [26-31], [32-36], [37-50], [51, 52]	
Few studies consider policy dimensions of TRM or regulatory frameworks, particularly in the utility industry	[53, 54], [32], [34], [37]	TRM goals must align with regional-level factors for utility industry and associated products
TRM generally used at company-, industry-, and national-level, rather than incorporating regional utility concerns	[55-63] [53, 54, 64-67]	Additional work needed prioritizing R&D, acquisition processes, and barriers in utility related industries
More work also needed prioritizing R&D, acquisition, and barriers	[31-43], [68-75]	

FIGURE 2 SMART GRID & ELECTRIC VEHICLE LITERATURE GAPS

Research Concept	References	Research Gaps
Smart grid roadmap literature typically focuses on operational plans for utilities as opposed to regional energy planning	[76], [77], [78-83], [84, 85], [86-92], [93]	Smart grid planning literature could benefit from better alignment with technology roadmapping literature
Generally do not consider regional goals and structural barriers to business and market adoption	[94-103], [104-107], [108, 109], [55, 59-62, 110-112], [64, 65], [113-116]	Process needed to create roadmaps for smart grid technologies that integrate business modeling with regulatory factors and policy factors to meet regional energy planning objectives and overcome structural barriers
No current SG roadmaps for Oregon or the Pacific Northwest.	[95, 96, 98, 99]	
Significant planning also needed for electric EV smart charging roadmap	[56-58], [117], [9-15], [26], [118-121]	Customization needed to develop technology roadmapping processes for EV smart charging systems

FIGURE 3 RESOURCE PLANNING & POLICY LITERATURE GAPS

Research Concept	References	Research Gaps
Strategic alignment of business model and policy frameworks particularly important for regulated industries like electric utilities	[122], [123], [124], [125-131], [84, 85, 94-97], [101], [88, 89], [55, 59, 110-112], [113], [132, 133]	Need to incorporate an understanding of utility regulation and planning processes to create strategic alignment between business models and policy frameworks
Unique regional energy policy planning issues in Pacific Northwest due to regulatory frameworks	[98-100, 102], [92], [108, 109], [60-62], [32-34], [115]	TRM methods need to be adapted to unique regulatory frameworks for regional utility industries
Multiple perspectives view is critical for creating robust planning models in the utility industry	[1-3], [56-58], [69-74], [134, 135]	Strong need for robust, multiple perspective planning models in the utility industry that create strategic alignment between business models, policy, and regulatory requirements

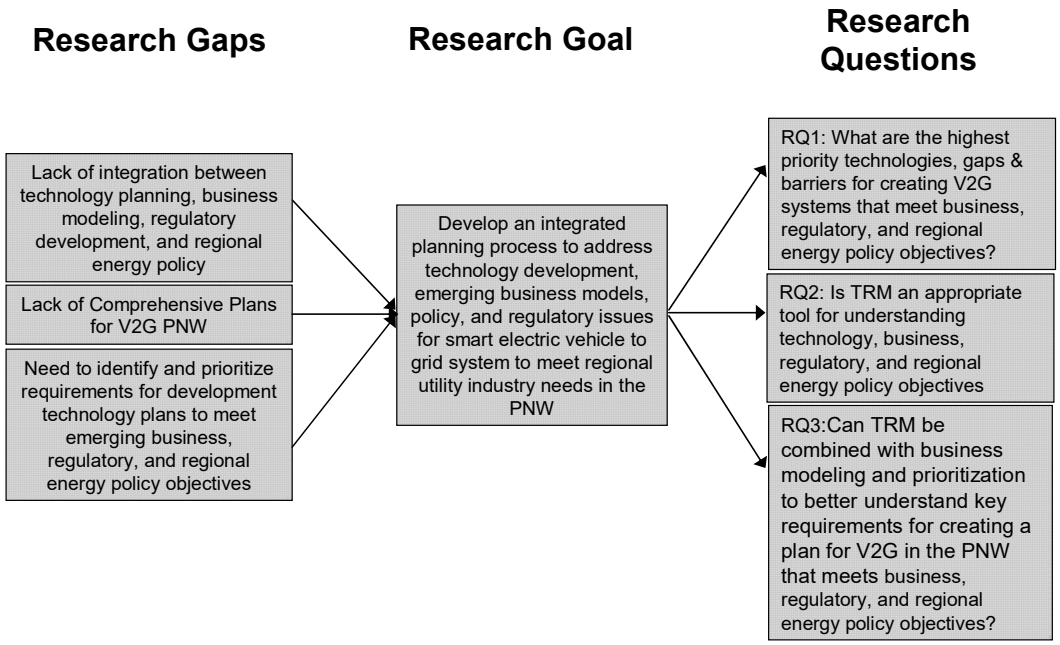

Figure 4: Summary of Research Gaps, Goals, and Questions

II. METHODOLOGY AND RESULTS

The following diagram outlines the key steps that are expected to be needed to conduct the research described in the paper up to this point.

The first step was to establish two expert panels that were required to conduct the initial research. The following criteria were used for the selection of experts who will provide judgment data for this study. Experts were generally management-level professionals with at least five years of experience and a degree in a relevant discipline to the research topic being discussed. The members of each panel were selected to provide balance and to represent a range of viewpoints. The goal of the panel is span multiple industries and disciplines to achieve a cross section designed to eliminate bias.

Data Collection will be conducted in a series of 5 phases: Phases 1 through 4, as well as a Phase 0 for instrument testing. These phases are listed on the table below and then described in further detail in this section. The experts were asked to participate in up to three workshops, which had a duration of approximately 2 hours for the first two workshops and about 4 hours for the final workshop.

In the first workshop, the stakeholder information was translated into drivers of value production for products and services for a technology roadmap. Product and service performance factors necessary to satisfy these drivers will then be identified. Current products and services that meet existing performance requirements will be identified, along with any gaps or deficiencies in being able to meet these requirements.

		Phase 1	Phase 2	Phase 3	Phase 4
Documents	Technology Planning for Business, Regulatory & Policy Integration	Start-up Business Model Development	Industry Analysis	Prioritization & Verification	Analysis & Synthesis
Methods	Research Design Diagram	Business Concept Development	Modified 5 Forces (Reg Indus), Profit Modeling	TRM Constrcution & Prioritization	Integrated TRM & Analysis
Processes	Literature, Experts (6-8)	Literature, Email Virtual Panel (6-8)	Literature, Email Virtual Panel (6-8)	Workshop (12-16)	Research Synthesis, Expert Feedback (12-18)
Description	Utility Experts, Pol Anlyts, EV/V2G Bus & Tech Experts	Utility Execs, Pol Anlyts, EV/V2G Bus Experts	Utility Execs, Pol Anlyts, EV/V2G Bus Experts	Utility Experts, Pol Anlyts, EV/V2G Bus & Tech Experts	Data Analysis, Validation & Conclusions
Validation	Content & Face Validity Tools	Content Validity Tools	Content Validity Tools	Criteria Validity Tools	Criteria Validity Tools
Examples	Complete B&R Model and Complete Prioritized TRM	Stakeholder-Objective Matrix, Business Sub-Models, Business Summary, Stakeholder Perspectives, and Business Model Overview	Modified 5 Forces Model, Business-Stakeholder Alternatives Matrix, Industry Factor Alternatives Matrix, Statics & Dynamic Business Models	Grouped Drivers, Impact Matrices, Initial TRM and Prioritization	Final Integrated TRM, Analysis or Alternatives and Priorities

Figure 5 Research Outline

The second workshop analyzed emerging technologies and compared them to required technology characteristics that are expected to be important for those technologies. Potential solutions were examined to see how they may meet required characteristics. This information will then be used to determine if gaps exist in technology requirements and the present state of development for these technologies. If gaps are identified, then descriptions of R&D programs necessary to fill these gaps will be created.

In the third workshop, the current market environment and policy environment with respect to EVSC was examined. If any market or policy elements negatively impacted product or service performance in the first workshop, items on the Solutions layer show possible ways to address such market or policy barriers. Specific mitigation strategies, such as policy changes or market incentives may then be considered to overcome these barriers.

The output of the second and third workshops were then analyzed in order to determine which technology-product gaps are the most significant to address and which market and policy barriers are the important as well. The end result of this is an EVSC roadmap which will help stakeholders understand the most critical elements that are necessary to achieve goals. Potential outcomes can then be analyzed, along with prioritization scores to determine the main factors necessary for key stakeholders to achieve desired outcomes and the factor dependencies required. More detail on the prioritization process will be described in the next section, along with the information needed to construct the technology roadmap.

The following tables povide a set of tools designed to assist with the roadmap development and prioritization process. A series of data collection instruments, matrixes, and prioritization tools are presented to perform various stages of roadmap construction and assessment of the various input factors.

#	Grouped Market Drivers	Priority	Notes and Constituent Drivers
DM1	Energy Management / Emissions & Sustainability	√√√	Green consumers, carbon footprint, managing fuel costs. Linked to DM3
DM2	Improved EV Battery Performance	√√√√	Low battery costs, high capacity / range, fast charge, long life
DM3	Reduced Vehicle Costs	√√√√	Linked to DM2
DM4	Consumer EV / Charging Incentives	√√√√	Subsidies, benefits, financing

#	Grouped Business Drivers	Priority	Notes and Constituent Drivers
DB1	Transactive Energy Business Standards Development	√√√	Linked to Go8, PC2, S2-6,B5
DB2	Charging Infrastructure Requirements	√√	Linked to GP5, Go1, Go6-9, Gp3-4
DB3	Business Partnerships and Policies	√√√	Linked to DB1, PC2-3, Go2, S5-6
DB4	Need for grid support services, enhanced stability	√√	Linked to DB1, DB3, DR5
DB5	Business Ownership Structures and Financing	√√√√	Linked to DP7

Figure 6: Grouped Drivers - Market and Business
Source: [2, 31, 38]

#	Grouped Policy Drivers	Priority	Notes and Constituent Drivers
DP1	Reducing Vehicle Emissions	√√√√	Linked to DP3-6, DP8
DP2	Vehicle Fuel Economy / Energy Efficiency	√√√	Linked to DP3-5
DP3	State / Regional Energy Planning Goals	√√√	Linked to DP1-2, DP4-6, DP8
DP4	State / Regional Emissions Policies, Plans	√√	Linked to DP1-3, DP4-6
DP5	Electric Vehicle Adoption Goals, plans	√√	Linked to DP1-4, DP6-9, DR1-5
DP6	RPS and need for Renewable Energy Integration	√√√	Linked to DP1-5, DP7-9,DR 3, DR5
DP7	Business EV / Charging Incentives	√√√√	Linked to DR2-5, DB5
DP8	Renewable Energy Integration Needs	√√√√	Linked to DP6, DP9
DP9	Charging Infrastructure Upgrades and Investment Needs	√√√√	Linked toDP6-8, DP3-5, DR4-5

#	Grouped Regulatory Drivers	Priority	Notes and Constituent Drivers
DR1	Zero Emissions Vehicle Sales Mandate (ZEV / PZEV)	√√√	ZEV sales requirement in CA and other states. Linked to DP1, DP4, DP5
DR2	Regulation & Legislation on EV charging rates and processes	√√√√	Linked to DP5,DP7,DR4-5
DR3	Transactive Energy Standards Development	√√√	Linked to DP6-9, DR4-5
DR4	Charging Hardware / Software Standardization	√√√√	Linked to DP5, DP8, DP9
DR5	Plans for Grid Modernization and Stability	√√√√	Linked to DP-56, DP8-9

Figure 7: Grouped Drivers - Regulatory and Policy
Source: [2, 31, 38]

		Market				Business / Regulatory						
	Column Priorities (1-10)	2	9	9	2	2	6	6	6	7		
		DM1: Energy management / emissions and sustainability	DM2: Improved electric vehicle battery performance	DM3: Reduced Vehicle Costs	DM4: Consumer Incentives and Finance	DB1: Grid Interface and Transactive Energy Business Standards Development	DB2: Charging Infrastructure Requirements to meet regional vehicle & emissions plan	DB3: Business Partnership Policies,Structures & Guidelines	DB4: Development of Standardized Business Ownership Structures, and Models	DB5: Vision for EV Charging Infrastructure Deployment	Normalized Prioritization Mk	Normalized Prioritization B/R
Outputs & Plans	O1: Development of products, and/or services for emmissions tracking, energy management, and sustainability awareness for green consumers.	3	1	2			2			1	6	3
	O2: Development of support systems and warranty services for advanced batteries	2	3	3			2	2	2	2	10	8
	O3: Improved performance EV chargers to quickly recharge batteries with minimal reduction of battery longevity	1	3	3	1	2	3	2	2	2	10	9
	O4: Improved software tools and systems for quantification of transactive energy benefits to a variety of stakeholders	1	2	2	3	3	2	2	2	2	8	8
	Pn1: Charging Infrastructure Plan - Establish policies and practices for installing equipment on grid, interfacing with systems, performing charging, and plan for charging infrastructure investment.	1	1		2	3	3	2	2	2	3	9
	Pn2: Utility, Investor, and Aggregator-Owned partnership structures, and operations.	1			2	2	2	3	2	2	1	9
	Pn3: Subsidies, credits, financing, and incentives to promote EV chargers and provide grid support.	1			2	2	2	3	3	2	1	10

Figure 8: Market, Business, Regulatory & Policy Drivers vs. Plans and Outputs
Source: [2, 31, 38]

		Outputs				Plans				
	B/R	3	1	3	8	9	10	10		
	Mk	6	9	10	7	4	1	1		
		O1: Development of products, and/or services for emmissions tracking, energy management, and sustainability awareness for	O2: Development of products, such as silicone electrodes for faster charging of high capacity batteries	O3: Improved performance EV chargers to quickly recharge batteries with minimal reduction of battery longevity / warranty	O4: Improved software tools and systems for quantification of transactive energy benefits to a variety of stakeholders	Pn1: Charging Infrastructure Plan - Explains policies and practices for installing equipment on grid, interfacing	Pn2: Partnership policies & guidelines - policies and regulations business partnership strucutres, rates,	Pn3: Promotions, subsidies, credits, and privileges to encourage EV charger use and provide grid support.	B/R	Mk
Technologies & Barriers	T1: Lower EV Charger Costs (upfront cost)	1	3	3	2	2	1	1	7	9
	T2: More Efficient EV Charging Systems (operating cost)	2	3	3	2	2	1	1	7	10
	T3: Improved metering, energy management systems for environmentally conscious consumers.	3	2	2	2	1			4	8
	T4: Interface for EV Charging Payment System and TE Support	2		2	3	2	3	2	10	7
	BE1: Lack of Grid Interface Processes & Utility Reg Stds for TE	1			2	2	3	2	8	4
	BE2: Lack of Vision for EVs as Part of Emissions Planning, Grid Support, and Renewables Integration	1			3	3	2	2	9	5
	BE3: Lack of Partnership & Generalized Business Model Frameworks	1			2	3	3	2	9	4
	BE4: Lack of general framework for Ownersihp Terms and Structures	1			2	2	3	2	8	4

Figure 9: Plans & Outputs vs. Technologies & Barriers
Source: [2, 31, 38]

		Technologies				Barriers					
	T/B	8	9	9	10	5	8	5	5		
	P/G	5	5	1	7	7	7	8	7		
		T1: Lower EV Charger Costs (upfront cost)	T2: More Efficient EV Charging Systems (operating cost)	T3: Improved metering, energy management systems for environmentally conscious consumers.	T4: Interface for EV Charging Payment System and TE Support	BE1: Lack of Grid Interface Processes & Utility Reg Stds for TE	BE2: Lack of Vision for EVs as Part of Emissions Planning, Grid Support, and Renewables Integration	BE3: Lack of Partnership & Generalized Business Model Frameworks	BE4: Lack of general framework for Ownership Terms and Structures	Normalized Prioritization	
										T/B	P/G
Research, Development, and	RD1: Low Cost Charger Development	3	2	2	1	1	1			8	6
	RD2: Quick Charge & Device Mgt Development	2	3	2	1	1				7	5
	RD3:EV Charging HW / SW Std Development	2	2	3	2	2	1	1	1	10	9
	BM1: Grid Interface Requiremnts & Utility Reg Std Specifications	1	1	1	2	2	1	2	1	7	8
	BM2: Regional EV Plan for Emiss & Charger Deploymt	1	1	1	2	2	3	1	2	9	10
	BM3: Business Partnership Policies, Guidelines			1	1	1	1	3	2	5	7
	BM4: Business Ownership Structure, Terms & Models			1	1	1	1	2	3	5	7

Figure 10: Technologies and Barriers vs. R&D and Barrier Mitigation

After finishing the initial data gathering and prioritization processes, a series of roadmap models were constructed incorporating the data. Several types of roadmaps were created to examine different aspects of this research. First, an overall roadmap was created that showed the combined effect of business, government, consumer, and market factors over the entire 10-year time span of the roadmap. This roadmap is consists of three parts, representing different set of layers on the roadmap. Part 1 is composed of three layers: (1) Drivers; (2) Gaps, Goals, and Products; and (3) Product Characteristics and Barriers. Part 2 contains two layers: (1) a continuation of Product Characteristics and Barriers; and (2) Solutions, which involve Technology, Business Model, Market, Regulatory, and Barrier Mitigation. Part 3 has 1 layer, which is a continuation of the Solutions layer started in Part 2. Parts 1, 2, and 3 or the overall roadmap are shown in the following figures.

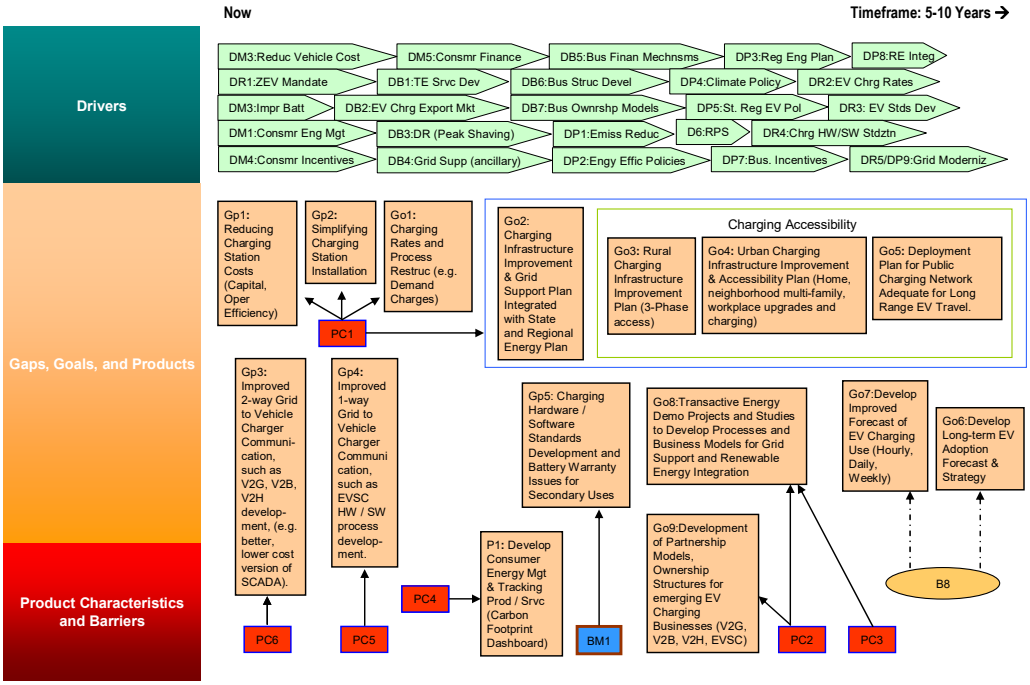

Figure 11: Integrated TRM Model: Electric Vehicle Charging - Part 1

As previously mentioned, Part 1 of the overall roadmap represents the top 3 layers, which consists of Drivers, Gaps, Goals, and Products, as well as Product Characteristics and Barriers. Part 2 of the roadmap then shows the next 2 layers, starting with a continuation of Product Characteristics and Barriers, and then the initial portion of the Solutions layer. Part 2 is shown below.

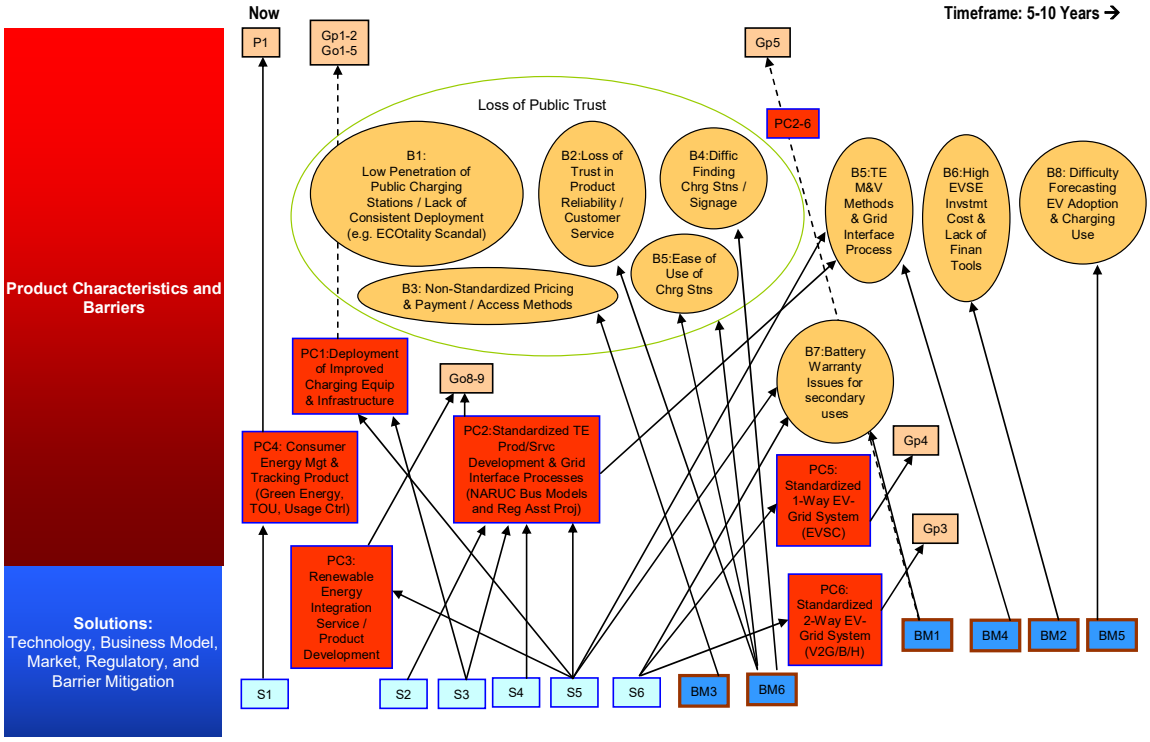

Figure 12: Integrated TRM Model: Electric Vehicle Charging - Part 2

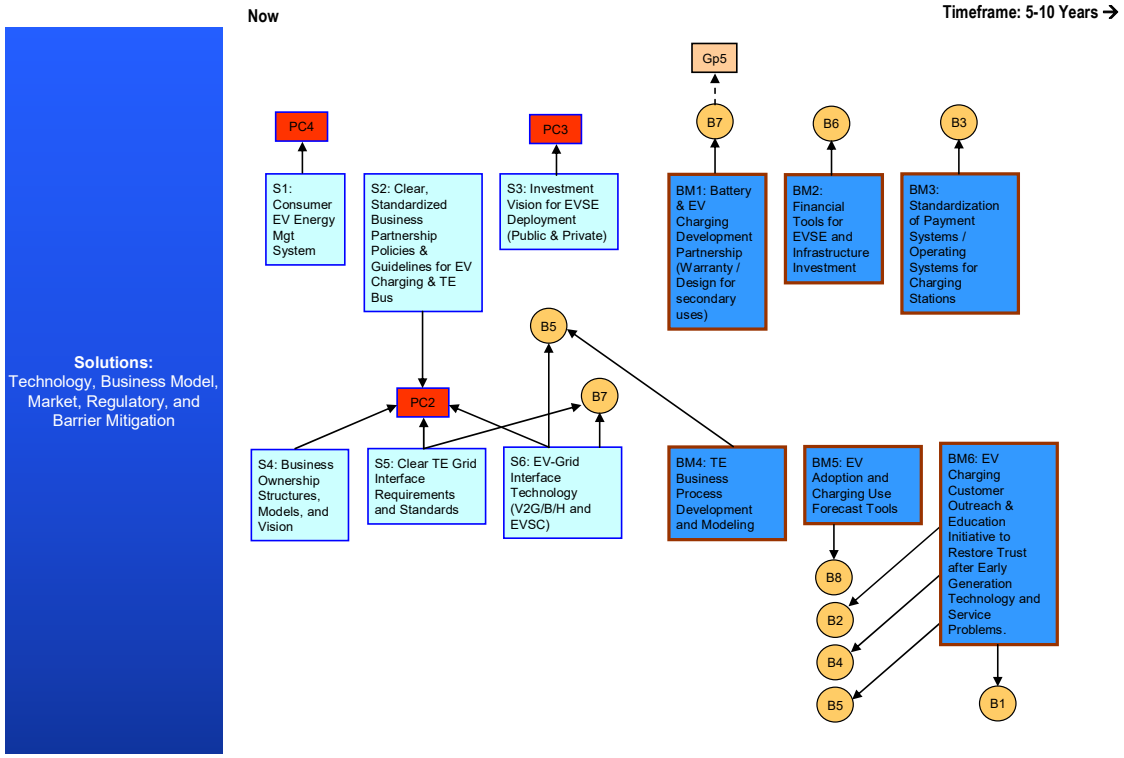

Figure 13: Integrated TRM Model: Electric Vehicle Charging - Part 3

Part 2 of the general roadmap consists of the third and fourth layers, which starts with a continuation of the Product Characteristics and Barriers layer and then begins the initial portion of the Solutions layer. Part 3 is shown above.

Part 3 of the general roadmap consists of the fourth layer, which began in Part 2. After showing each of these three parts, a number of important facts about the overall roadmap are discussed below, as well as some ways to improve the organization of the roadmap. To make it easier to focus on specific aspects of the roadmap over shorter time horizons, the roadmap is further broken into version A and version B for each of the of the 3 parts. Version A reorganizes the roadmap with a Business and Regulatory Organizational Focus, while version B reorganizes the roadmap with a Consumer and Market focus. Additional details about the organization of the roadmap are provided in the next section.

Several key pieces of information can be seen from the above figures. Key stakeholders include consumers, businesses, government organizations (GO), and non-government organization (NGO), and regulatory agencies . Decisions can then be made regarding whether to focus first on specific user segments among these stakeholders or on a combinations of segments. Further decisions can be made regarding different options for ownership structure and primary profit mechanisms. Ownership structures include the possibility of consumers, utilities, or third-parties, such as energy service aggregators owning and/or operating EV charging equipment and services. Key profit mechanisms include the following: (1) Direct fees for vehicle charging and/or parking fees; (2) membership fees and fees for other bundled and premium services, such as internet access or auxiliary vehicle power hook-up fees; advertiser fees or fees for consumers to opt-out of advertisements; ancillary service fees, which provide essential services to utilities, such as voltage and frequency regulation; or energy efficiency optimization contracts and energy aggregation contracts, which allow a network operator to manage and optimize energy use over a grid or micro-grid. Other profit mechanism or combinations of mechanisms are also possible, but these were the main mechanisms identified through conversations with experts who participated in data gathering workshops for this study. Options for financing and distribution methods related to each business model were also considered that were appropriate for each of these cases. Methods for financing EV charging equipment purchase include rebates and tax credits for consumers, on-bill financing through utility companies, and third-party owned equipment with a service lease, or charging as a service models. Additional details about each of these points discussed above are provided in section 7.3.3, under the discussion of business models and in Appendix 5, where each of the business model specifications are described.

The overall roadmap shown in Parts 1, 2, and 3 summarizes a great deal of information about the technology, business, and regulatory landscape facing the electric vehicle charging industry. However, because it summarizes so many factors in one place, this can make the roadmap look cluttered and difficult to read. Therefore, to make it easier to focus on specific aspects of the roadmap, the follow sections breaks each of the 3 parts into 2 sections. Section A shows a Business and Regulatory focused version of the roadmap. Section B shows Consumer and Market focused version of the roadmap. Each of these are show below as parts 1 through 3, sections A and B.

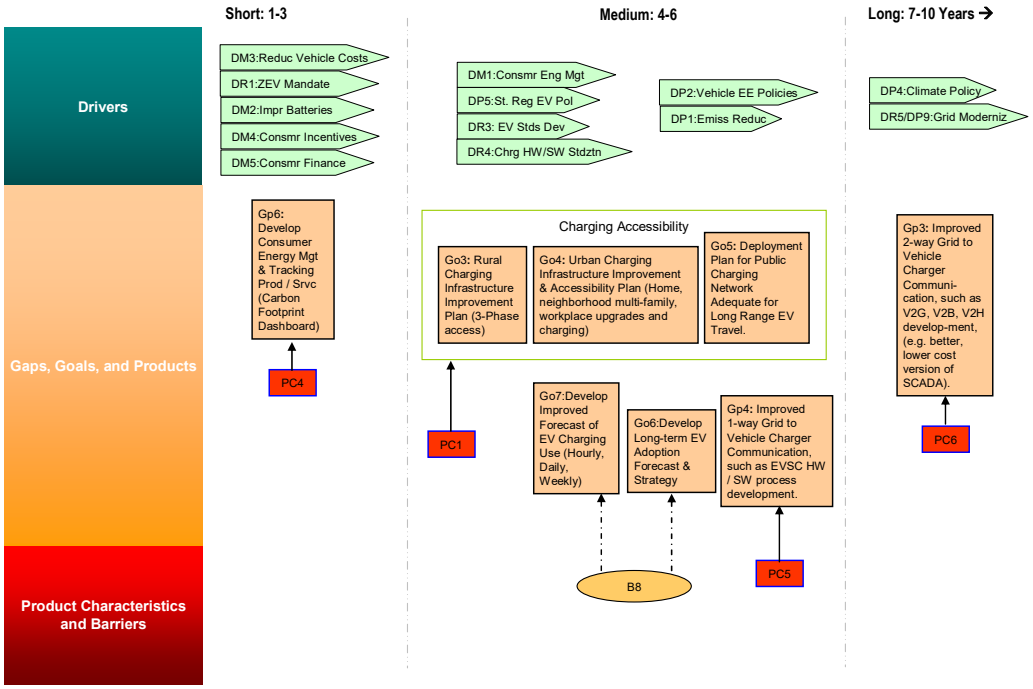

Figure 14: Integrated TRM Model: Electric Vehicle Charging - Part 1a

Part 1a of the general roadmap consists of the third and fourth layers, which starts with a continuation of the Product Characteristics and Barriers layer and then begins the initial portion of the Solutions layer.

Part 1b of the general roadmap consists of the third and fourth layers, which starts with a continuation of the Product Characteristics and Barriers layer and then begins the initial portion of the Solutions layer.

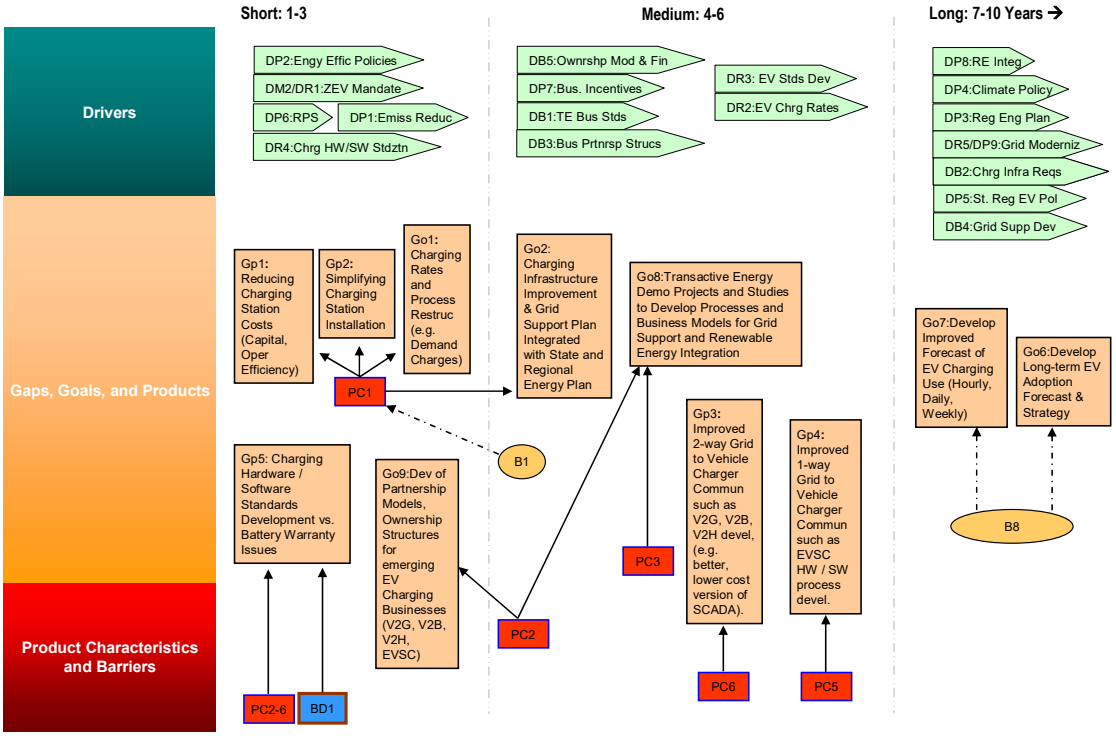

Figure 15: Integrated TRM Model: Electric Vehicle Charging - Part 1b

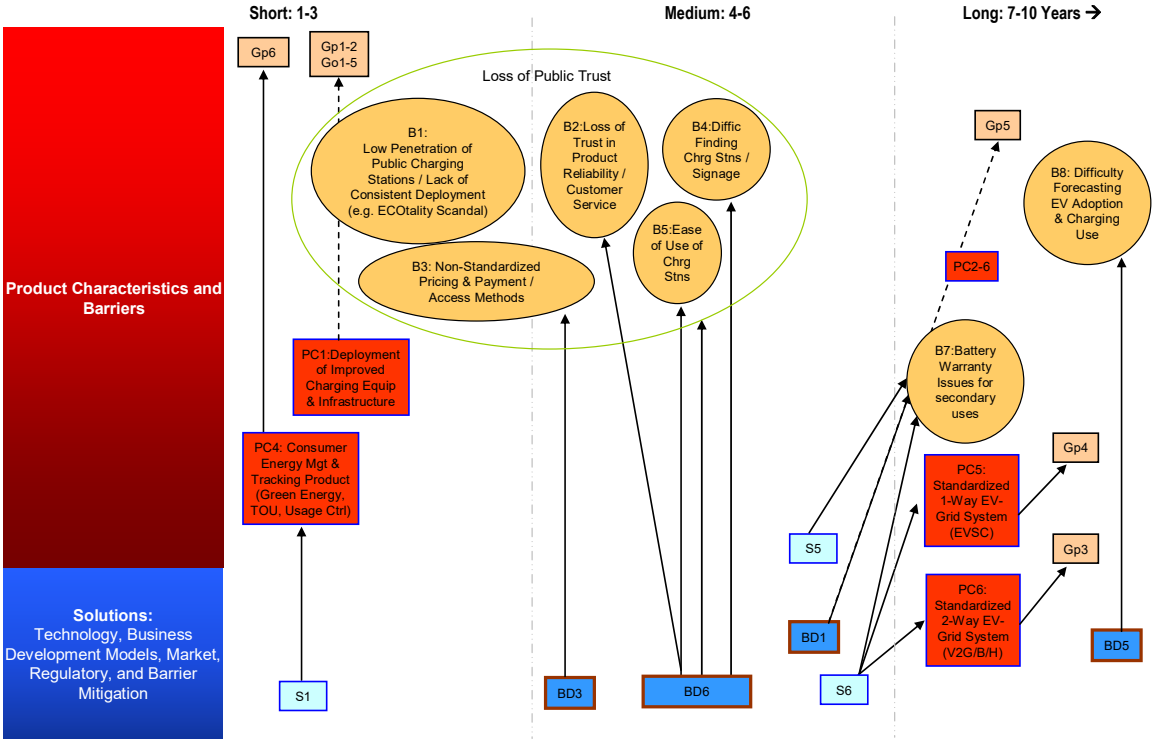

Figure 16: Integrated TRM Model: Electric Vehicle Charging - Part 2a

Part 2a of the general roadmap consists of the third and fourth layers, which starts with a continuation of the Product Characteristics and Barriers layer and then begins the initial portion of the Solutions layer.

Part 2b of the general roadmap consists of the third and fourth layers, which starts with a continuation of the Product Characteristics and Barriers layer and then begins the initial portion of the Solutions layer.

Part 3a of the general roadmap consists of the third and fourth layers, which starts with a continuation of the Product Characteristics and Barriers layer and then begins the initial portion of the Solutions layer.

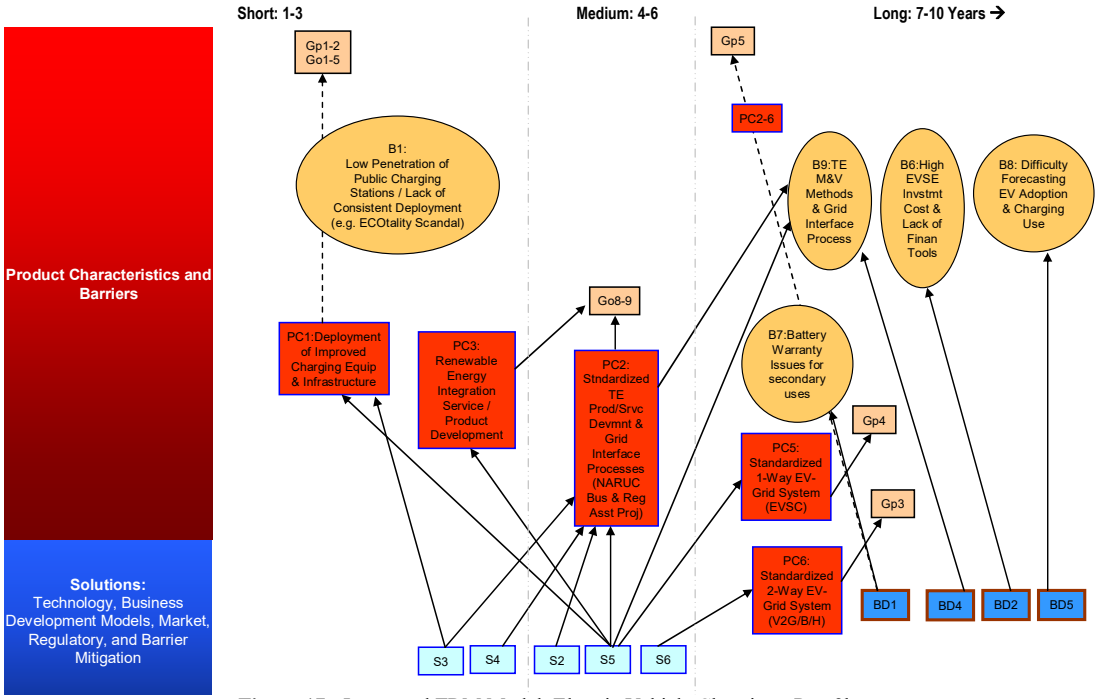

Figure 17: Integrated TRM Model: Electric Vehicle Charging - Part 2b

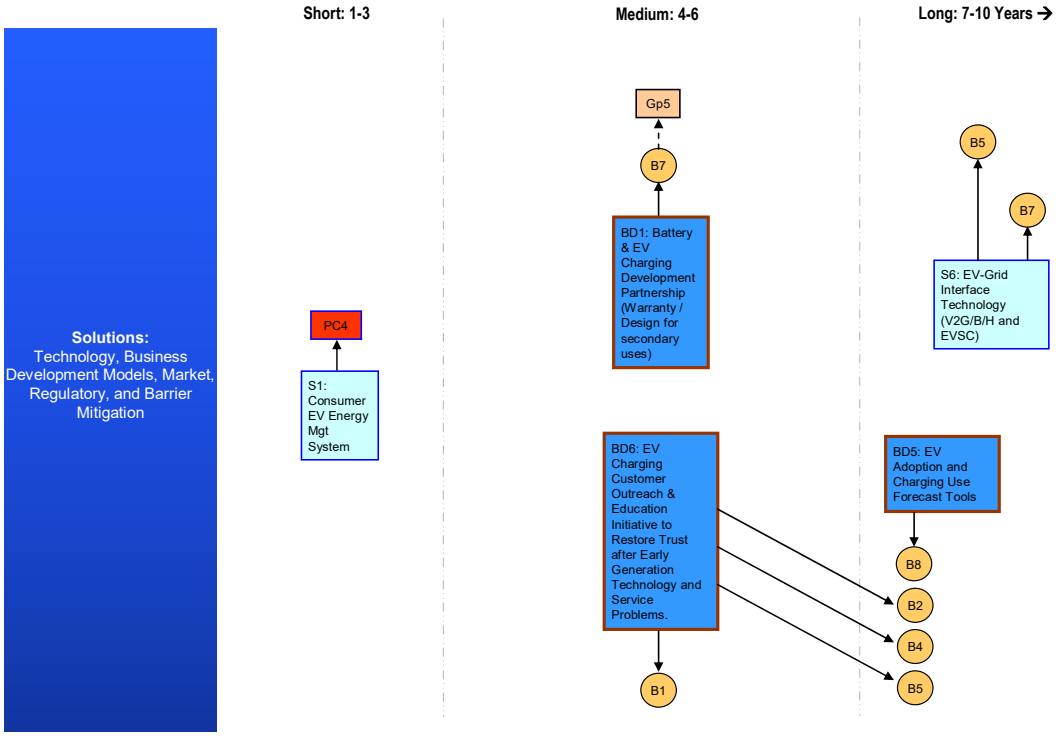

Figure 18: Integrated TRM Model: Electric Vehicle Charging - Part 3a

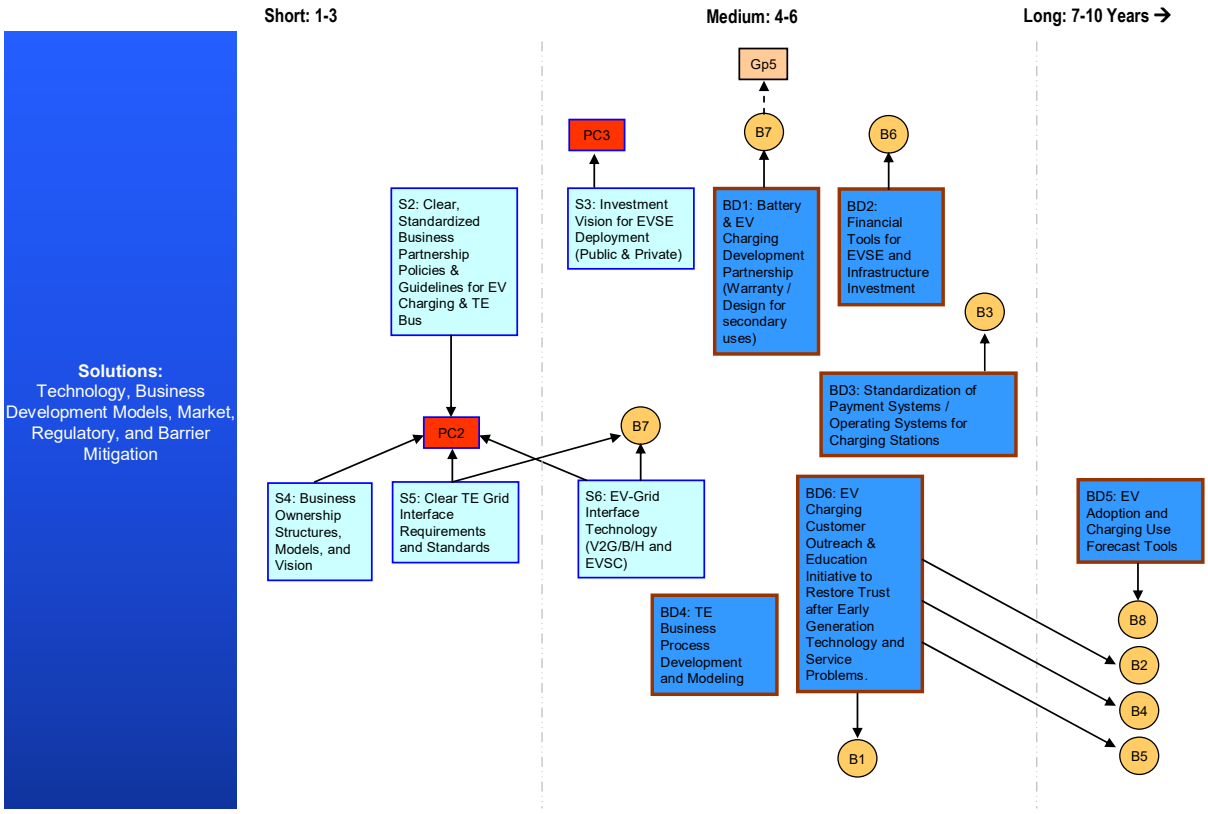

Figure 19: Integrated TRM Model: Electric Vehicle Charging - Part 3b

Part 3b of the general roadmap consists of the third and fourth layers, which starts with a continuation of the Product Characteristics and Barriers layer and then begins the initial portion of the Solutions layer.

III. CONCLUSIONS, AND RECOMMENDATIONS

The main outcome of this research is the development of a process to help integrate technology roadmapping with business modeling, as well as regulatory and policy planning, and to thus enable better understanding of opportunities for emerging technologies in emerging environments. This process is expected to be especially important for dealing with regulated industries, such as the utility sector, which has historically had one of the lowest rates of research and development investment of any major technology-based industry, only 0.25% of revenue [128]. The are many reasons for this, including common regulatory structures, and various justifications for such regulatory structures, as discussed in previous sections. However, the result of this investment pattern has clearly been a slow, careful deployment of technology, which has focused on durable, well-understood devices and systems, which have often been deployed and operated for decades at a time. While this may have had some favorable effect of protecting utility ratepayers from investing in risky or uncertain new technologies, it has also caused the industry to remain one that is still largely analog and manual in an age where many if not most other technologies are becoming digital and automated. To develop and successfully deploy critical new energy-related technology in the 21st century, at a time of increasing concern and urgency over rising energy costs and environmental damage caused by current technology, careful planning will be required, and new methods which gracefully integrate technology, business, regulatory, and policy consideration into a holistic approach may prove extremely useful. Creating a framework to assist with such efforts is a primary aim of this research.

This research also focuses on the emerging smart grid industry, since smart grid technologies appear to have great potential to drive future innovation in the electrical utility sector. However, this framework could be applied to many other emerging technology and industry environments as well. But, new tools are needed to tailor the development process to a variety of unique requirements. This research offers one such set of tools and processes to achieve this goal.

A number of key conclusions have been described in different sections of this study and can now be summarized, along with recommendations for next steps. Contributions the research makes to the existing body of knowledge in this

field are described in the next section, followed by limitations and assumptions. There was consensus that development of EV charging hardware and software standards (RD3) was extremely important from technology, business, and regulatory perspectives. Improved DC quick chargers (P3) were also important from a technology perspective, and development of clear, consistent standards would help enable these efforts, removing a key barrier to more wide-spread deployment. Creation of support systems and warranty services for advanced batteries (P2) was very important from technology, business, and market perspectives. There was consensus that regional planning visions on charger deployment should be developed that could help integrate with existing plans to reach environmental goals and emissions targets. There was a divergence of views on the development of partnership structures (G2) as well as incentives and financing for electric vehicle charging (G3). These were seen as important from the Business and Regulatory perspective, but less so from the Market perspective. Therefore, the recommendations for next steps based on this data would be to focus on hardware/software standards (RD3), quick charger development (P2), and deployment plans (BD2). Once these standards are developed and deployment plans are implemented, partnerships (G2) and incentives (G3) would then make sense to explore. The research then looks at overall a series of technology roadmaps that incorporate those issues and related challenges over an approximately 10 year horizon and looked at specific alternatives, such as various business model options, which could be used to address specific challenges at different points in that timeline.

Several types of roadmaps were created to examine different aspects of this research. First, an overall roadmap was created that showed the combined effect of business, consumer, regulatory, and market factors over the entire 10-year time span of the roadmap. The roadmap showed many key elements that relate to ownership structure and primary profit mechanism for stakeholders involved in implementing aspects of the roadmap. These mechanisms included: Direct fees for vehicle charging and/or parking fees; membership fees and fees for other bundled and premium services, such as internet access or auxillary vehicle power hook-up fees; advertiser fees or fees for consumers to opt-out of advertisements; ancillary service fees, which provide essential services to utilities, such as voltage and frequency regulation; or energy efficiency optimization contracts and energy aggregation contracts, which allow a network operator to manage and optimize energy use over a grid or micro-grid. The roadmap was then broken into two parts. Section A shows a Business and Regulatory focused version of the roadmap. Section B shows Consumer and Market focused version of the roadmap.

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