Northwest **Power** and
Conservation Council

March 2, 2021

MEMORANDUM

TO: **Council Members**

FROM: **Ben Kujala**

SUBJECT: **Robustness of EE Scenario Summary**

BACKGROUND:

Presenter: Ben Kujala

Summary: At the February Power Committee Meeting, we presented our work to date on the Robustness of EE Scenario. This scenario is designed to explore the uncertainty in the acquisition rate of energy efficiency as well as efficiency's capacity contribution.

While we've done substantial testing thus far, we're incorporating the needs assessment from our Redeveloped GENESYS model into RPM and anticipate having results on March 6th or 7th that will allow us to update and add to the body of work on this scenario. In the presentation that is included in packet we've indicated where we anticipate updates and additional analysis to be completed over the weekend.

Relevance: As a priority resource in the Power Act, it is critical to understand the impacts of uncertainty in energy efficiency acquisition.

Background:

The January 28, 2021 Power Committee webinar presentation that provided additional context on the inputs for this scenario is available here: https://nwcouncil.box.com/s/sb1jaorxm4hq48lisr782o205eormnzq

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The February Power Committee presentation on the Robustness of EE Scenario is available here:
https://www.nwcouncil.org/sites/default/files/2021_0209_p2.pdf

Robustness of EE Scenario Findings

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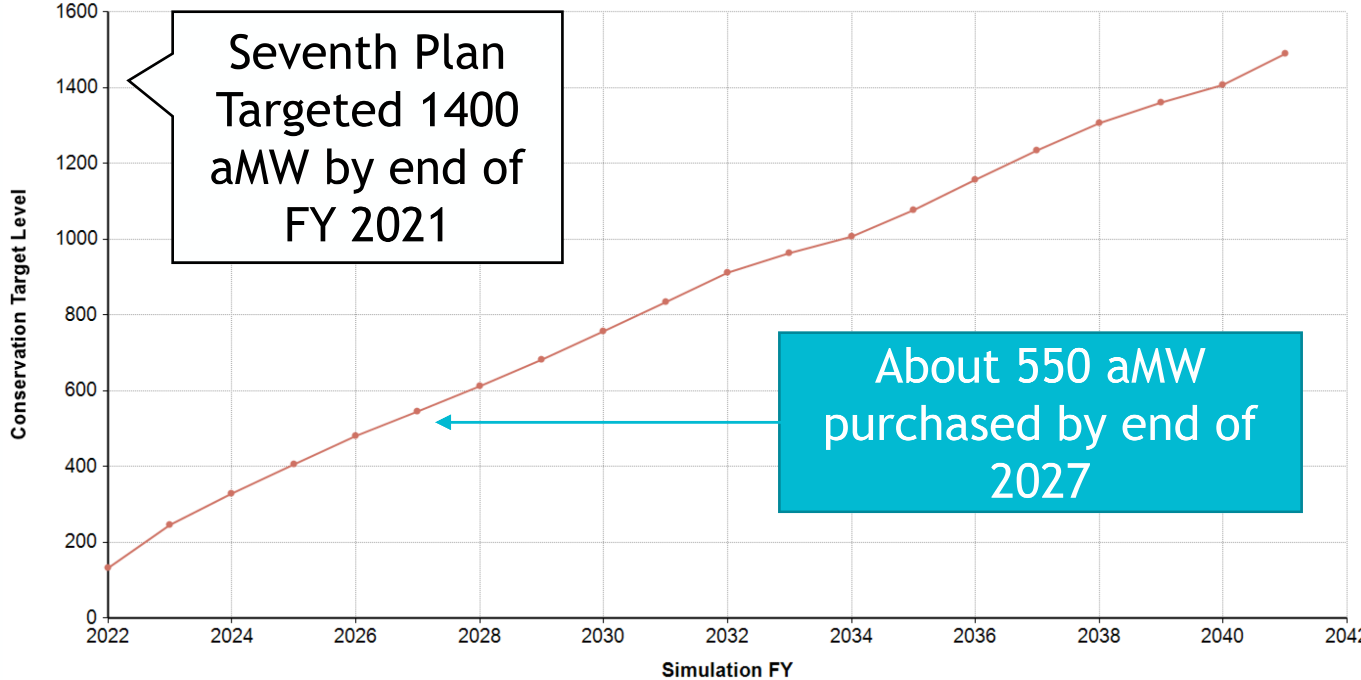
Maximum Amount of Conservation Purchased by FY



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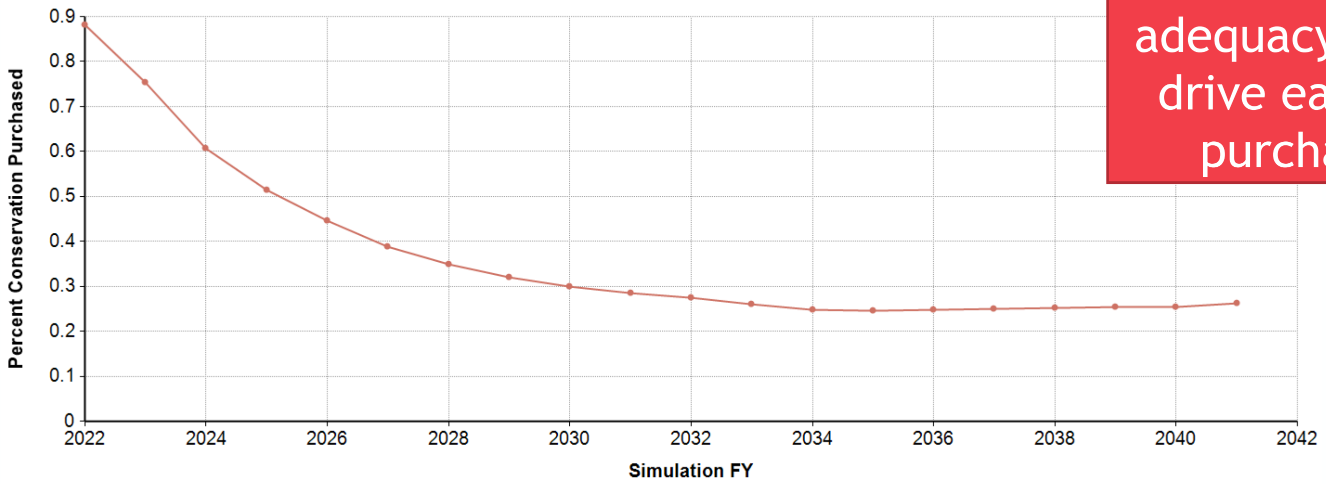
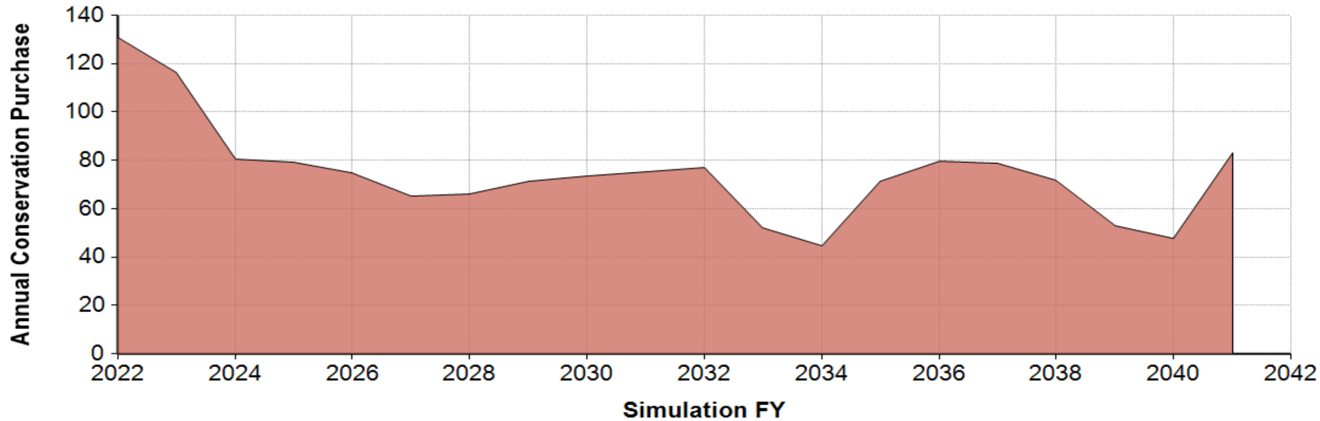
Percent of Conservation Supply Purchased

Near-term adequacy needs drive early EE purchases





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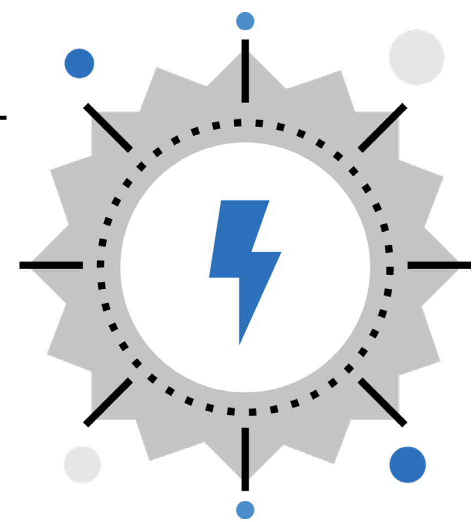
Test robustness of energy efficiency

- Test sensitivity of the regional resource acquisition cost & risk to varying amounts of energy efficiency available
  - Change ramp rates assumption to reflect increased/decreased acquisition, due to:
    - Changes in EE budgets due to unforeseen policies
    - Uncertainty in impacts
  - Increase/decrease maximum acquisition over 20-years to reflect possible new technologies or slow downs
- Test varying the capacity contribution of EE
  - Analyze how EE's seasonal peak contribution is impacting its acquisition



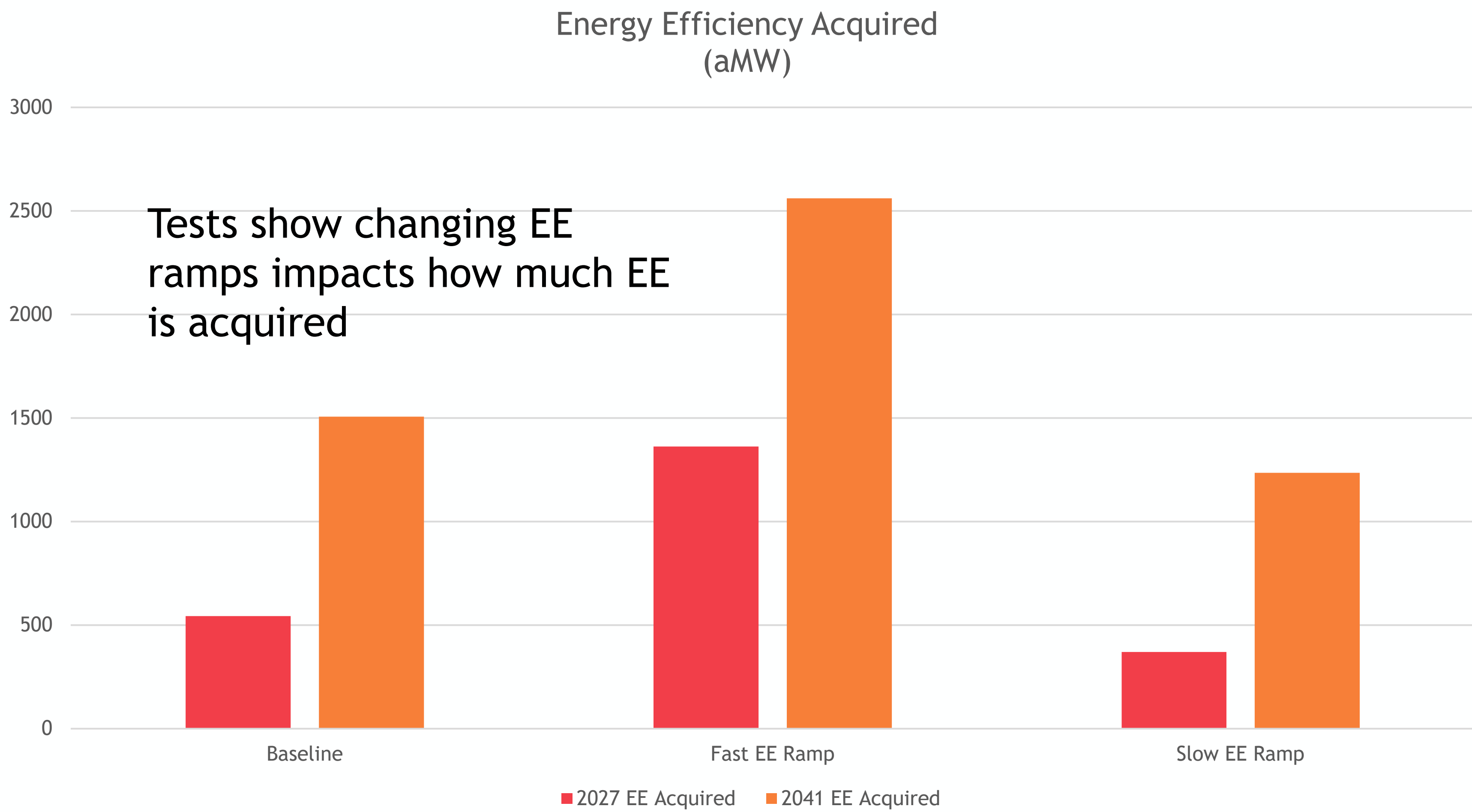
Comparing to Baseline

- What is the total system cost?
  - Numbers reported do not include penalties – adequacy is represented separately and other penalties are negligible
- How much EE is acquired?
- Does it increase or decrease adequacy?
  - All tests are driven by the same adequacy requirement – but penalties help drive toward those results and indicate how closely the requirements are followed
  - Penalties are relative to an unrestricted RPM build penalty amount
- What are the impacts on Greenhouse Gas Emissions?

EE Ramping Test

- What if more or less EE is available? What if you can get it faster or slower?
- Observations:
  - Faster ramps respond to adequacy signal but do not necessarily make resource strategy more adequate
  - Slower ramps limit initial uptake of EE early but results in other resource builds that increase the overall cost

Tests show changing EE ramps impacts how much EE is acquired



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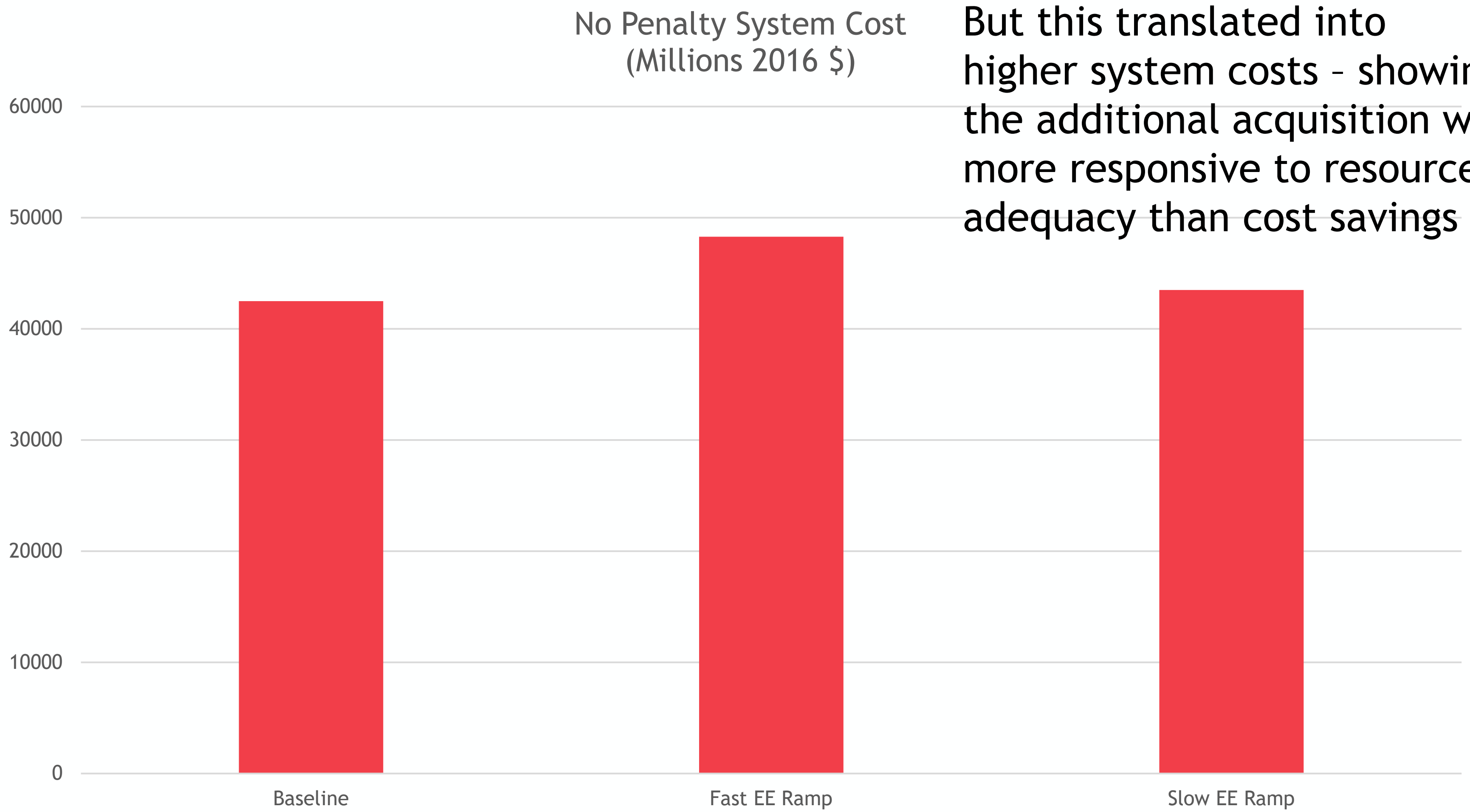
But this translated into higher system costs – showing the additional acquisition was more responsive to resource adequacy than cost savings



Bin Test

- How much does how we formulate the EE supply curves impact the results?
- Bins in baseline are collected based on the cost of the EE measures
- This test changed the bins to size them based on keeping roughly equal sized increment on the EE supply up to $130 per MWh
- Observations:
  - EE acquired results from RPM are very sensitive to how we represent the supply curves

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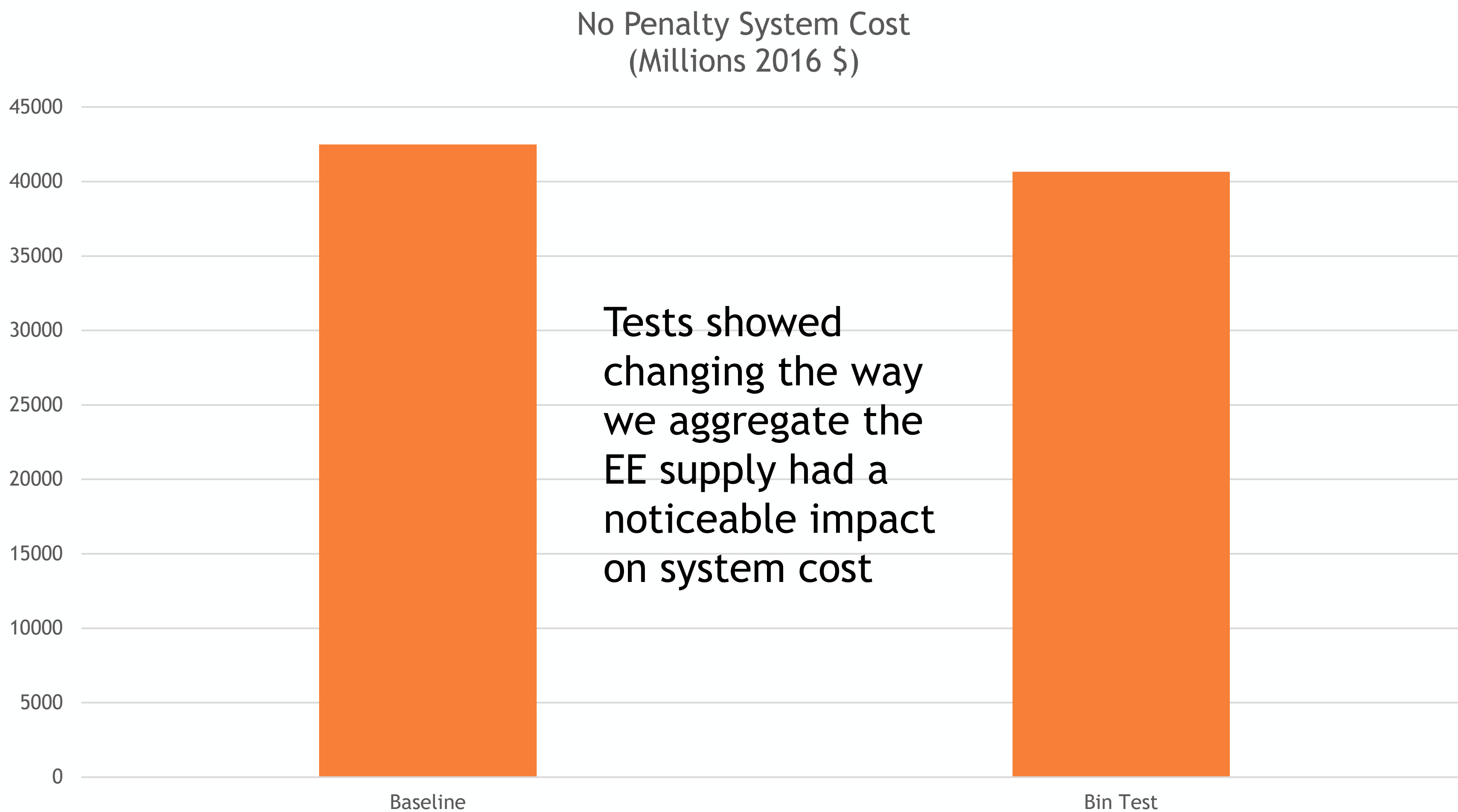

Tests showed changing the way we aggregate the EE supply had a noticeable impact on system cost

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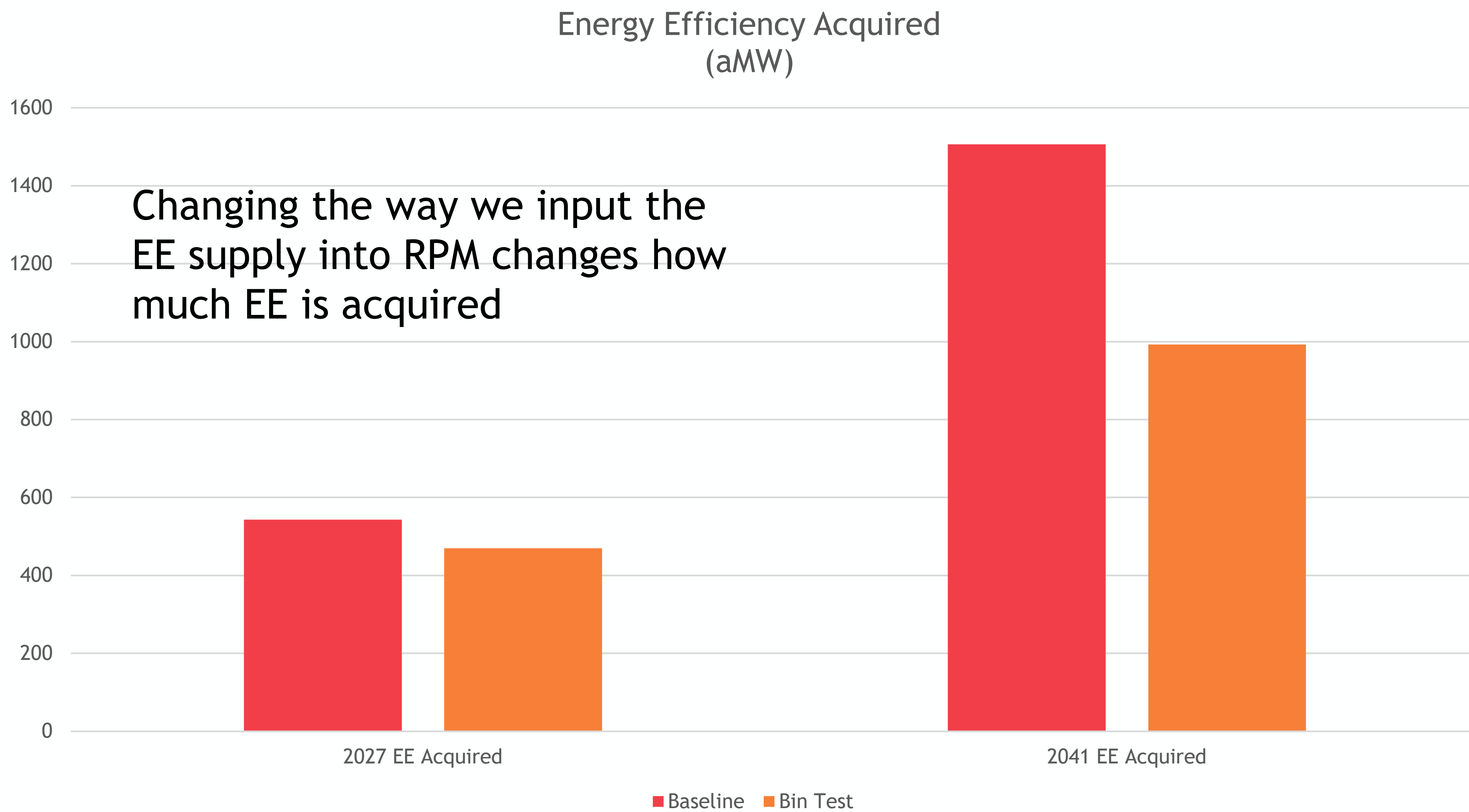
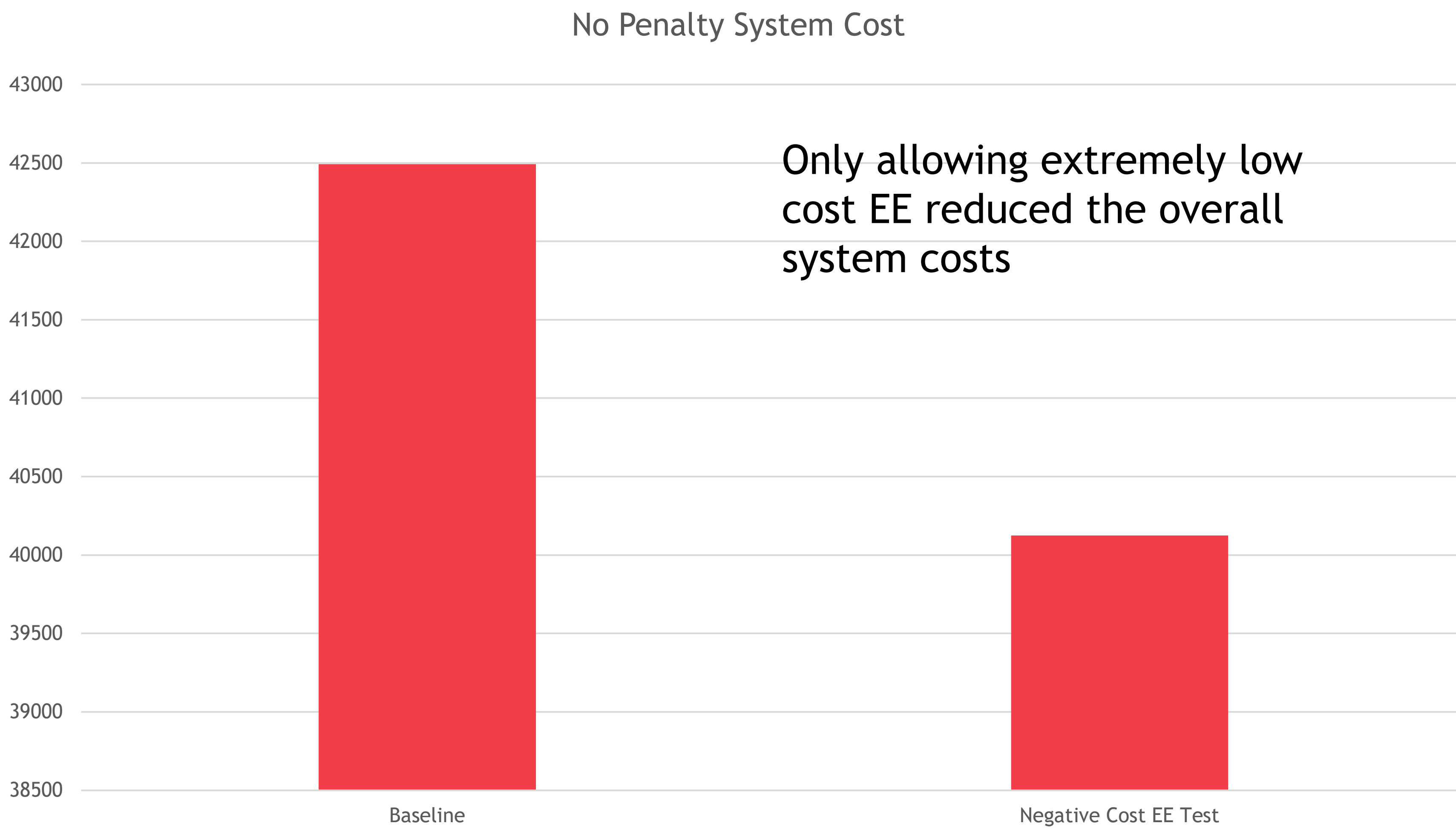


Changing the way we input the EE supply into RPM changes how much EE is acquired

Negative Cost EE Only Test

- What if we only buy EE that has a negative cost?
- Observations:
  - Hardest time getting to a similar adequacy result - substantially higher penalties
  - Significantly reduces no penalty system costs to limit early EE purchases



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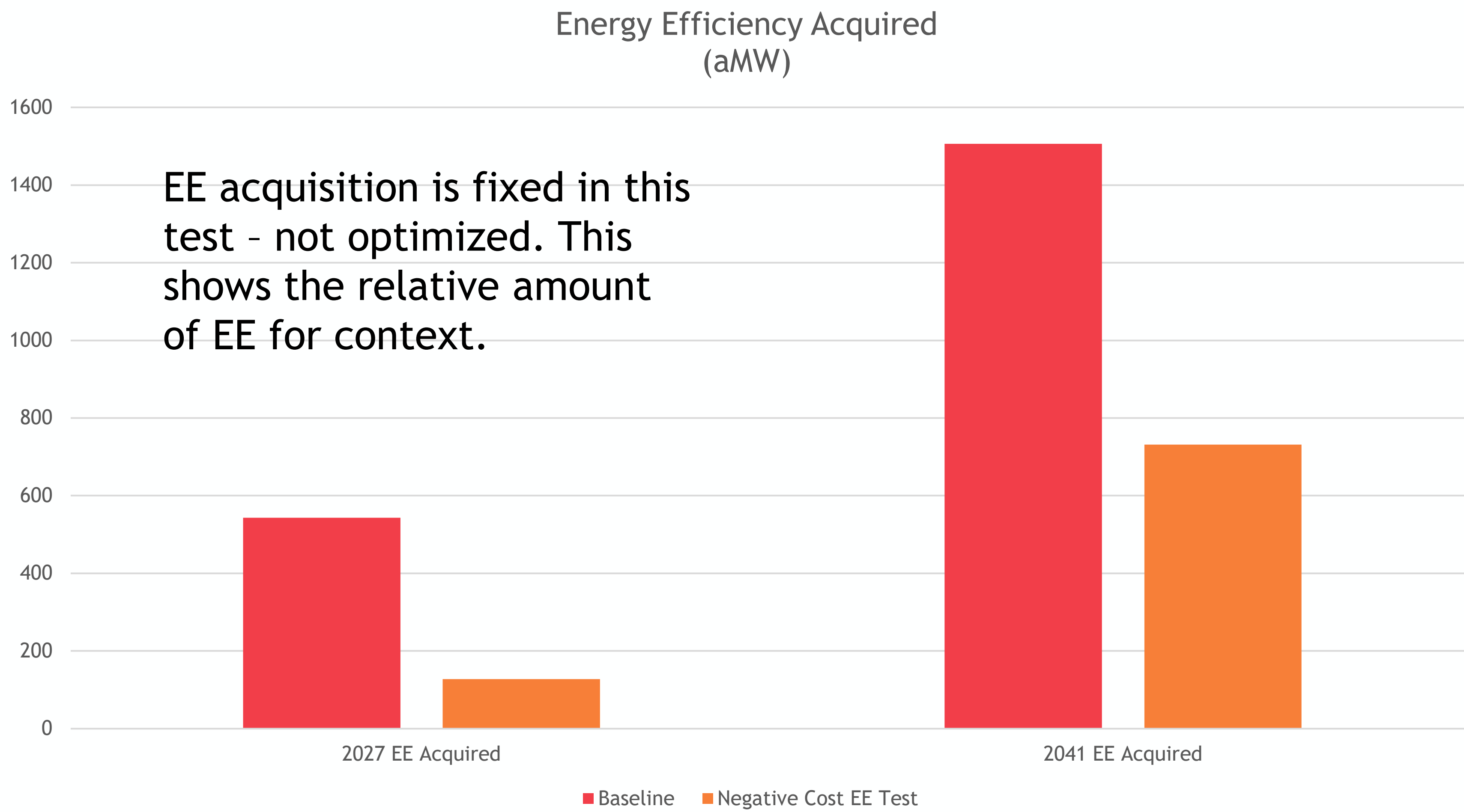
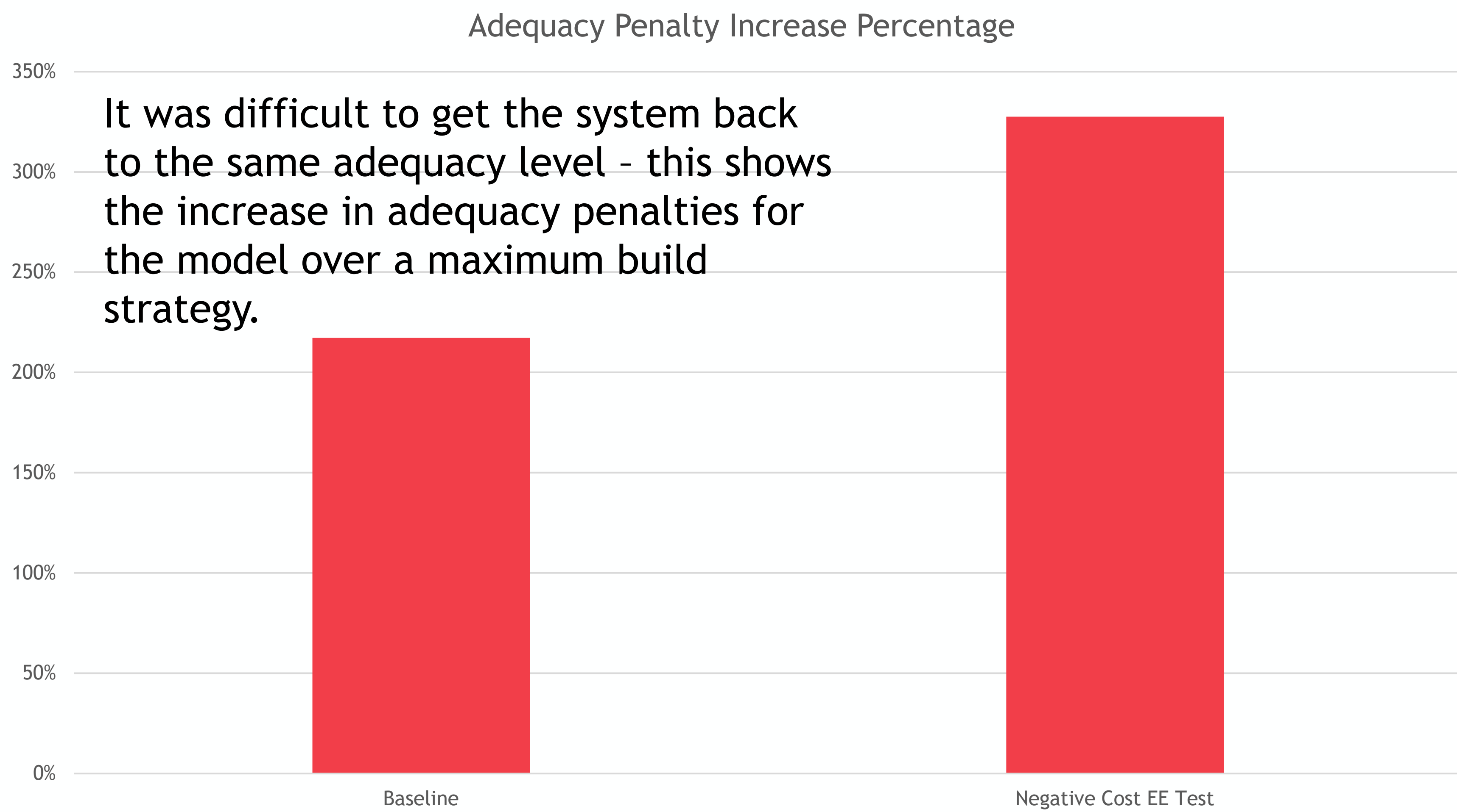
EE acquisition is fixed in this test – not optimized. This shows the relative amount of EE for context.

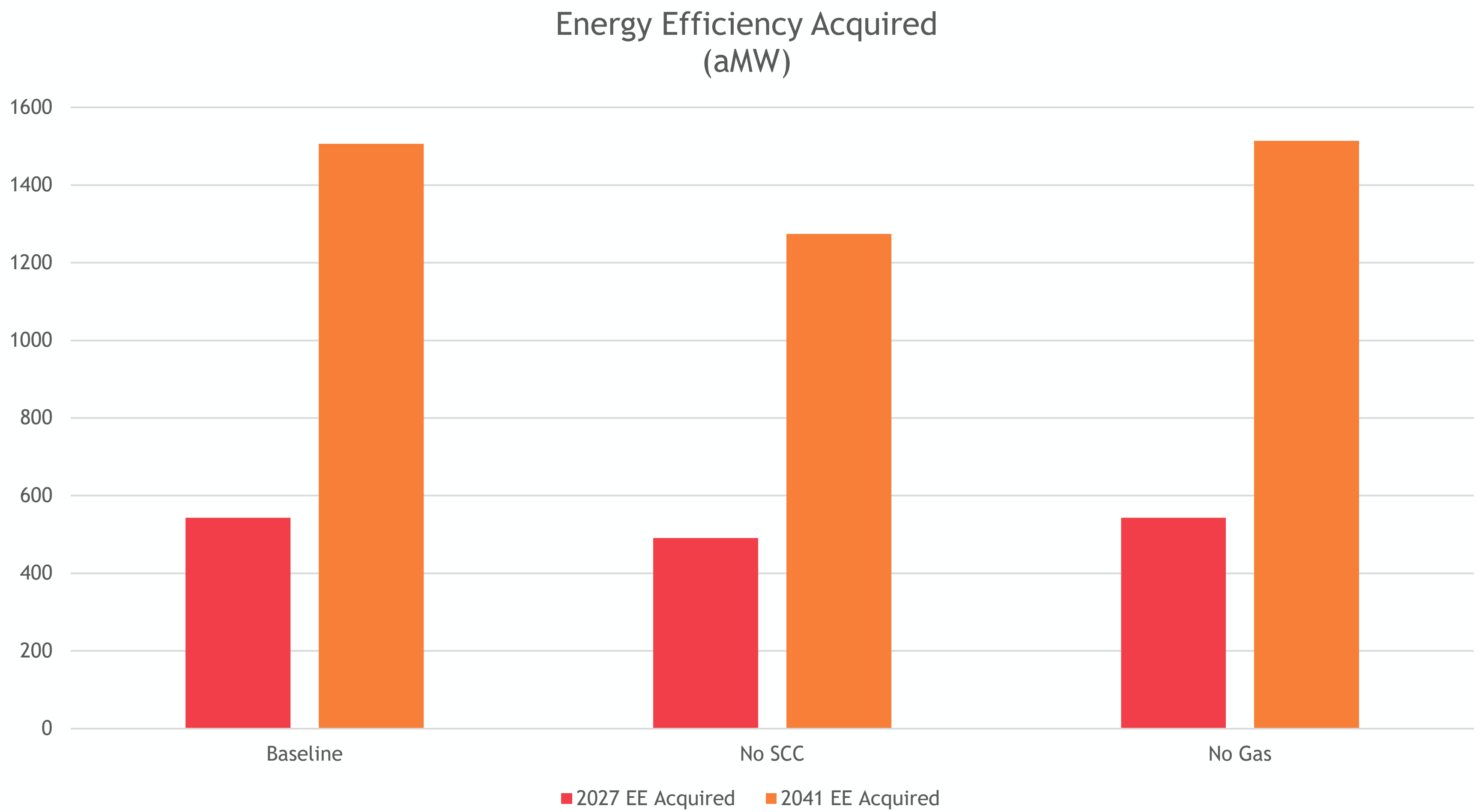


It was difficult to get the system back to the same adequacy level – this shows the increase in adequacy penalties for the model over a maximum build strategy.



GHG Testing

- What happens when the Social Cost of Carbon is excluded? What if you cannot build new natural gas generation?
- Observations:
  - Similar action plan period results – EE is less responsive to SCC change in the near-term with updated adequacy information
  - Minimal reduction in emissions from the no gas test



This test showed similar amounts of EE in the action plan time frame

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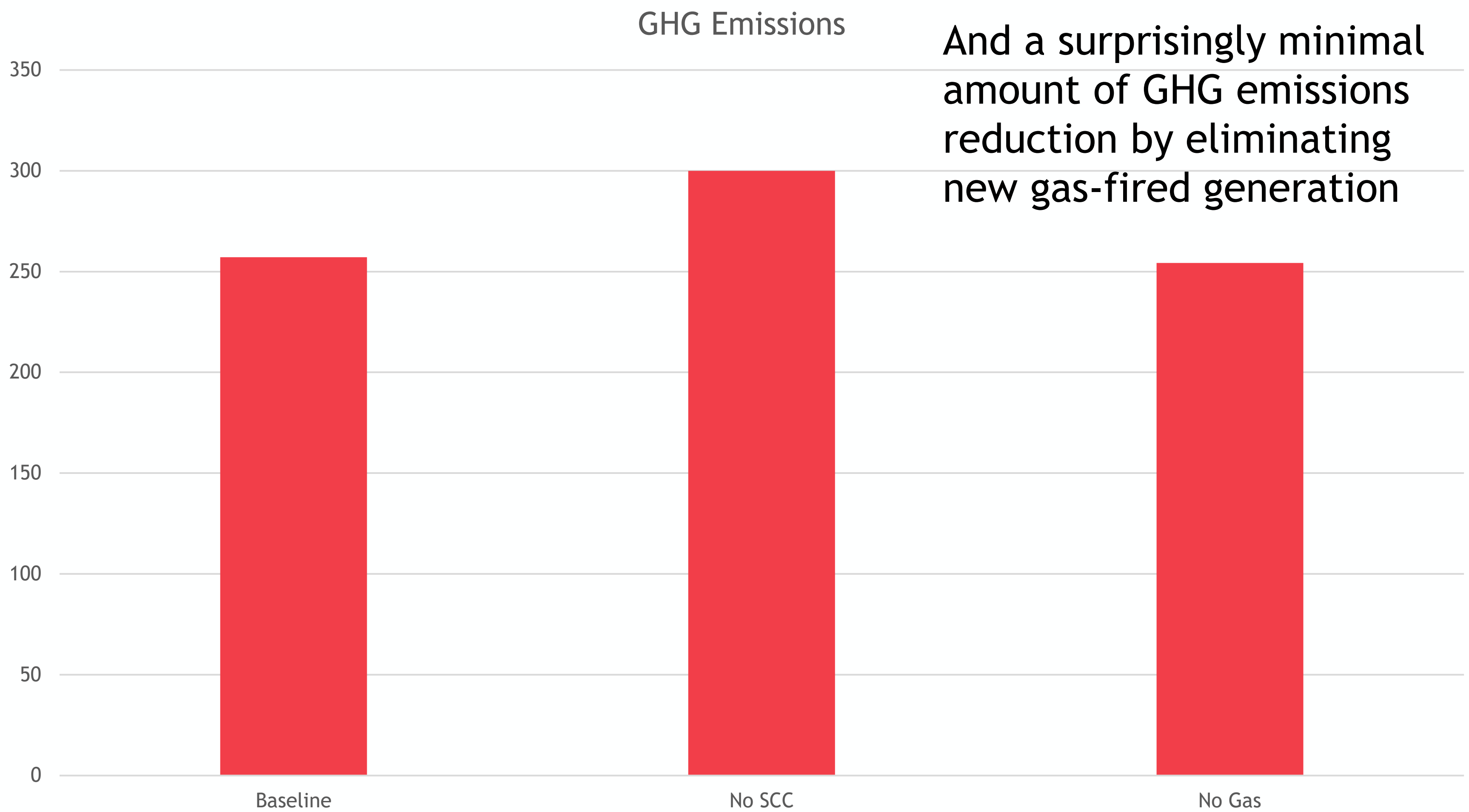
And a surprisingly minimal amount of GHG emissions reduction by eliminating new gas-fired generation

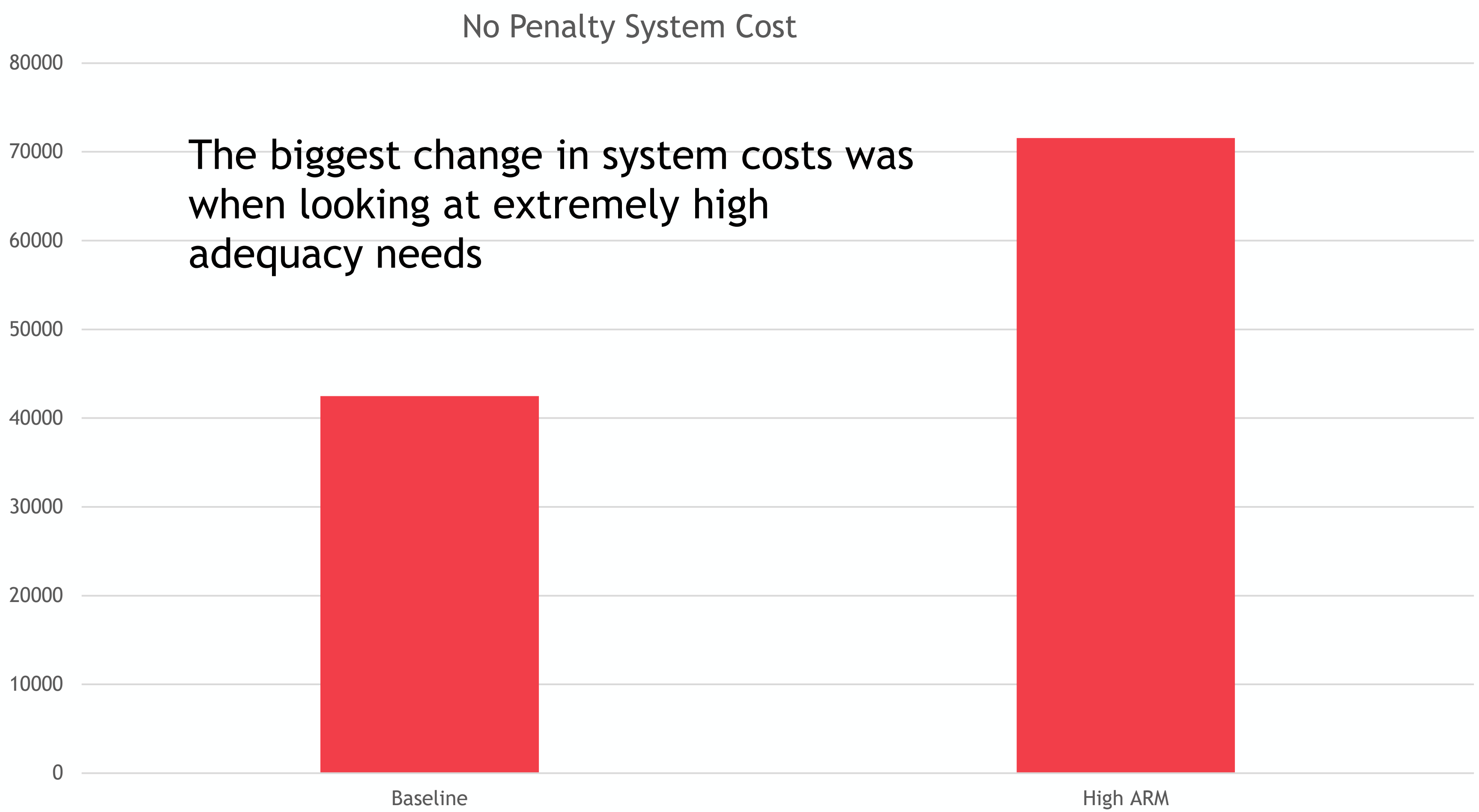


Higher Adequacy Need

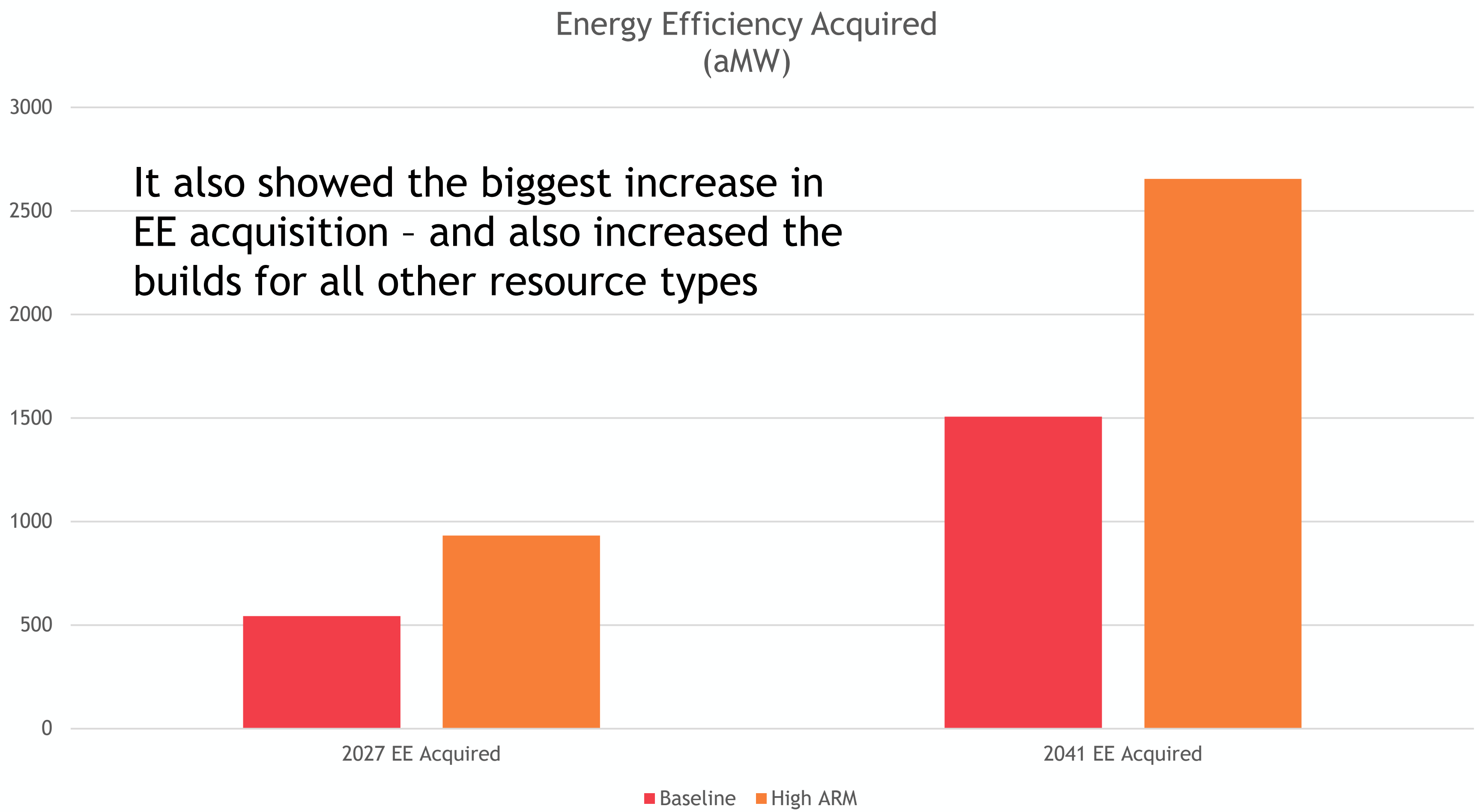
- How sensitive is EE to the adequacy need? What if the adequacy needs seen in our 2023 study persisted through 2027 & 2031?

- To test this we fixed the Adequacy Reserve Margins (ARMs) based on the 2023 results which show a higher need than the later runs

The biggest change in system costs was when looking at extremely high adequacy needs



It also showed the biggest increase in EE acquisition – and also increased the builds for all other resource types



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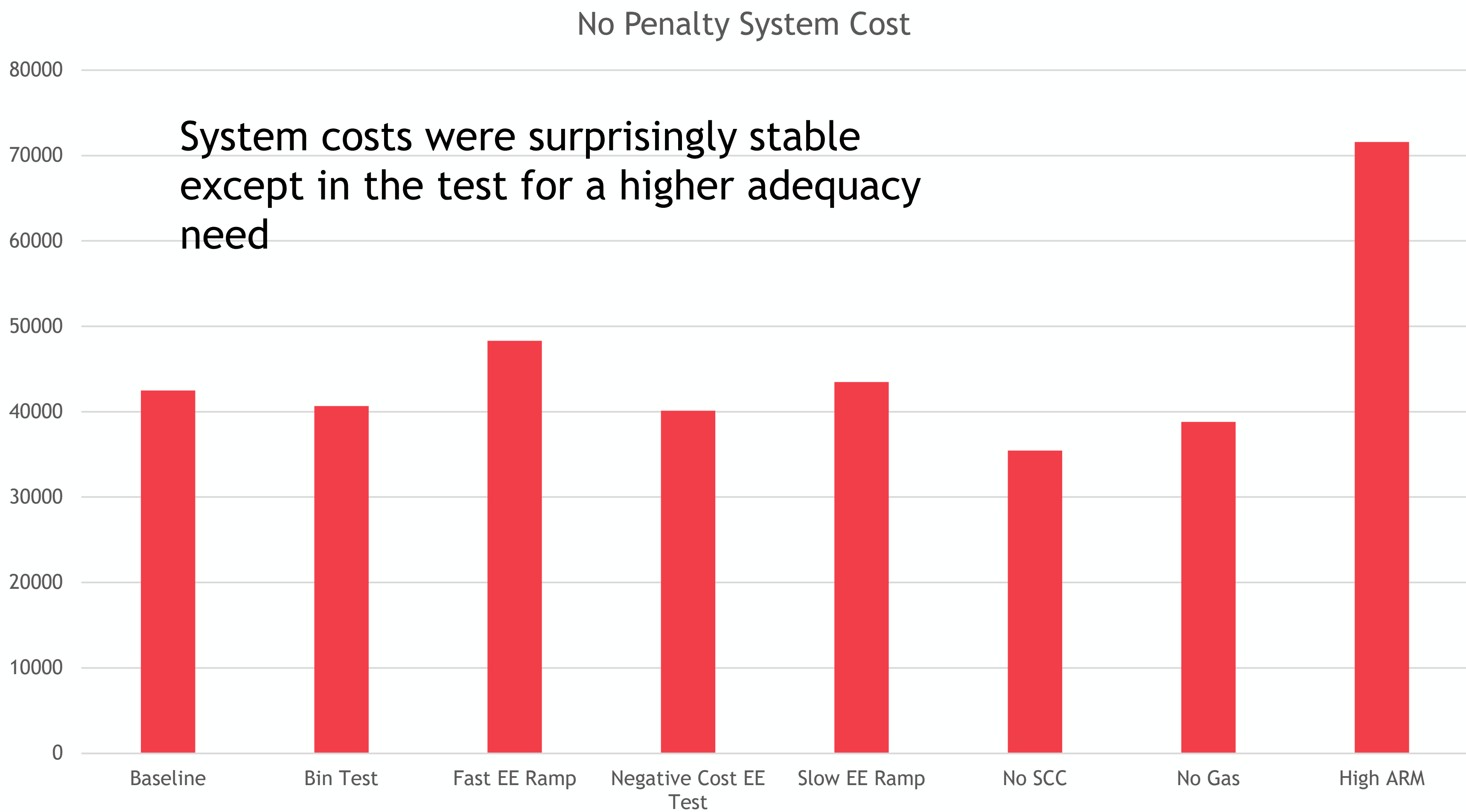
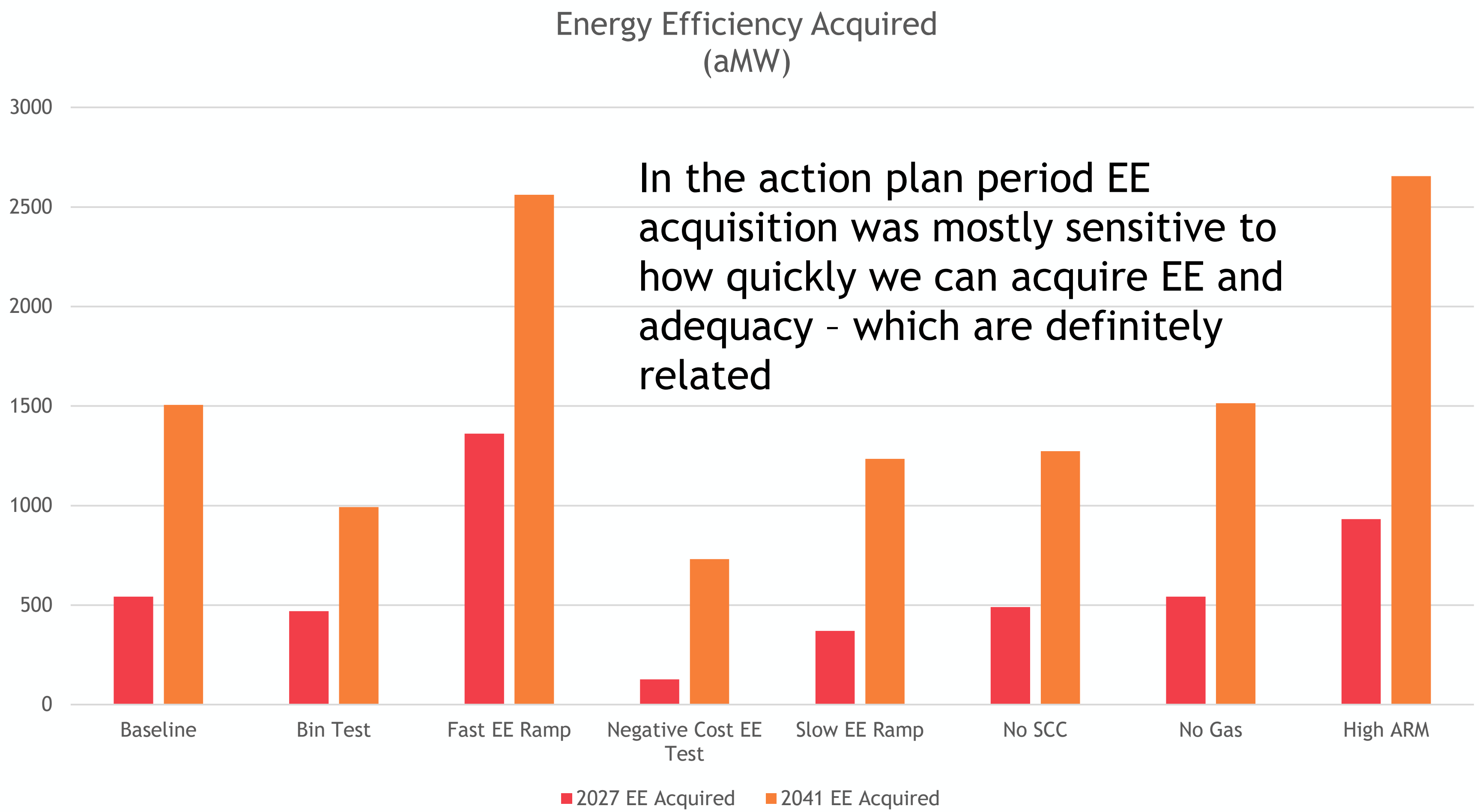
Higher Capacity Contribution

- How sensitive is EE to the capacity contribution assumptions?
- In our needs assessment, EE shows strong contributions to reducing winter peak needs and is relatively better than other resources at reducing summer and fall needs as well
- However, testing increasing capacity contribution by 150% and 250% resulted in no change in EE acquisition – rather changes to other resources acquired

Summary Results


No Penalty System Cost
System costs were surprisingly stable except in the test for a higher adequacy need
80000
70000
60000
50000
40000
30000
20000
10000
0
Baseline
Bin Test
Fast EE Ramp
Negative Cost EE Test
Slow EE Ramp
No SCC
No Gas
High ARM



In the action plan period EE acquisition was mostly sensitive to how quickly we can acquire EE and adequacy – which are definitely related

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Conclusions

- System costs are extremely low, most of these NPVs translate to approximately 2 to 3 billion 2016 $ fixed annual payment – the region spent 14.7 billion in 2018 which includes some costs captured in these NPV figures
  - A similar calculation for the Seventh Plan scenario including the social cost of carbon translated to a 4.5 billion 2012 $ fixed annual payment
- The amount of EE acquired is surprisingly sensitive to how the supply curves are assigned to bins and to how quickly the bins ramp
- Adequacy needs can drive higher EE acquisition but this tends to happen when other options have been exhausted in the current RPM setup
- Testing increased capacity contribution didn't substantially change acquisition of EE but decreased other resource acquisition

Questions

Extra Slides

Caveats

- Tests were meant to be indicative of the impacts on Energy Efficiency Acquisition and were not designed or analyzed to look at other impacts

Analysis Unchanged by Needs Assessment Updates

This presentation was originally given in the February Power Committee Meeting, since that meeting we updated the capacity contribution of resources in the baseline conditions with our needs assessment.

While that work changed some of the resources selected in RPM – the impact on Energy Efficiency was minimal. Prior to the updated needs assessment RPM showed 543 aMW purchased by the end of 2027. With the updates it changed to 545 aMW purchase by 2027. For 2041 we previously had 1506 aMW purchased originally which changed to 1489.

Given the minimal changes in EE acquisition, the analysis shown in this presentation was not repeated.

Annual payments equivalent to NPV

Recall the formula for NPV:

$$NPV = \sum \frac{R_t}{(1+d)^t}$$

Where t is time, d is the discount rate, and R_t is the payment at time t. To get an equivalent annual payment assume $R_i = R_j = R$ for all times $i \neq j$ then rearrangement gives:

$$R = \frac{NPV}{\sum \frac{1}{(1+d)^t}}$$

Given our real discount rate of 3.8% per year and our time horizon of 30 years (including end effects), this translates to approximately

$$R \approx \frac{NPV}{17.72}$$

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