2021 DOE Vehicle Technology Office Annual Merit Review Presentation

Demonstration of Utility Managed Smart Charging For Multiple Benefit Streams

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Project ID #: elt264



This presentation does not contain any proprietary, confidential, or otherwise restricted information

Overview

Timeline

- Project Start: Oct 2020
- Project End: Dec 2023
- Percent complete: 5%

Barriers and Technical Targets

- Public Service Commission (PSC) Approval
- Developing attractive incentive structures
- Meeting enrollment expectations

Budget

- Total Project Funding: $11.4M
  - DOE Share: $5M
  - Exelon share: $6.4M
- Funding for FY 2020: $0
- Funding for FY 2021: $1.6M
- Percent complete: 5%

Partners

- Argonne National Laboratory (ANL)
- Smart Electric Power Alliance (SEPA)
- Greenlots
- Weave Grid
- Qmulus
- Project Lead: Exelon, BSC

Relevance

Overall Objective

- Research, develop, and conduct a wide-scale demonstration of a utility Smart Charge Management (SCM) system to develop optimal managed charging structures for grid value, evaluate the impact of EV charging on local distribution utility operations, and evaluate the utilities' ability to control EV charging load based on grid conditions.

Project Impacts

- Identify managed charging techniques that can be shared industry-wide
- Reduce the impact EV charging has on the utility's distribution and transmission systems
- Lessen the ratepayer capital investment required to manage EV charging demand
- Identify cybersecurity risks and vulnerabilities of EVSEs and vehicle telematics software
- Understand grid impacts of EV charging

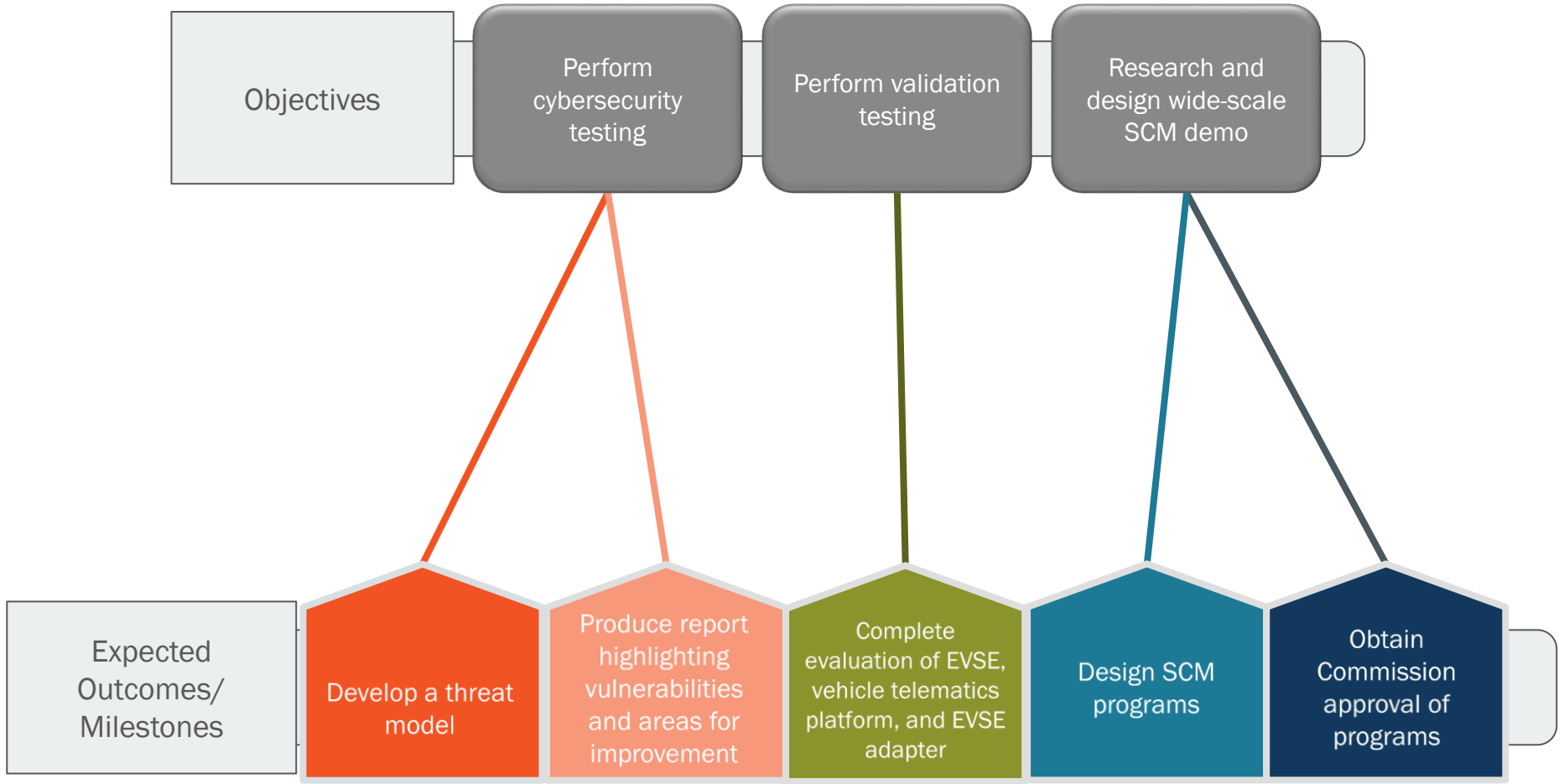
Milestones – Budget Periods 1 and 2

Month/Year	Description of Milestone Go/No-go	Status
November 2021	Produce an Attack Graph, create a threat model and produce a report highlighting vulnerabilities, areas for improvement and recommendations.	Delayed
November 2021	Identify EVSE and software telematics ability to receive DR events.	Delayed
December 2021	Publish report documenting the market research.	On-track
September 2021	Design all aspects of the SCM demonstration.	On-track
September 2021	Produce a benefit-cost analysis, ratepayer impact assessment, and detailed budget for review with the Maryland Public Service Commission (PSC). Receive PSC approval (Go/No-Go)	On-track
September 2021	Signed contracts for the delivery and installation of EVSE and smart charge devices.	On-track
July 2022	Completion of ATEAM software simulation and report summarizing findings.	On-track
February 2022	Implement customer engagement program.	On-track
December 2022	Complete cyber assessment report.	On-track
December 2022	Install 200 L2 and DCFC utility-owned public stations to be utilized for demonstration. (Go/No-go)	On-track
December 2022	Enroll 1,000 customers in SCM demonstration. (Go/No-go)	On-track

Approach - Budget Period 1

Testing, Research and Program Design

Perform cybersecurity testing and validation of the electric vehicle supply equipment (EVSE), smart adapter and vehicle telematics-based software platform's ability to provide electric grid services and research into the behavior of EV owners under different incentive structures.

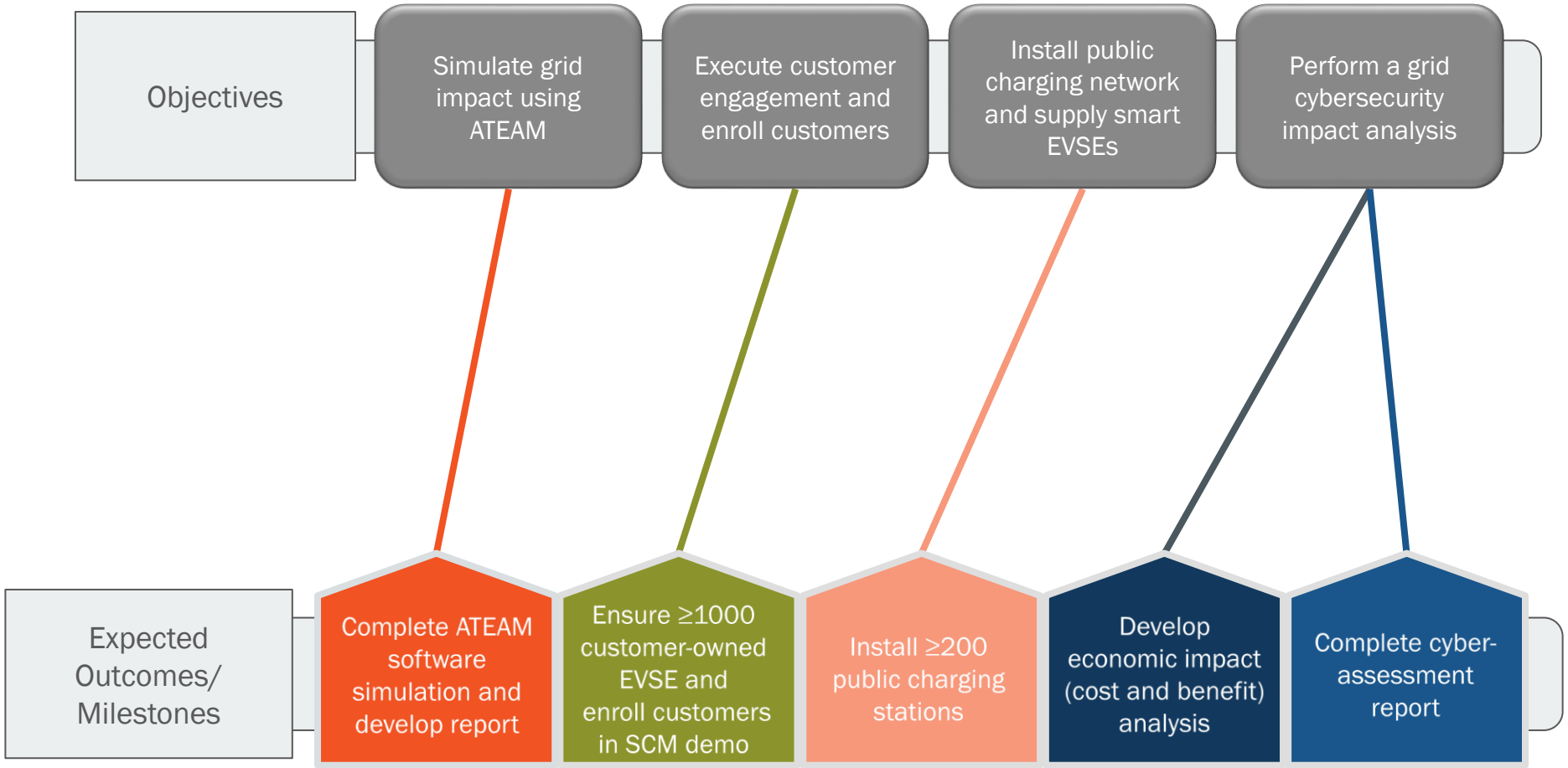


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Approach - Budget Period 2

Grid Impact Simulation, Customer Engagement and Charger/Smart Device Deployment

Simulate the impact of EV charging on the grid. Design innovative tactics that will maximize the customer participation, flexible resource availability, and grid benefits. Market programs to customers, enroll them in smart charging program. Install utility-owned charging network.



Any proposed future work is subject to change based on funding levels.

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Technical Accomplishments and Progress

Perform Market Research and Industry Interviews	• SEPA identified rate design and marketing best practices
	  • Reviewed reports that contain primary research data
	  • Performed interviews with ten utilities that already executed or participated in managed charging projects
	  • Developed memo summarizing initial research results
	• Identified several common features of successful programs
	  • Marketing that utilizes multiple channels to inform customers about the program has notably higher success.
	  • Flexibility in incentive choice, metering type, and participation in managed charging events engaged more customers and contributed to a positive customer experience.
	  • Easy access user interface to engage with program and set participation is critical. Customers prefer mobile interface.
	• Developed best practices for each customer class that will be used for program design.
	• SEPA is working on white paper that will be published and circulated
		BGE An Exelon Company
		pepco An Exelon Company
		Smart Electric Power Alliance

Design SCM programs	• Use market research gathered from smart charging demonstrations
	• Collect residential, Multi-Unit Dwelling (MUD), and public charging data
	  • Data will inform the development of smart charge measures for each customer segment & determine scope of demonstration
	  • Utilizing BGE and PHI's existing EVsmart programs
	• Develop unique incentives and smart charge actions for each customer segment to be evaluated
	• Develop a marketing and outreach program to attract the desired level of customer participation
	• Present program design to PSC working group for input
	  • PSC requests utilities utilize working group for new program design
		BGE An Exelon Company
		pepco An Exelon Company
		Smart Electric Power Alliance

Acquire EVSEs and vehicle telematics platform	• Use RFP process to determine best hardware and software platforms for running smart charge management programs
	  • Release RFPs
	  • Assess managed charging capabilities of chargers
	  • Select vendors and negotiate contract pricing and volumes
	  • Execute contracts
		BGE An Exelon Company
		pepco An Exelon Company

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Technical Accomplishments and Progress – Remainder of BP1

Develop a threat model	• Demonstrate the integrity of the EVSE or vehicle telematics software and the communication network • Develop a threat model depicting threats; vulnerabilities; and possible consequences of compromising for each of the different delineated systems within the charging infrastructure	Argonne NATIONAL LABORATORY

Produce report highlighting vulnerabilities and areas for improvement	• Utilize open-source tools to search for and identify vulnerabilities
	  • Produce assessment report and develop guidelines and best practices
	  • Attack graphs, threat models and characterization of vulnerabilities
	  • Link to National Institute of Standards and Technology (NIST) best practices and guidelines
		Argonne NATIONAL LABORATORY

Complete evaluation of EVSE, vehicle telematics platform, and EVSE adapter	• Simulate and test the provision of demand response and evaluate response times using EVSE platforms, includes integration with OpenADR 2.0b VTN for:
	  • Receiving DR events
	  • Simulating day-ahead and hour-ahead DR events
	  • Targeted DR using eiTarget attribute of OpenADR
	  • Testing response times for at different curtailment of chargers
	• Identify EVSE and vehicle telematics-based software platform's ability to meet demands of frequency regulation services
	  • Perform integration with utility frequency regulation signal source
	  • Simulate signals for Reg A and Reg D signals and test response time
	• Test vehicle telematics-based software platform's ability to perform DR, simulate utility control
		Argonne NATIONAL LABORATORY
		greenlots A Member of the Shell Group
		WeaveGrid
		QMULUS

Responses to Prior Year Reviewer's Comments

This is the first year the project has been reviewed.

Collaboration and Coordination

Stakeholder	Responsibilities
BGE An Exelon Company	Contractual Role: PRIME (EXELON BSC) • Managing the smart charge demonstrations
pepco An Exelon Company	Contractual Role: PRIME (EXLEON BSC) • Managing the smart charge demonstrations
Argonne NATIONAL LABORATORY	Contractual Role: Sub-recipient • Cyber security testing and validation • Develop threat model and vulnerability report • Grid analysis, cyber impact analysis, and economic analysis using ATEAM and ATD tools
greenlots A Member of the Shell Group	Contractual Role: Sub-recipient • EVSE hardware and network provider • Implement local or regional pricing for public charging for advanced management of DSO • Evaluate frequency regulation in laboratory simulation and small-scale physical demonstration
WeaveGrid	Contractual Role: Vendor • Provide vehicle telematics software solution • Utilize AMI and distribution network data disaggregated charging load and find existing EV customers • Evaluate ability to control EV charging load based on grid conditions at the feeder and transformer level
QMULUS™	Contractual Role: Vendor • Provide smart charge adapters to convert any non-networked EVSE into smart networked charging station • Work with network provider platform or vehicle telematics platform to provide advanced grid services
Smart Electric Power Alliance	Contractual Role: Vendor • Provide SCM program market research • Post demonstration evaluating and reporting

Remaining Barriers and Challenges

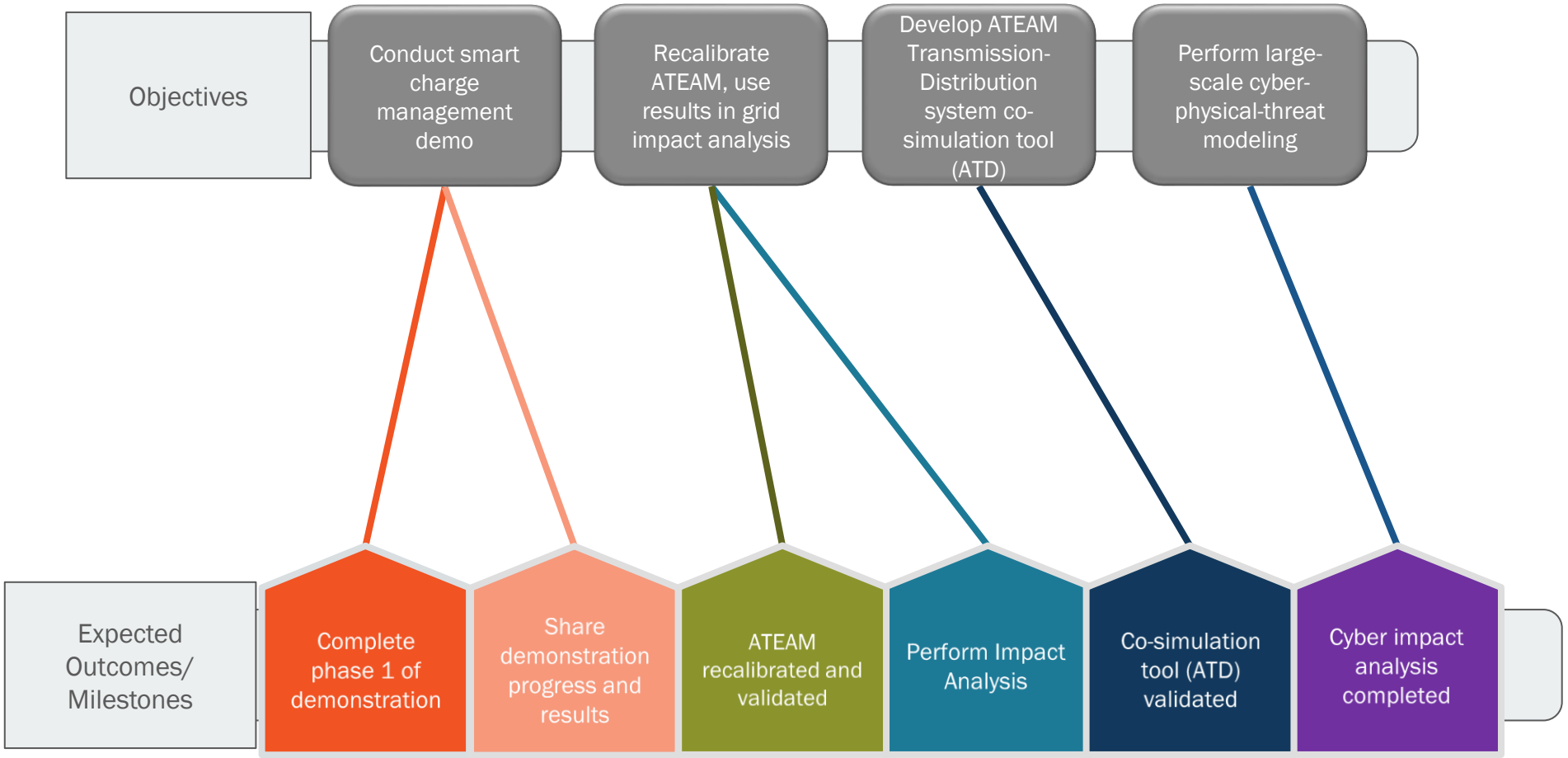
- Determine the cybersecurity vulnerabilities of the EVSE hardware, network and vehicle telematics software solution
- Determine the current managed charging functionality of the EVSE hardware, network and vehicle telematics software solution and understand gaps that need to be addressed prior to large-scale demonstration
- Must enroll at least 1,000 customers in SCM programs for each demonstration period, in BP3 & BP4
- Develop SCM program communication and control methodology
- Understand impact high EV adoption has on distribution & transmission system
- Receive project approval from PSC

Any proposed future work is subject to change based on funding levels.

Proposed Future Research - Budget Period 3

Wide-scale customer demonstration, Stage 1

Conduct the first year of utility-managed charging program under a portfolio of tactics to test customer behavior and grid impact. Evaluate impacts and adjust tactics to deliver more beneficial grid results and better drive customer behavior.

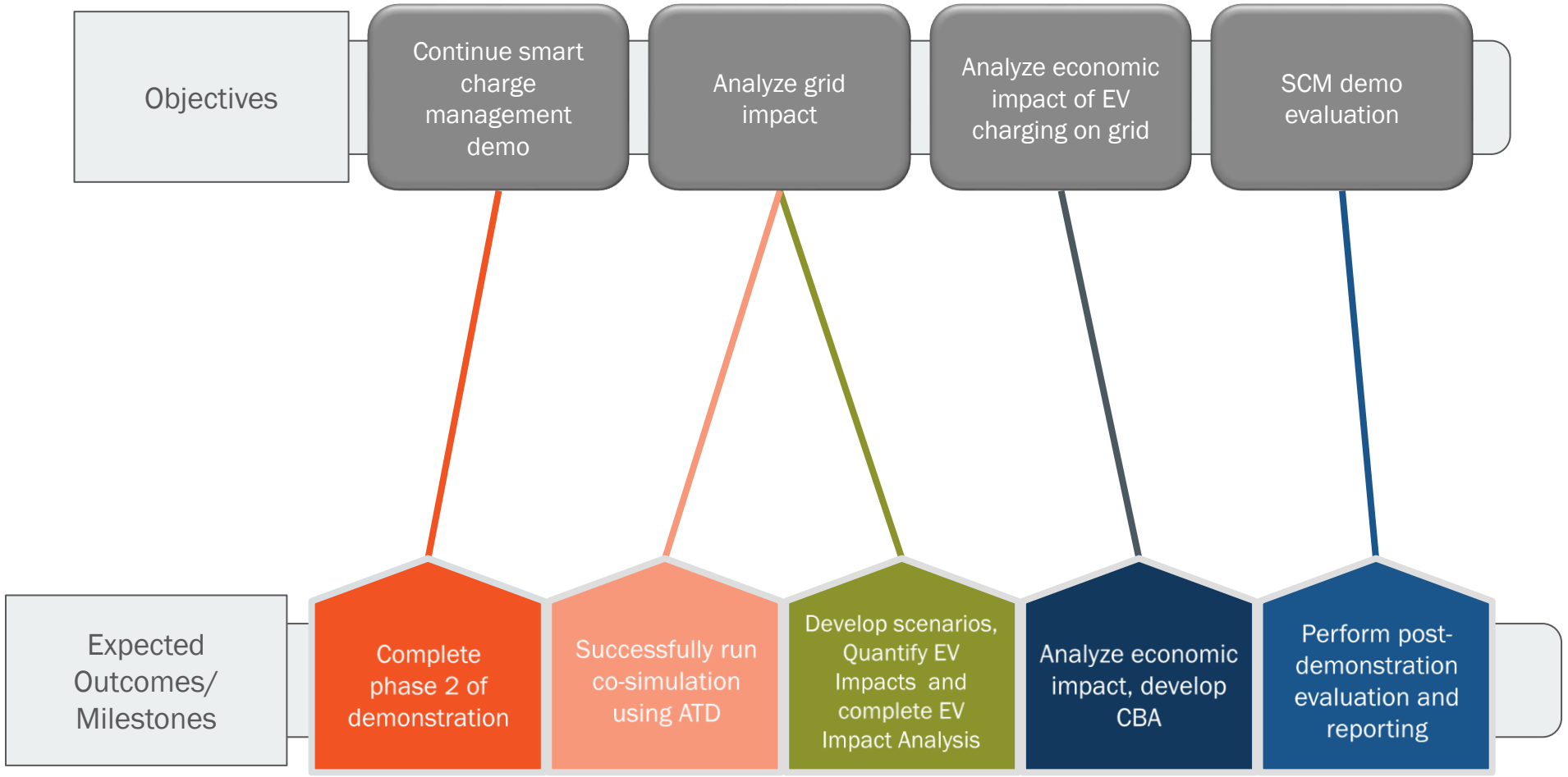


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Proposed Future Research - Budget Period 4

Customer Demonstration Stage 2, Evaluation and Reporting

Conduct the second year of managed charging demonstration. Perform analysis on customer behavior, quantify demonstration benefits, produce and share report of results.



Any proposed future work is subject to change based on funding levels.

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Summary

What we're working on:

- Continue to perform market research
- Finish cybersecurity and validation testing plans
- Execute SCM program design and develop marketing/outreach strategy

What's coming next:

- Request Public Service Commisison Approval
- Install charging network
- Understand EV charging impact
- Enroll customers in SCM programs

What we're building towards:

- Perform wide-scale SCM demonstration
- Analyze grid impact
- Perform post-demonstration evaluation and reporting

Any proposed future work is subject to change based on funding levels.