February 4, 2020

MEMORANDUM

TO: **Power Committee**

FROM: **Ben Kujala**

SUBJECT: **Review of Plan Scenarios – Part 2**

BACKGROUND:

Presenter: Ben Kujala

Summary: The proposed scenarios were presented to the Power Committee in July (https://www.nwcouncil.org/sites/default/files/2019_0716_p1.pdf) and the Power Committee provided feedback on the scenario list in August.

The first three scenarios (Early retirement of coal generation, Change reliance on extra-regional markets for resource adequacy, and Analyze the Bonneville portfolio) were reviewed at the January Power Committee meeting. (https://www.nwcouncil.org/sites/default/files/2020_01_p1.pdf)

This presentation details how staff proposes implementing the remaining scenarios in the power plan analytical process. The scenarios discussed in this presentation are:

- Test Robustness of Energy Efficiency
- Organized/Limited Markets for Energy and Capacity
- Greenhouse Gas Tipping Point
- Paths to Decarbonization

Relevance: The scenarios and associated analyses help develop findings for drafting the plan.

Workplan: A.1.1 Develop and analyze scenarios for the Power Plan

Review of Plan Scenarios - Part 2

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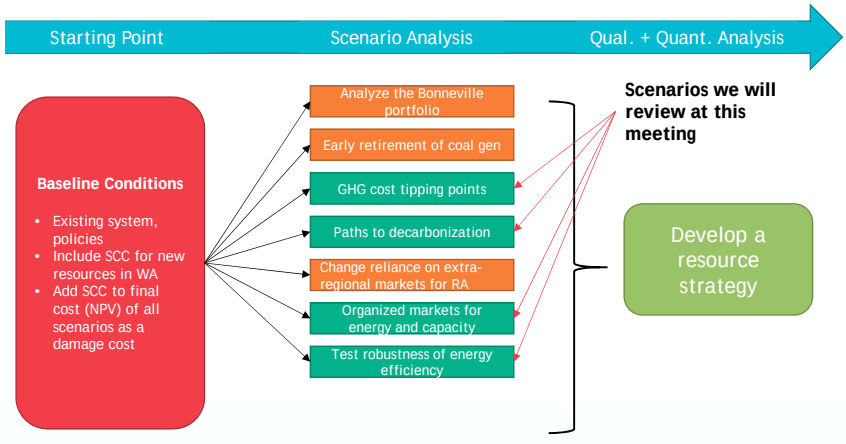
Building the 2021 Power Plan



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What are the high-level themes?

- GHG Emissions
- Resource Adequacy
- Market Expansion
- Recommendations to Bonneville

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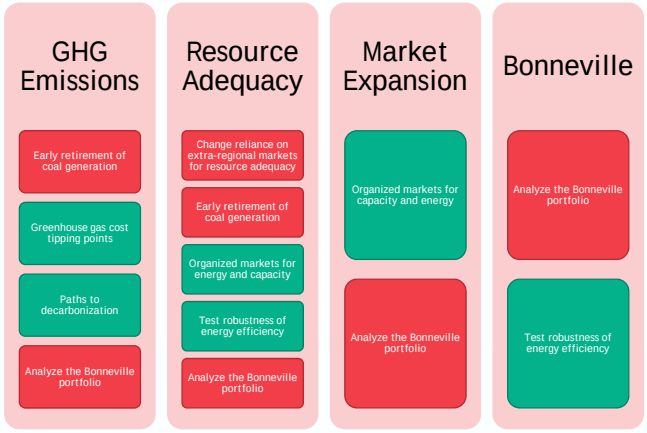
Primary connection to high-Level themes



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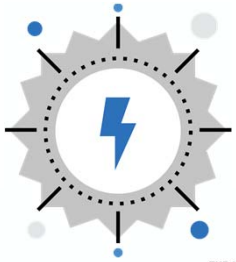
Test robustness of energy efficiency

- Test increasing and decreasing the supply and uptake of energy efficiency
- Examine impacts on regional cost and risk



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Proposed in-scope

- Test increasing EE supply and examine the impacts on portfolio cost
  - Use differing ramp rates reflecting accelerating/decelerating EE acquisition
  - Increase/decrease maximum achievable EE in 20-year horizon
  - Add in emerging EE measures to see impact of additional EE in later years or include >100% ramp rate on existing EE to emulate emerging tech
- Test varying the capacity contribution of EE
  - Change kW impact or load profile to see value of capacity contribution; potentially as a modifier to the ASCC
- Test the interaction between the availability of EE and the availability of DR
  - Modify potential and/or modify elasticity between EE and DR, as DR availability is tied to EE ramp rates

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Proposed out-of-scope

- Non-electric EE (e.g. Natural gas EE)
- Limiting the acquisition of EE to a "market price"
- Any changes to the load forecast driving the number of units for EE
- Testing secondary impacts of changing EE capacity impacts on other resources – this would require rerunning all ASCC studies

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Organized / limited markets for energy and capacity

- Look at the impact on the cost of new resources
- Estimate changes to adequacy and reserve requirements

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Proposed in-scope

- Change in Generating Resource Potential available to the region – in an organized market transmission would not limit the resource options available to the region
- Change in Wheeling Charges – these charges are based on charges to get in and out of balancing authorities and existing markets
- Change in market price caps – markets would implement price caps which could limit the value resources like DR get in the market. (CAISO uses $1000 a MWh)
- Adjust regional Planning Reserve Margin (PRM) – simple adjustments to look at the impact of markets on reducing the resources needed for adequacy

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Proposed in-scope

- Adjust market availability in GENESYS – probably most of the impact would be on the Adequacy Reserve Margin
- Change the peak hour of EE supply curves to match WECC-wide peak versus regional peak
- Change the supply curve ramp rates and maximum potential to reflect market signal for capacity from EE and DR
  - Increase program participation rates with increased marketing/incentive costs by utilities

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Proposed out-of-scope

- Transmission expansion – transmission planning in an organized market would be simpler and likely more efficient but our models and responsibilities do not encompass transmission expansion
- Adequacy studies for outside the region
- Defining the footprint, products, rules, etc. of a particular implementation of organized markets for energy or capacity
- Changes in generating or demand-side resource potential outside the region
- Change in debt financing for resources – assuming the same mix of public, IOU, and IPP debt
- Change in loads based on Transactive style pricing or increasing consumer uptake of distributed generation

Greenhouse gas cost tipping points

- Look at adding a regional price for greenhouse gas emissions in addition to existing policies
- Explore thresholds where the resource strategy changes based on responding to the carbon price

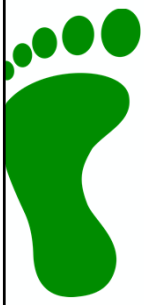
Proposed in-scope

- Test a range of greenhouse gas prices for inside and outside the region
  - Market prices could impact the uptake of energy efficiency depending on how much is acquired in the baseline conditions
- Expand generating resource reference plant options / potential to give additional depth resources that do not emit greenhouse gases
- Examine change in retail price of electricity based on a carbon tax passed through to consumer
- Test for sufficient reserves and examine resources used to supply reserves

Proposed out-of-scope

- Only applied to the electric sector for this scenario. Other sectors will be explored in the *Paths to decarbonization* scenario.
- Changes in adequacy requirements based on different levels of carbon pricing (ARM and ASCC)
- Change in consumer response to pricing may be analyzed in Energy2020, but we will likely not take different loads to downstream processes

Paths to decarbonization



- Look at potential approaches to reducing greenhouse gas emissions both in the electric sector and in other economic sectors
- Quantify how emissions in the electric sector can be reduced and how that will net out with emissions in the other economic sectors like transportation and end-use of natural gas
- Explore the practical limits of how far emissions can be reduced, e.g. a percentage relative to 1990 emissions, and how quickly that reduction can be achieved

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Aggregate Initial Model Emissions (MMT CO2e)

	Historic	Estimate	Initial Model Forecast	
	1990	2018	2040	2050
Energy Related Emissions	156	178	180	193
Non-Energy Related Emissions	41	50	50	51
Total Energy & Non-Energy Emissions	**198**	**229**	**229**	**243**
Target reduction as percent of 1990 levels			50%	80%
Target emissions level			99	40

Numbers rounded to the nearest MMT

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Context on decarbonization – electric sector (MMT CO2e)

	Historic	Estimate	Natural-Gas-Limited Electricity Price Forecast	
	1990	2018	2040	2050
Electric Sector	46	37	19	20
Coal	40	13	1	1
Natural Gas	2	21	15	15
Wood	4	2	4	4

80% of electric sector's 1990 emissions levels is 9.2 MMT CO2e

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Context on decarbonization – other energy sectors (MMT CO2e)

	Historic	Estimate	Initial Model Forecast	
	1990	2018	2040	2050
Residential/ Commercial	18	25	30	33
Coal	0	0	0	0
Natural Gas	10	18	21	23
Oil	4	3	3	3
Wood	3	4	6	7
Industrial, w/o Agric	25	23	19	17
Coal	2	1	1	1
Natural Gas	9	10	8	8
Oil	4	3	3	3
Wood	9	10	6	5

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Context on decarbonization – transportation (MMT CO2e)

	Historic	Estimate	Initial Model Forecast	
	1990	2018	2040	2050
Transportation	68	93	**111**	**122**
Motor Gasoline	39	49	46	42
Diesel	15	30	47	59
Natural Gas / Other	13	15	19	21

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Context on decarbonization – non-energy emissions (MMT CO2e)

	Historic	Estimate	Initial Model Forecast	
	1990	2018	2040	2050
Total Non-Energy Emissions	41.4	50.2	49.6	50.6
Industrial, w/o Agric	2	2	2	2
Waste Management	6.15	8.23	9.85	10.44
Solid Waste	4.71	6.36	7.65	8.13
Waste Water	1.28	1.73	2.04	2.15
Incineration	0.16	0.13	0.16	0.16
Agriculture	24.5	29.9	29.0	29.7
Industrial Processes	8.9	9.9	8.7	8.4

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Proposed in-scope

- Natural Gas Price and related emissions
  - Change in wholesale price based on reduced demand
  - Reduce upstream methane emission reductions
  - Test price based on blending natural gas to reduce emissions intensity of natural gas fuel
  - Estimate impact of fuel switching on the retail price of natural gas
- Regional Transportation fuel consumption
  - Transportation fuel switching – test increase EV adoption
  - Increase gasoline efficiency – increase CAFÉ standards to 80 MPG or 100 MPG by 2050
  - Increase in alternative delivery methods (Policies to reduce miles travelled)
  - Evaluate alternative fuels (hydrogen, biofuel)

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Proposed in-scope

- Consumption of Natural Gas (End-use)
  - Natural gas retail price increase – reflecting emissions cost to consumers may impact consumer choice
  - Reduce greenhouse gas intensity of natural gas fuel – e.g. RNG blending
  - Evaluate alternative fuels (hydrogen, biofuel) for industrial processes
- Generating Resources
  - Accelerated retirements – coal and natural-gas-fired generation
  - Added resources – offshore wind, SMR, enhanced geothermal, etc.
  - Increased potential of non-GHG-emitting resources (i.e. conventional geothermal and pumped storage)

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Proposed in-scope

- Load Forecast
  - Increase behind-the-meter solar and battery penetration (net zero homes)
  - Increase standards
  - Increase alternative fuels penetration – hydrogen & biofuel
  - Acquire EE outside electric load (e.g. in natural gas end-use)
  - Test no new gas/oil/coal consumption for residential and commercial sectors
  - Increase efficiency of use for both electricity and natural gas
  - Implement economy-wide consumer GHG pricing - test $50 & $100 per ton CO2e

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Proposed in-scope

- California
  - Fuel switching of load outside region – new and/or replace on burnout
  - Estimate electrical loads as a result of deep-decarbonization
- EE
  - Increased units from fuel switch
  - Increase availability a la EE Robustness
  - Increased availability from emerging technologies
  - Update with aggressive retrofits

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Proposed in-scope

- DR
  - Events based on highest GHG emission hours?
  - Increased potential from increased units/loads
  - Update potential based on changes in units and load forecast
- Greenhouse Gas Sink
  - Need supply curve, costs, and limitations
  - Inventory of potential policy initiatives
  - Supply curve is proxy for other reductions (expensive, not the first measure)

Proposed in-scope

- Estimate System Adequacy Requirements (GENESYS)
  - Optimize Hydro & Regional Generation based on GHG emissions
  - Review adequacy based on retirements and markets outside the region
- Forecast Electricity Price (AURORA) & RPM
  - WECC-wide carbon tax or carbon cap, restrict new resource options
  - Expand 100 percent clean (accelerate)
  - Dispatch based on GHG emissions
  - Possible Time-Of-Use rate structure study

Proposed out-of-scope

- RNG past 20% of supply mix
- Transmission expansion
- Carbon Capture for thermal generation
- Increased RPS
- Evaluating total consumer cost (equipment cost)

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