Clean Coalition
Making Clean Local Energy Accessible Now

TAC FIX IMPACT MODEL DETAILED OVERVIEW

Contents

Goal of Spreadsheet

The TAC Fix Impact spreadsheet ("the Model") illustrates the potential impact of the Clean Coalition's proposed Transmission Access Charge (TAC) Fix on TAC rates and payments, both immediately and in the long term, by modeling the Clean Coalition's proposed change in the TAC Billing Determinant and how additional new distributed generation (DG)[1] output reduces the transmission investment required to serve new Transmission Energy Downflow (MWh of energy crossing transmission and distribution substations). The Model enables consideration of various DG deployment scenarios that are multiples of the Business As Usual (BAU) DG deployments forecasted by PG&E.

Drivers of transmission investment

Transmission delivers energy from remote generation sites to customers. To the extent that demand can be reduced for additional transmission facilities, investment in new facilities is not needed. Significant evidence already exists that DG deployment reduces transmission investment. For example, increased utilization of distributed energy resources, most notably including rooftop solar as a DG resource, has already resulted in Pacific Gas & Electric canceling $190 million worth of low-voltage transmission upgrades in the 2015–2016 transmission planning process.[2]

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[1] DG includes (i) wholesale DG (WDG), or small energy resources that interconnect to the distribution grid to serve local load, and (ii) Behind the Meter (BTM) generation exports to the distribution grid (for example, Net Metering (NEM) customer exports).

[2] California ISO, 2015-2016 Transmission Plan (Mar. 28, 2016), available at

For sake of simplicity, the Model assumes growth in Transmission Energy Downflow served by CAISO (MWh Gross Load minus MWh DG output) drives growth in transmission investment. Given the significance of transmission investments required to meet RPS mandates, the Clean Coalition decided that the Model should assume growth in annual, not peak, Transmission Energy Downflow drives growth in transmission investment:

- According to comments made by CAISO and various stakeholders in CAISO's Wholesale Billing Determinant stakeholder initiative, California's current growth in transmission investment is primarily driven by (i) growth in peak load, and (ii) compliance with state RPS mandates (i.e., to enable integrating remote renewable integration procured for RPS purposes into the grid).
- According to a 2013 Edison Electric Institute (EEI) report, 76% of the proposed expenditure on transmission in between now and 2023 for EEI members (California is well represented) is specifically to integrate centralized renewable energy to the transmission grid. Since that report was issued, California increased its RPS to 50% renewable energy by 2030. Utilities and other Load Serving Entities (LSEs) could procure cost-effective Wholesale DG to the extent it is available instead of centralized renewable energy to meet the new 50% RPS, thereby reducing the need for new transmission infrastructure.

Note About Terminology

1.) Although CAISO introduced the term End User Metered Load ("EUML") to the TAC Wholesale Billing Determinant initiative to describe aggregate electricity usage as measured at customer meters, the Model uses the term "Gross Load" and is populated with historical Gross Load data because EUML data is not publicly available.
2.) In its filings, the Clean Coalition calls EUML "Customer Energy Downflow" to improve understanding of the difference between customer energy received from the distribution grid, and the portion of customer energy delivered through Transmission Energy Downflow.

Core Assumptions

Load served locally for an example IOU, PG&E

The Load_Served_Locally tab shows the mix of DG resources for an example IOU, PG&E, over the 10 year period 2016-2025. The data is from PG&E's July 1, 2015 Distribution Resources Plan (DRP) filing.

There are two categories of DG:

1. **Wholesale (WDG).** WDG is interconnected to the distribution grid, on the utility side of the meter. 100% of the energy generated by WDG is injected directly into the distribution grid

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https://www.caiso.com/Documents/Board-Approved2015-2016TransmissionPlan.pdf.

2. **NEM**. NEM DG is interconnected behind the customer meter. Energy generated by NEM is first consumed by the customer. Any energy generated that is not consumed by the customer is exported to the distribution grid.

The Model assumes a certain percentage of energy generated by NEM DG is exported (the remainder serves onsite customer energy needs). By default this export share is 50%, with an Average MWh Yield per MW DG capacity.

The Model forecasts PG&E's Gross Load by copying the actual 2016 data from the TAC_Impact_Immediate tab, and assuming the load growth is the same as CAISO Gross Load growth used in TAC_Impact_20_Years tab.

Based on current and forecasted Gross Load for PG&E, PG&E's DG deployments in MW per its 2015 DRP filing (calculated by applying a capacity factor assumption to DRP filing data about capacity available during peak load), the Model calculates share of Gross Load served by DG.

Variables the user may adjust

Variable	Use/Impact	Default
MW DG (various types)	• Enables calculating share of Gross Load served by DG for PG&E • Source of BAU forecast of DG deployed by PG&E	See Model
Share of energy generated by NEM DG exported to the distribution grid	• Enables calculating share of Gross Load served by DG for PG&E • Impacts BAU and three scenarios' forecast of energy generated by DG	50.0%
Average MWh Yield per MW DG capacity	• Enables calculating share of Gross Load served by DG for PG&E • Impacts BAU and three scenarios' forecast of energy generated by DG	2,000
Capacity factor	• Enables calculating MW of DG deployed from data about capacity available during peak load	See Model

2016 actual PTO TRR and Gross Load, and TAC rates

The TAC_Impact_Immediate tab shows how TAC rates are calculated based on actual 2016 data submitted to CAISO January 1, 2016 about each Participating Transmission Owner (PTO)'s High Voltage (HV) and Low Voltage (LV) Transmission Revenue Requirement (TRR), Gross Load, HVTAC rate and payments, and LVTAC rate and payments.

For all PTOs, a single HVTAC rate is calculated as total CAISO HV TRR divided by total CAISO HV Gross Load. Total CAISO is calculated as the sum of PTOs. Gross Load is used to measure transmission usage.

For each PTO that owns LV transmission assets, a unique LVTAC rate is calculated as PTO LV TRR divided by PTO LV Gross Load. HV and LV Gross Loads are the same for each PTO that owns LV transmission assets.

Each PTO's TAC payments are calculated as TAC rate multiplied by Gross Load. Total CAISO TRR equals aggregate HV and LVTAC payments to CAISO by all PTOs.

Variables the user may adjust

Variable	Use/Impact	Default
PTO HV TRR, LV TRR & Gross Load	Enables calculating PTO TAC rates currently and after the TAC fix	See Model

The TAC Fix

The TAC Fix changes the metric used to measure transmission usage from Gross Load to Transmission Energy Downflow. Gross Load is measured at the customer meter, whereas Transmission Energy Downflow is measured at the transmission and distribution substations. Gross Load exceeds Transmission Energy Downflow by the amount of energy generated by DG.

The TAC Fix does not change each PTO's 2016 HV and LV TRR (or total CAISO TRR), but will reduce future transmission revenue requirements.

Immediate Impact of TAC Fix in 2016

The TAC_Impact_Immediate tab also shows how TAC rates change immediately following the TAC Fix.

Since TRR remains the same while measured transmission usage declines, the TAC Fix causes an immediate increase in HVTAC and LVTAC rates to generate the same revenue requirement for PTOs. Both HVTAC and LVTAC increase by the same percentage.

The Model calculates the Post-TAC Fix metric for transmission energy usage, Transmission Energy Downflow, for each PTO service area by assuming that all PTOs have the same share of Gross Load served by WGD + NEM exports as the example IOU. Using the same logic it employed for calculating actual 2016 TAC rate, the Model then calculates the Post-TAC Fix 2016 HVTAC rate for all PTOs, and Post-TAC Fix LVTAC rate for each PTO that owns LV transmission assets.

Finally, the Model shows how the TAC Fix impacts the transmission energy usage metric (i.e., the TAC billing determinant metric) for both PG&E and CAISO, PG&E's 2016 TAC rates and for the PG&E service territory, the TAC payments previously allocated based on WDG + NEM exports, subsidizing centralized generation.

Forecasting BAU

Overview

For BAU, the Model forecasts key metrics for an example IOU, PG&E, using simple assumptions. The BAU HVTAC rate forecast assumes that HVTAC rates, when taking into account CapEx, O&M, ROE and depreciation, grow a constant rate per year on both a nominal and real basis. Real growth is calculated as nominal growth minus inflation.

One of the Model's most important default assumptions is that BAU HVTAC rates grow 7.0% per year on a nominal basis (5.0% real) from 2016-2035. The source of this assumption is complex but solid, and conservative:

1. A CAISO memorandum about TAC rate forecasts from October 25, 2012 indicated that (i) HVTAC rates had grown about 15.0% per year from 2005-2014, and (ii) CAISO forecasted 8.0% annual growth in HVTAC rates over 8 years, from the 2012 rate of $6.81 to the 2020 rate of $12.58.
2. The Palo Alto Municipal Utility independently developed an estimated levelized 20 year Total TAC rate of 2.8¢/kWh, which implies a 7.0% annualized Total TAC rate increase over that period. Although this Palo Alto study's methodology is proprietary, the results are publicly available.
3. The Clean Coalition has submitted uncontroverted testimony to the CPUC and made multiple presentations to CAISO using the 7.0% annualized future TAC growth rate, and CAISO has never contradicted this or offered an alternative.
4. More recent CAISO TAC forecasts are not publicly available. In its most recent transmission plan, CAISO forecasted the HVTAC rate impacts of ONLY currently approved projects, excluding any future identification of additional transmission projects.
5. The Clean Coalition considers the 7.0% nominal growth assumption conservative, given the cost of new transmission infrastructure and the potential for new transmission related to increased use of large scale renewables, especially with California's new 2030 RPS standards and long-term goals regarding renewable energy. Furthermore, 7.0% is about half the actual annualized rate increase from 2005-2014, a reasonable estimate given that load growth, peak demand, and RPS standards are not expected to increase in the future at rates less than half those of the past decade.

The Model forecasts HVTAC rates separately from LVTAC rates because a single HVTAC rate for all Load Serving Entities (LSEs) is calculated by dividing the TRR by total CAISO-wide MWh of transmission usage, whereas LVTAC rates are calculated individually for each PTO service territory.

PG&E's Year 1 HVTAC rate data is copied from the TAC_Immediate_Impact spreadsheet's 'Actual TAC Rate & Payments by PTOs to CAISO - Filed January 1, 2016' section. Year 2-20 HVTAC rates are forecasted by multiplying the previous year's HVTAC rate by (1+ real growth rate). The Model uses real growth rates instead of nominal, which provides results in current dollars. As such, reported 20-year cumulative and levelized results are not impacted by inflation.

20-year levelized TAC rates are calculated as the average of the values for the 20 year forecast.

The Model forecasts Total PG&E TAC rates by dividing the sum of PG&E's HVTAC and LVTAC payments by PG&E's annual Gross Load.

The Model uses 2014 PG&E Total TAC rate forecast data - the most recent publicly available.

Variables the user may adjust

Variable	Use/Impact	Default
Year 1 for 20-year BAU & Scenario forecasts	Label only, does not impact any calculation or forecast	2016
Nominal annual growth in TAC rate	For BAU (and Scenario 0), enables calculating real growth in TAC rates	7.0%
Inflation	For BAU (and Scenario 0),enables calculating real growth in TAC rates	2.0%

PG&E TAC payments to CAISO (Equals TRR)

For BAU, PG&E's HVTAC payments are calculated as the HVTAC rate multiplied by PG&E's annual Gross Load.

The Model forecasts PG&E's LVTAC payments to CAISO by copying 2016 data from the TAC_Immediate_Impact tab, and assuming that the ratio of HVTAC payments to LVTAC payments remains the same as the 2016 ratio over 20 years.

The Model calculates PG&E's cumulative total TAC payments to CAISO to use as a baseline for calculating the ratepayer impact of the TAC Fix for three scenarios.

20-year levelized Total TAC payments to CAISO are calculated as the average of the values for the 20 year forecast.

PG&E share of Gross Load served by WDG + NEM exports

For this section, the Model first forecasts PG&E Gross Load by copying 2016-2025 data from the Load_Served_Locally tab, and assuming after that PG&E growth is the same as CAISO Gross Load growth.

PG&E's share of Gross Load served by WDG + NEM exports for 2016-2025 is copied from PG&E's share of Gross Load served by WDG + NEM exports from the Load_Served_Locally tab. A key simplifying assumption for the Model is that when forecasting PG&E's share of Gross Load served by WDG + NEM exports for 2026-2035, each year is assumed to have incrementally higher growth than the previous year; the increment used is the average absolute difference in annual growth rates from 2016-2025. Using incremental growth of growth rates is more realistic than percentage change in growth rates, which result in exponentially higher values.

The Model calculates PG&E WDG + NEM exports (GWh) by multiplying PG&E Gross Load by the share of Gross Load served by WDG + NEM exports.

Next, the Model derives PG&E NEM DG capacity plus WDG capacity serving local loads (MW) by dividing PG&E WDG + NEM exports (GWh) by the average WDG yield assumed in the Load_Served_Locally tab.

Finally, the Model forecasts PG&E's Total WDG + NEM DG (MW) by copying 2016-2025 data from the Load_Served_Locally tab. The Model forecasts 2026-2035 by dividing PG&E NEM DG capacity plus WDG capacity serving local loads (MW) by the Ratio of DG capacity serving local loads to total DG, which is assumed after 2025 to remain the same as 2025: 57%. This is a conservative assumption because the ratio of WDG to NEM DG is expected to increase after the TAC Fix, because WDG will be about 3 cents/kWh less expensive in utility Least Cost Best Fit analyses of procurement options.

The Model also calculates PG&E's Total WDG + NEM DG added (MW).

CAISO share of Gross Load served by WDG + NEM exports

For this section, first the Model forecasts CAISO Gross Load by copying 2016 data from the TAC_Immediate_Impact tab, and forecasting future Gross Load based on an assumption about overall CAISO load growth.

The Model uses Gross Load forecasts from 2014 to enable consistency with the PG&E Total TAC rate forecast data, which is from 2014.

A key simplifying assumption for the Model is that CAISO's share of Gross Load served by WDG + NEM exports is the same as PG&E's, for both BAU and each scenario.

The Model calculates CAISO WDG + NEM exports (GWh) by multiplying CAISO Gross Load by the share of Gross Load served by WDG + NEM exports.

Variables the user may adjust

Variable	Use/Impact	Default
Growth in CAISO Annual Gross Load	• For BAU (and Scenario 0), enables forecasting PG&E's Gross Load , since PG&E is assumed to have the same growth as CAISO • For BAU, enables forecasting CAISO HVTRR • For three scenarios, enables forecasting CAISO HVTRR	2.0%

Cumulative Total CAISO TRR

For this section, the Model first calculates CAISO HVTRR by multiplying CAISO Gross Load by the HVTAC rate.

Next, the Model forecasts CAISO LVTRR by copying 2016 data from the TAC_Immediate_Impact tab, and assuming that the ratio of HVTRR to LVRR remains the same as the 2016 ratio over 20 years.

Finally, the Model calculates cumulative total CAISO TRR.

CAISO peak load served by CAISO WDG

The Model includes this section because peak load growth is a significant driver of transmission investment.

First, the Model forecasts CAISO peak load based on actual 2016 and 2020 data. It calculates a single annual growth rate from 2016-2020 to match the 2020 data, and uses this annual growth rate to calculate peak load for every year after 2016.

Next, the Model forecasts CAISO NEM DG capacity plus WDG capacity serving local loads (MW) by multiplying CAISO WDG + NEM exports (GWh) by the average MWh yield per MW DG capacity assumed in the Load_Served_Locally tab.

The Model then forecasts Total CAISO WDG + NEM export generation peak load contribution (MW) by multiplying CAISO NEM DG capacity plus WDG capacity serving local loads (MW) by an assumption about the WDG + NEM export production at peak load period in relation to nameplate capacity. This assumption is based on the capacity factors PG&E used in its 2015 DRP filing to forecast DG deployments during peak times – see the Load_Served_Locally tab.

Finally, the Model calculates the share of CAISO peak load served by CAISO WDG + NEM exports.

Variables the user may adjust

Variable	Use/Impact	Default
CAISO peak load (i.e., Transmission Energy Downflow (TED)) (MW)	• For BAU and Scenario 0, enables forecasting share of CAISO peak load served by CAISO WDG to use as a baseline for calculating the ratepayer impact of the TAC Fix for three scenarios	49,243

	• For three Post-TAC Fix scenarios, enables forecasting change in share of CAISO peak load served by CAISO WDG	
Growth in CAISO peak load	• For BAU and Scenario 0, enables forecasting share of CAISO peak load served by CAISO WDG to use as a baseline for calculating the ratepayer impact of the TAC Fix for three scenarios • For three Post-TAC Fix scenarios, enables forecasting change in share of CAISO peak load served by CAISO WDG	0.3%

Scenario 0: BAU with New Billing Determinant (No Additional DG)

Overview

The purpose of Scenario 0 is (i) to show the impact of a change of a single variable, the TAC billing determinant, by comparing Scenario 0 to BAU, and (ii) enable scenarios with DG deployments in excess of BAU to show the impact of a single variable, the amount of DG deployment, by comparing to each scenario to Scenario 0.

Thus, the logic driving Scenario 0 is nearly identical to that of BAU, with changes noted in the text below describing Scenario 0.

For Scenario 0, the Model calculates two baselines that the three Post-TAC Fix scenarios use to forecast TAC rates, given different levels of DG deployment:

- The TAC rate increase per MWh of new Transmission Energy Downflow (the "BAU TAC CapEx&ROE Baseline")
- The HVTAC rate increase due to O&M as a percentage of last year's TAC rate (the "BAU TAC O&M Baseline).

PG&E TAC rates

There are two differences between Scenario 0 and BAU:

1. Scenario 0's PG&E Year 1 HVTAC rate data is copied from the TAC_Immediate_Impact spreadsheet's 'Post-Fix TAC Rate & Payments' section instead of from the 'Actual TAC Rate & Payments by PTOs to CAISO - Filed January 1, 2016' section
2. Scenario 0's Total PG&E TAC rate is calculated by dividing the sum of PG&E's HVTAC and LVTAC payments by PG&E's Transmission Energy Downflow instead of Gross Load.

PG&E TAC payments to CAISO (Equals TRR)

There are two differences between Scenario 0 and BAU:

1. Scenario 0 forecasts PG&E Transmission Energy Downflow by subtracting PG&E WDG + NEM exports from PG&E Gross Load
2. Scenario 0's PG&E HVTAC payments to CAISO (HVTRR) are calculated by multiplying the HVTAC rate by CAISO Transmission Energy Downflow instead of Gross Load.

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PG&E share of Gross Load served by WDG + NEM exports

No changes – Scenario 0 uses the same logic as BAU.

CAISO share of Gross Load served by WDG + NEM exports

No changes – Scenario 0 uses the same logic as BAU.

Cumulative Total CAISO TRR

There is one difference in how Scenario 0 and BAU calculate TRR: Scenario 0's CAISO HVTRR is calculated by multiplying the HVTAC rate by CAISO Transmission Energy Downflow instead of Gross Load.

Scenario 0 forecasts slightly less cumulative total CAISO TRR over 20 years than BAU because (i) Transmission Energy Downflow doesn't grow as fast as Gross Load, since Share of CAISO Gross Load served by WDG + NEM exports increases due to growing DG deployments, yet (ii) both Scenario 0 and BAU use the same HVTAC rate growth assumption over 20 years.

Calculating BAU TAC Baselines

To calculate the BAU TAC Baselines used to forecast TAC rates for the three Post-TAC Fix scenarios' different levels of WDG + NEM exports, the Model forecasts

- HVTAC rate decline due to depreciation of assets driving TRR ($/MWh)
- The resulting HVTAC rate end of year in absence of (i) new TED requiring new transmission, and (ii) O&M ($/MWh)
- HVTAC rate increase due to CapEx, O&M and ROE resulting from new CAISO Transmission Energy Downflow ($/MWh)
- HVTAC rate increase due to O&M ($/MWh), based on an assumption about O&M's share of the HVTAC rate increase due to CapEx, O&M and ROE
- HVTAC rate increase due to CapEx and ROE resulting from new CAISO Transmission Energy Downflow ($/MWh).

Next, the Model forecasts CAISO Transmission Energy Downflow (TED) (GWh) by subtracting CAISO WDG + NEM exports (GWh) from CAISO Gross Load, and calculates new CAISO TED.

Finally, the Model calculates the BAU TAC Baselines:

- **BAU TAC CapEx&ROE Baseline**, or HVTAC rate increase per MWh new CAISO TED due to CapEx and ROE ($/MWh), by dividing the HVTAC rate increase due to CapEx and ROE resulting from new CAISO Transmission Energy Downflow ($/MWh) by new CAISO Transmission Energy Downflow
- **BAU TAC O&M Baseline**, or HVTAC rate increase due to O&M as a percentage of last year's TAC rate, by dividing the HVTAC rate increase due to O&M ($/MWh) by the prior year's HVTAC rate.

The Clean Coalition forecasts TAC rates using the BAU TAC Baselines because:

- TRR includes ROE on depreciated prior and new capital expenditures (CapEx) on transmission (new CapEx required is reduced by increased DG deployment), O&M including replacement cost related to existing transmission as it ages, which is relatively constant percentage of the non-depreciated value

  - Thus the three Post-TAC Fix scenarios forecast that HVTAC rates do increase to some extent due to O&M, even if the share of new CAISO Gross Load served by new DG output is 100%. These HVTAC O&M rate increases vary based on transmission investment (i.e., they decline if transmission investment declines)
  - Since O&M is assumed to include replacement costs, the assumption used to calculate the Baselines based on O&M's share of BAU HVTAC increases could be as high as 50% in the future; 20% is a realistic minimum.
- The current TAC rate pays for the amortized cost of existing infrastructure and O&M, so although infrastructure is depreciating, it will need new capital investment to replace aging capacity. As a result:
  - If annual replacement CapEx required is equal to annual depreciation on existing HV transmission assets, and no additional capacity is needed, HVTAC rates would remain stable and not decline
  - If annual replacement CapEx required is half the annual depreciation on existing HV transmission assets, and no additional capacity is needed, HVTAC rates would stabilize at 50% of the current rate (in real $) + annual the cost of CAISO operations.

Variables the user may adjust

Variable	**Use/Impact**	**Default**
Depreciation lifetime of assets driving TRR (years)	• For Scenario 0, enables calculating the BAU TAC Baseline • For three Post-TAC Fix scenarios, enables forecasting HVTAC rates	40
O&M share of HVTAC rate increase due to CapEx, O&M and ROE	Enables calculating the BAU TAC Baselines	20.0%

CAISO peak load served by CAISO WDG

No changes – Scenario 0 use the same logic as BAU.

Three Post-TAC Fix Scenarios

Overview

For three Post-TAC Fix DG growth scenarios, the Model forecasts (i) DG deployments in excess of the BAU baseline, and to what extent energy generated by the additional DG reduces the amount of new Transmission Energy Downflow (ii) TAC rates, by multiplying the BAU TAC CapEx&O&M Baseline by the amount of new Transmission Energy Downflow, and the BAU TAC O&M Baseline by the prior year's HVTAC rate. As DG serves a greater share of new Transmission Energy Downflow, forecasted TAC rates decrease due to reduced investment in new transmission assets.

PG&E TAC rates

PG&E's Year 1 HVTAC rate data is copied from the TAC_Immediate_Impact spreadsheet' s 'Post-Fix TAC Rate & Payments' section.

To forecast Year 2-20 HVTAC rates, the Model first reduces the current year's HVTAC rate by depreciation. Despite various scenario assumptions and associated calculations, each year's depreciation must be at least equal to the 2016 depreciation amount because current capital investments will be depreciating throughout the entire forecast period. To forecast HVTAC rate growth due to CapEx, O&M and ROE with different amounts of DG deployment, the Model:

1. Forecasts new CAISO Transmission Energy Downflow (TED) by subtracting CAISO WDG + NEM exports from CAISO Gross Load
2. Calculates the HVTAC rate increase due to new CAISO Transmission Energy Downflow (TED) requiring new transmission CapEx and ROE ($/MWh) by multiplying the BAU TAC CapEx& O&M Baseline by new CAISO Transmission Energy Downflow
3. Calculates the HVTAC rate increase due to O&M for transmission assets ($/MWh) by multiplying the BAU TAC O&M Baseline by the prior year's HVTAC rate.

The Model forecasts HVTAC rates separately from LVTAC rates because a single HVTAC rate for all Load Serving Entities (LSEs) is calculated by dividing the TRR by total transmission usage, whereas LVTAC rates are calculated individually for each PTO that owns LV transmission assets.

20-year levelized TAC rates are calculated as the average of the values for the 20 year forecast.

The Model forecasts Total PG&E TAC rates by dividing the sum of PG&E's HVTAC and LVTAC payments by PG&E's annual Gross Load.

PG&E TAC payments to CAISO (Equals TRR)

For this section, the Model starts by forecasting the Post-TAC Fix transmission usage metric, Transmission Energy Downflow, by copying 2016 data from the Load_Served_Locally tab, and calculating 2017-2035 by subtracting PG&E WDG + NEM exports (GWh) from PG&E Gross Load.

The Model calculates Post-TAC Fix Scenario PG&E HVTAC payments by multiplying the HVTAC rate by PG&E's Transmission Energy Downflow.

The Model forecasts PG&E's LVTAC payments to CAISO by copying 2016 data from the TAC_Immediate_Impact tab, and assuming that the ratio of HVTAC payments to LVTAC payments remains the same as the 2016 ratio over 20 years.

The Model calculates PG&E's cumulative total TAC payments to CAISO compared to Scenario 0, to calculate the ratepayer impact of different DG deployments resulting from the TAC Fix for the three Post-TAC Fix scenarios separate from any Model-forecasted impacts due to changing the TAC billing determinant from Gross Load to Transmission Energy Downflow.

20-year levelized Total TAC payments to CAISO are calculated as the average of the values for the 20 year forecast.

PG&E share of Gross Load served by WDG + NEM exports

For this section, the Model first forecasts PG&E annual Gross Load by copying 2016-2025 data from the Load_Served_Locally tab, and assuming after that PG&E growth is the same as CAISO Gross Load growth.

Next, the Model forecasts Total WDG + NEM DG added (MW) based on the key assumption driving scenarios: it multiplies the Total WDG + NEM DG added multiplier versus Scenario 0 by Scenario 0's Total WDG + NEM DG added (which is the same as BAU's). To forecast PG&E Total WDG + NEM DG (MW), the Model copies 2016 data from the Load_Served_Locally tab, and forecasts Year 2-20 values by adding Total WDG + NEM DG added (MW) to the previous year's value. The Model also calculates the difference in DG deployment between each Post-TAC Fix Scenario and Scenario 0 (which is the same as BAU).

Then, to forecast PG&E NEM DG capacity plus WDG capacity serving local loads (MW), for 2016-2025 the Model multiplies PG&E Total WDG + NEM DG (MW) by the ratio of DG capacity serving local loads to total DG for that year, as calculated in the Load_Served_Locally tab. To forecast 2026-2035, the Model assumes that the ratio of DG capacity serving local loads to total DG after 2025 remains the same as 2025, about 57%.

To calculate PG&E WDG + NEM exports (GWh), the Model multiplies PG&E NEM DG capacity plus WDG capacity serving local loads (MW) by the average WDG yield assumed in the Load_Served_Locally tab.

Finally, the Model calculates the Share of PG&E Gross Load served by WDG + NEM exports by dividing PG&E WDG + NEM exports (GWh) by PG&E Gross Load.

NOTE: You can set a Post-TAC Fix Scenario's BAU multiplier assumption to 100%, and note how forecasted TAC rates and payments to CAISO (TRR) then exactly match those from Scenario 0.

Variables the user may adjust

Variable	Use/Impact	Default
Total WDG + NEM DG added multiplier versus Scenario 0	Drives extent of change in DG deployment resulting from the TAC Fix	See Model's Post-TAC Fix scenarios

Flags and manual adjustments

To avoid scenarios involving any stranded overall transmission capacity, which the Clean Coalition considers an unrealistic case, the Model enforces a limit that Share of new CAISO annual Gross Load served by new WDG + new NEM exports cannot exceed 100% (enforcing this limit means that new CAISO TED never falls below 0 during the forecast time period). This section utilizes a flag to indicate when the user needs to make a manual adjustment to enforce this limit, because the Model cannot enforce the limit automatically. This flag will only appear when the BAU multiplier used for the scenario is about 2.5x or more.

In the **FLAG if new DG GWh > new CAISO Gross Load** row, an "ERROR" message appears if new DG GWh exceeds new CAISO Gross Load. If a flag appears for a particular year, change the Total WDG+NEM DG added (MW) to a manual value that causes the share of new Gross Load served by new DG to be 100%. Once the share of new Gross Load served by new DG is less than or equal to 100%, the flag will disappear.

NOTE: if the user makes manual adjustments to accommodate a BAU multiplier of 2.5 or more, and then wants to try a different BAU multiplier for that scenario, the user should (i) restore the calculation logic to cells that were changed to a manual value by copying the logic from adjacent cells in the same row (ii) change the BAU multiplier to the new value, and (iii) make manual adjustments to eliminate flags.

Finally, for each year the Model calculates PG&E's share of annual PG&E Gross Load served by WDG + NEM exports (MW) to compare to BAU and calculate the impact of the TAC Fix for three scenarios.

Variables the user may adjust

Variable	Use/Impact	Default
Total WDG + NEM DG added (MW) ***for individual year(s) in the forecast***	Eliminate any flags	Not a user variable

TAC rates growth slows dramatically with high BAU multipliers

If the user chooses a BAU multiplier high enough to cause the Share of new CAISO annual Gross Load served by new WDG + new NEM exports to be close to 100%, TAC rate growth slows dramatically and may appear to flatline. Forecasted rate increases would be then driven primarily, or only, by O&M growth, and would be nearly or fully offset by depreciation.

CAISO share of annual Gross Load served by WDG + NEM exports

For this section, first the Model forecasts CAISO annual Gross Load by copying 2016 data from the TAC_Immediate_Impact tab, then forecasts 2017-2035 Gross Load based on an assumption about overall CAISO load growth.

A key simplifying assumption for the Model is that CAISO's share of Gross Load served by WDG + NEM exports is the same as PG&E's, for both BAU and each scenario.

CAISO's share of annual Gross Load served by WDG + NEM exports is copied from the scenario's forecasted PG&E share of Gross Load served by WDG + NEM exports.

The Model calculates CAISO WDG + NEM exports (GWh) by multiplying CAISO Gross Load by the share of Gross Load served by WDG + NEM exports.

To enable enforcing the limit described in the "Flags and manual adjustments" sub-section above, the Model then calculates new CAISO WDG + NEM exports, and Share of new CAISO annual Gross Load served by new WDG + NEM exports.

Variables the user may adjust

Variable	Use/Impact	Default
Share of new CAISO annual Gross Load served by new WDG + new NEM exports	Enables enforcing a limit to avoid scenarios involving any stranded overall transmission capacity	100%

Cumulative Total CAISO TRR

First, the Model forecasts CAISO HVTRR by multiplying the HVTAC rate by CAISO Transmission Energy Downflow.

Next, the Model forecasts CAISO LVTRR by copying 2016 data from the TAC_Immediate_Impact tab, and assuming that the ratio of HVTRR to LVRR remains the same as the 2016 ratio over 20 years.

Finally, the Model calculates cumulative total CAISO TRR, to compare to Scenario 0 and calculate the impact of the TAC Fix for the three Post-TAC Fix Scenarios.

CAISO peak load served by CAISO WDG

The Model includes this section because peak load growth is a significant driver of transmission investment.

First, the Model forecasts CAISO peak load based on actual 2016 and 2020 data. It calculates a single annual growth rate from 2016-2020 to match the 2020 data, and uses this annual growth rate to calculate peak load for every year after 2016.

Next, the Model forecasts CAISO NEM DG capacity plus WDG capacity serving local loads (MW) by multiplying CAISO WDG + NEM exports (GWh) by the average MWh yield per MW DG capacity assumed in the Load_Served_Locally tab.

The Model then forecasts Total CAISO WDG + NEM export generation at peak load contribution (MW) by multiplying CAISO NEM DG capacity plus WDG capacity serving local loads (MW) by an assumption about the WDG + NEM export production at peak load period in relation to nameplate capacity. This assumption is based on the capacity factors PG&E used in its 2015 DRP filing to forecast DG deployments during peak times – see the Load_Served_Locally tab.

Finally, the Model calculates the share of CAISO peak load served by CAISO WDG + NEM exports to compare to Scenario 0 and calculate the impact of the TAC Fix for the three Post-TAC Fix Scenarios.

Summarizing Impact of TAC Rate Fix for Three Scenarios

Scenarios Comparison

The "Scenarios_Comparison" tab compares (i) the BAU's TAC rate forecast to that of Scenario 0 to show the impact of a change of a single variable, the TAC billing determinant, by comparing Scenario 0 to BAU, and (ii) the three Post-TAC Fix Scenarios to BAU, to show a simplified impact of the TAC Fix that facilitates messaging about the TAC Fix impact to third parties.

Next, the tab aggregates cumulative CAISO payments and CAIS peak load from each of the Scenarios, to serve as a data store from which the "Summary" tab can pull a subset of information and graphs. Savings are indicated by negative numbers.

Summary

The "Summary" tab shows the impact of the TAC Fix on various Scenarios and metrics. It copies a subset of values from other tabs, and organizes them in a clean summary. Like the "Scenarios_Comparison" tab, it first compares the BAU's TAC rate forecast to that of Scenario 0 to show the impact of a change of a single variable, the TAC billing determinant, by comparing Scenario 0 to BAU. However, unlike the "Scenarios_Comparison" tab, it then compares the three Post-TAC Fix Scenarios to Scenario 0 to show the impact of changing a single variable, the amount of DG deployment.

The only calculations in "Summary" tab is "time to neutral years," which compares scenario TAC rates to BAU TAC rates for each year of the forecast, to determine when scenario TAC rates fall below BAU TAC rates.