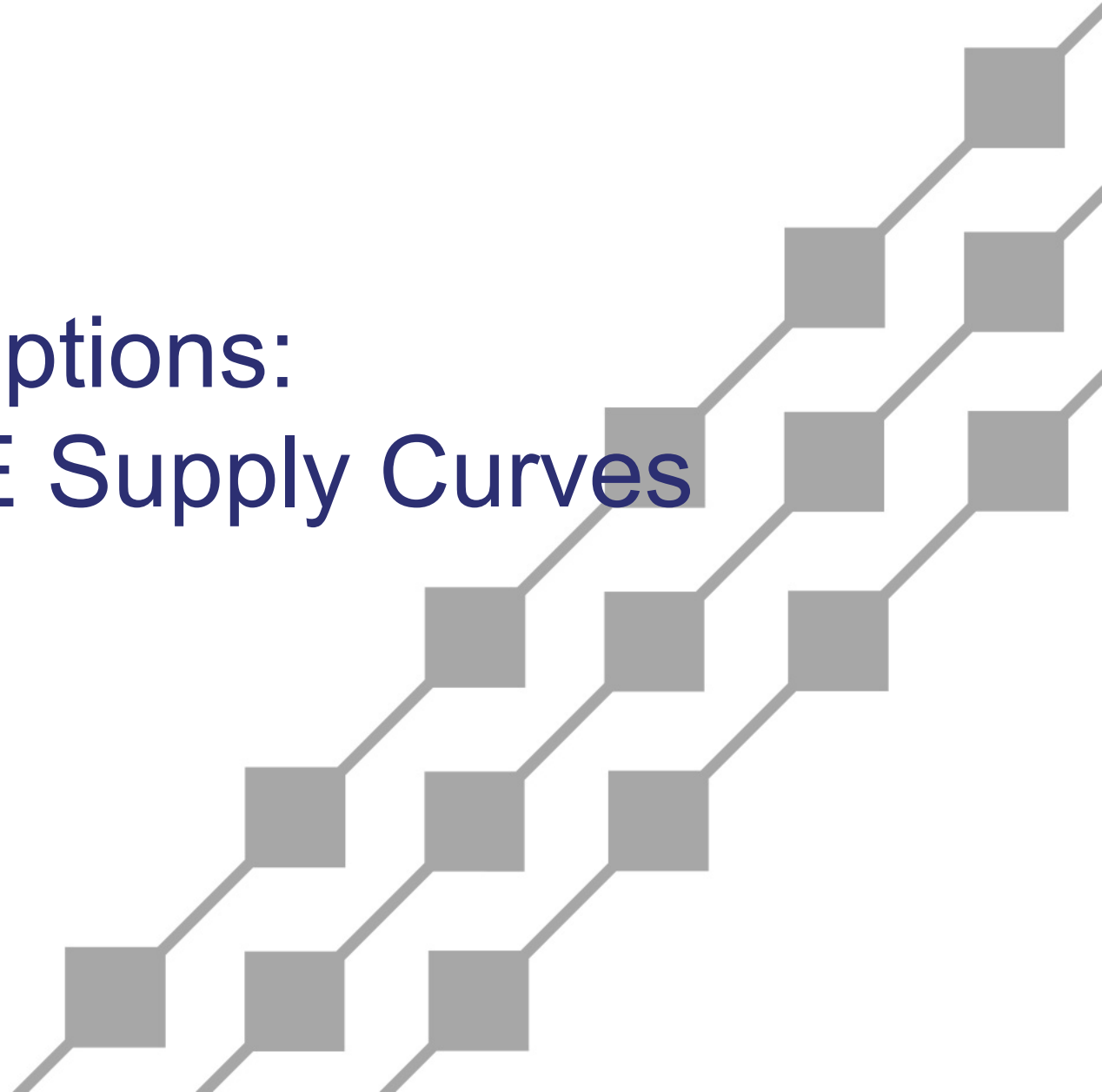




**Hawaiian
Electric**

IGP Input and Assumptions: TOU Analysis and EE Supply Curves

September 23, 2021



Agenda: Review and Feedback



Non-DER, Non-EV TOU Assumptions



Preliminary Estimated Impacts



AEG EE Supply Curves



Customer Load Flexibility is a Significant Component of IGP Inputs and Assumptions

- ◆ DER Customer Load Shifting
 - PV paired with BESS
 - Emergency Demand Response/Scheduled Dispatch
- ◆ Electric Vehicle Managed Charging



TOU Rate Assumptions

- ◆ Hawaiian Electric ARD Final Proposal, March 15, 2021
- ◆ Default TOU rate (aka “opt-out”)
- ◆ Rates phased in from 2022 to 2026
 - Enabled by AMI implementation, 100% by Dec 2025
 - Default TOU rate phase-in by Dec 2026



Literature Review

- ◆ SMUD SmartPricing Options, September 2014
- ◆ NV Energy Nevada Dynamic Pricing Trial, October 2015
- ◆ KIUC TOU Solar Rate Pilot Program, May 2017
- ◆ Hawaiian Electric Interim TOU Program, January 2020
- ◆ UHERO Integrating Renewable Energy: A Commercial Sector Perspective on Price-Responsive Load-Shifting, July 2018
- ◆ AEG/Brattle Group State of Hawaii Market Potential Study, August 2020



Key Takeaways – Load Shifting

- ◆ Residential load shifting can be estimated using elasticity of substitution
 - SMUD: Default TOU rate results in lower elasticity, but higher participation than opt-in¹
 - All other pilots and studies: Opt-in or volunteer²
 - NV Energy: Very wide variability in customers' elasticities³
 - KIUC and HE: Inconclusive elasticity⁴
 - AEG/Brattle Group: Range of elasticities based on their own literature review of primarily residential opt-in utility studies⁵
- ◆ UHERO review of Hawaii commercial load shapes suggests limited opportunity for commercial load shifting⁶



Key Takeaways – Energy Use

- ◆ Change in overall residential energy use is small or inconclusive
 - SMUD showed a 1% decrease in use for default TOU rate⁷
 - NV Energy concluded customers did not reduce energy use⁸
 - KIUC suggested after controlling for weather, consumption increased⁹
 - Hawaiian Electric results were inconclusive based on limited baseline data¹⁰
 - AEG/Brattle Group applied a range reductions based on their own literature review¹¹



Key Takeaways – Summary

- ◆ SMUD study provides the best proxy for base-case assumptions for elasticity of substitution (load shifting) and drop-out/opt-out rates¹²
- ◆ AEG study range of elasticity of substitution can inform sensitivities
- ◆ Potential reduction in total energy consumption is inconclusive and not material to IGP analysis
- ◆ Potential commercial class load shift is not material to IGP analysis

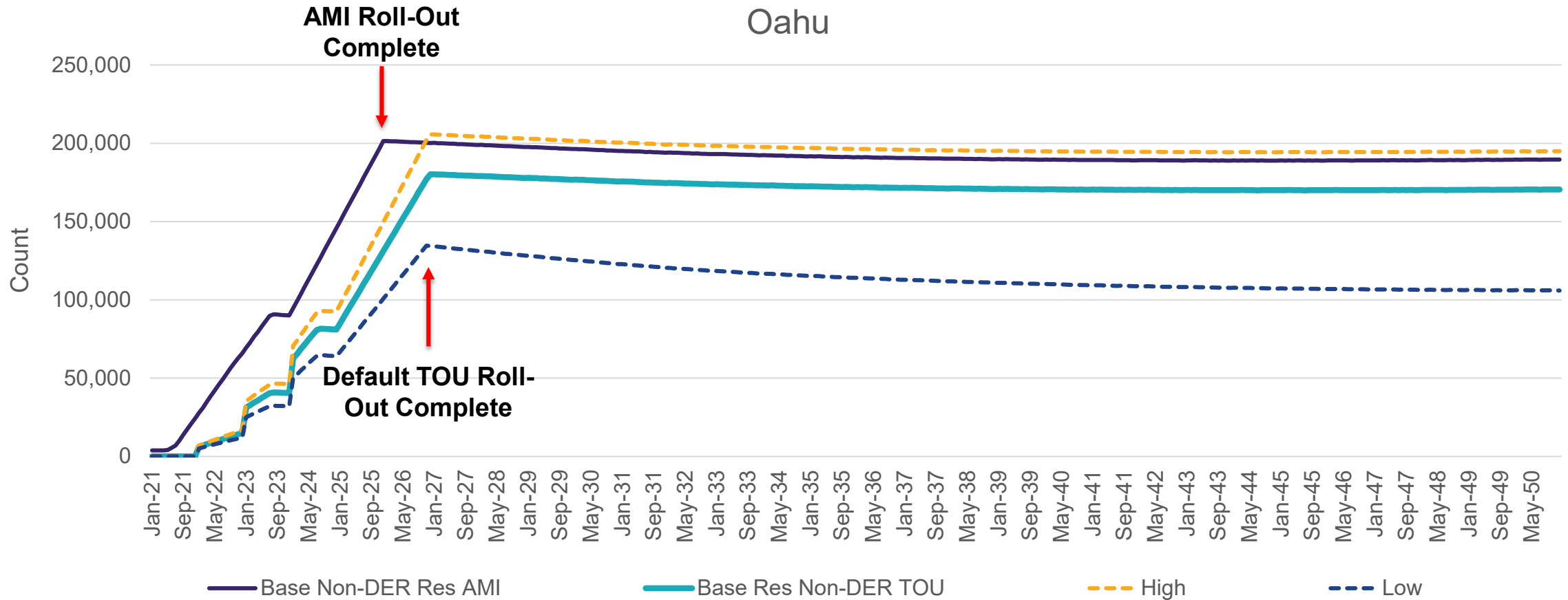


TOU Load Impact Assumptions Summary

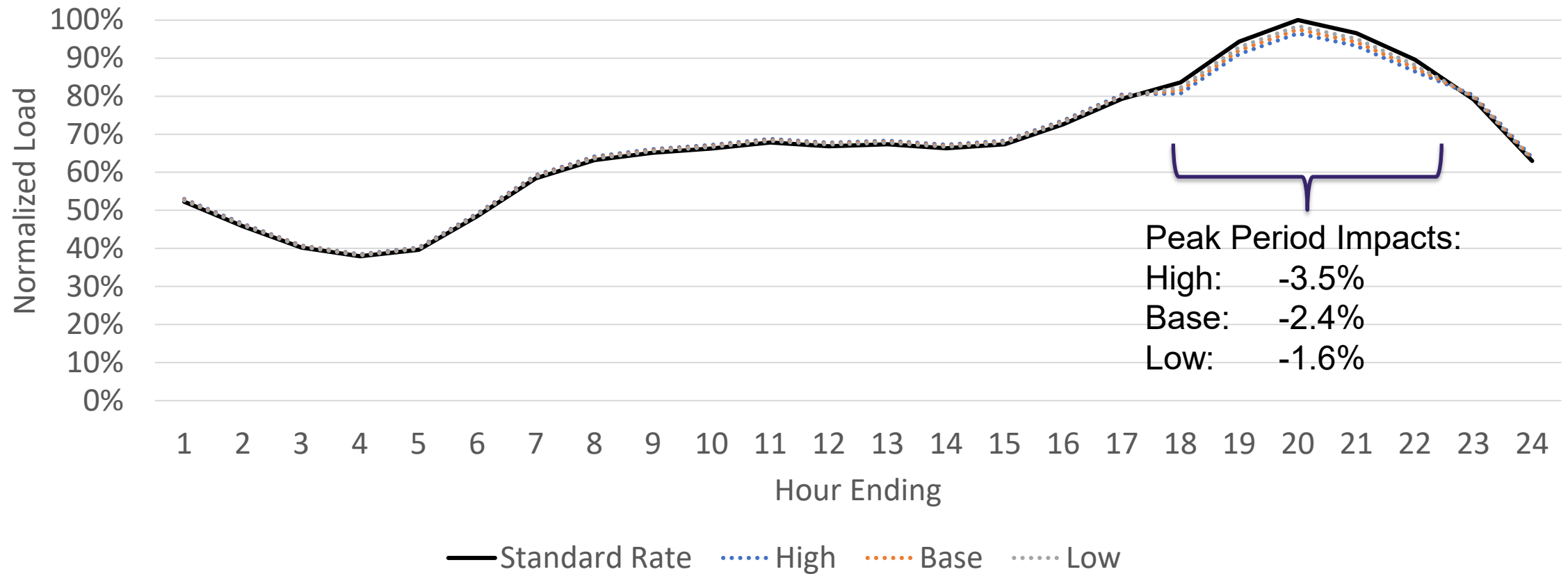
Input	Low	Base	High
Rates	Hawaiian Electric Final ARD Proposal	Hawaiian Electric Final ARD Proposal	Hawaiian Electric Final ARD Proposal
Residential Customer Pool	All Non-DER Residential Customers = Residential Forecast Minus High DER Sch-R Forecast	All Non-DER Residential Customers = Residential Forecast Minus Base DER Sch-R Forecast	All Non-DER Residential Customers = Residential Forecast Minus Low DER Sch-R Forecast
AMI Rollout	100% by end of 2025	100% by end of 2025	100% by end of 2025
TOU Rollout	Default TOU rolls out to all customers by end of 2026	Default TOU rolls out to all customers by end of 2026	Default TOU rolls out to all customers by end of 2026
Load Shift Method	Net Zero Load Shift	Net Zero Load Shift	Net Zero Load Shift
TOU Opt-Out Rate [%]	25%	10%	0%
Price Elasticity	-0.045	-0.070	-0.100



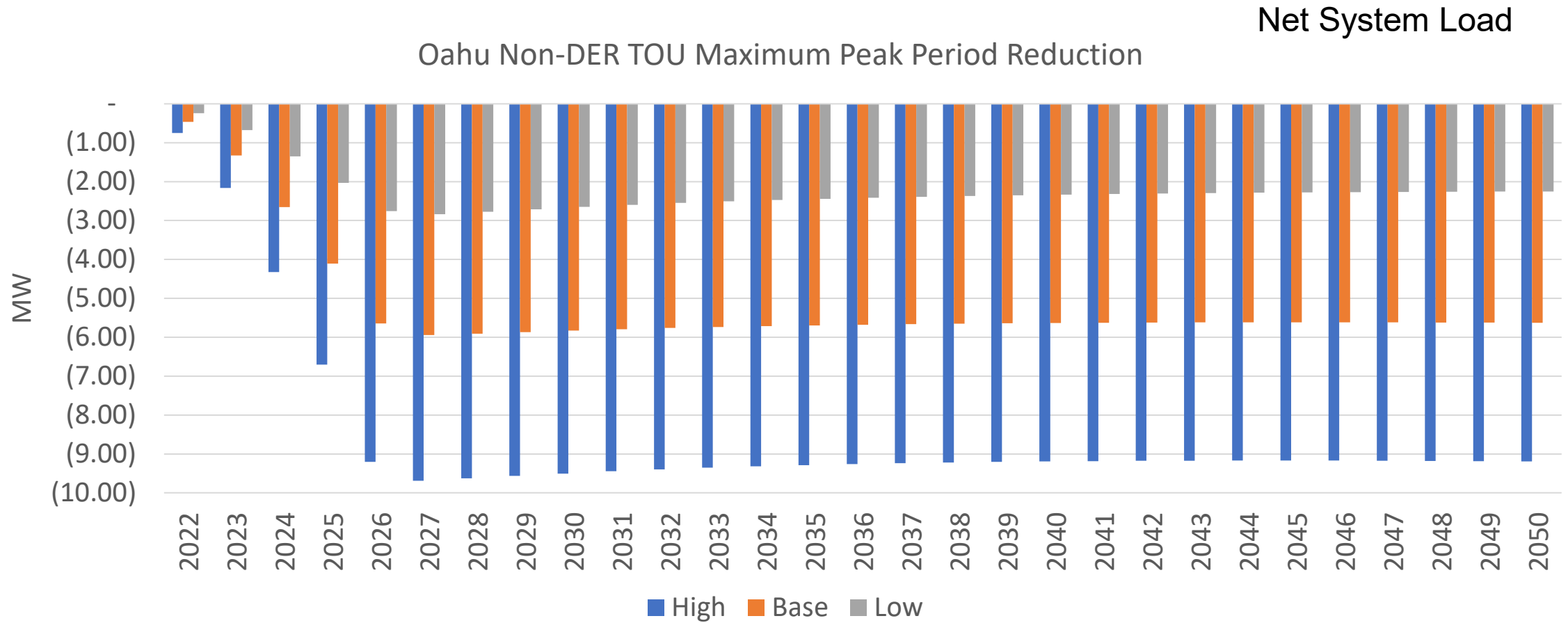
Residential non-DER TOU participation declines over time due to growth in DER participation



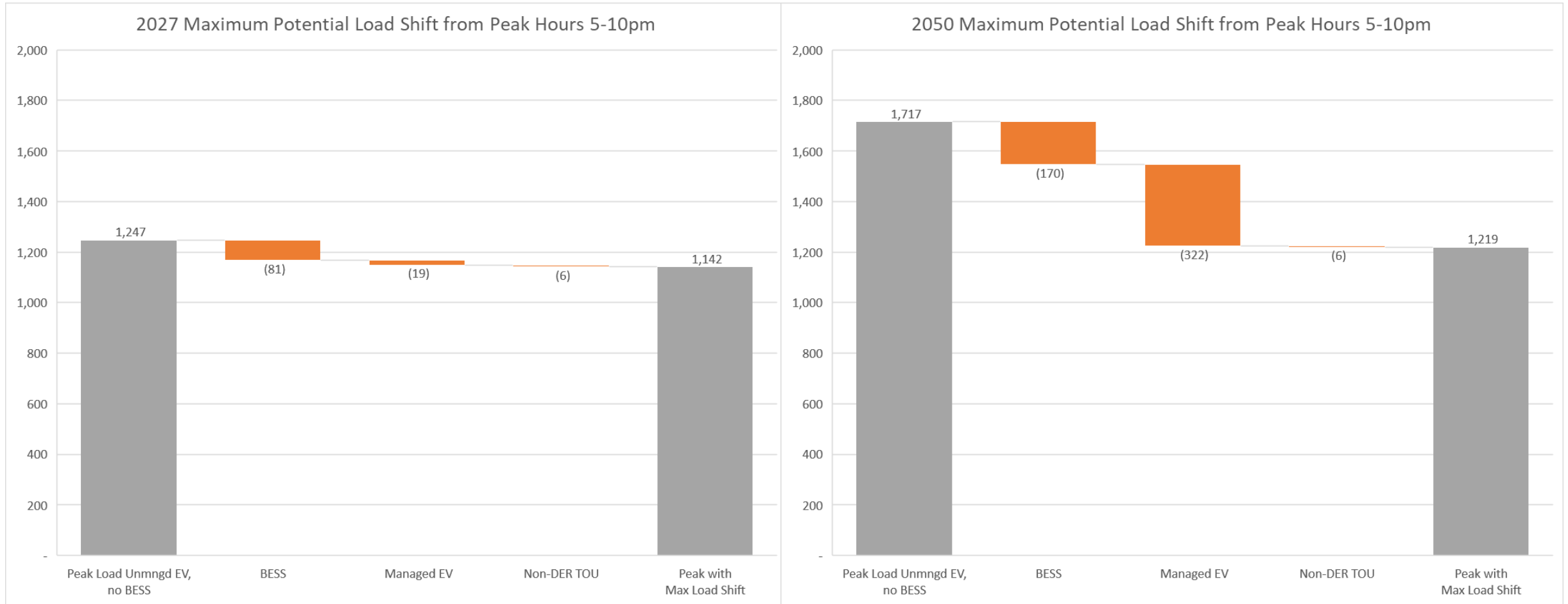
Non-DER Residential Standard vs TOU Rate Profiles – O‘ahu



Summary of Preliminary Results – O‘ahu

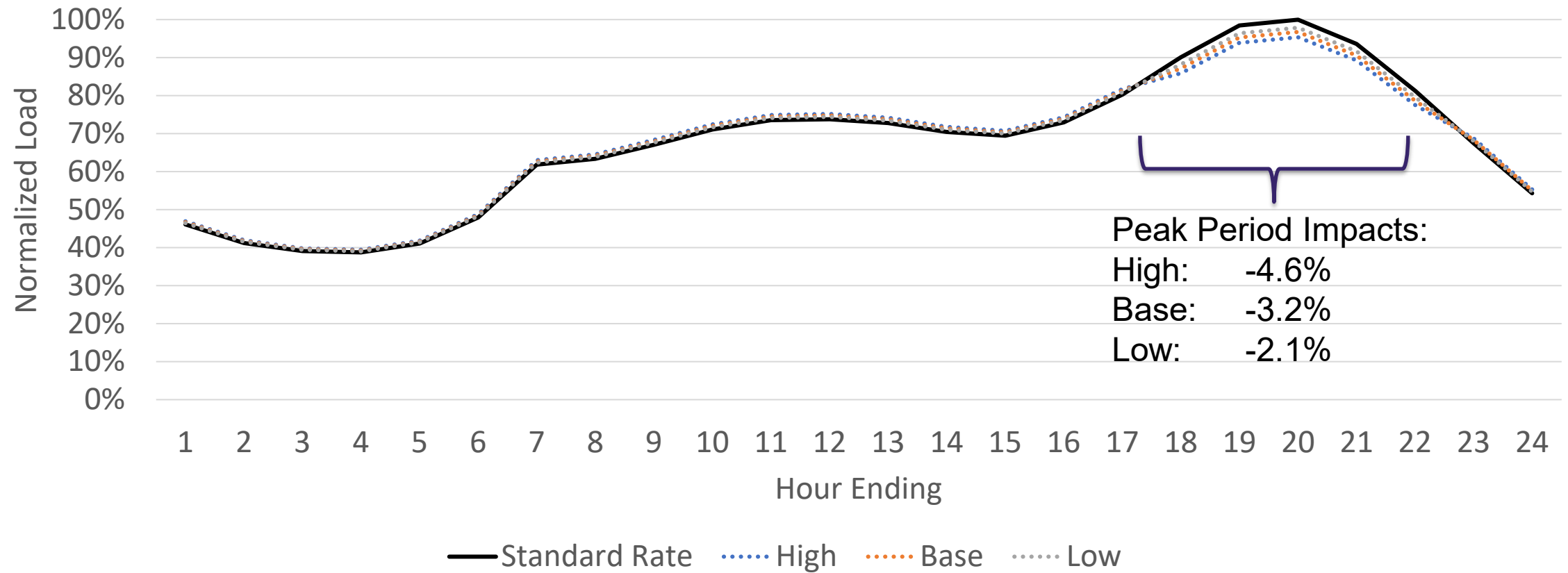


Comparison of Load Shift Impacts – O‘ahu

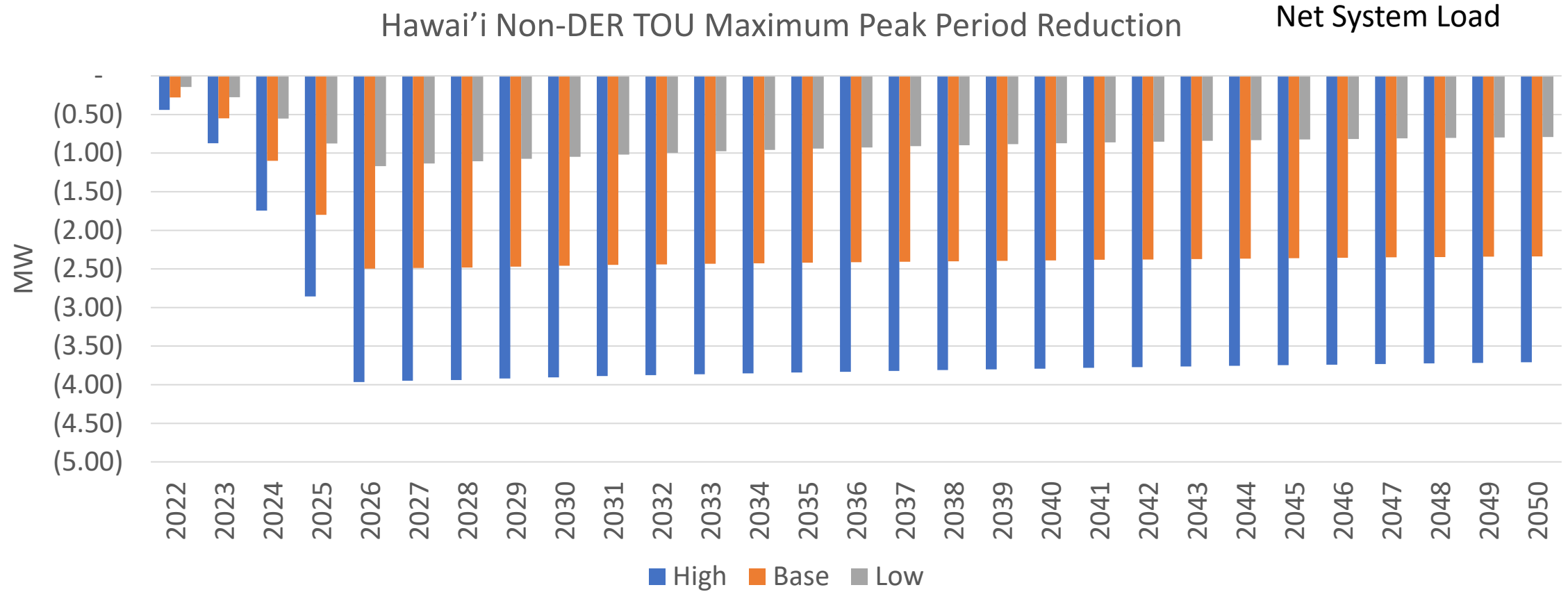


Charts illustrate the maximum potential of each layer. Impacts are not necessarily coincident

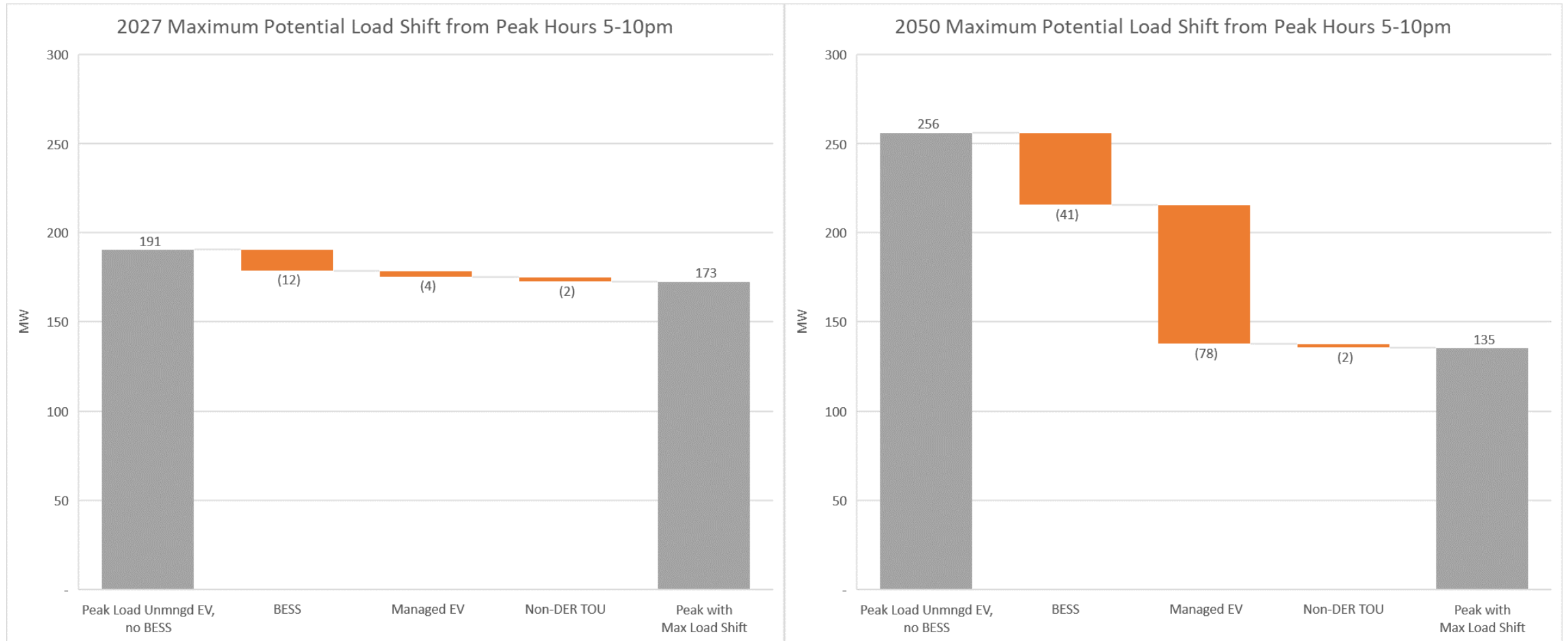
Non-DER Residential Standard vs TOU Rate Profiles- Hawaii



Summary of Preliminary Results – Hawai‘i

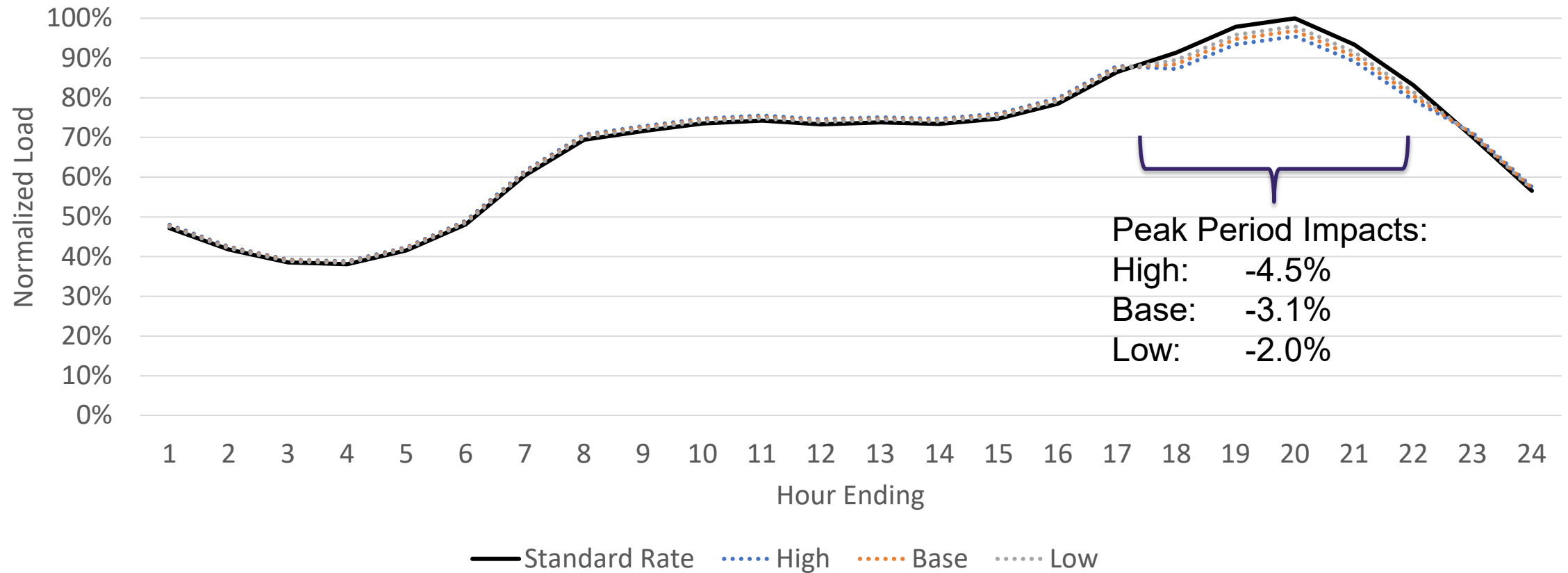


Comparison of Load Shift Impacts – Hawai‘i

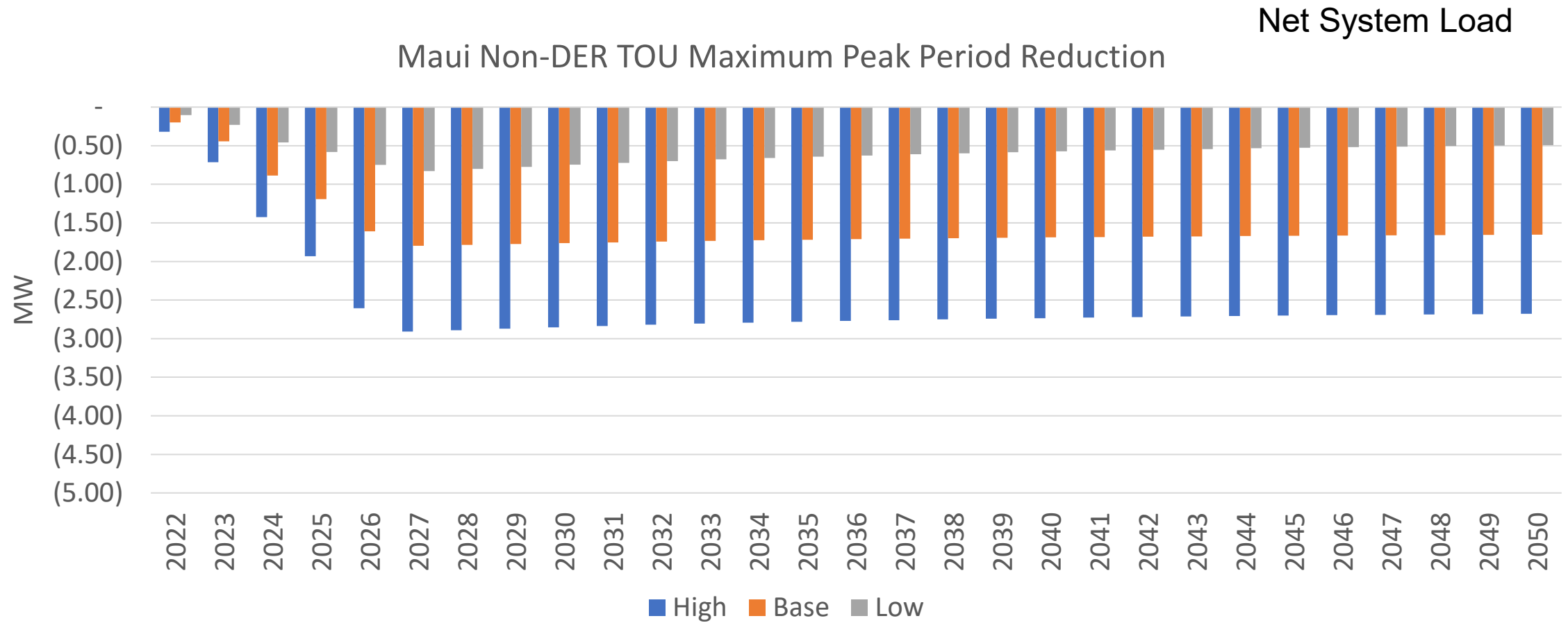


Charts illustrate the maximum potential of each layer. Impacts are not necessarily coincident

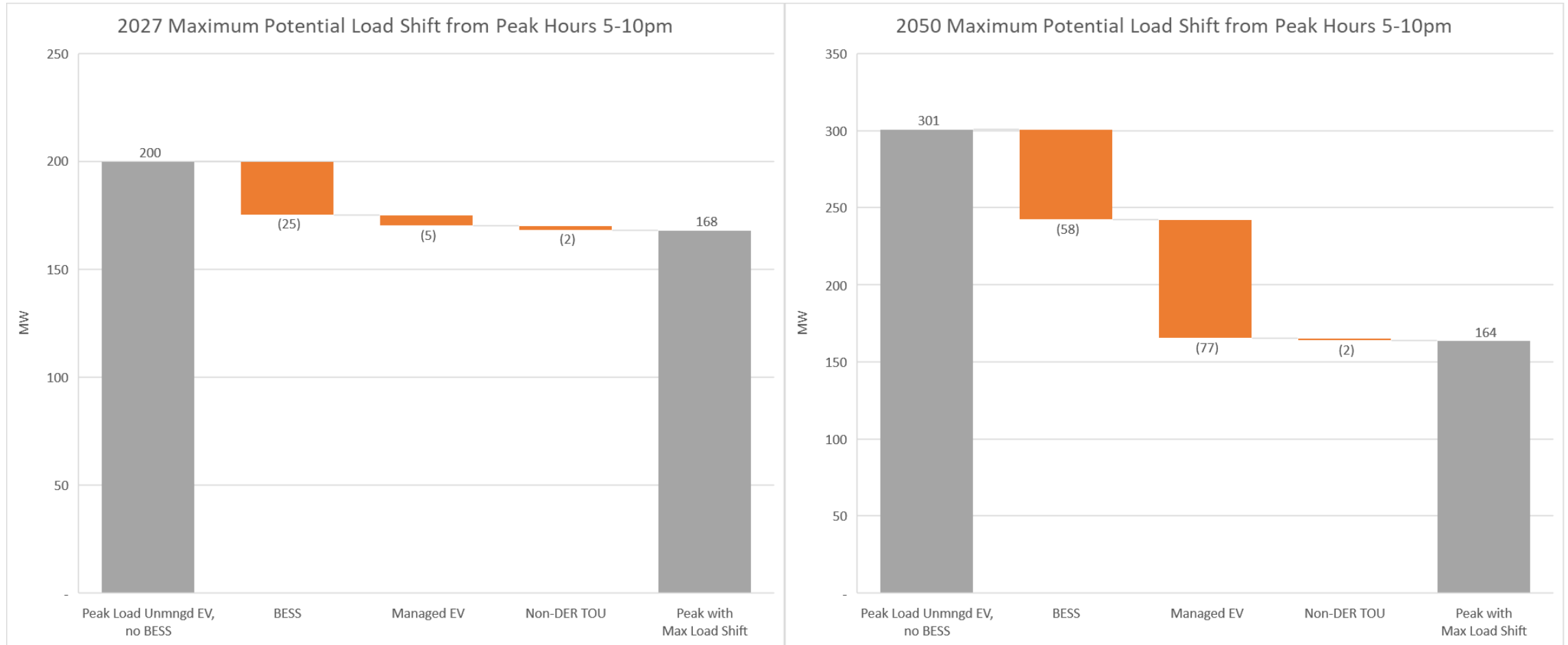
Non-DER Residential Standard vs TOU Rate Profiles- Maui



Summary of Preliminary Results - Maui



Comparison of Load Shift Impacts – Maui



Charts illustrate the maximum potential of each layer. Impacts are not necessarily coincident

Conclusions

- ◆ Resulting impact to residential non-DER, non-EV customer peak load is consistent with industry studies
- ◆ Estimated impact to total peak load is small relative to peak load, other flexible load impacts, and the range of IGP load bookends
- ◆ IGP inputs and assumptions capture enough load flexibility and broad enough range of load without including non-DER, non-EV TOU load shift
- ◆ Recommendation: Move forward without adding this layer to the IGP Inputs and Assumptions



References – Links to Studies

<https://www.smud.org/-/media/Documents/Corporate/About-Us/Energy-Research-and-Development/research-SmartPricing-options-final-evaluation.ashx>

https://www.energy.gov/sites/prod/files/2016/12/f34/NV_Energy_NDPT_Final_Report_20151026.pdf

<https://kiuc.coopwebbuilder3.com/sites/kiuc/files/documents/Letter%20to%20PUC%20submitting%20TOU-S%20Pilot%20Final%20Evaluation%20Report.pdf>

<https://uhero.hawaii.edu/integrating-renewable-energy-a-commercial-sector-perspective-on-price-responsive-load-shifting/>

<https://dms.puc.hawaii.gov/dms/DocumentViewer?pid=A1001001A20B03B04321I00481>

<https://puc.hawaii.gov/wp-content/uploads/2021/02/Hawaii-2020-Market-Potential-Study-Final-Report.pdf>



References – Footnotes

- 1 SMUD SmartPricing Options Pilot Evaluation, at 2-3, 69
- 2 Nevada Dynamic Pricing Trial Final Report, at 1
KIUC Time of Use Pilot Final Evaluation Study, at 1
Hawaiian Electric Interim Time-of-Use Program Annual Report, at 2
State of Hawaii Market Potential Study, at 55
- 3 Nevada Dynamic Pricing Trial Final Report, at 81
- 4 KIUC Time of Use Pilot Final Evaluation Study, at 9-10
Hawaiian Electric Interim Time-of-Use Program Annual Report, at 13-15
- 5 State of Hawaii Market Potential Study, at 56
- 6 UHERO Integrating Renewable Energy: A Commercial Sector Perspective on Price Responsive Load-Shifting, at 18-19
- 7 SMUD SmartPricing Options Pilot Evaluation, at 5
- 8 Nevada Dynamic Pricing Trial Final Report, at 2
- 9 KIUC Time of Use Pilot Final Evaluation Study, at 6
- 10 Hawaiian Electric Interim Time-of-Use Program Annual Report, at 13-15
- 11 State of Hawaii Market Potential Study, at 55
- 12 SMUD SmartPricing Options Pilot Evaluation, at 3



AEG Supply Curves

- ◆ EE Bundles Summary and Costs, and Hourly curves provided in Excel:
 - <https://www.hawaiianelectric.com/clean-energy-hawaii/integrated-grid-planning/stakeholder-engagement/key-stakeholder-documents>
- ◆ Seeking feedback by September 30 to finalize supply curves in October.





Mahalo

Any Questions