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October 25, 2012

MEMORANDUM

TO: Power Committee

FROM: Steven Simmons

SUBJECT: Update on the Wholesale Electricity Price Forecast

As part of the Mid Term Assessment, staff is preparing a long term wholesale electricity market price forecast. Preliminary forecast results were presented at the September and October Power Committee meetings. Since then, work on the forecasting model has continued, with refinements to input parameters pertaining to resource capacities, natural gas prices, plant heat rates, and CO₂ emission rates. The final stage of modeling runs is currently underway and is expected to be complete by November 2. The presentation itself is not yet ready since the modeling work is incomplete at this time, however results from several of the model runs will be presented at the November Power Committee meeting; the remaining model results will be reviewed in the Mid-Term assessment report.

In addition to producing the price forecast, work has progressed on using the Council production cost model to evaluate CO₂ emissions both WECC wide, and for the Northwest region. As a result of the work to date, modeled CO₂ emission levels have compared fairly well to actual emission data as reported by the EPA and EIA. One expected benefit of the development of an accurate emission model is to analyze the effect of potential federal carbon regulatory policies and California's expected cap and trade program on CO₂ emissions, generation, and natural gas fuel consumption for the region.

Update On The Wholesale Electricity Price Forecast

Forecast & Modeling Results

November 6, 2012

Steven Simmons

Today's Discussion

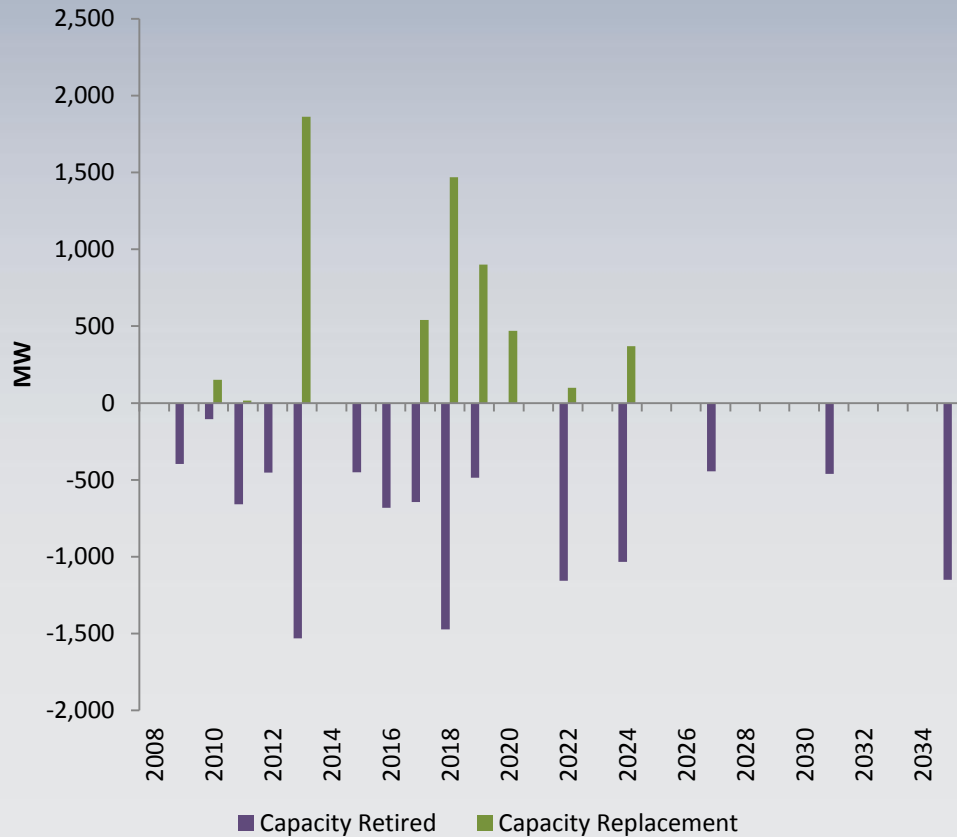
- California Once Through Cooling (OTC) Assumptions
- CO₂ emission modeling
- Base Case Results
- Scenario/Sensitivities
- Emission Projections
- Final Work

California Once Through Cooling

- In May of 2012, the California State Water Resources Control Board adopted a statewide water quality control policy on the use of Once Through Cooling (OTC)
- The regulation would phase out the use of OTC systems over time for coastal area power plants in the state.
- For modeling purposes, the assumptions include
 - 18 plants to remain in operation through mitigation or retrofits – 10,797 MW capacity
 - 41 plants to retire, primarily old gas fired steam turbine plants – 11,127 MW capacity
 - 34 plant replacements – 5,877 MW capacity
 - Results in roughly a 5,250 net reduction in capacity
- San Onofre nuclear units are down, and modeled to return to service starting in 2014
- We will run a scenario with San Onofre retired based on OTC

California Once Through Cooling Assumptions

1) OTC Capacity - Assumed Retirements and Replacements through Time



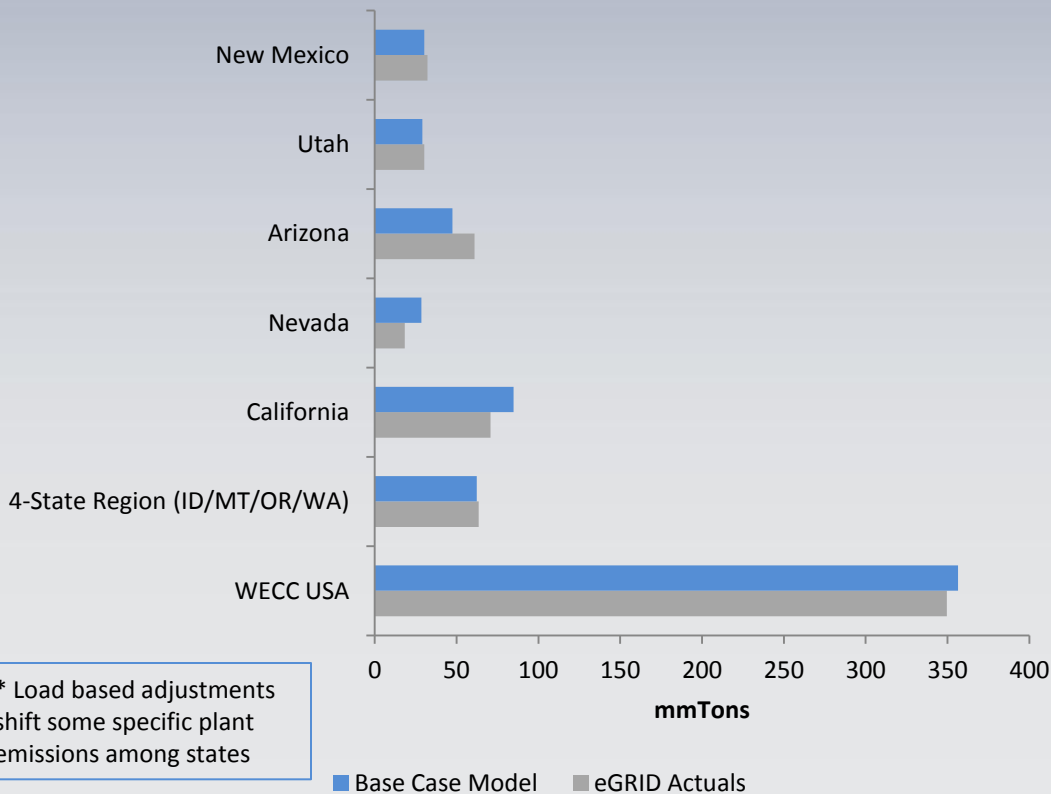
Plant	Capacity-MW	
Diablo Canyon 1,2	2,240	Continue to Operate
Encina 4,5	630	Continue to Operate
Mandelay 1,2	430	Continue to Operate
Morro Bay 3,4	673	Continue to Operate
Moss Landing CC 1,2	1,020	Continue to Operate
Moss Landing Power Plant 6,7	1,509	Continue to Operate
Ormond Beach 1,2	1,516	Continue to Operate
Pittsburg 5,6	629	Continue to Operate
San Onofre 2,3	2,150	Continue to Operate
Total	10,797	Continue to Operate
Haynes CC	1,150	Retirement
El Segundo 3,4	650	Retirement
Alamitos 1-6	1,997	Retirement
Contra Costa 6,7	672	Retirement
Encina 1-3	320	Retirement
Harbor CC	462	Retirement
Haynes 1,2,5,6	979	Retirement
Humboldt Bay ST 1,2	105	Retirement
Huntington Beach 1-4	904	Retirement
Pittsburg 7	682	Retirement
Potrero 3-6	362	Retirement
Redondo Beach 5-8	1,334	Retirement
Scattergood 1-3	817	Retirement
South Bay 1-4	693	Retirement
Total	11,127	Retirement
Alamitos 1-6 R	1,470	Replacement
Carlsbad Energy Center 1,2	540	Replacement
El Segundo CC 1,2	537	Replacement
Haynes 11-16	600	Replacement
Humboldt Bay IC 1-10	167	Replacement
Huntington Beach Energy Proj 1,2	939	Replacement
Marsh Landing Gen Station 1-4	724	Replacement
Redondo Beach 7,8	900	Replacement
Total	5,877	Replacement

CO2 Emission Modeling

- The AURORAxmp[®] electric market model calculates CO₂ emission quantities in tons based on
 - power output
 - plant specific heat rate (Btu/kWh)
 - fuel specific emission rate (lb/mmBtu)
- The EPA publishes a database for grid connected power plants in the US
 - Emissions & Generation Resource Integrated Database – eGRID 2012 Year 2009
 - Emissions, including CO₂, are estimated using information from various sources, with the majority sourced from EPA/CAMD (clean air markets division) data. The data is reported by plant, and is aggregated in many forms including by state.
 - <http://www.epa.gov/egrid>
- Work was completed to compare model results from the forecast with eGRID values for 2009 – the most recent year with actual emissions data available

Historic CO₂ Emissions

2) CO₂ Emissions - 2009
Reported & Modeled *



Decent accuracy in the comparison between model backcast and EPA reported quantities for a single year (2009)

4-State Region (ID/MT/OR/WA)
Delta of -1.3 mmtons
-2 % error

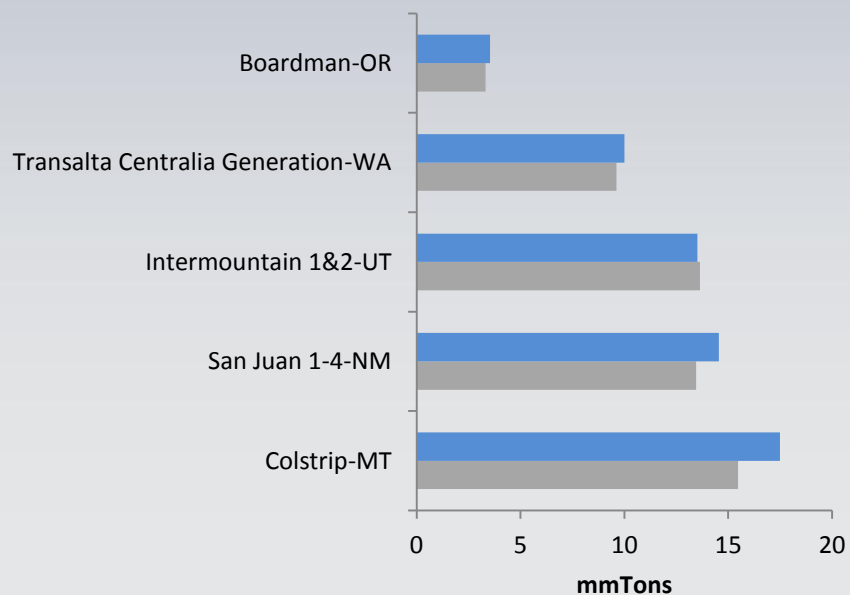
WECC US region
Delta of 6.8 mmtons
2 % error

Historic CO2 Emissions

Plant level, emission percentage error between model and eGrid

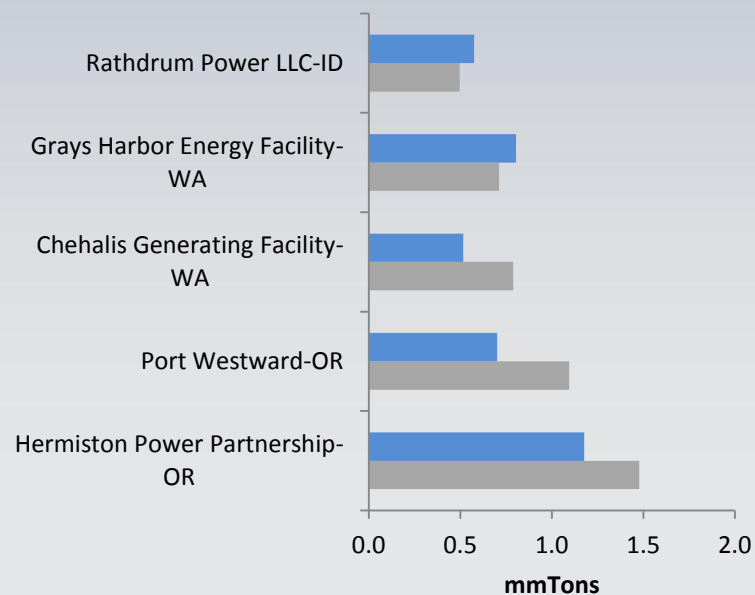
- Coal -0.8 % to +13%
- Ntrl Gas -36% to +16%

**3) CO2 Emissions - 2009
Selected Coal Plants**



■ Base Case Model ■ eGrid Actuals

**4) CO2 Emissions - 2009
Selected Natural Gas Plants**



■ Base Case Model ■ eGrid Actuals

Electricity Price Forecast

Base Case includes

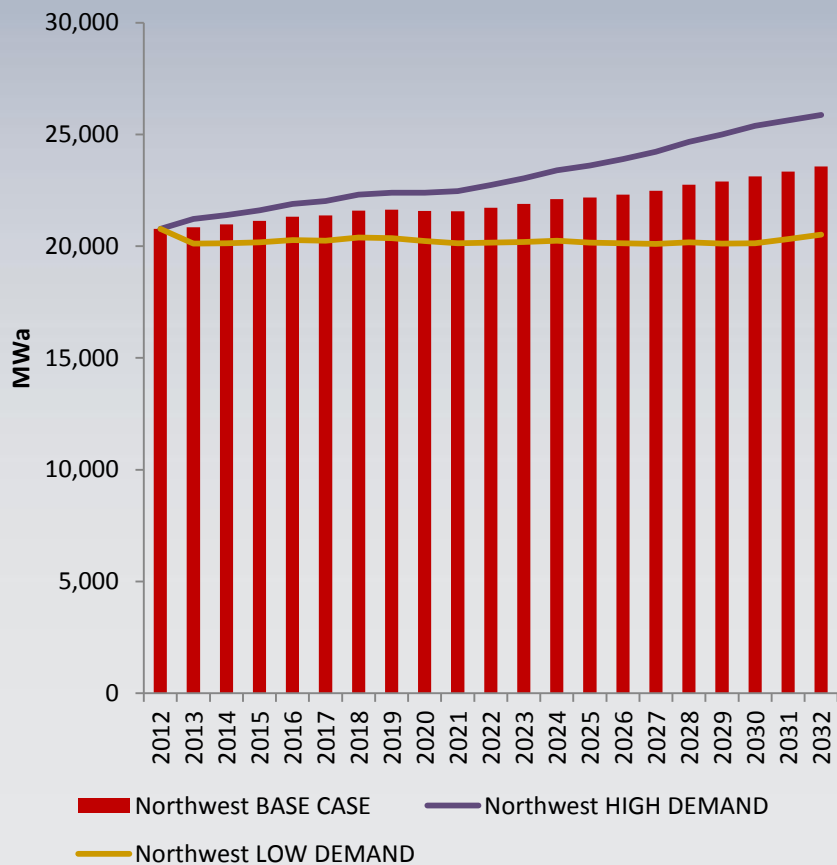
- Medium Demand Forecast
- Medium Natural Gas Price Forecast
- Federal CO₂ Regulatory Cost beginning in 2015
- CO₂ Cap & Trade Programs in CA and BC beginning in 2013 & 2008
- Significantly lower electricity prices than 6th Plan Forecast, due to lower demand, lower gas prices, deferred CO₂ regulation

5) Wholesale Electric Price Forecast
Average at Mid C

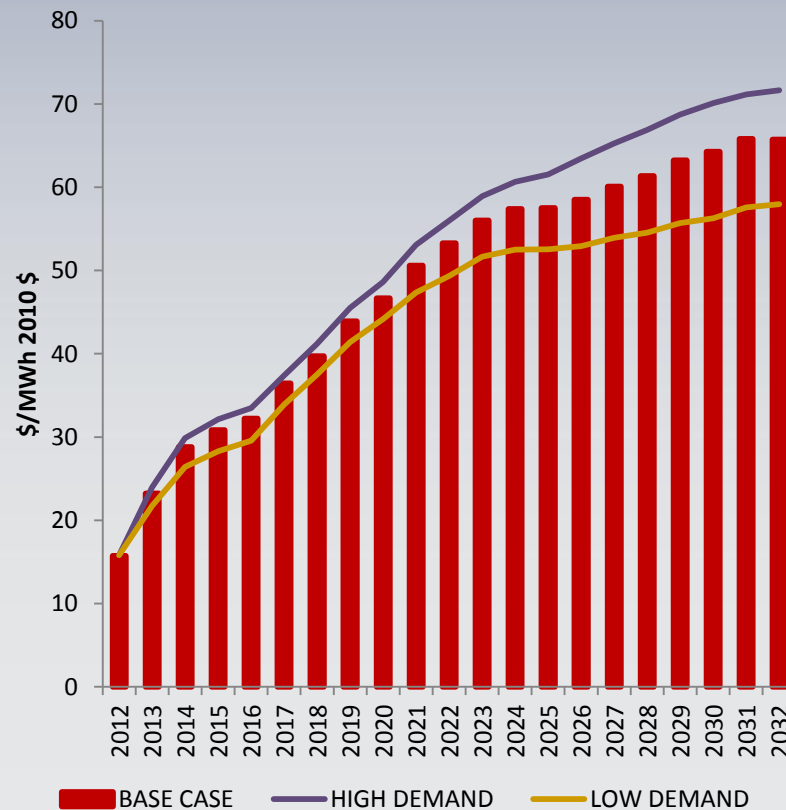


Demand Sensitivity

6) Demand Forecast - Northwest Region

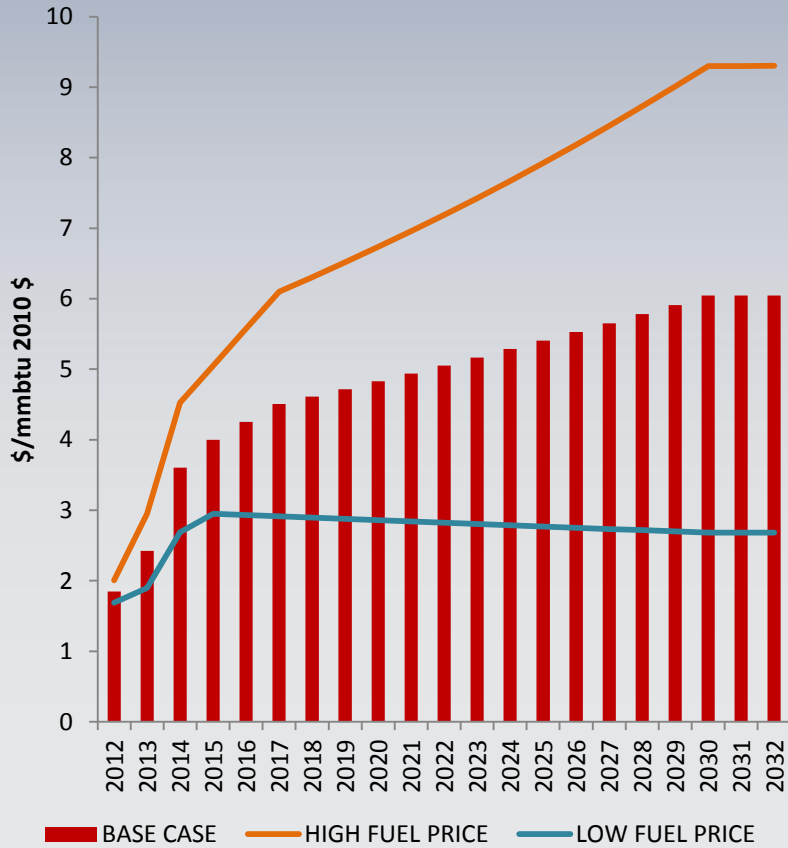


7) Wholesale Electric Price Forecast Average at Mid C

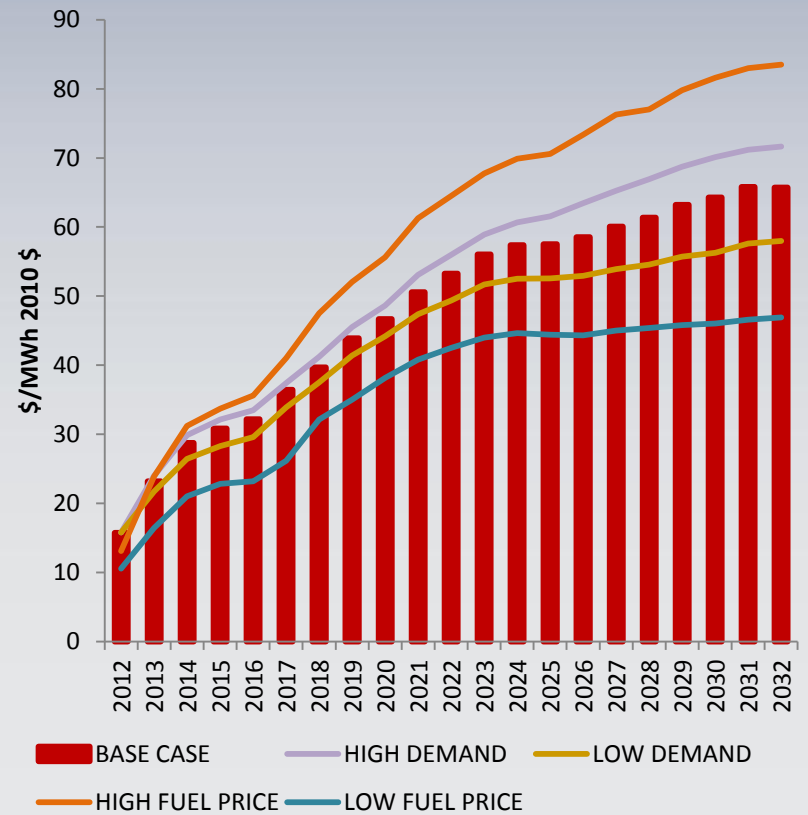


Fuel Price Sensitivity

8) Natural Gas Price Forecast - PNW East



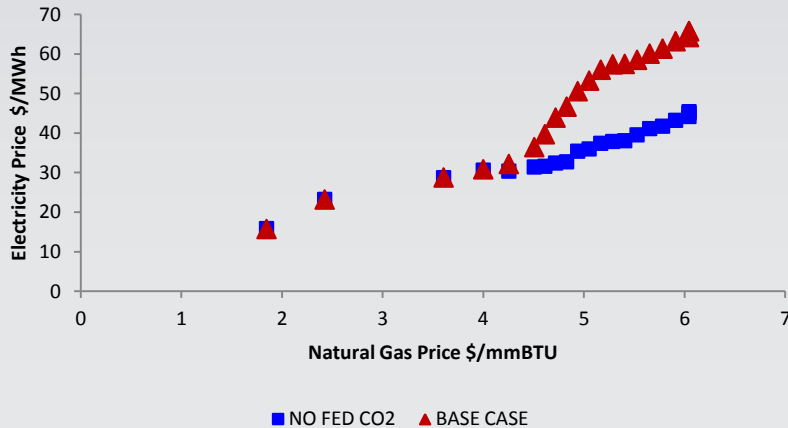
9) Wholesale Electric Price Forecast Average at Mid C



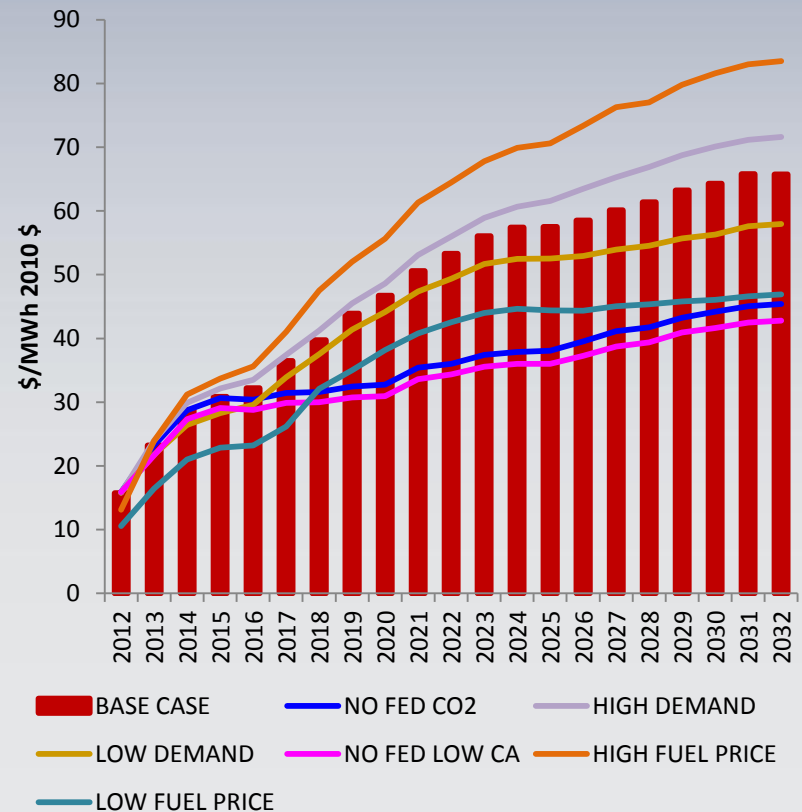
CO2 Regulatory Cost Sensitivity

- Base Case includes Federal Regulatory Cost for CO2 emission beginning in 2015 and CA cost in 2013
- Case with No Federal Regulatory Cost for CO2 emission
- Case with No Federal and Reduced CO2 cost for California AB32

11) Wholesale Electric Price Forecast against Natural Gas Price Forecast

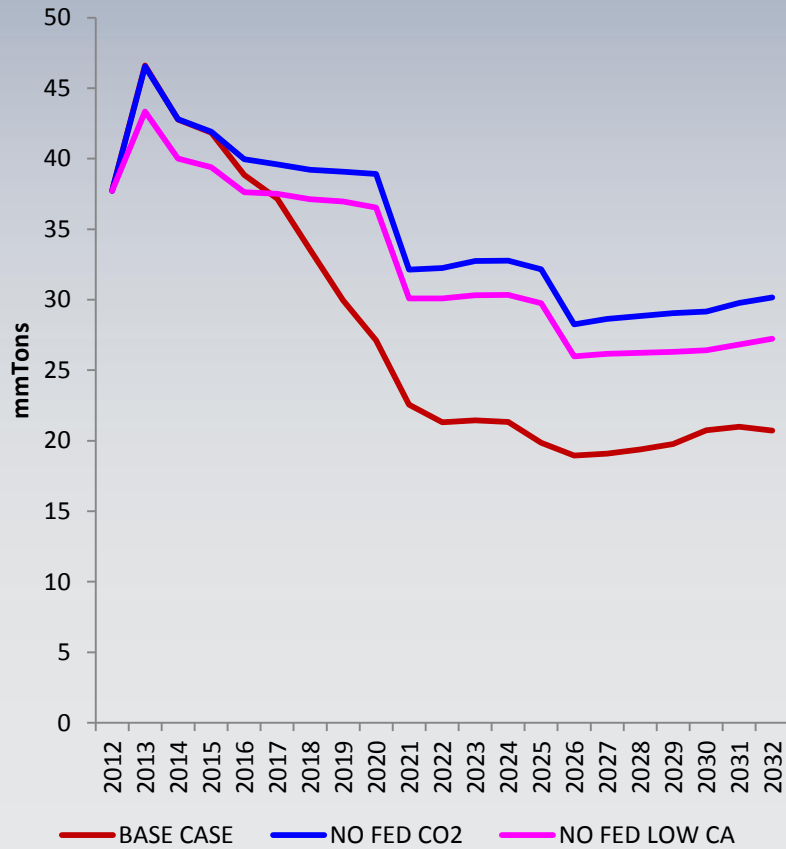


10) Wholesale Electric Price Forecast Average at Mid C

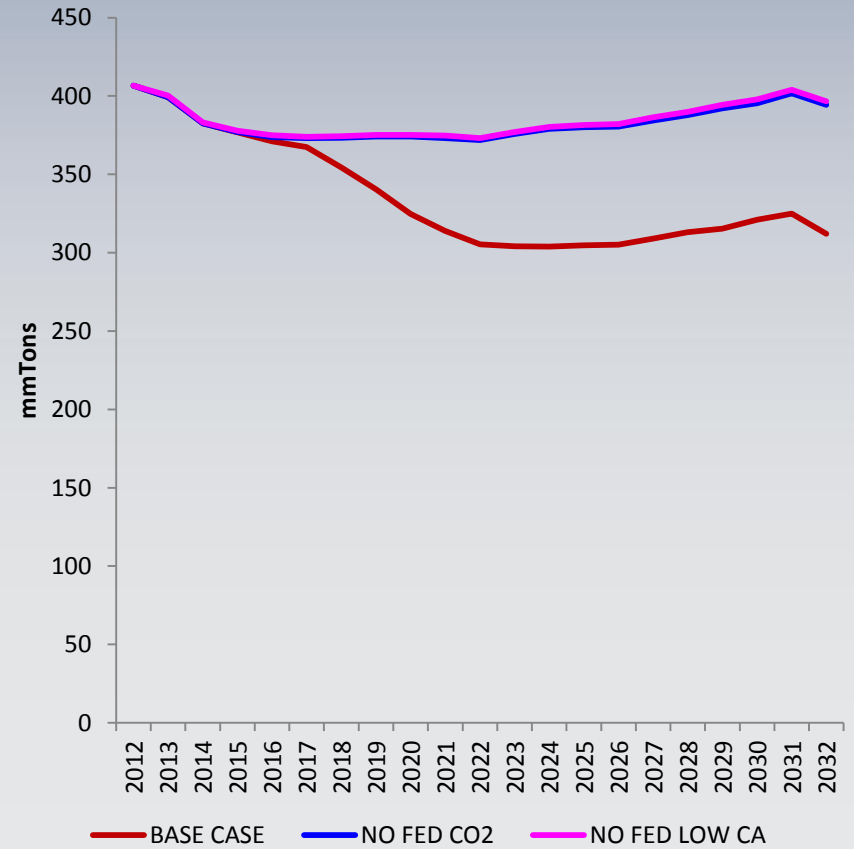


CO2 Emissions Projections

13) CO2 Emission Projection - Northwest



14) CO2 Emission Projection - WECC



Remaining Work

- Further examination of fuel consumption, resource mix, and CO₂ emission trends
- Running a model case assuming San Onofre Nuclear plant is retired and looking at the impact on NW generation and import/exports