CENTER FOR CLIMATE AND ENERGY SOLUTIONS

TASK 2: BUSINESS MODEL SUMMARIES (DRAFT – DO NOT QUOTE OR CITE)

Introduction

The goal of this study is to identify sustainable business models that the private sector can execute to address EV charging infrastructure gaps in Washington state. In general, a business model describes the ways a business makes money by offering a product or service. The key component of a business model is its value proposition – the value a customer receives in exchange for payment or value-transfer. In addition to the value proposition, a business model consists of the target market for a product or service, the cost and revenue streams to demonstrate the concept's viability, guidance on implementing or demonstrating the concept, and methods to test the concept's success or failure.

Experience in Washington and across the country has shown that it is currently infeasible to construct a sufficiently profitable business case to attract private investment in publicly available EV charging investments based solely on direct revenues from EV charging services. As a result, the business models explored in this study are aimed at capturing additional indirect sources of value that EV charging stations may generate, such as:

- Increased sales of other products and services at businesses located near EV chargers;
- Increased tourism business from EV travel to popular destinations;
- Employee engagement and retention benefits of offering EV charging at the workplace;
- Increased sales of EVs;
- Sales of advertising at EV charging stations; and
- "Clean technology" marketing and brand-strengthening opportunities.

To make these business model as actionable as possible, each concept should:

- Be private-sector focused;
- Identify key private sector stakeholders and the value proposition for each;
- Consider the target market for charging services;
- Evaluate the expected financial performance and identify critical success and failure criteria; and
- Allow for a range of state and local government roles and provide sufficient detail to help inform possible near-term government action.

In this document, two business models designed to capture indirect sources of value are identified and described. Next, the financial case for these business models is quantified. Financial analysis was conducted by applying each model to real-world EV infrastructure gaps in the state. Appendix A provides instruction on how to use the financial analysis tool and information about the default assumptions used in the analyses presented here.

Description of Business Models

Based on the ideas and perspectives raised at the Business Model Workshop conducted on October 1, 2014, as part of this study, two business models were identified that show strong potential:

- **Business Model 1**: Business Funding Partners for Charging Network Development along Major Roadways
- **Business Model 2**: Stakeholder Funding Pools for Charging Network Development that Enables EV Travel to Tourism Destinations and Employment Regions

A combination of the two business models was also explored.

These business models are described below and are compared in Table 1.

Table 1: Comparison of EV Charging Business Models

	BUSINESS MODEL 1	**BUSINESS MODEL 2**
Brief description	A large business that benefits from expanded access to EV charging infrastructure subsidizes the deployment of a network of DC fast charging stations that enables interregional EV travel.	A group of businesses located in a tourism destination or employment region contributes to a funding pool that is used to subsidize the cost of deploying a network of DC fast charging and Level 2 charging stations that enables EV travel to and within the region.
Sources of indirect value	• Increased sales of EVs • "Clean technology" marketing and brand-strengthening opportunities	• Increased sales of other products and services at businesses located near EV chargers • Increased tourism business from EV travel to popular destinations • Employee engagement and retention benefits of offering EV charging at the workplace
Candidate businesses	Large businesses, including: • Automakers	Smaller, local businesses, including: • Hotels

	BUSINESS MODEL 1	**BUSINESS MODEL 2**
	• Electric utilities • Retail chains • Restaurant chains	• Retailers • Restaurants • Tourist attractions • Commercial real estate owners • Employers
Form of funding	Direct transfer of funds from funding partner to charging station owner operator	Funding pools from smaller contributions by local businesses transferred to charging station owner operator
Infrastructure gap focus	• DC fast charging stations along major interregional roadways	• DC fast charging along roadways that enable travel to the destination • DC fast charging and Level 2 charging stations that enable travel within the region

Business Model 1: Business Funding Partners for Charging Network Development along Major Roadways

Summary: A large business that benefits from expanded access to EV charging infrastructure would contribute funding that subsidizes the deployment a DC fast charging network for interregional EV travel. The business could also act as a site host. Charging stations could be owned and managed by the site hosts or by a third-party charging service provider.

Target market for charging services: The primary target market of this business model is BEV drivers taking interregional trips that are longer than the expected range of their vehicles, although PHEV drivers that seek charging services at convenient locations along major roadways may also contribute to demand for these services in the future.[1]

Potential players and value propositions: A range of businesses may see value in helping to fund a network of charging stations along major roadways, including:

- Automakers, for whom DC fast chargers along major roadways could serve as a useful marketing tool to help sell more EVs;
- Electric utilities or electricity power generators, who may wish to expand access to charging in their service territories to serve their customers; and
- Retail chains and restaurant chains, for whom on-site charging stations may provide additional sales.

From the perspective of the charging station project developer, which may be the business funding partner or a third-party charging service provider, the value proposition also includes direct revenues from charging services fees.

For all private sector participants, support for and operation of EV charging stations may also present marketing opportunities.

Business Model 2: Stakeholder Funding Pools for Charging Network Development that Enables EV Travel to Tourism Destinations and Employment Regions

Summary: A group of businesses located in a popular tourism destination or employment region may be willing to contribute to a funding pool that would subsidize the cost of deploying a DC fast charging network for EV travel *to the region*. In addition, the funding pool could also be used to subsidize the deployment of DC fast charging and/or Level 2 stations at sites *within the destination region*. Members of the group would commit to acting as site hosts. Charging stations could be owned and managed by the site hosts or by a third-party charging service provider.

Target market for charging services: The primary target market of this business model is BEV drivers taking trips to tourism destinations. These drivers may demand charging services to travel to and from the tourism destination and/or to travel within the destination region. PHEV drivers seeking charging on trips to, from, and within the tourism destinations may also contribute to demand for these services.

Potential players and value propositions: A range of businesses located in tourism destinations and employment centers may see value in collectively supporting a network of charging stations that enable BEV travel to, from, and within their region. For each business, the value of contributing funds towards the deployment of these charging stations would be increased sales associated with on-site charging as well as clean technology marketing opportunities. These businesses could include:

- Hotels,
- Retailers,
- Commercial real estate owners,
- Restaurants,
- Tourist attractions, and
- Employers.

In addition to direct involvement of local businesses, local chambers of commerce could also play a role in planning, coordinating, and/or funding charging station deployment.

From the perspective of the charging station project developer, which may be the tourism destination businesses, employers, or a third-party charging service provider, the value proposition also includes direct revenues from charging services fees.

Financial Analyses of Business Models

To evaluate the expected financial performance of the business models and to identify critical success and failure conditions, a financial analysis tool was developed that can be used to analyze a variety of alternative EV charging investment arrangements under a wide range of market assumptions. The financial analysis tool is described in detail in Appendix A.

The financial analysis tool was used to quantify the expected financial performance of each of the two business models, as well as a combination of the two models. For each business model financial analysis, the business model is applied to address a real-world example EV charging infrastructure gap in the state. These scenarios do not include a public sector role. While the goal is for these business models to be broadly applicable to many EV infrastructure projects, specific EV charging gaps were selected to provide real-world context to the analyses. The infrastructure gaps used as examples for each business model are presented in Table 2.

In addition, the financial analysis tool can also evaluate public sector roles in EV charging station investment projects, including the financial performance from the public sector entity perspective, although government roles are not considered here and will be explored in the next phase of work.

Table 2: EV Infrastructure Gaps Considered for Business Model Financial Analyses

	BUSINESS MODEL 1	**BUSINESS MODEL 2**	**BUSINESS MODELS 1 & 2 (COMBINATION)**
EV Infrastructure gap	Interregional travel on I-90 between Seattle and Spokane	Travel to Ocean Shores (from Longview and the Puget Sound region) and within the destination region	Travel to Tri-Cities and Walla Walla (from Spokane and the Puget Sound region) and within the destination regions

For each infrastructure gap, the additional DC fast charging stations were spaced 40 miles apart.[2] A second, denser DC fast charging station deployment scenario was also analyzed, with stations 20 miles apart, to provide convenience and safety through station redundancy.

Where possible, charging stations were sited in cities or towns with existing retail, restaurant, and/or gas stations. Siting near commercial businesses is preferential because it:

- Enhances station visibility, increases convenience for drivers, and improves the potential for retail business indirect revenue benefits; and
- Increases the likelihood that three-phase power is already available on site, which reduces the need for costly utility upgrades during installation.

Along some less populated stretches of major roadways, deployment sites with existing businesses were not available, and the number and location of such sites is indicated.

Business Model 2 includes both DC fast charging and Level 2 charging stations. The analysis assumes the deployment of several Level 2 charging stations, dispersed throughout the region.

To evaluate the business case for each player's involvement in the business model, the financial analysis estimates the performance of a charging station network deployment project from two distinct private-sector perspectives:

- Charging station project owner operator
- Project funding partner (a single large business or a funding pool)

For each of these perspectives, the tool estimates a set of financial metrics that can help to evaluate whether participation in each business model makes sense from each entity's perspective. Definitions of each of these financial metrics, as well as explanations of their relevance to evaluating the feasibility of the business model, are provided below in Table 3.

Table 3: Financial Analysis Metrics Used to Evaluate the Success of the Business Model

METRIC	DEFINITION	RELEVANCE TO FEASIBILITY OF THE BUSINESS MODEL
Total capital investment / Amount of station funding provided	The amount of funds invested/ contributed to pay for charging station deployment.	Indicates whether it is realistic for the entity to invest/contribute funds at this level, based on that entity's access to funds.
Net present value (NPV)	The total value (revenue) of the project to the entity, net of the costs faced by the entity, in present value dollars.	Shows whether the entity will realize net profitability over the lifetime of the project. In most cases, a business entity's NPV must be positive for that entity to consider involvement in the project.
Discounted payback period	The period of time required for the project to generate net positive value for the entity.	Helps determine whether involvement in the project generates net profitability quickly enough to attract investment from the entity. Many private investors are only interested in projects that can achieve payback within 3 to 5 years.

The model also calculates financial metrics for total project performance as a whole—as if all of the entities' perspectives are combined into a single entity—to evaluate whether the project generates net value in total. Total project performance metrics are useful because a project may perform well (e.g., generate net value) as a whole, but fail to perform adequately for a particular entity. In such a case, the roles of each entity may need to be adjusted to make the business model actionable. Conversely, a project may perform well for a particular entity's perspective, but fail to generate net value as a whole, in which case the business model may not capture enough value to be worth pursuing. In such a case, additional sources of value may need to be identified.

While each financial analysis scenario incorporates some unique assumptions associated with the particular business models and gaps analyzed, all three scenarios share some general parameters. In each scenario, a station owner operator business bears the costs and receives direct revenues associated with the network of EV charging stations. A project funding partner business (or set of businesses contributing to a funding pool), provides some level of funding to the owner operator in the form of a cash transfer without expectation of repayment. This cash transfer amount is some fraction of the estimated indirect value (revenue) gained by the funding partner as a result of the EV charging station project. Table 4 and Table 5 provide an overview of cost and revenue components from the perspective of each business entity. The full list of market assumptions incorporated in the model is provided in Appendix A.

Table 4: Key Cost Components for Business Entities in Financial Analysis

COST CATEGORY	OWNER OPERATOR COSTS	PROJECT FUNDING PARTNER OR FUNDING POOL COSTS
Station capital costs	• Equipment • Installation	N/A
Station operating costs	• Electricity • Maintenance • Site access	N/A
Financing and funding costs	• Interest paid on loans • Returns paid to equity investors	• Funds provided to station owner operator (without expectation of repayment)

Table 5: Key Revenue Components for Business Entities in the Financial Analysis Tool

REVENUE CATEGORY	OWNER OPERATOR REVENUES	PROJECT FUNDING PARTNER OR FUNDING POOL REVENUES
Direct revenue from stations	• Energy-based user fees	N/A
Indirect revenue from stations	N/A	One or more of the following: • Increased sales of other products and services at businesses located near EV chargers; • Increased tourism business from EV travel to popular destinations; • Employee engagement and retention benefits of offering EV charging at the workplace; • Increased sales of EVs; • "Green" marketing and brand-strengthening opportunities

Critical thresholds for success and failure for both business funding partners and third-party project developers were identified based on a series of sensitivity analyses. In each sensitivity analysis, the change in project NPV and payback period are shown over a range of possible values for a single variable, holding all other variables constant.

Descriptions and results of each of the three financial analysis scenarios are provided below.

Applying Business Model 1 to Enable Interregional EV Travel on Interstate 90

Business Model 1 ("Business Funding Partners for Charging Network Development along Major Roadways") was applied to deployment of a DC fast charging network along Interstate 90 (I-90).

Geographic description of infrastructure gap: DC fast charging station availability is insufficient to enable east-west travel of BEVs between Seattle and Spokane along I-90, as shown in Figure 1.

Figure 1: Existing DC Fast Charging Stations and EV Infrastructure Gaps between Seattle and Spokane along I-90

Brown circles (●) indicate locations of existing DC fast charging stations. Lengths of road highlighted in green (▬) indicate sections along the route where BEV travel is currently possible using existing publicly accessible DC fast charging stations. Lengths of road highlighted in red (▬) indicate sections along the route where BEV travel is currently not possible using existing publicly accessible DC fast charging stations.

Reason for considering this gap: I-90 between Seattle to Spokane is a critical east-west corridor in the state. BEVs cannot currently travel this road using publicly accessible charging infrastructure.

Additional infrastructure needed and siting considerations: The locations of additional DC fast charging stations needed to address this infrastructure gap are presented in Figure 2. The number of DC fast charging stations needed is presented in Table 6.

Figure 2: Candidate Locations of Additional DC Fast Charging Stations Deployed to Enable BEV Travel between Seattle and Spokane along I-90

Orange circles (●) indicate candidate locations of new DC fast charging stations spaced 40 miles apart. Red circles (●) indicate additional locations of DC fast charging stations under a denser deployment scenario, assuming spacing 20 miles apart. Circles

marked with a grey square ( ) indicate stations that were necessarily sited in rural areas (far from existing commercial locations), which may be more costly to deploy, less convenient to use, and present fewer opportunities to capture indirect revenue. Brown circles ( ) indicate locations of existing DC fast charging stations.

Table 6: Charging Stations Deployed Using Business Model 1 to Enable BEV Travel between Seattle and Spokane along I-90, under Two Scenarios

STATION TYPE	MINIMUM DEPLOYMENT SCENARIO (40-MILE SPACING)	DENSER DEPLOYMENT SCENARIO (20-MILE SPACING)
DC fast charging stations	6 total stations (6 sited near commercial locations, 0 sited in rural, non-business locations)	18 total stations (13 sited near commercial locations, 5 sited in rural, non-business locations)

For each gap along major roadways, approximate candidate sites were identified using the location of commercial centers along the route. Commercial centers are the primary target sites because they are (1) convenient charging sites for EV drivers, (2) likely to have site hosts with incentive to participate in charging deployment projects, and (3) likely to have access to three-phase power on site, which reduces project costs. Rural spans of major roadways without commercial centers that may pose a siting challenge were also identified. Where data is readily available, spans of major roadways without access to three-phase power were also identified as challenging siting areas.

Description of scenario and assumptions: In this model, a large business that benefits from expanded access to EV charging infrastructure gives $42,000 of upfront funding to an EV charging service provider. These funds are used to deploy a network of DC fast charging stations along I-90 at 40 mile spacing. The payment of $42,000 is based on the assumption that the funding partner is willing to contribute $7,000 in cash per DC fast charger at the start of the project because each DC fast charger generates $8,000 in increased revenue per year of revenue over its operational life, and the present value of the resulting increased profit is $7,000. (The model also assumes that the private partner is willing to transfer 100 percent of this expected value to the owner operator to subsidize station deployment.) The estimated indirect value of each charging station to the funding partner is based on the automaker marketing calculation presented at the Business Models Workshop and included in a forthcoming section of this report. This cash transfer amounts to 20 percent of the DC fast charging station equipment cost.

Financial performance: The financial analysis results, presented in Table 7, show that:

- Station deployment costs a total of $561,600.
- The owner operator funds the station deployment with a mix of private-sector loans and equity. The owner operator also receives $42,000 from the funding partner. The NPV of the project for the owner operator is -$118,207, so the project does not reach payback and, as a result, the business model is not sustainable from the owner operator perspective.

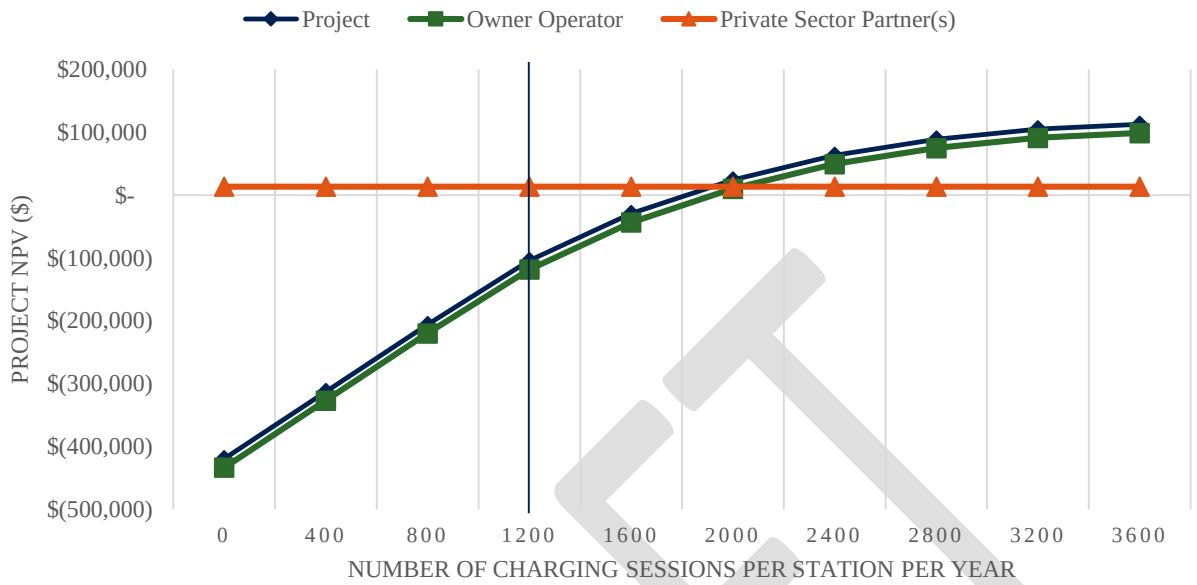
- The funding partner contributes $42,000 to the owner operator directly in the form of a cash transfer and appears as revenue on the owner operators balance sheet. The NPV of the project for the funding partner is +$13,744 and the project reaches payback in 6 years. As a result, the business model is sustainable from the funding partner perspective. However, the business model still may not attract funding partners because the payback period of 6 years may be too long for some businesses.

Table 7: Results of Financial Analysis of Applying Business Model 1 to Enable BEV Travel between Seattle and Spokane along I-90

FINANCIAL METRIC	RESULT
Total project level perspective	
Total capital investment (spent on charging station deployment)	$561,600
NPV	-$104,346
Payback period	No payback
Owner operator perspective	
Funds spent on stations (equity)	$224,640
Funds spent on stations (loans)	$336,960
NPV	-$118,207
Payback period	No payback
Funding partner perspective	
Amount of funds transferred to owner operator	$42,000
NPV	+$13,744
Payback period	6 years

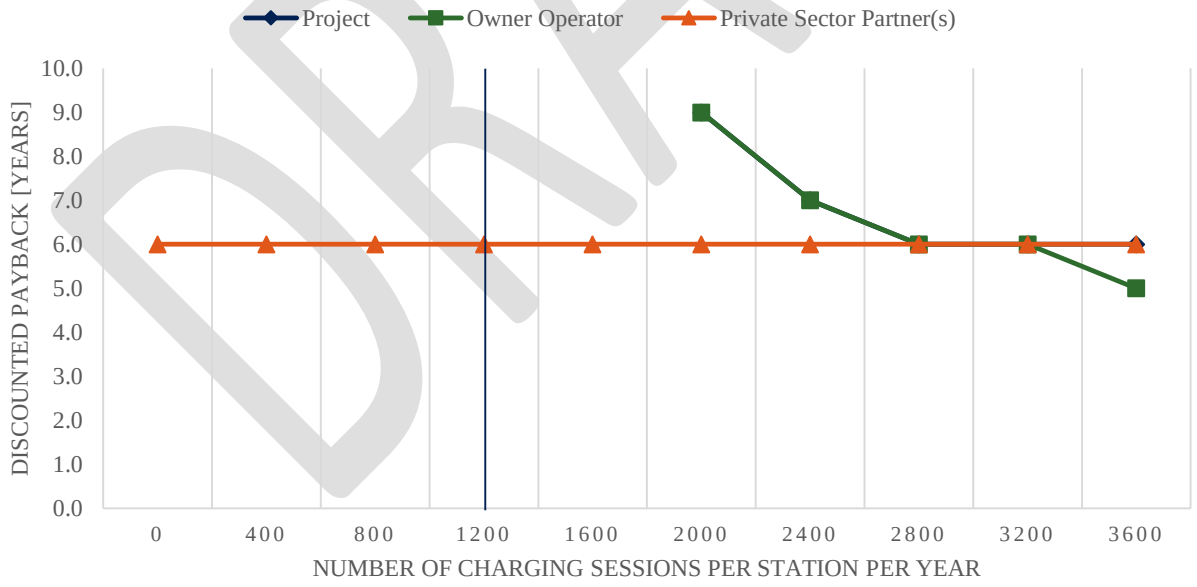
Higher utilization yields a positive NPV from the project and owner operator perspective. The base case scenario assumes the six new stations will be used 1,200 times per year (3.3 charging sessions per day) in the first year. EV charging station projects that begin in future years may experience higher initial charging station utilization rates if more EVs are on the road. If utilization is much higher, the business case is significantly improved for the owner operator. Figure 3 shows that if station utilization in the first year is greater than 2,000 sessions per year (5.5 sessions per day), then the project generates a positive NPV and is financially sustainable for the owner-operator. However, the business model still may not attract owner operator investment because the payback period for the owner-operator may be too long. As shown in Figure 4, for the payback period to be within 5 years, the initial charging station utilization rate must be at least 3,600 sessions per year—close to the assumed 10 sessions per day maximum utilization level due to station crowding. Utilization at this level initially and continuing over a sustained period is probably unrealistic at this time.

Figure 3: Business Model 1 Project NPV (Charging Station Utilization Sensitivity)



Dark vertical line indicates base case scenario assumption value.

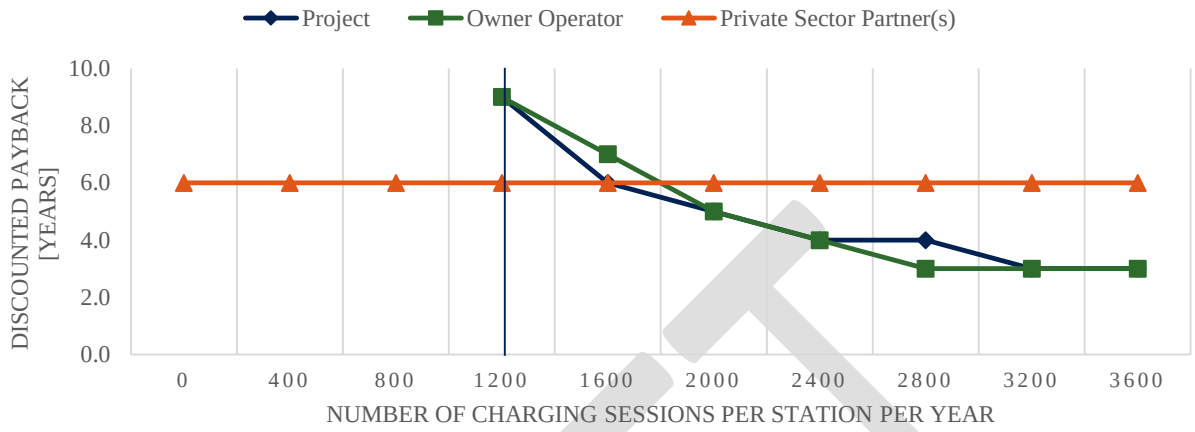
Figure 4: Business Model 1 Project Payback (Charging Station Utilization Sensitivity)



Dark vertical line indicates base case scenario assumption value. In this scenario, the project payback is the same as the owner operator payback.

Increasing the energy-based user charge improves the payback period from the project and owner operator perspectives. If the energy-based user fee is increased to from $0.50 to $0.70 and the initial station utilization is at least 2,000 sessions per year, then the owner operator reaches payback within 5 years, as shown in Figure 5.

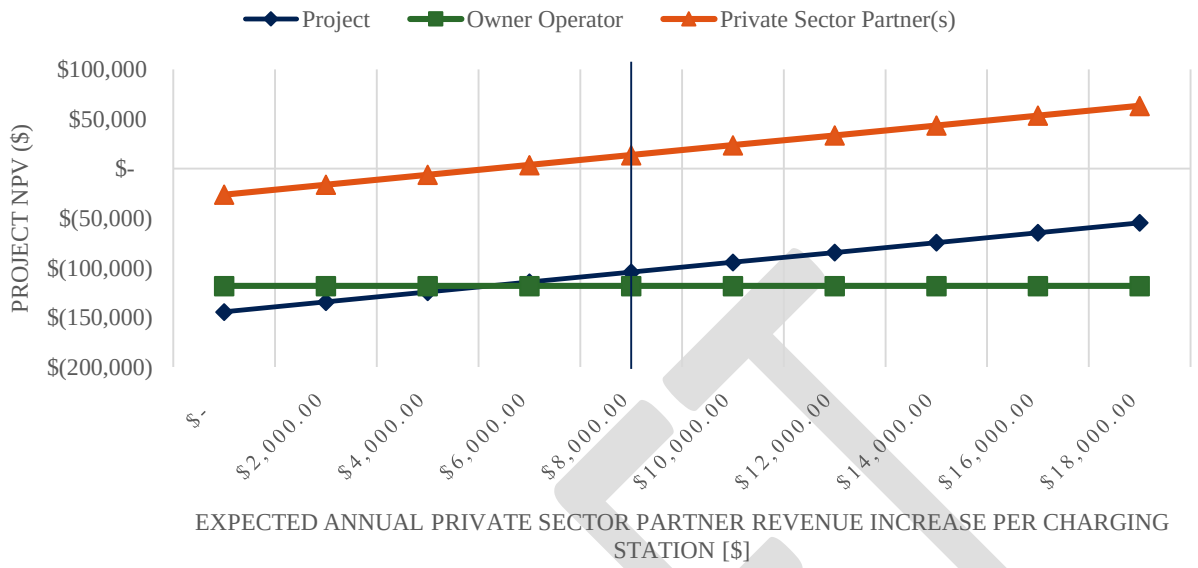
Figure 5: Business Model 1 Project Payback (Charging Station Utilization Sensitivity and Energy-Based User Fee of $0.70)



Dark vertical line indicates base case scenario assumption value, but results differ from the base case model because the per-energy user fee has also been changed from base case assumptions.

Funding partner interest depends on expected indirect value. Funding partner participation in this business model is dependent on the expected indirect value (increased revenue) generated by station deployment. As noted above, the model assumes that each DC fast charging station generates $8,000 in increased revenue each year, which translates to a willingness to subsidize each DC fast charging station by $7,000 up front. Figure 6 shows that if the expected indirect value generated by each station drops below $6,000, then the project does not generate net value to the funding partner, in which case the funding partner is unlikely to participate in the project.

Figure 6: Business Model 1 Project NPV (DC Fast Charging Indirect Revenue Sensitivity)



Dark vertical line indicates base case scenario assumption value.

Applying Business Model 1 Summary

- Under the base case assumptions, the business model is not sustainable from the owner operator perspective. Without significantly higher station utilization, higher energy-based user fees, or additional interventions by third parties, the owner operator will not have a positive NPV under this business model.
- If charging station utilization is significantly higher, as could be the case for EV charging station projects that begin in future years when more EVs may be on the road, then the business model can be sustainable for the owner operator.
- The viability of the business model is conditional on funding partner participation, which itself is highly dependent on the level of indirect value that the funding partner expects to gain from the charging stations.

Applying Business Model 2 to Enable EV Travel to and within Ocean Shores

Business Model 2 ("Stakeholder Funding Pools for Charging Network Development that Enables EV Travel to Tourism Destinations and Employment Regions") was applied a network of EV charging stations that would enable travel to, from, and within Ocean Shores.

Geographic description infrastructure of gap: DC fast charging station availability is insufficient to enable BEV travel along major roadways to and from tourism destinations in Ocean Shores from inland, populated areas—such as the Puget Sound region, Olympia, and Longview—as shown in Figure 7. Also, there are no publicly available DC fast charging or Level 2 charging stations available to enable BEV travel within the destination region.

Figure 7: Existing DC Fast Charging Stations Along Major Roadways between Seattle and Ocean Shores and Between Longview and Ocean Shores

Brown circles (●) indicate locations of existing DC fast charging stations. Lengths of road highlighted in green (▬) indicate sections along the route where BEV travel is currently possible using existing publicly accessible DC fast charging stations at 40 miles apart. Lengths of road highlighted in red (▬) indicate sections along the route where BEV travel is currently not possible using existing publicly accessible DC fast charging stations.

Reason for considering this gap: Demand for EV charging services can be expected to be moderately high along these routes and within the region because Ocean Shores is a popular destination due to its coastal tourism, convention centers, casino, and other attractions, and may be a likely destination for BEV travelers.

Additional infrastructure needed and siting considerations: The locations of additional DC fast charging stations needed to address this infrastructure gap are presented in Figure 8. The number of DC fast charging stations needed is presented in Table 8, along with the estimated number of Level 2 charging stations based on the assumption that five commercial site hosts each deploy five Level 2 stations at their place of business.

Figure 8: Candidate Locations of Additional DC Fast Charging Stations Deployed to Enable BEV Travel to and from Ocean Shores

Orange circles (●) indicate locations of new DC fast charging stations at 40 mile spacing. Red circles (●) indicate additional candidate locations of DC fast charging stations under a denser deployment scenario at 20 mile spacing. All of the stations can be sited near existing commercial locations. Brown circles (●) indicate locations of existing DC fast charging stations. Not shown in the figure are 25 Level 2 stations, five at five sites in Ocean Shores.

Table 8: Charging Stations Deployed Using Business Model 2 to Enable BEV Travel to, from, and within Ocean Shores, under Two Scenarios

STATION TYPE	MINIMUM DEPLOYMENT SCENARIO (40-MILE SPACING)	DENSER DEPLOYMENT SCENARIO (20-MILE SPACING)
DC fast charging stations	3 total stations (2 sited along major roadways near commercial locations, 0 sited along major roadways in rural, non-business locations, and 1 sited in Ocean Shores)	9 total stations (8 sited along major roadways near commercial locations, 0 sited along major roadways in rural, non-business locations, and 1 sited in Ocean Shores)
Level 2 charging stations	25 total stations (5 stations each at 5 sites in Ocean Shores)	25 total stations (5 stations each at 5 sites in Ocean Shores)

Description of scenario and assumptions: In this model, a group of six businesses located in Ocean Shores contributes to a funding pool that is used to subsidize the cost of deploying a network of charging stations that enables EV travel to and within the region. Each of these businesses acts as a site host to one or more station owned and operated by a charging service provider. Of these hosts, five businesses each host five Level 2 charging stations and one business hosts a single DC fast-charging station. Each business expects to gain $1 in increased revenue per minute that EV drivers spend charging at their site, with a maximum expected additional revenue per charging session of $25. Each business agrees to contribute 10 percent of the actual revenue stream each year to the funding pool. Based on these assumptions, total annual contributions to the funding pool grow from $28,000 in the first year to $84,125 in the tenth year.

Financial performance: The financial analysis results, presented in Table 9, show that:

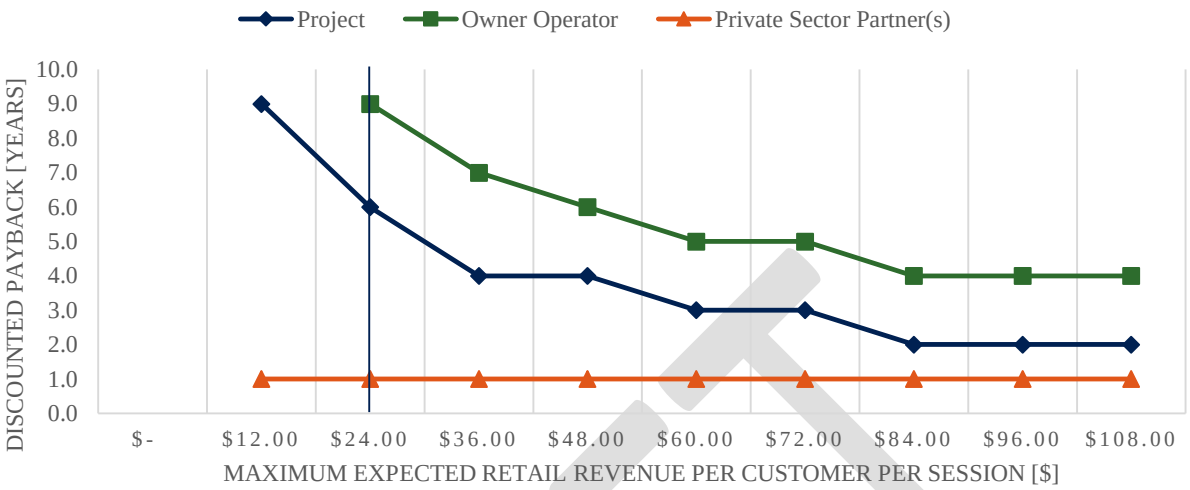
- Station deployment costs a total of $501,500.
- The owner operator funds the station deployment with a mix of private-sector loans and equity. The owner operator also receives between $28,000 and $84,125 annually from the funding pool. The NPV of the project for the owner operator is +$49,439 and the project reaches payback in 9 years. As a result, the business model is sustainable from the owner operator perspective. However, the business model still may not attract owner operators because the payback period of 9 years may be too long for some businesses.
- The local businesses collectively contribute between $28,000 and $84,125 annually into a funding pool that is provided to the owner operator as a cash transfer and appears revenue on the owner operator's balance sheet. The NPV of the project from the perspective of the local businesses collectively is +$206,566. The local businesses realize instant payback because they simply pay a percentage of their estimated revenues and do not contribute upfront funds towards capital investment.

Table 9: Results of Financial Analysis of Applying Business Model 2 to Enable BEV Travel to, from, and within Ocean Shores

FINANCIAL METRIC	RESULT
Total project level perspective	
Total capital investment (spent on charging station deployment)	$501,500
NPV	+$256,870
Payback period	6 years
Owner operator perspective	
Funds spent on stations (equity)	$200,600
Funds spent on stations (loans)	$300,900
NPV	+$49,439
Payback period	9 years
Collective funding pool perspective (6 businesses)	
Amount of funds transferred to owner operator annually	$28,000 - $84,125
NPV	+$206,566
Payback period	1 year

Greater revenue per customer decreases the payback period from the owner operator perspective. The owner operator's payback period would be shorter if they were to receive additional money from the funding pool, as a result of greater increases in retail spending by EV drivers when they charge at local businesses. This is because local businesses contribute a percentage of these estimated increased revenues to the funding pool. If the maximum revenue increase per charging event is 50 percent higher ($36 instead of $25) then the payback period for the owner operator is 7 years, as shown in Figure 9. For the owner operator to reach payback within 5 years, the estimated maximum revenue per charging event must be greater than $60.

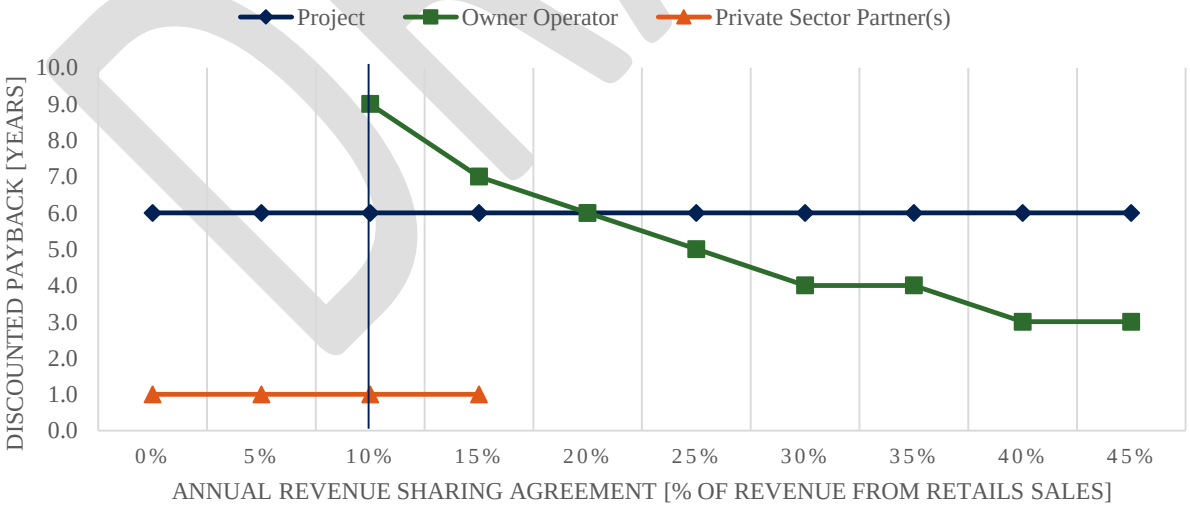
Figure 9: Business Model 2 Project NPV (Maximum Retail Revenue Sensitivity)



Dark vertical line indicates base case scenario assumption value.

Increasing the share of revenue to the funding pool significantly decreases the payback period from the owner operator perspective. The owner operator can reach payback within 5 years if the local businesses contribute 25 percent of their revenues to the funding pool, as shown in Figure 10. However, local businesses may not be willing or able to contribute such a high fraction of revenues, depending on their profit margins on their core business.

Figure 10: Business Model 2 Project Payback (Revenue Increase Percent Shared by Local Businesses with Station Owner Operator Sensitivity)



Dark vertical line indicates base case scenario assumption value. This Figure shows that if local businesses contribute 10 percent of their increased EV revenue to the project, the owner operator's payback period is 9 years. If the local businesses contribute 20 percent of increased EV revenue, payback is in 6 years. To achieve payback in 5 years – a common industry practice – businesses must contribute 25 percent of their EV revenue to the project.

A potentially attractive proposition for local businesses. The analysis shows that this business model may be highly attractive to local businesses—as long as estimated revenue increases are actually realized. However, it is difficult for local businesses to reliably estimate potential revenue increases from offering EV charging on site; this may present a challenge for garnering local business participation in this business model.

Applying Business Model 2 Summary

- Under the base case assumptions, the business model is sustainable from the owner operator perspective, but the 9-year payback period may be too long to be compelling for some businesses.

- Owner operator payback is sensitive to the amount of indirect revenues realized by local businesses and the percentage of those revenues that they share with the owner operator. The owner operator can reach payback within 5 years if the estimated maximum indirect revenue per charging event is greater than $60 (2.4 times the base case value of $25). On the other hand, if local business share less than 10 percent of their additional indirect revenues from on-site charging stations then, under base case assumptions, the business model becomes unsustainable for the owner operator.

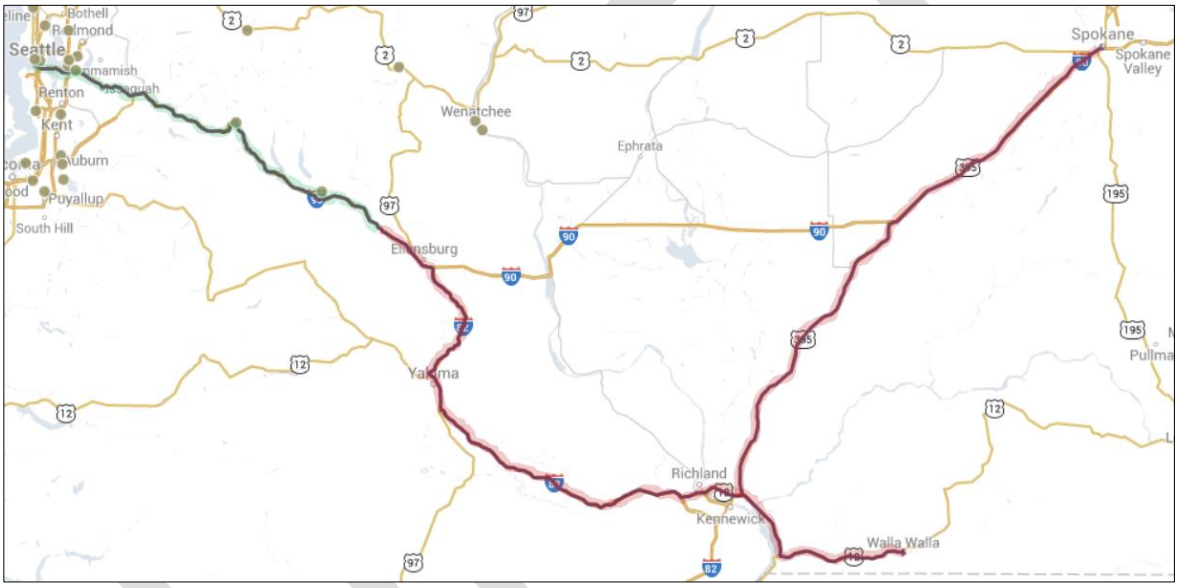
- The local businesses realize instant payback because they simply pay a percentage of their estimated revenues and do not contribute upfront funds towards capital investment—but if the real or perceived indirect value of charging stations is low, then local businesses may not participate in this business model.

Applying Business Models 1 & 2 in Combination to Enable EV Travel to and within Tri-Cities and Walla Walla

Business Models 1 and 2 were applied in combination to enable travel to, from, and within the Tri-Cities and Walla Walla areas.

Geographic description of infrastructure gap: DC fast charging station availability is insufficient to enable BEV travel along major roadways to and from tourism destinations in the Tri-Cities and Walla Walla areas from populated areas, such as Spokane and the Puget Sound region, as shown in Figure 11. Also, Level 2 stations are relatively sparse within the destination region, with two publicly available Level 2 stations in the Tri-Cities area and one in Walla Walla.

Figure 11: Existing DC Fast Charging Stations Along Major Roadways to Walla Walla and Tri-Cities from Seattle and Spokane



Brown circles (●) indicate locations of existing DC fast charging stations. Lengths of road highlighted in green (▬) indicate sections along the route where BEV travel is currently possible using existing publicly accessible DC fast charging stations. Lengths of road highlighted in red (▬) of road indicate sections along the route where BEV travel is currently not possible using existing publicly accessible DC fast charging stations.

Reason for considering this gap: Demand for EV charging services can be expected to be relatively high along these routes and at these destinations for two reasons. First, the Tri-Cities region is an energy sector employment center, where employees at workplaces such as the Columbia Generation Station, the Hanford Site, and the Pacific Northwest National Laboratory may be likely to demand EV charging services. Second, Walla Walla and the Tri Cities are popular tourism destinations, with over 300 wineries, and may be a likely destination for BEV travelers.

Additional infrastructure needed and siting considerations: The locations of additional DC fast charging stations needed to address this infrastructure gap are presented in Figure 12. The number of DC fast charging stations needed is presented in Table 10, along with the estimated number of Level 2 charging stations based

on the assumption that ten commercial site hosts (five in the Tri-Cities area and five in the Walla Walla area) each deploy five Level 2 stations at their place of business.

Figure 12: Candidate Locations of Additional DC Fast Charging Stations Deployed to Enable BEV Travel along Major Roadways to Walla Walla and Tri-Cities from Seattle and Spokane

Orange circles (●) indicate candidate locations of new DC fast charging stations based on stations situated 40 mile apart. Red circles (●) indicate additional candidate locations of DC fast charging stations at 20 mile spacing. Circles marked with a grey square (■) indicate stations that were necessarily sited in rural areas (far from existing commercial locations), which may be more costly to deploy, less convenient to use, and present fewer opportunities to capture indirect revenue. Brown circles (●) indicate locations of existing DC fast charging stations. Not shown in the figure are 50 Level 2 stations, five stations each at ten total sites in the Tri-Cities and Walla Walla areas.

Table 10: Charging Stations Deployed Using Business Models 1 & 2 to Enable BEV Travel to Walla Walla and Tri-Cities from Seattle and Spokane, under Two Scenarios

STATION TYPE	MINIMUM DEPLOYMENT SCENARIO (40-MILE SPACING)	DENSER DEPLOYMENT SCENARIO (20-MILE SPACING)
DC fast charging stations	10 (8 sited along major roadways in commercial locations, 0 sited along major roadways in rural, non-business locations, 1 sited in the Tri-Cities area, and 1 sited in Walla Walla)	26 (17 sited along major roadways in commercial locations, 7 sited along major roadways in rural non-business locations, 1 sited in the Tri-Cities area, and 1 sited in Walla Walla)
Level 2 charging stations	50 (5 stations each at 10 total sites in the Tri-Cities and Walla Walla areas)	50 (5 stations each at 10 total sites in the Tri-Cities and Walla Walla areas)

Description of scenario and assumptions: This scenario models a combination of the two business models. In this model, a large business that benefits from expanded access to EV charging infrastructure gives $95,000 of upfront funding to an EV charging service provider. The payment of $95,000 is based on the assumption that the funding partner expects indirect value of $7,000 for each DC fast charging station and $500 for each Level 2 charging station over the operational life of the equipment. In this case, the private partner is willing to transfer 100 percent of this expected value to the owner operator to subsidize station deployment. The estimated indirect value of each charging station to the funding partner is based on the automaker marketing calculation presented at the Business Models Workshop and included in a forthcoming section of this report. This cash transfer amounts to 20 percent of the DC fast charging and Level 2 charging station equipment cost.

In addition, a group of twelve small businesses located in the Tri-Cities and Walla Walla areas contribute to a funding pool that provides additional funding to the EV charging service provider. Each of these businesses acts as a site host to one or more stations owned and operated by a charging service provider. Among these businesses, ten host five Level 2 charging stations each and two host a single DC fast charging station. Each business expects to gain $1 in increased revenue per minute that EV drivers spend charging at their site, with a maximum expected additional revenue per charging session of $25. Each business agrees to contribute 10 percent of this revenue stream each year to the funding pool. Based on these assumptions, total annual contributions to the funding pool grow from $66,850 in the first year to $179,100 in the tenth year.

Together, these funds from the large and small businesses are used to subsidize the cost of deploying of a network of charging stations that enables EV travel to and within the region.

Financial performance: The financial analysis results, presented in Table 11, show that:

- Station deployment costs a total of $1,385,185.
- The owner operator funds the station deployment with a mix of private-sector loans and equity. The owner operator also receives $95,000 initially and between $66,850-$179,100 annually from the funding partner and funding pool. The NPV of the project for the owner operator is +$96,384 and the project reaches payback in 9 years. As a result, the business model is sustainable from the owner operator perspective. However, the business model still may not attract owner operators because the payback period of 9 years may be too long for some businesses.
- The funding partner contributes $95,000 initially to the owner operator. The local businesses collectively contribute between $66,850-$179,100 annually into a funding pool that is transferred to the owner operator. The NPV of the project for the perspective of the funding partner and the local businesses collectively is $399,199. The local businesses realize instant payback since they simply pay a percentage of their estimated revenues and do not contribute upfront funds towards capital investment.

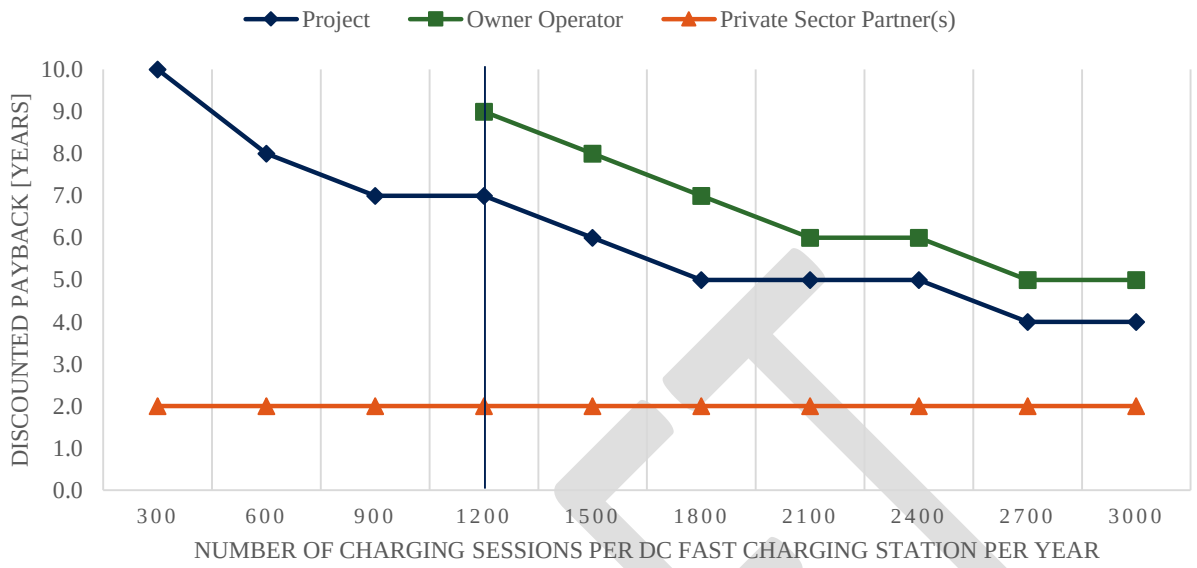
Table 11: Results of Financial Analysis of Applying Business Models 1 & 2 to Enable BEV Travel to Walla Walla and Tri-Cities from Seattle and Spokane

FINANCIAL METRIC	RESULT
Total project level perspective	
Total capital investment (spent on charging station deployment)	$1,385,185
NPV	+$497,424
Payback period	7 years
Owner operator perspective	
Funds spent on stations (equity)	$554,074
Funds spent on stations (loans)	$831,111
NPV	+$96,384
Payback period	9 years
Funding partner/pool perspective	
Amount of funds transferred to owner operator initially	$95,000
Amount of funds transferred to owner operator annually	$66,850-$179,100
NPV	$399,199
Payback period	2 years

Payback for the owner operator is highly sensitive to station utilization. The base case financial analysis assumes that each station will experience 1,200 DC fast charging sessions per year (3.3 sessions per day) in the first year. Figure 13 shows that if initial station utilization is greater than 3,000 charging sessions per year (8.2 sessions per day), then the owner-operator realizes a payback within five years. However, if the initial DC fast charging station utilization is below 1,200 charging sessions per year (2.7 sessions per day), the project is not financially sustainable for the owner operator. This is shown in Figure 14 (the NPV of the project falls below zero).

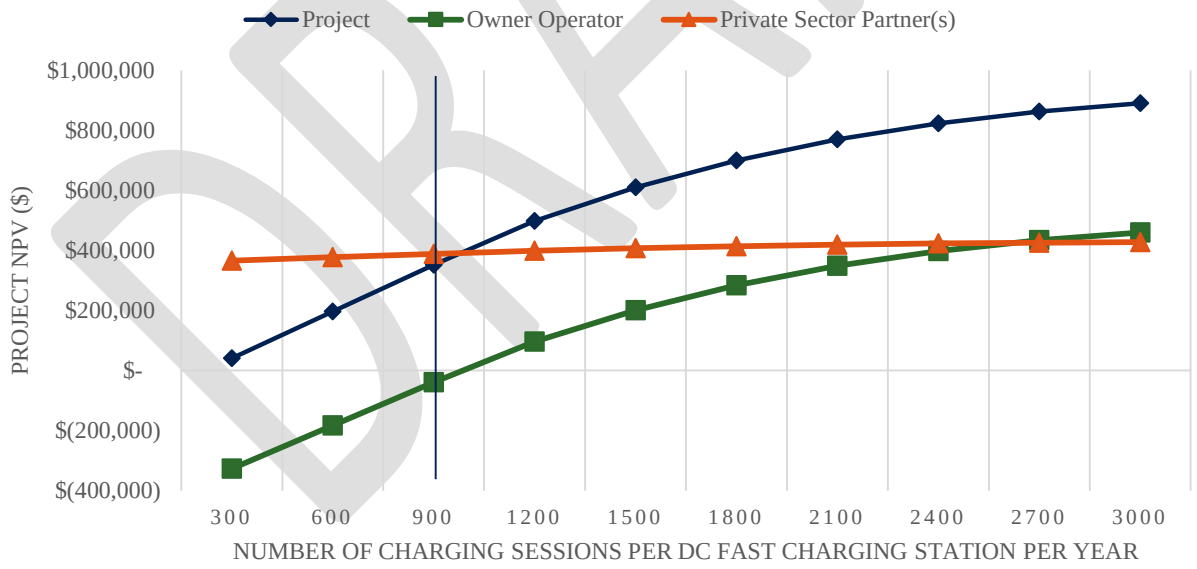
From the perspective of the business funding partner/funding pool, the financial performance of the project is not very sensitive to station utilization, as shown in Figure 14. This is because the indirect value to the business funding partner (Business Model 1 private partner) are not dependent on station utilization and because the indirect value to the funding pool contributors (Business Model 2 local businesses) varies very little with station utilization (because they simply pay a percentage of their revenues to the pool).

Figure 13: Business Models 1 & 2 Project Payback (DC Fast Charging Utilization Sensitivity)



Dark vertical line indicates base case scenario assumption value.

Figure 14: Business Models 1 & 2 Project NPV (DC Fast Charging Utilization Sensitivity)

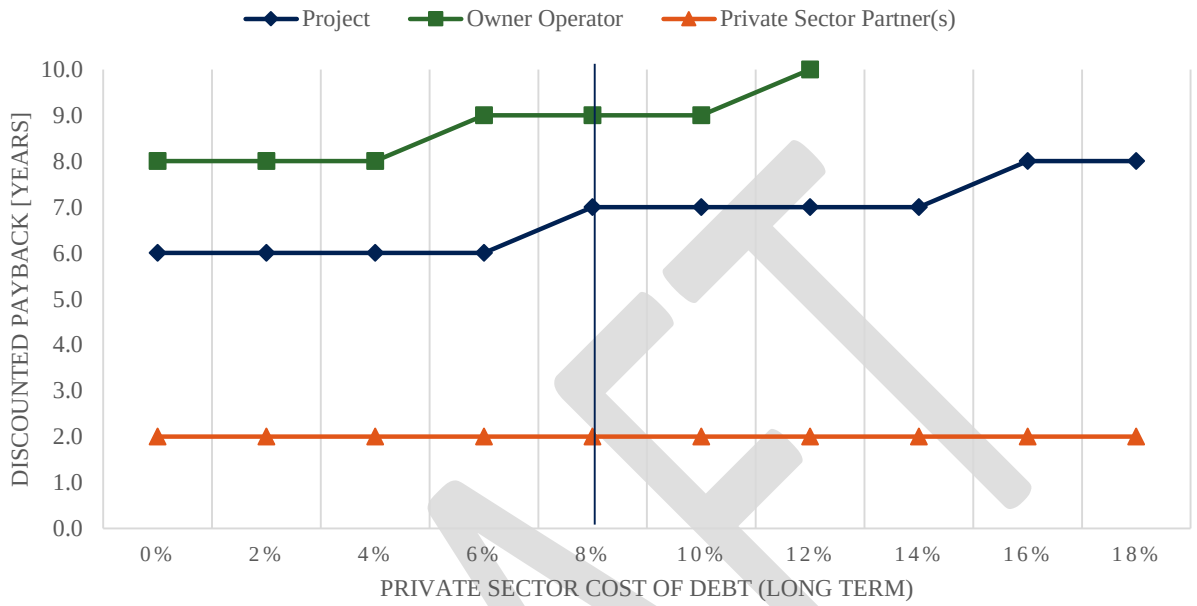


Dark vertical line indicates base case scenario assumption value.

Payback for the owner operator is also sensitive to the cost of debt (the interest rate on private-sector loans). The base case financial analysis assumes that the cost of debt to the owner operator is 8 percent. Figure 15 shows that if the cost of debt were to be lowered to 2 percent, then the owner operator could realize payback within 8 years. However, it is highly unlikely that private lenders would provide loans to the owner operator, or any business, at a 2 percent interest rate. In fact, it is quite possible that private lenders would perceive an EV charging

business venture as relatively risky, and charge a higher interest rate. If the owner operator cannot obtain loans at an interest rate at or below 10 percent, then the project is not financially sustainable.

Figure 15: Business Models 1 & 2 Project Payback (Cost of Debt Sensitivity)



Dark vertical line indicates base case scenario assumption value.

Applying Business Models 1 and 2 Summary

- Under the base case assumptions, the business model is sustainable from the owner operator perspective, but the 9-year payback period may be too long to be compelling for some businesses.
- Payback for the owner operator is highly sensitive to station utilization. If initial station utilization is greater than 3,000 charging sessions per year (8.2 sessions per day), then the owner-operator realizes a payback within five years. However, if the initial DC fast charging station utilization is below 1,200 charging sessions per year (2.7 sessions per day), the project is not financially sustainable for the owner operator.
- Payback for the owner operator is also sensitive to the cost of debt (the interest rate on private-sector loans). The base case financial analysis assumes that the cost of debt to the owner operator is 8 percent. If the owner operator cannot obtain loans at an interest rate at or below 10 percent, then the project is not financially sustainable.
- As discussed in Business Models 1 and 2 above, the viability of the business model depends on the real and perceived amount of indirect value gained by funding partners and local businesses. If the indirect value of charging stations is perceived to be low, then these may not participate in this business model.

Appendix A: Financial Analysis Approach and Assumptions

DRAFT TEXT – Full model description and list of assumptions in progress.

To evaluate the business case for each player involved in these business models, the C2ES team developed a comprehensive financial analysis that can estimate the performance of a charging station network deployment project from three distinct perspectives:

- Charging station project owner operator
- External project partner (large business funding partner funder, tourism bureau, commerce chamber, or deployment "funding pool")
- State or local government

As depicted in the figure below, each perspective was modeled with its own discounted cash flow (DCF) analysis, which allows for calculation of project cash flows, internal rates of return (IRR), and payback to be calculated from each perspective. In addition, the charging station project owner operator perspective is modeled as a standalone business, with income statements, balance sheets, and cash flows that encapsulate the performance of the charging services business as an independent entity (not simply as a small project conducted by a larger existing company). The model is also capable of accounting for business funding partners or funding pool contributors who also act as charging station owner operators. An overview of the financial analysis structure and an output dashboard are presented in the figures below.

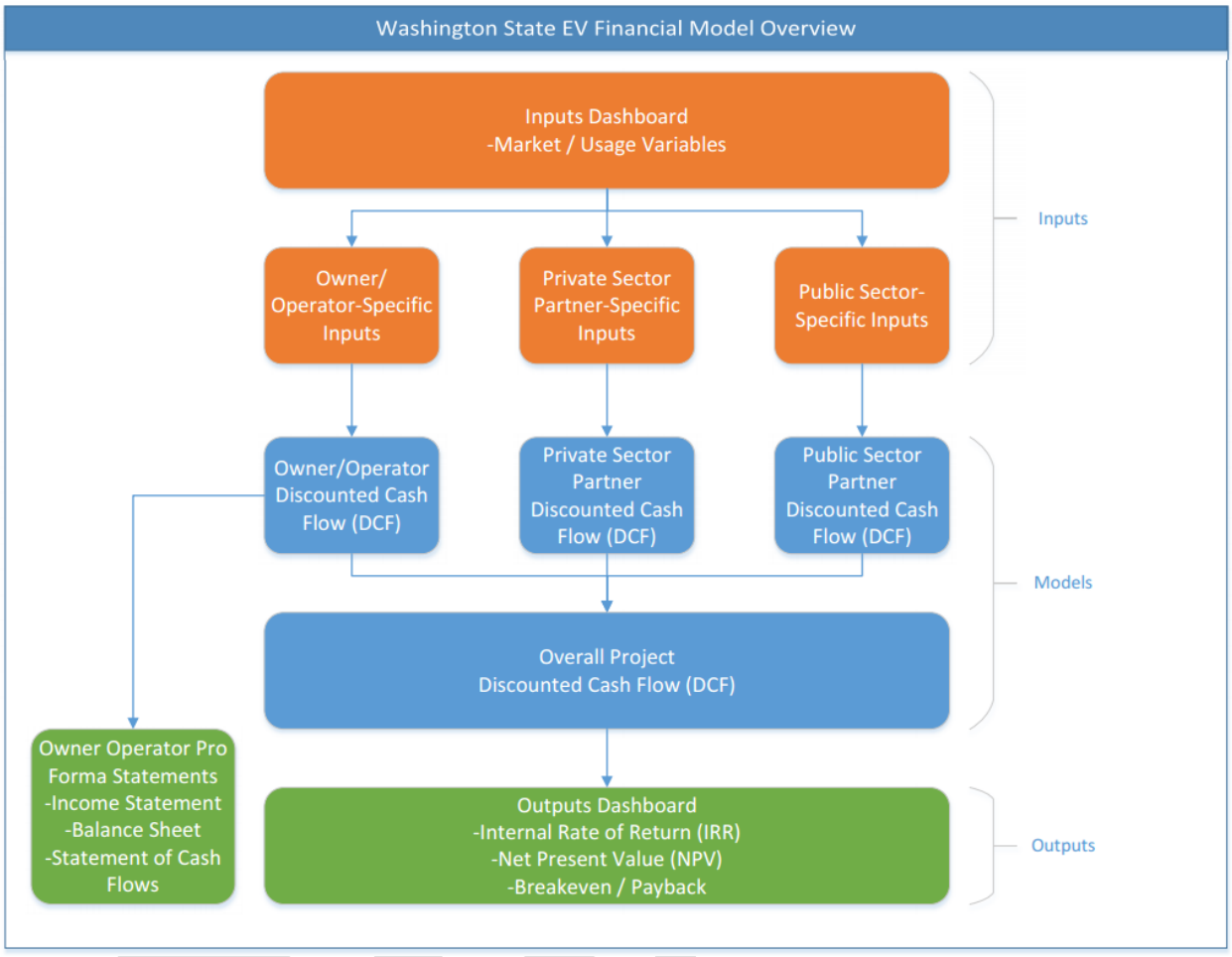
Where possible, the each scenario incorporated input data that is specific to the infrastructure gap, such as initial station utilization and number and type of stations needed.

For each of these scenarios, a "base case scenario" was provided to demonstrate the financial viability of the business model under a scenario that incorporates reasonable assumptions. These base case scenarios are accompanied by sensitivity analyses that demonstrate the critical success and failure conditions on factors such as:

- Charging station utilization (as a function of EV adoption rates)
- Number and type of charging stations deployed
- Indirect value of charging stations to funding partners
- Cost of funds
- Availability of other revenue sources, such as state funding or subscription fees

As the "value of charging" is a critical but uncertain parameter, a reasonable estimate of value of charging services to key players (e.g., increased retail sales) was used to define realistic funding contribution levels, and the sensitivity of the business model to this assumption will be quantified.

Figure 16: Overview of Financial Analysis Tool Structure



TBD: Add Financial Analysis Tool Input List here (as table with values)

---

[1] The current generation of PHEVs do not support DC fast charging, but this may change with future offerings.

[2] The "Assessing the EV Charging Network in Washington State" report section provides the rationale for this spacing requirement.