EV Charger Regulatory Asset Base (RAB) Model

Version 2.0 - Interactive dashboard here | python code here

The Kerbside Charger Model provides a framework for evaluating the economic impacts of large-scale EV charging infrastructure deployment. It provides an overview of the financial costs of deployment, the distributional impacts on household bills, market competition dynamics, and a range of variable parameters to model the risk of technology obsolescence, efficiency decay, and deployment delays.

Purpose of the Model:

The model aims to provide policymakers, regulators, and industry stakeholders with an open-source tool to support decisions about the future of EV charging infrastructure in Australia. It calculates how such an investment would impact household electricity bills over a 15-year period, to address critical questions facing policy makers:

- What are the bill impacts of a significant EV charging infrastructure investment?
- What is the distributional impact across different household income levels?
- How do risks surrounding deployment rate and efficiency affect outcomes?
- How might RAB investment affect private market development?

Structure of the Model:

1. **Phased Rollout**: The model assumes a configurable number of chargers installed annually for a specified deployment period, with flexibility to account for implementation delays.

2. **Regulatory Asset Base**: Tracks the value of assets as new investments are added and existing assets are depreciated, with variable parameters for technological obsolescence and early asset retirement.

3. **Revenue Requirement**: Calculated based on:
    - Return on capital (WACC × average RAB)
    - Operating expenses with efficiency adjustments
    - Regulatory depreciation

4. **Bill Impact**: Spreads the revenue requirement across the customer base with additional analysis of impacts by income quintile, highlighting equity and affordability considerations.

5. **Market Competition**: Analyses the relationship between RAB investments and private market development, with variables for potential displacement effects.

Financial Methodology:

- **Straight-line Depreciation**: Each cohort of chargers is depreciated evenly over its asset life.
- **WACC**: We have used the regulatory vanilla WACC set out in the final decision by the AER of 5.95% over the period.
- **RAB Roll-forward**: Opening RAB + Additions – Depreciation – Obsolescence Write-offs = Closing RAB
- **Efficiency Adjustments**: Operating costs can be adjusted by an efficiency factor that can degrade over time, reflecting real-world operational challenges.

Model Parameters:

Deployment Parameters	**Default Value**	**Description**
Chargers Per Year	6000	Number of chargers deployed annually
Deployment Period	5 years	Number of years during which chargers are deployed
Deployment Delay Factor	1.0	Multiplier affecting deployment speed (>1 means slower deployment)
Market Displacement Rate	0%	Rate at which RAB deployment displaces private market investment (0-100%)
Obsolescence Rate	5%	Annual rate at which technology becomes obsolete, potentially requiring early replacement.

Financial Parameters	**Default Value**	**Description**
CapEx Per Charger	$6000	Capital expenditure per charger
OpEx Per Charger	$500	Annual operating expense per charger
Customer Base	1,800,000	Number of customers over which costs are spread
Asset Life	8 years	Depreciation period for each charger
WACC	5.95%	Post-tax weighted average cost of capital (subject to regulation)
Efficiency Factor	1.0	Operational efficiency multiplier (1.0 = fully efficient, >1.0 = inefficient)

Analysis Modules:

The model has five integrated tabs to highlight different aspects of EV charger deployment.

1. **Financial Overview:** This contains a high level summary of the total revenue requirement and cost schedule over the analysis period. It also breaks down the average, peak and cumulative impact on household bills.

2. **Asset Evolution:** A simple visualisation of the growth and decline phases of the Regulated Asset Base, including cumulative additions, depreciation, and any technological obsolescence.

3. **Distributional Impact:** Analysis of the differential impact of average increase in energy costs across household income quintiles. Lower income households pay more as a percentage of their income and energy costs, and yet derive less benefit from EV charger deployment since they are less likely to own an electric vehicle.

4. **Market Competition Effects:** Currently, this is a crude visualisation showing an arbitrary impact on the incentive to private market development. Our assumption is that the RAB model will significantly displace and suppress private capital investment in kerbside charging, and may also have flow-on effects for other charger markets, such as DC public fast charging. We will build out the alternative investment scenario based on public-private investment models such as the LEVI model successfully deployed in the UK.

5. **Monte Carlo Analysis:** Tests parameter sensitivity through probabilistic simulation across a distribution of likely ranges. Demonstrates a distribution of bill impacts across multiple scenarios and confidence intervals, and aids in analysis of risk factors by demonstrating which inputs most significantly impact outcomes.

   The risk intervals used in this analysis:

Appendix: Questions for Peer Review

Deployment parameters:

- Are our default parameter values reasonable for the Australian market?

- Are there known differences in the cost profile of deployment in different geographies - eg. rural vs urban?

- How might we better model technology obsolescence for chargers? It seems less like a *rate* of decay, and more like a probability of being superseded entirely. Should this be modelled as accelerated depreciation or treated as a discrete write-off?

- Market impacts - beyond simply modelling the displacement of private investment, how do we account for:
  - the potential suppression of competing hardware/solutions when large-scale public procurement locks in a single technology?
  - And if a disruptive technology emerges, what is the true cost of switching or retrofitting once capital is already sunk into less-competitive infrastructure?
  - Example: *NBN is a financial albatross for Australia with highest cost, lowest internet speeds*

Financial methodology:

- Given the regulated WACC period covers 2024-2029, what would an appropriate adjustment be to the WACC over the subsequent 10 year period?

- Is the 15 year analysis period appropriate, or should it be reduced considering the rate of technological development in this market?

- Any insights/analogues for modelling efficiency factors and degradation especially for regulated monopolies operating non-core technologies? One thought here is to model it on both sides - ie. a learning curve during which there are deployment efficiencies/economies of scale, followed by a period of degradation when operating this asset class alongside core business.

- Are there any other risk factors we should be modelling in that we aren't? Ie. charger underutilisation?

Model functionality:

- Are there any visualisations / data points that would enhance the usefulness of this model from a policy / regulatory perspective?

- Did you identify any bugs in the UI or calculations that made the model more difficult to use?