EV Charger Regulatory Asset Base (RAB) Model - Version 1.0

Interactive web dashboard of model available here

Briefing Notes

Overview

This briefing document provides an introduction to the EV Charger Regulatory Asset Base (RAB) Model, which simulates the financial implications of a large-scale electric vehicle charging infrastructure rollout. The model calculates how such an investment would impact household electricity bills over a 15-year period.

Purpose of the Model

The model answers critical questions for policymakers and regulators:

- What are the bill impacts of a significant EV charging infrastructure investment?
- How do key parameters like deployment rate, capital costs, and financing costs affect outcomes?
- What is the total revenue requirement to support the investment?
- How do costs evolve over time as the asset base matures?

Key Model Structure

Core Components

1. **Phased Rollout**: The model assumes a fixed number of chargers installed annually for the first 6 years.
2. **Regulatory Asset Base**: Tracks the value of assets as new investments are added and existing assets are depreciated.
3. **Revenue Requirement**: Calculated based on:
    - Return on capital (WACC × average RAB)
    - Operating expenses
    - Regulatory depreciation
    - Less any third-party revenue or shared asset offsets
4. **Bill Impact**: Spreads the revenue requirement across the customer base.

Financial Methodology

- **Straight-line Depreciation**: Each cohort of chargers is depreciated evenly over its asset life
- **Period-specific WACC**: Different weighted average costs of capital for years 1-5, 6-10, and 11-15
- **RAB Roll-forward**: Opening RAB + Additions – Depreciation = Closing RAB

Base Case Assumptions

Parameter	Base Case Value	Description
Chargers Per Year	5,000	Number of chargers installed in each of years 1-6
CapEx Per Charger	$6,000	Capital expenditure per charger
OpEx Per Charger	$500	Annual operating expense per charger
Asset Life	8 years	Depreciation period for each charger
WACC (Years 1-5)	5.8%	Post-tax weighted average cost of capital, first regulatory period
WACC (Years 6-10)	6.0%	Second regulatory period
WACC (Years 11-15)	5.5%	Third regulatory period
Customer Base	1,800,000	Number of households over which costs are spread
Third-Party Revenue	$100	Annual per-charger revenue from non-regulated sources
Shared Asset Offset	$0	Annual per-charger offset for shared asset usage

Alternative Scenarios Modeled

1. High Cost Case

Represents a more conservative set of assumptions with higher costs:

- **CapEx Per Charger**: $9,000 (+50% vs base case)
- **OpEx Per Charger**: $750 (+50% vs base case)
- **WACC (Years 1-5)**: 5.85% (slightly higher than base case)

2. Low Cost Case

Represents a more optimistic outcome with lower costs:

- **CapEx Per Charger**: $4,500 (-25% vs base case)
- **OpEx Per Charger**: $400 (-20% vs base case)
- **WACC (Years 1-5)**: 5.0% (lower financing costs)

3. More Chargers

Tests the impact of a more aggressive rollout schedule:

- **Chargers Per Year**: 7,500 (+50% vs base case)
- All other parameters unchanged from base case

Key Metrics and Outputs

The model produces several important outputs for each scenario:

1. **Annual Bill Impact**: The year-by-year impact on household bills
2. **Cumulative Bill Impact**: The running total of bill impacts over the 15-year period
3. **Peak Bill Impact**: The maximum annual impact on bills and the year in which it occurs
4. **Average Bill Impact**: The average annual impact across the 15-year period
5. **Total Revenue Requirement**: The cumulative amount needed to fund the investment
6. **RAB Evolution**: How the regulatory asset base grows and declines over time

Sensitivity Analysis

The model includes tornado charts to help visualize which parameters have the greatest influence on outcomes. Key sensitivities examined include:

1. **WACC**: Tests various costs of capital from 4.25% to 6.75%
2. **Chargers Per Year**: Tests deployment rates from 2,500 to 7,500 per year
3. **CapEx Per Charger**: Tests capital costs from $4,500 to $7,500 per charger

Headline Insights

The model reveals several critical insights about EV charger deployment:

1. **Bill Impact Trajectory**: The annual household bill impact typically peaks around Year 6-7 when deployment is complete, then gradually declines as assets depreciate. This creates a "hump-shaped" cost profile over time.

2. **Cost Magnitude**: In the base case scenario, the average annual bill impact is approximately $20-30 per household, with cumulative costs over 15 years reaching around $300-450 per household.

3. **Capital vs. Operating Costs**: Capital costs drive approximately 70-75% of the total bill impact, while ongoing operating costs account for 25-30%. This highlights the importance of achieving competitive installation costs.
4. **Deployment Scale Trade-offs**: A 50% increase in charger deployment (from 5,000 to 7,500 annually) increases peak bill impacts by approximately 50%, creating a direct scaling relationship.
5. **Cost Sensitivity**: The model demonstrates that bill impacts are most sensitive to:
    - Capital costs per charger (highest sensitivity)
    - Number of chargers deployed (medium sensitivity)
    - Cost of capital/WACC (lower but still significant sensitivity)
6. **Recovery Timeline**: Approximately 75% of the total 15-year bill impact occurs in the first 8 years, during and immediately after the deployment phase.
7. **Scenario Range**: Across the modeled scenarios, the cumulative bill impact varies by a factor of roughly 2.5x between the most optimistic and most conservative cases, demonstrating the importance of effective cost management.

Using the Interactive Dashboard

The model is implemented as an interactive Streamlit dashboard available here.

The python code is available here.

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