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January 7, 2021

## MEMORANDUM

**TO: Power Committee**

**FROM: Ben Kujala**

**SUBJECT: Update on Baseline Conditions in the RPM**

### **BACKGROUND:**

Presenter: Ben Kujala, John Ollis

Summary: Since sharing the first look at Regional Portfolio Model (RPM) results there have been data updates, advisory committee input, stakeholder conversations and email, and dozens of tests run to help understand the sensitivity of the model to different parameters and assumptions.

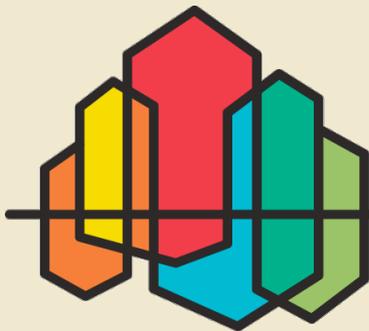
This discussion will be an opportunity for staff to share with the members the factors we've discovered heavily influence the resource strategies in the RPM. These factors include:

- How the Social Cost of Carbon changes resource selection
- What resources change given different adequacy signals
- How import and export limits impact resource selection and renewable curtailment
- Factors driving higher renewable builds
- How resource build rates impact resource selection
- What changes when natural gas generation is excluded

Staff will make a recommendation on what should be included in the baseline conditions, taking into consideration feedback from the advisory committees. We will solicit feedback from the members both during and after the meeting to help guide the development of these baseline conditions which will be used for comparison as we move forward with scenario analysis.

These results are being taken to a joint meeting of the System Analysis Advisory Committee and the Resource Adequacy Advisory Committee on January 8<sup>th</sup> for feedback. The presentation will be finalized when we incorporate that feedback and thus will not be included in the packet.

# Update on Baseline Conditions in the RPM



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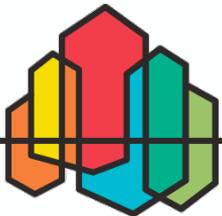
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# Updates and Further Analyses

Since sharing the first look at RPM results there have been

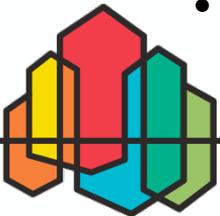
- Data updates
- Advisory committee input
- Stakeholder conversations and email
- Dozens of different runs to test the sensitivity of RPM to different parameters

Results here reflect this work and may not directly cross-walk to the first look results – however any substantial change to high-level conclusions will be called out and examined in this presentation



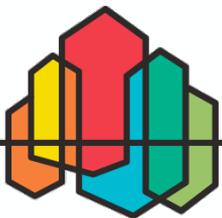
# What are baseline conditions?

- Baseline conditions are a basis for comparison when developing scenarios
- Baseline conditions are assumptions that are common between 2 or more scenarios
- Baseline conditions are **not**:
  - Business as usual
  - Most likely scenario
  - Default forecast
  - Recommended regional resource strategy



# Results that Follow are **Directional**

Note, testing done in RPM has been to get a general sense of the impact of changing parameters. In particular, ARMs and ASCC parameters from GENESYS will change when we get a final run from the Redeveloped GENESYS model



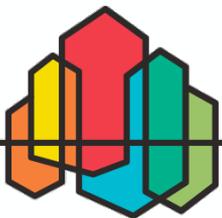
# Incorporating Social Cost of Carbon into RPM

RPM includes carbon costs in the portfolio separate from whether the cost is included in dispatch.

Optimization is done to reduce this cost even when resources are not dispatching based on a carbon price signal

Upstream emissions are included

Dispatch can be altered based on carbon costs – this will be explored in scenarios



# Social Cost of Carbon

Including the Social Cost of Carbon in the portfolio cost has been the parameter with the biggest impact thus far.

Observations from testing zero Cost of Carbon:

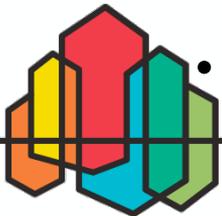
- Under 255 aMW cumulative EE acquired by 2026 – or less than 25% of the EE potential
- Increased build of natural gas generation
- Decreased near-term build of renewable resources from 9 GW to around 1500 MW

• Similar DR outcomes



# Resource Build Rate

- Generating Resource and DR build rate has a substantial impact on what resources get built
  - Restrictive build rates for cheaper resources means the model moves on to more expensive resources when it runs out of the options to build the cheap resources
  - Increase on average of 700 MW DR build
- Not related as much to total potential as how much can be built per decision period (year)
- Observations from testing build rates:
  - Increases renewables build in action plan period – up to the 14 to 16 GW range
  - Decreases natural gas generation and storage – 1 peaking gas plant built
  - Decreases EE acquisition



# No New Natural Gas Generation

Simply removing options from the model did not seem like a reasonable test of a resource strategy without natural gas generation. So to balance this test we doubled the DR and Generating Resource build rates.

Because of this results are very similar to just increasing the build rate.

Observations from no new gas generation test:

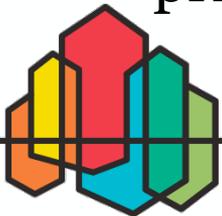
- Large increase in renewable generation builds
- Reduction in EE acquisition – under 400 aMW by 2026



# Factors driving higher renewable builds

## Building renewables:

- Quickly reduces emissions – energy efficiency tends to build slower but can get to a large cumulative reductions by the end
- Get REC and PTC revenue – thus make money when other resources lose money
- Meet RPS and Clean requirements – avoiding penalties built into RPM for missing these policy requirements
- Are substantially less expensive than in the 7<sup>th</sup> plan – thus more competitive with other resources including EE
- Are dispatchable – thus able to avoid significant negative price excursions that penalize non-dispatchable resources

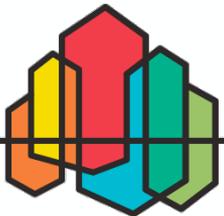


# Renewable Curtailment

Renewable curtailment is pervasive throughout all tests

Even without price iteration, renewables curtail based on external electricity price – i.e. in-region renewable resources curtail based on oversupply outside the region

The model trades off increases in curtailment against incremental reduction in the Social Cost of Carbon



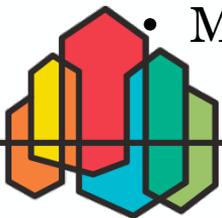
# Adequacy Reserve Margin

Observations from testing reduced Adequacy Reserve Margin (ARM):

- No DR developed
- Natural Gas Generation reduced to a single peaker in 2031
- Slight reduction in EE acquisition by 2026 – under 54% of total potential acquired
- Renewables build reduced but still substantial in the near-term around 5 to 6 GW

Observations from testing increased ARM:

- First couple of decision periods builds every option available and works up through expensive EE supply
- Higher optioning and development of DR – DR options are often part of the resources strategy but builds are rare except in the high ARM case
- Moderate EE build after initial couple of years



# Import and Export Limits

Observations from testing updated limits:

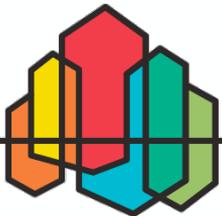
- No significant change from results seen in first look at baseline conditions

Observations from testing a 20K export limit:

- Prices still iterate down in some of the quarter
- NPV goes negative – i.e. the region is making more in the market than the cost of resources

Observations from testing a 50K export limit:

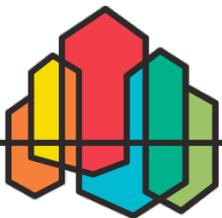
- Electricity prices did not iterate to lower prices in this run – little else could be learned since this was mostly to test the model functionality
- Renewable curtailment was still occurring though very infrequently



# REC Price & Regional RPS Requirement

Observation from testing zero REC price and large influx of unbundled RECs (2000 aMW per year):

- Renewables build moved from around 9 GW nameplate to around 7 GW nameplate
- Much smaller impact on renewables build than Social Cost of Carbon



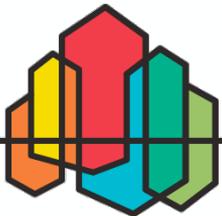
# Changing Initial Build Date for Resources

Not tested but as we get closer to the start of the study there will be more interest in changing when resources can be built.

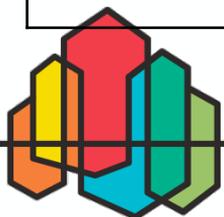
RPM does not have a representation of projects currently moving toward construction.

This could have unintended consequences:

- RPM has a immediacy bias – because we start with a adequacy shortfall things that are available early, especially if there are only a few option, will get built even if they are more expensive
- Large renewable build quickly changes the value proposition for other types of resources – this could create a compounding effect pushing other resources out of the resource strategy



Test	High Level Takeaways				
	EE	Ren	Gas	DR	Notes
Remove SCC in portfolio cost					SCC is an important factor driving baseline builds
No New Natural Gas (increase in other gen. resources to ensure sufficient options available)					Renewables are a quick build resource to meet near term needs, offsetting need and value of EE
Resource Build Rate					Restrictive build rates on cheaper resources means the model needs to select some more expensive resources
Low Adequacy Reserve Margin					The final ARM will likely be between these two tests. It has the potential to shift things around, but may not result in significant changes
High Adequacy Reserve Margin	Early 				
Import/Export Limits		N/A	N/A	N/A	Import/Export limits are not a key driver
REC Price & Supply					REC prices and requirements have a small to moderate impact on the renewables build



Decreased Build



Increased Build



Neutral to small impact

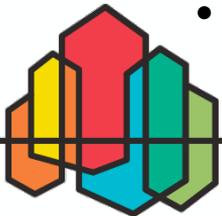
# Initial Thoughts on Changes to First Look

- Keep Social Cost of Carbon (SCC) as is – explicit dispatch based on SCC will be tested in scenarios as will no SCC
- Update import and export limits – not a large impact but why not use the most up to date data
- Increase generating resource build rates – restricting resource builds sends false signals to build more expensive resources because of near-term adequacy signals
- Keep natural gas generation in the baseline – perhaps reduce the total number of possible plants but eliminating it all together feels more appropriate for scenarios rather than baseline conditions



# Preliminary Results

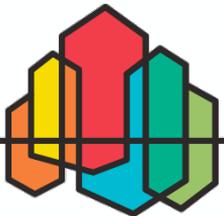
- Updating from first look results – but not with Redeveloped GENESYS adequacy results
  - Impact of this change could be similar to ARM test
- Main changes are updated generating resource build rates and updated import and export limits
- DR build rates not changed yet – currently under consideration
- Other changes include:
  - Increased REC and RPS penalties
  - Updated intra-period price curves
  - Updated EE supply curves
  - Updated DR resource information



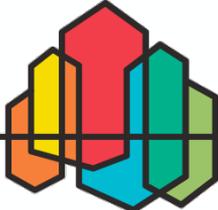
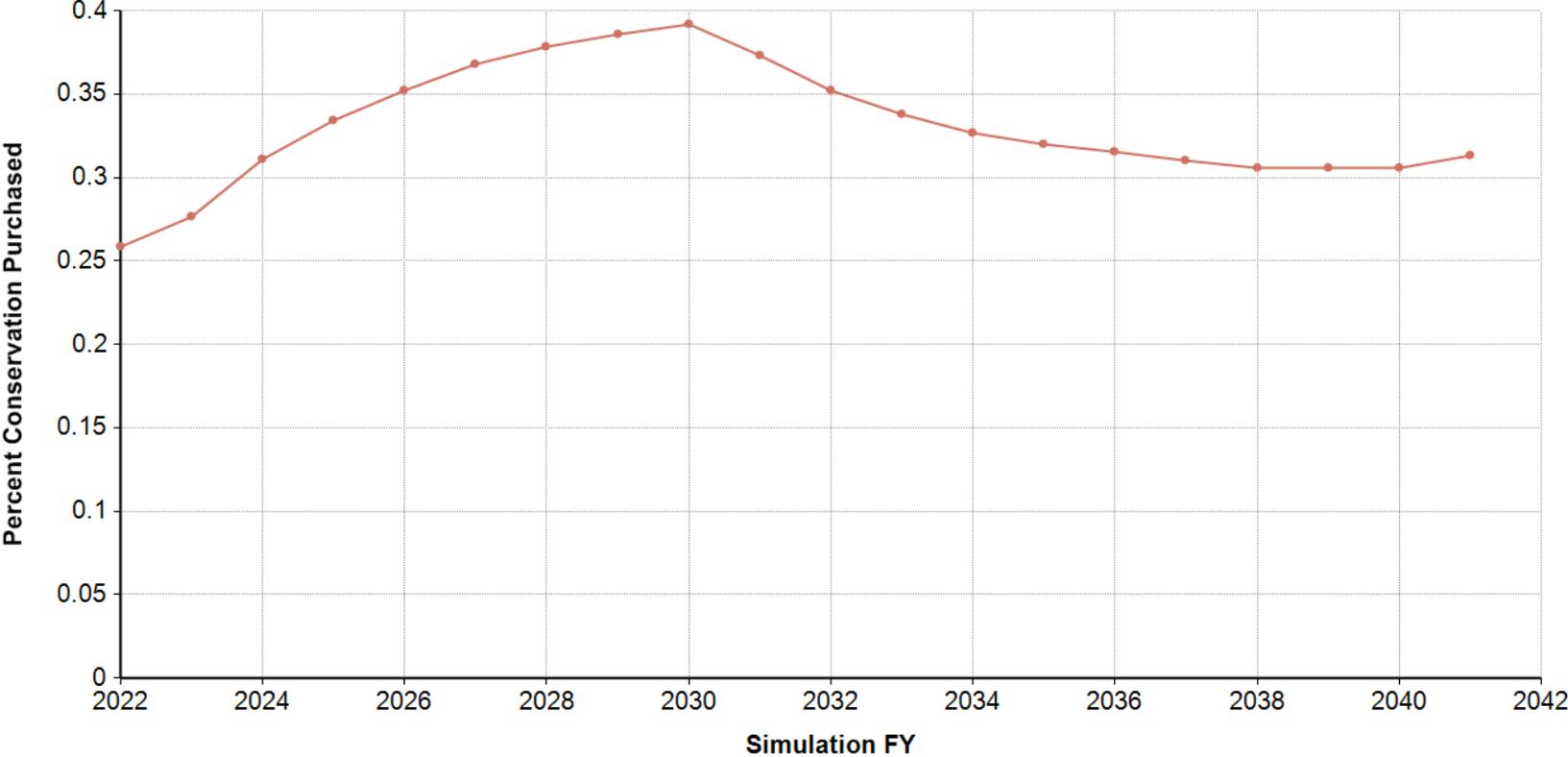
# High-level Changes

Relative to the first look presented in December:

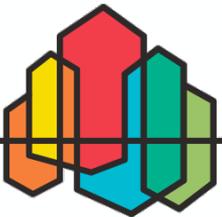
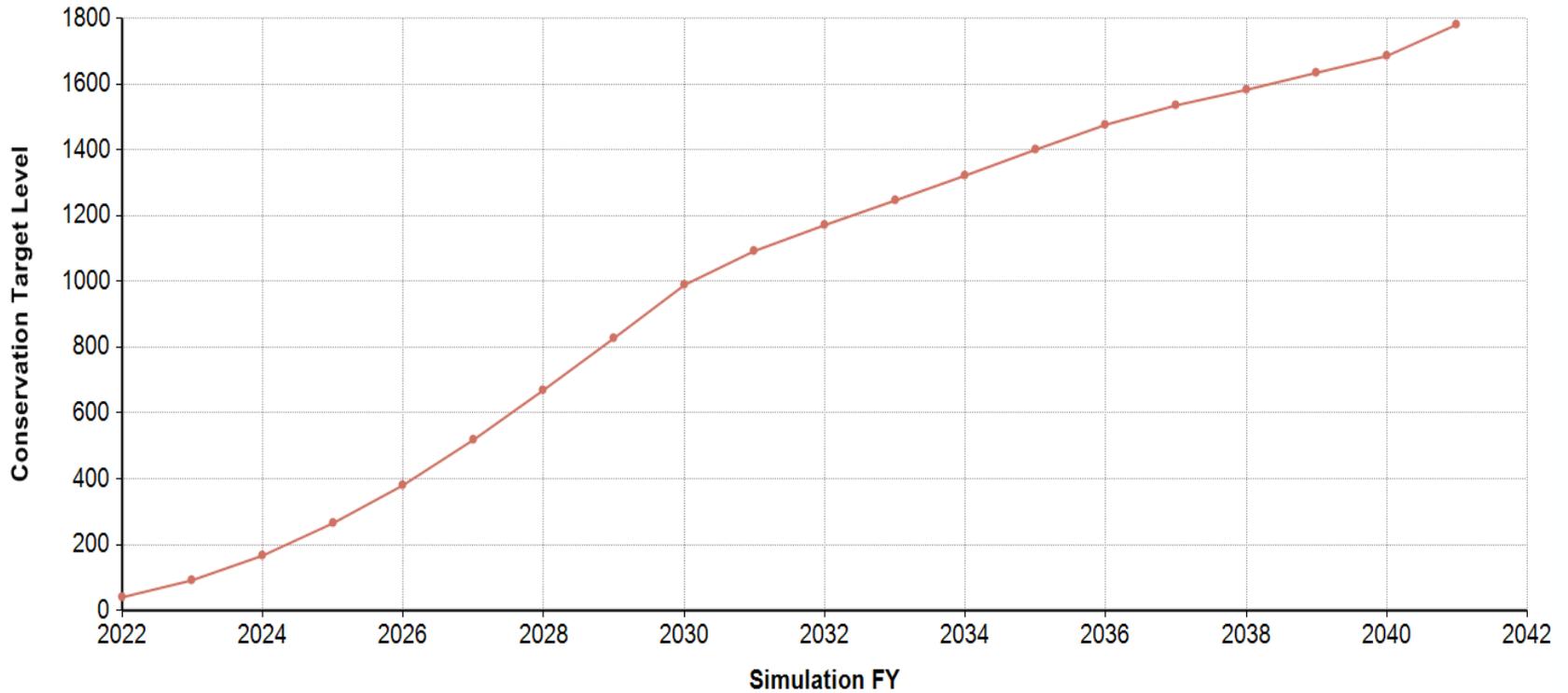
- Increase in the build of renewables – likely because of the increased build rate
- Decrease in the build of natural gas - large renewable build seems to drive down uptake of natural gas generation
  - No combined-cycle and three simple-cycle resources optioned
- Decrease in the build of EE – likely also a consequence of increased renewables build
- Similar DR results – more likely to change after we update the ARM



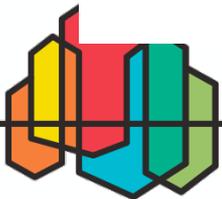
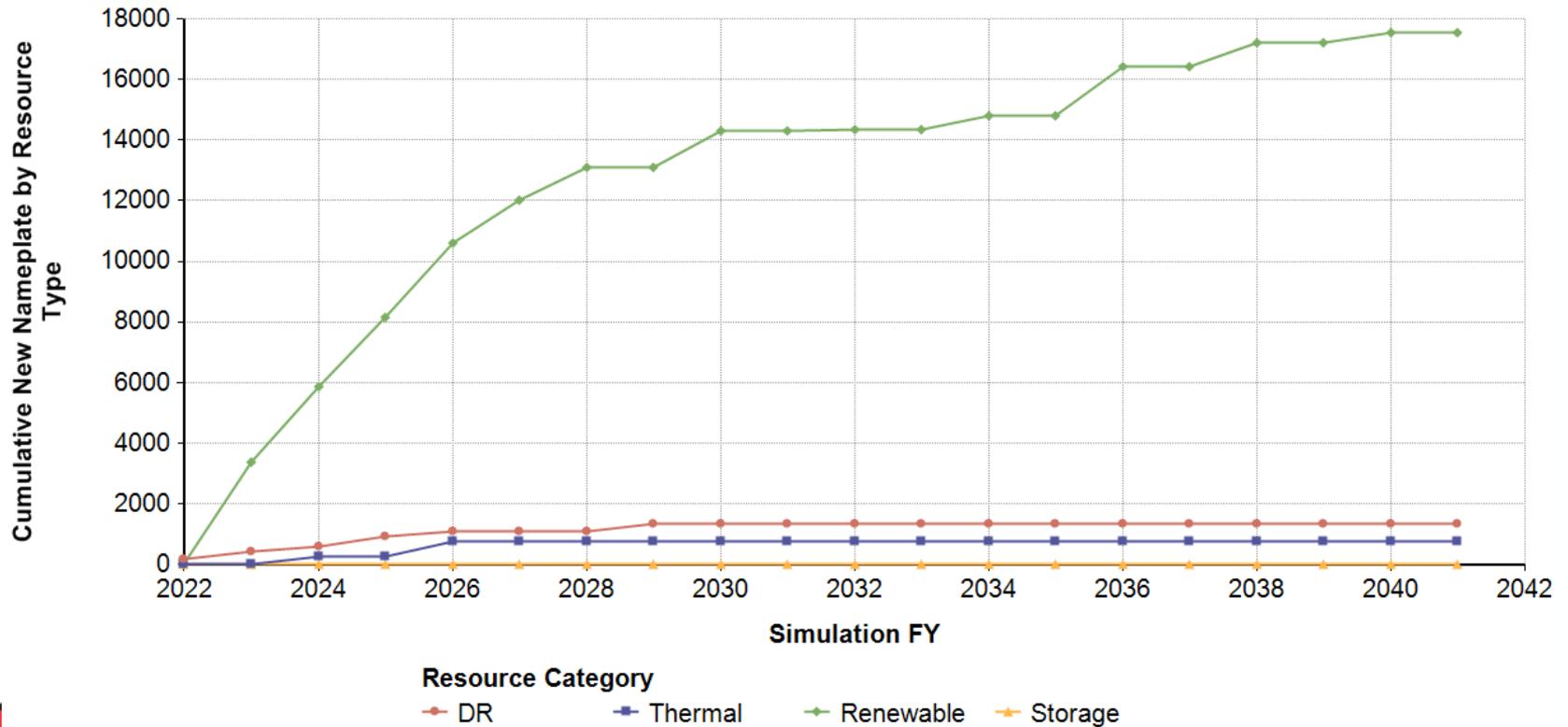
# Percent of Conservation Supply Purchased



# Maximum Amount of Conservation Purchased by FY



# Large Build of Renewables



A scenic landscape photograph of a mountain valley. In the foreground, a dark, calm lake is visible, surrounded by rocky, moss-covered terrain. A road or path winds through the valley, partially obscured by thick, white mist or low clouds that fill the middle ground. In the background, rugged mountain peaks rise above the clouds. The entire image is framed by a white, geometric, multi-sided shape that resembles a stylized house or a modern architectural element. The word "Questions" is written in a large, black, sans-serif font on the left side of the image.

# Questions