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Aligning System and Distribution-Level Forecasts

California Demand Analysis Working Group

Andy, Sukenik, Itron

November 17, 2026

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Section 1

1

Itron's Recommended Approach

Alternatives considered, geographic resolution, zonal-to-unified bridge, six-step approach, geospatial allocation, double-counting, known-load reconciliation, and critical data inputs

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Alternative Approaches Considered

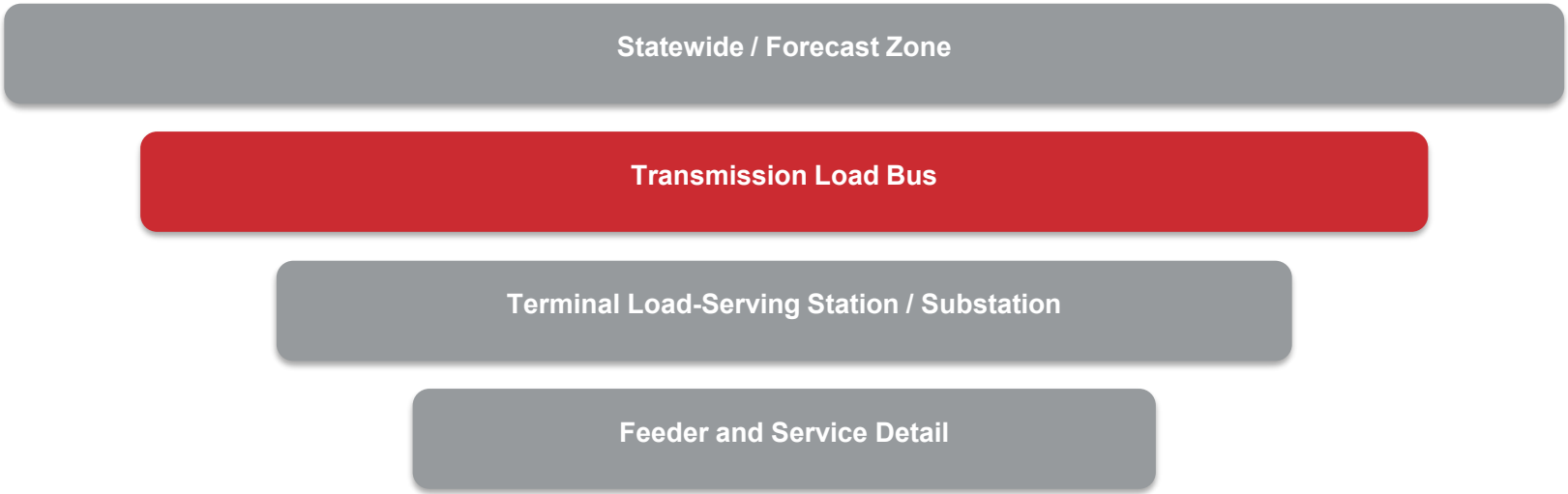
Approach	Assessment
Pure top-down allocation	Useful as a short-term benchmark, but likely insufficient on its own for local reliability and distribution planning.
Pure bottom-up IOU aggregation	Important comparison source; reconciliation requires consistency across IOU methods.
Project-specific overlay	Could be included as a component of the recommended framework, especially for known and pending loads.

Proposed Approach: **Leverages the strengths of each approach.**

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Initial Geographic Resolution

Recommended initial geographic resolution: **Transmission Load Bus level**, preserve path to increased granularity.



Near term: establish governed bus-level alignment using substation histories. Future phases can extend to finer distribution geographies where data quality and planning value justify the added complexity.

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From Forecast Zone to Transmission Load Bus

What the CEC has now, what must be added, and the resulting capability

Today: CEC Zonal Forecast

Planning area / forecast zone

- Baseline sector forecast
- Baseline transportation forecast
- Hourly forecast by PA
- Managed components and load modifiers (AAEE, AAFS, AATE, BTM PV / storage, TOU)
- Share-based allocation of load modifiers to buses

Bridge: What Is Needed

Source of each input

Cleansed SCADA and AMI histories
Source: IOUs / PTOs

Station-to-bus mapping
Source: IOUs / PTOs, CAISO

Driver-level waterfall and geospatial allocation indicators
Source: CEC, third-party data

Known and pending load overlap screens
Source: IOUs / PTOs, CEC

Calibration to system and zonal control totals
Source: CEC

Target: Transmission Bus

Hourly forecast at each WECC bus

- **Hourly forecast** at each WECC transmission load bus
- **Consistent** with CEC system and zonal control totals
- **Supports** Planning Forecast and Local Reliability Scenario
- **Repeatable** each forecast cycle

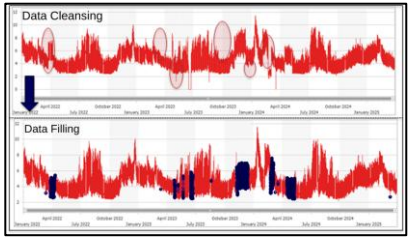
Result: one hourly forecast at each WECC bus that ties back to the CEC zonal forecast

AAEE: Additional Achievable Energy Efficiency · AAFS: Additional Achievable Fuel Substitution · AATE: Additional Achievable Transportation Electrification · TOU: time-of-use · BTM: behind-the-meter · AMI: advanced metering infrastructure

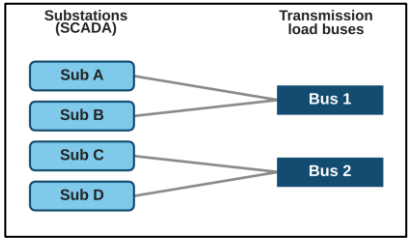
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Itron's Recommended Unified Forecasting Approach

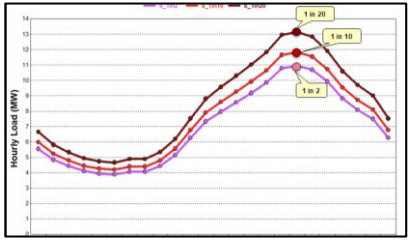
01 **Cleanse & Fill hourly substation SCADA data from each utility**



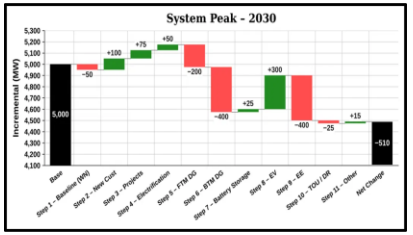
02 **Map substations to transmission load buses**



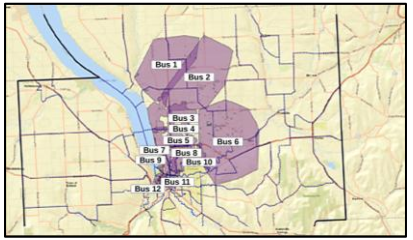
03 **Build hourly Existing Load models for each transmission load bus**



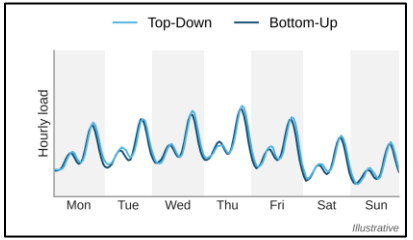
04 **Establish the Waterfall Forecast Architecture, applied by transmission load bus**



05 **Allocate waterfall drivers geospatially and treat overlaps for each transmission load bus**



06 **Calibrate the bottom-up forecasts to the zonal forecast**

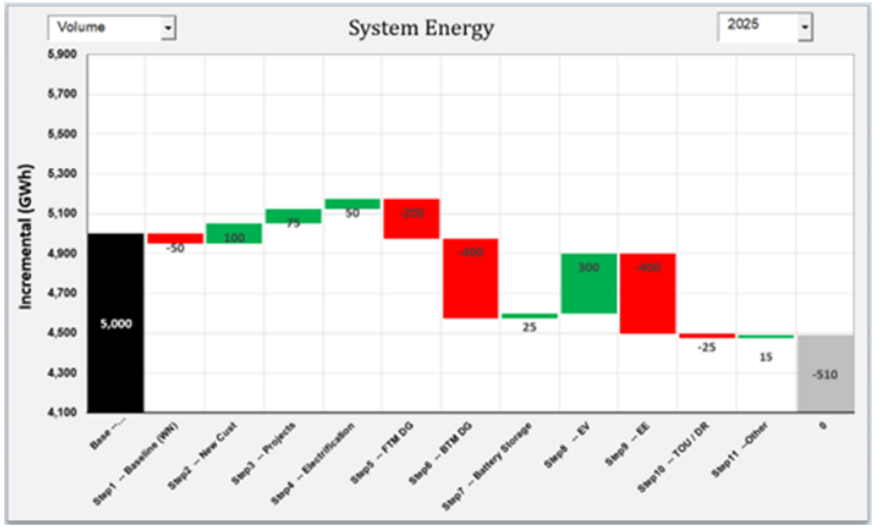


Output: Hourly forecast for each transmission load bus, by forecast component, that is consistent with the zonal forecast

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The Forecast Waterfall Architecture

Existing Load	Known & Pending Loads
Customer Growth	Transportation & Building Electrification
AAEE & Price Response	BTM DER & Storage



Each layer is defined by a stock or activity forecast and a unitized hourly impact shape — layers are allocated geographically, screened for overlap and reconciled to control totals.

This structure makes forecast differences explainable by driver, geography, vintage, and reconciliation status — rather than an unexplained aggregate variance.

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Geospatial Allocation of Key Drivers

Driver-specific indicators translate adjusted impacts to local geographies

Forecast Driver	Preferred Allocation Indicators	Target Geography
Mass-Market Growth	Household growth, permits, local development indicators	Census tract / block group / substation
LDV Transportation	DMV registrations, charger inventories	ZIP / substation / transmission load bus
MHDV Transportation	Fleet depots, transit yards, port/drayage activity	Project site / substation / load bus
AAEE & AAFS	Fuel-substitution turnover, program participation, AMI data	Forecast zone / climate zone / substation
DER & BTM Resources	Interconnection records, SGIP data, adoption histories	Customer location / feeder / substation

Allocation Indicators are projected based on highly resolved geospatial socio-economic inputs: e.g., income, education, political affiliation, etc.

AAEE / AAFS: Additional Achievable Energy Efficiency / Fuel Substitution · DER: distributed energy resources · BTM: behind-the-meter · LDV / MHDV: light-duty / medium- and heavy-duty vehicles · AMI: advanced metering infrastructure · SGIP: Self-Generation Incentive Program

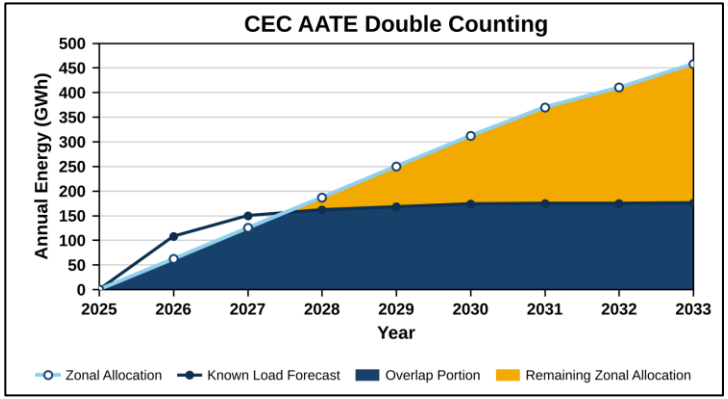
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Identifying and Avoiding Double-Counting

Screening known and pending loads at each bus (CEC AATE Example)

Approach

- Allocate zonal forecast components to WECC buses using geospatial indicators
- Screen each bus for double-counting: keep the most specific project-level load, reduce only the overlapping portion
- Calibrate back to the zonal total (net of the overlap)



Known and Pending Load Data Processing

Classify

Known and pending loads by sector

Convert

CEC verifies known and pending load feasibility and converts to annual energy

Segment

Loads into forecast components (customer growth, TE, BE, DER, etc.)

Compare

Zonal forecast growth to those impacts and adjust for overlap

TE: transportation electrification · BE: building electrification · DER: distributed energy resources · WECC: Western Electricity Coordinating Council

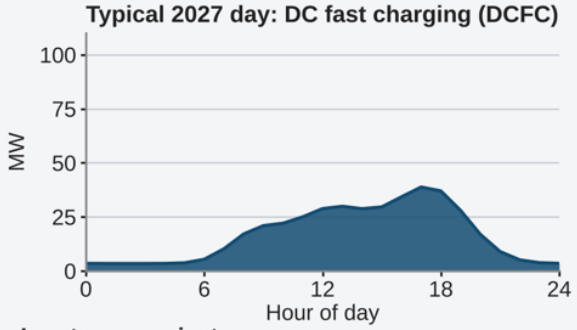
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Known Load Reconciliation (EV Example 1)

Annual energy is the neutral translation between known loads and the zonal forecast

Known Load Forecast

Bottom-up: utility project data to convert input assumptions to load



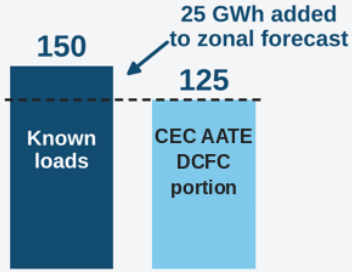
Inputs per project

Capacity · charging ports · utilization / ramp · load shape

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2027 Annual Energy

Common currency (GWh / year)



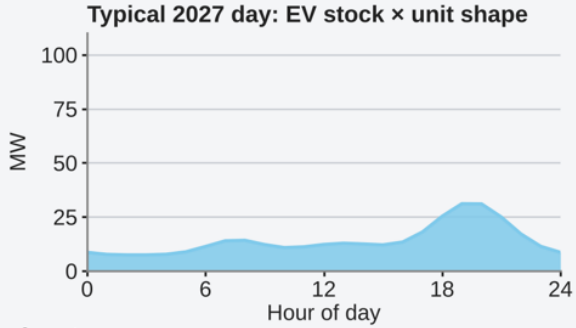
Reconciliation rule

Known loads (150) exceed baseline; the 25 GWh increment is added

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Zonal Forecast (CEC)

Top-down: stock × shape per unit



Inputs per zone

EV stock · kWh per vehicle · hourly shape per unit of stock

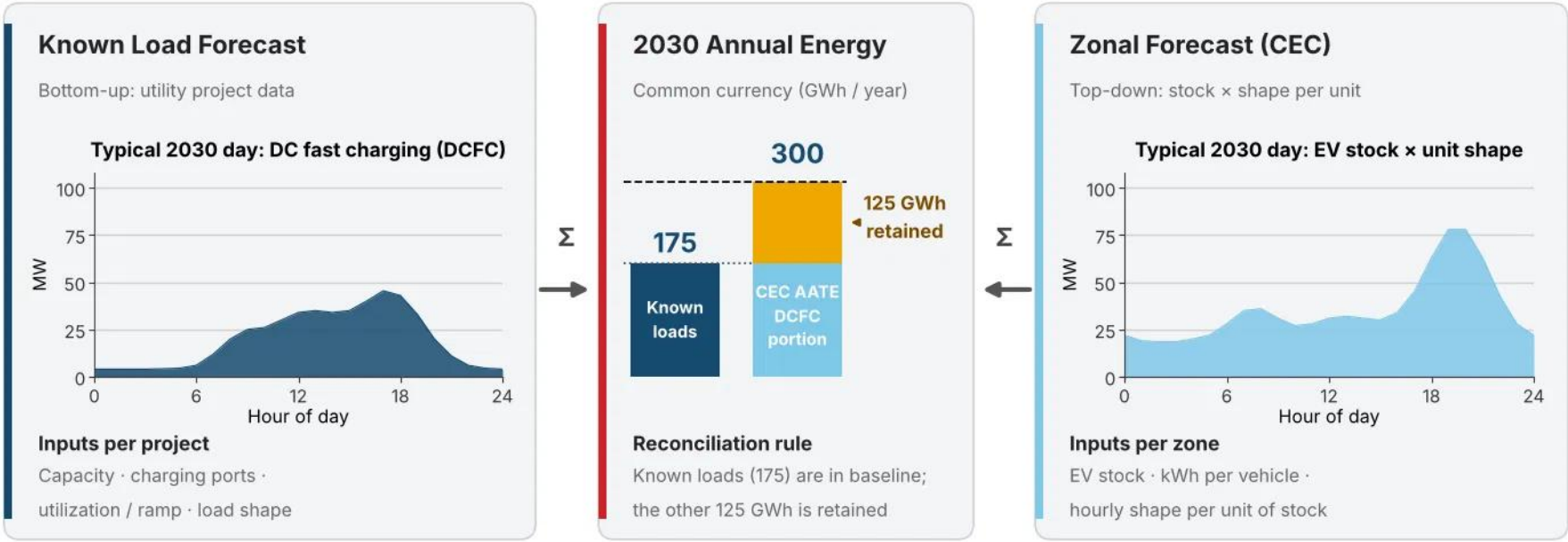
Different inputs and different hourly shapes, one common currency: annual energy lets CEC compare utility project data with its zonal forecast without forcing either side's assumptions.

Illustrative values for discussion; not forecast results.

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Known Load Reconciliation (EV Example 2)

Annual energy is the neutral translation between known loads and the zonal forecast



Different inputs and different hourly shapes, one common currency: annual energy lets CEC compare utility project data with its zonal forecast without forcing either side's assumptions.

Illustrative values for discussion; not forecast results.

Critical Data Inputs by Source

Stakeholder	Data Inputs
CAISO	• **Transmission planning references** (planning areas, buses) • **Station-to-bus mapping** coordinated with PTOs • **WECC / CAISO planning materials** (public)
Utilities **(with support from CPUC)**	• **Station SCADA** and seasonal peaks, with topology flags • **AMI interval data** and aggregated load profiles • **Station-to-bus mapping** (version-controlled) • **Known / pending load** and data-center project metadata • **DER, storage, EV, EE, TOU, DR** records by substation
CEC	• **Baseline forecast outputs** by planning area and forecast zone • **AAEE, AAFS, TOU, DR, PV/storage** assumptions and shapes • **Known-load and data-center** data requests (with CPUC support)
Third-Party / Public	• **Weather and climate** (NOAA, vendors) • **Census / ACS, building stock, permits** (e.g., NLR ResStock and ComStock) • **DMV registrations, charger inventories, SGIP, rate filings**

AAEE / AAFS: Additional Achievable Energy Efficiency / Fuel Substitution · TOU: time-of-use · DR: demand response · DER: distributed energy resources · AMI: advanced metering infrastructure · SGIP: Self-Generation Incentive Program

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Section 2

2

Next Steps

Proposed pilot, phased implementation

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Proposed Pilot

Validating the unified forecast approach on one utility before scaling

■ Proposed Pilot Scope:

- One utility, one forecast region
- Cleanse SCADA histories
- Create AMI pseudo-meter validation datasets
- Develop a substation-to-transmission-load-bus crosswalk
- Standardize known and pending load metadata
- Establish initial double-counting screens
- Execute Forecast Waterfall

Objectives	Key Activities
1: Data Preparation	SCADA cleansing, AMI validation, Topology crosswalk, known and pending-load standardization.
2: Integrated Forecast Construction	Existing Load layer, waterfall, driver-specific shapes, geospatial allocation, double-counting logs, calibration workflow.
3: Integrated Platform	Automated data pipelines, expanded assumptions library, formal annual governance.

A one-utility pilot lets the CEC test and refine the approach at low risk before scaling.

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Potential Extension: Natural Gas System Planning

Exploratory — beyond the scope of this report's recommendations

- The same general framework could inform natural gas forecasting to support decarbonization planning, though it would require adaptation — not a direct copy of the electric framework.
- **Most transferable elements:**
  - Governance structure and standardized assumptions library
  - Stock-and-shape treatment of major drivers
  - Geospatial allocation methods and double-counting controls
  - Reconciliation to adopted control totals
- Gas forecasting would require different source data — customer counts, therm sales, peak-day sendout, pipeline/regulator-station topology, and gas appliance stock.

Suggested next step: a narrowly scoped, separate assessment to determine whether a comparable gas-forecasting framework would be useful.

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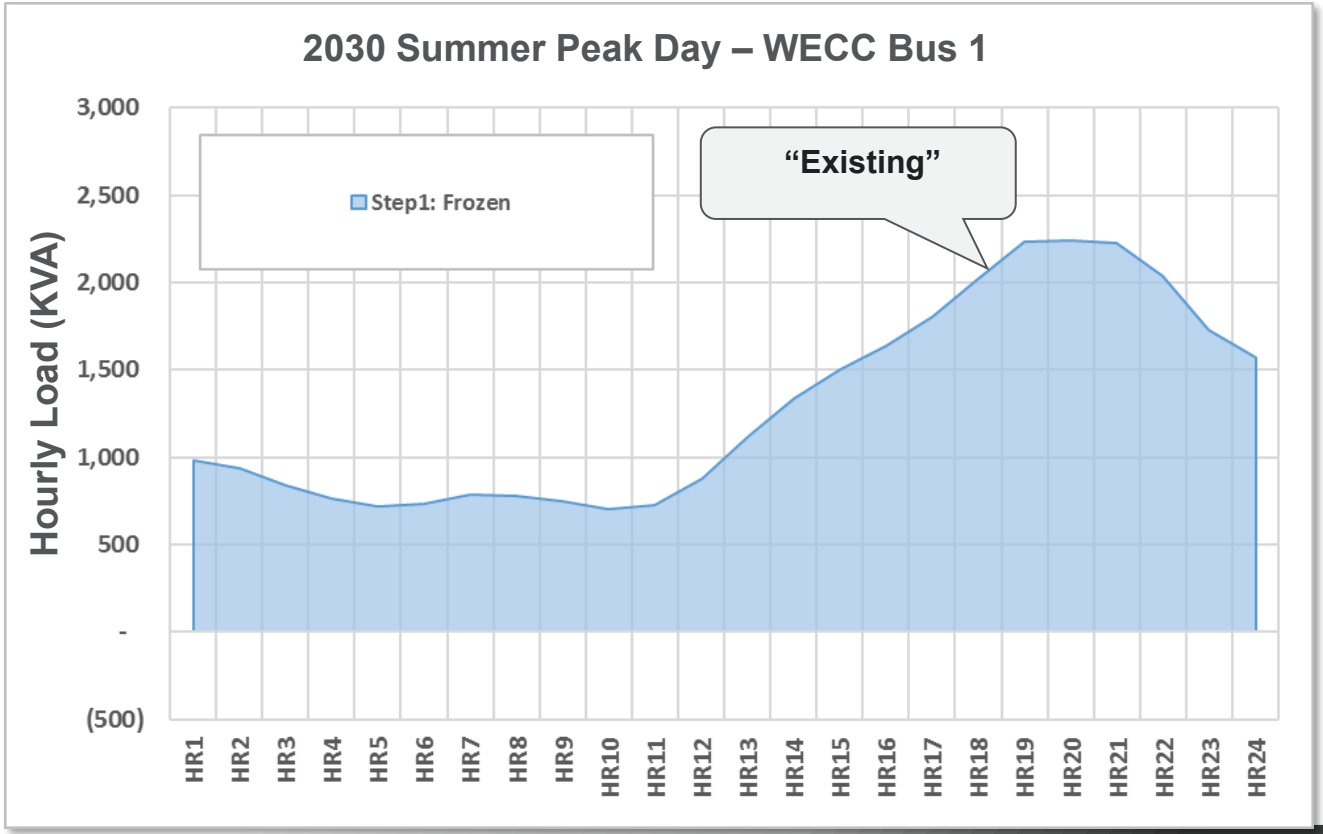
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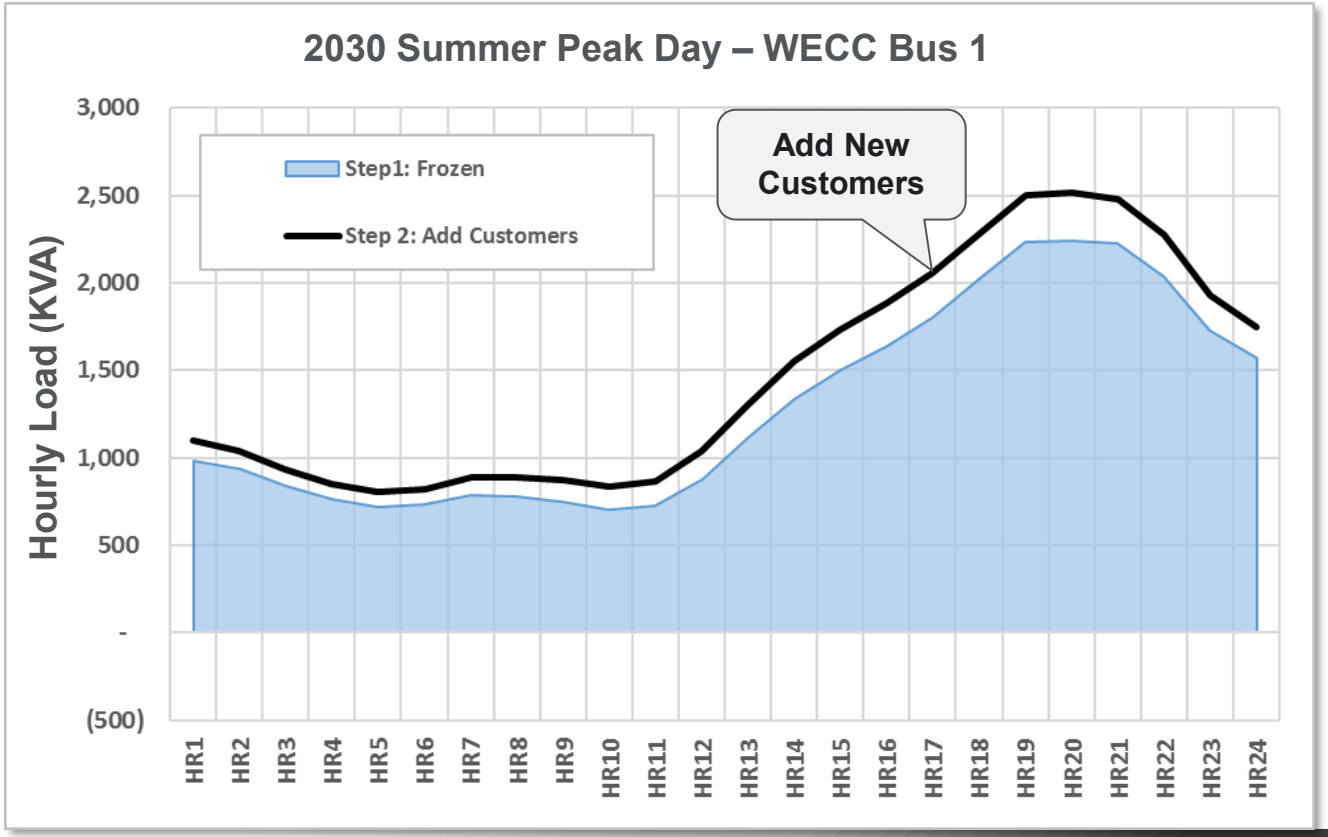
Appendix

Waterfall Layer 1: Existing Load Hourly Forecast



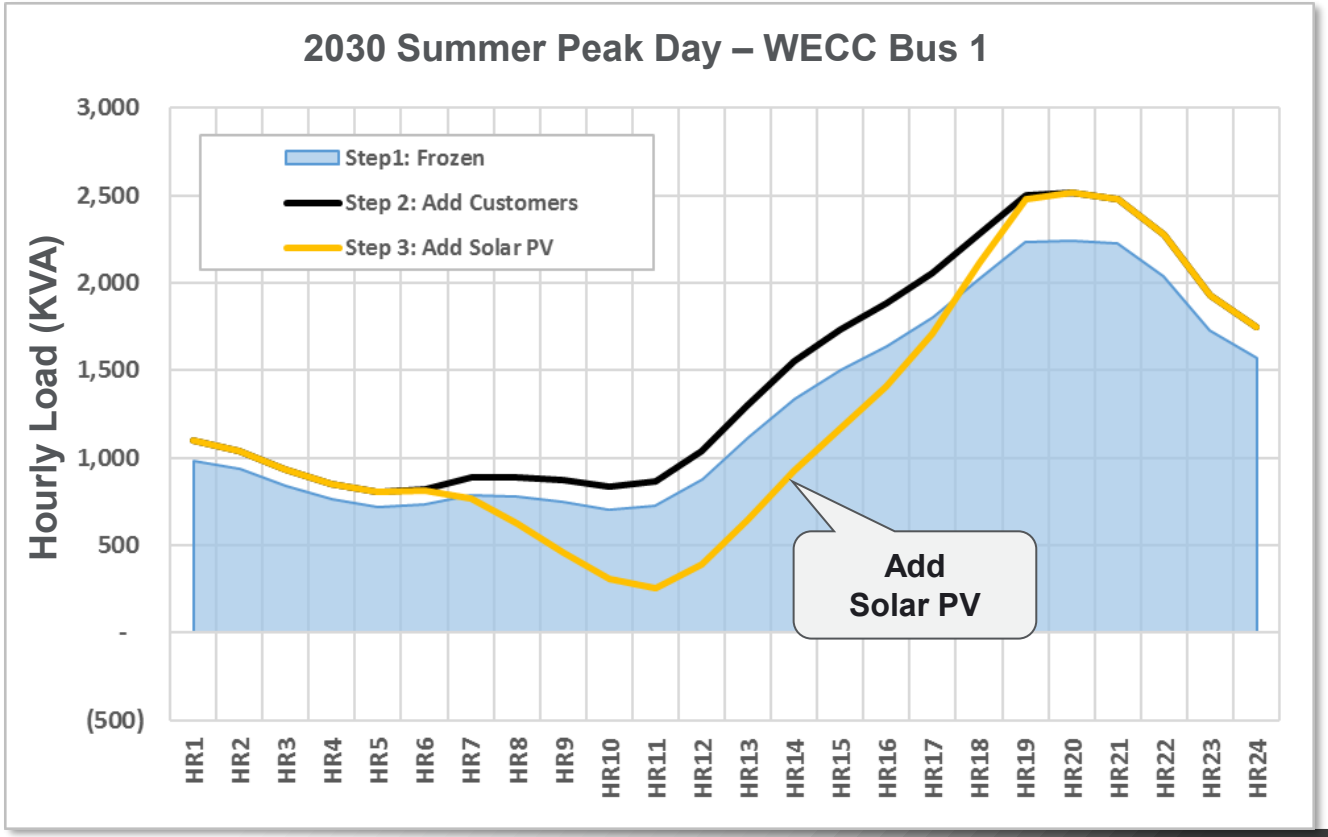
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Waterfall Layer 2: Add Customer Growth Impacts



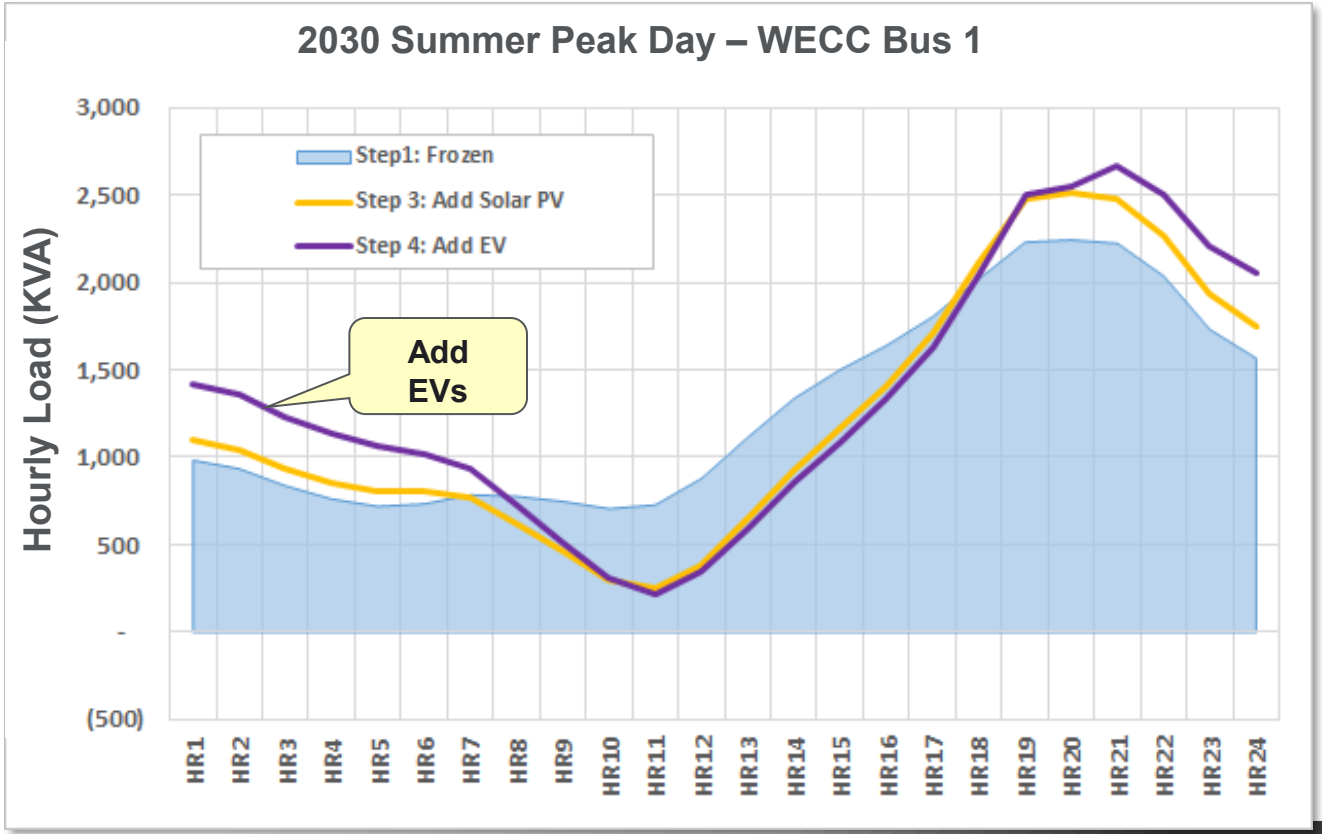
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Waterfall Layer 3: Add Incremental Solar PV Impacts



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Waterfall Layer 4: Add Electric Vehicles Impacts



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