HNEI
Hawai'i Natural Energy Institute
School of Ocean and Earth Science and Technology
University of Hawai'i at Mānoa

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School of Ocean and Earth Science and Technology
University of Hawaii at Manoa

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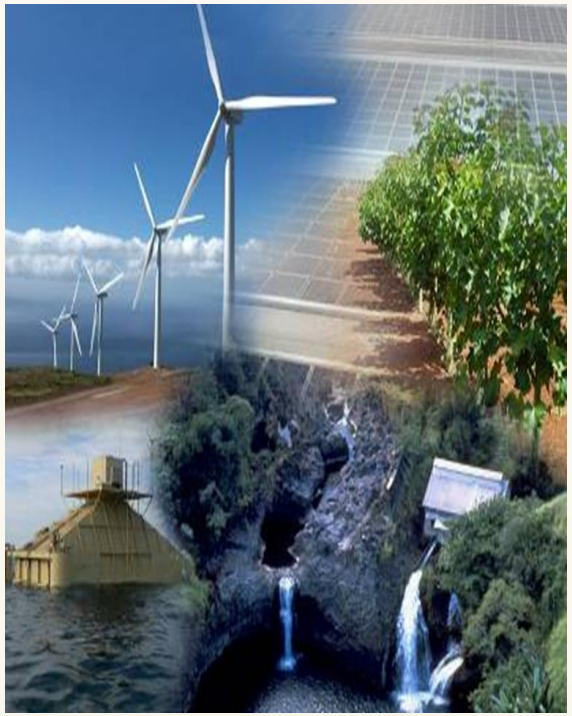
MĀNOA

Modern Grid Technology and Leading Practices Workshop



Roundtable Discussion: State of the Modern Grid

May 2017

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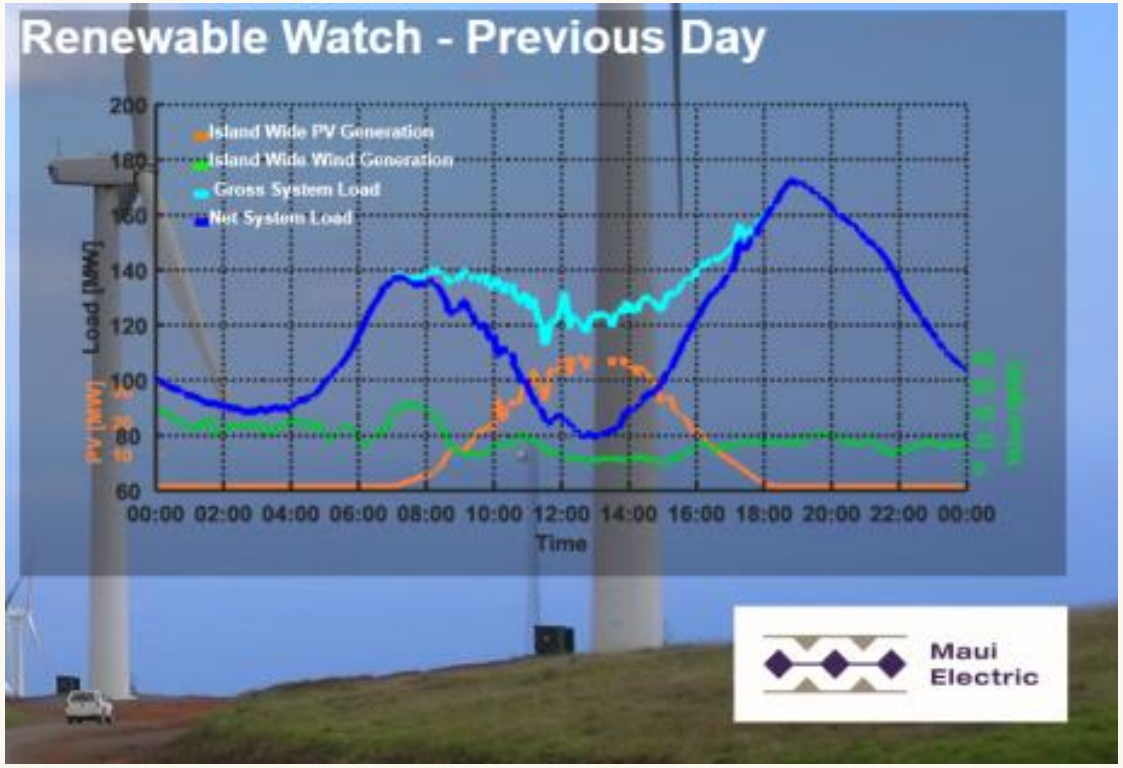
Assistant Researcher
Hawaii Natural Energy Institute

Reaching Near-Term Goals Requires Moving Beyond Current Grid Limitations

Grid "Congestion" Increasing in Peak Solar Hours



February 1, 2017
Maui Electric Grid Operations

Current analyses suggest near-term limits during these hours under status quo

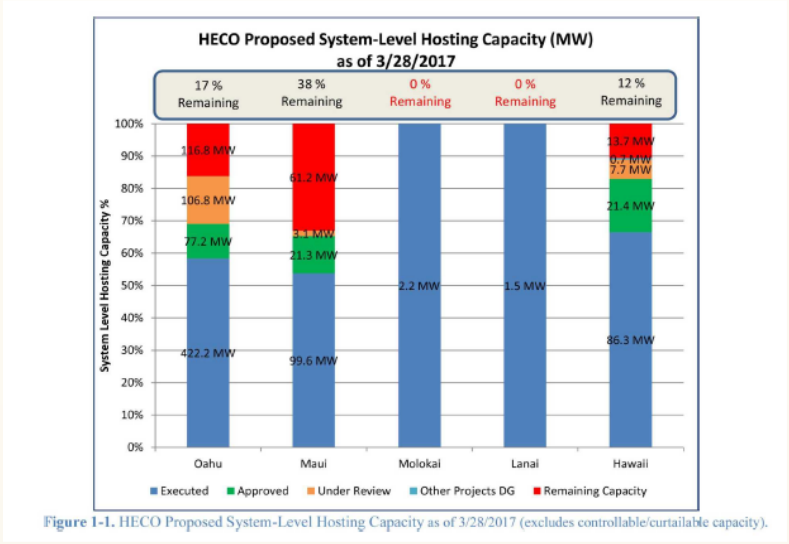
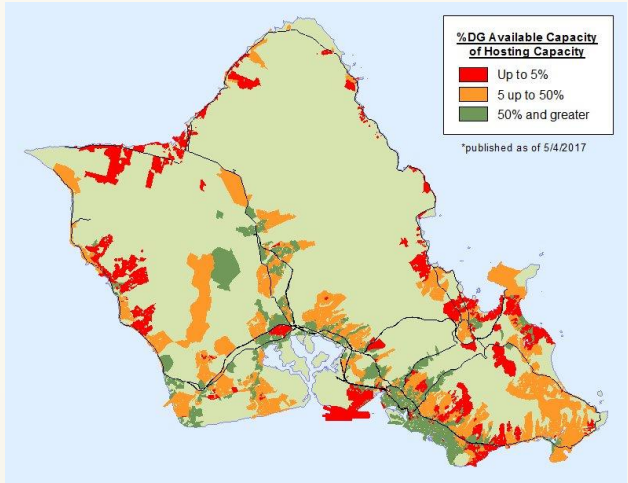
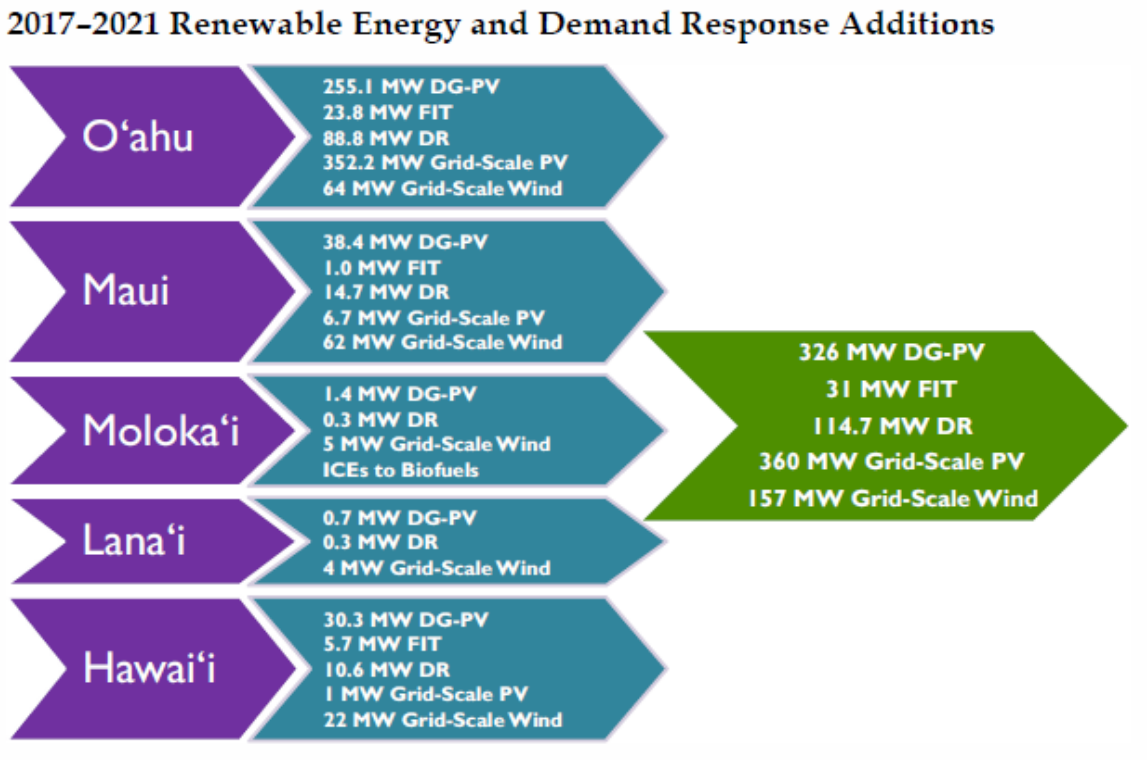


Figure 1-1. HECO Proposed System-Level Hosting Capacity as of 3/28/2017 (excludes controllable/curtailable capacity).



Reaching Near-Term Goals Requires Moving Beyond Current Grid Limitations

HECO Companies' Near-Term Action Plan



Substantial near-term growth projected for utility-scale renewables and distributed energy resources

Integrated Grid as Platform to Enable Clean Energy Future

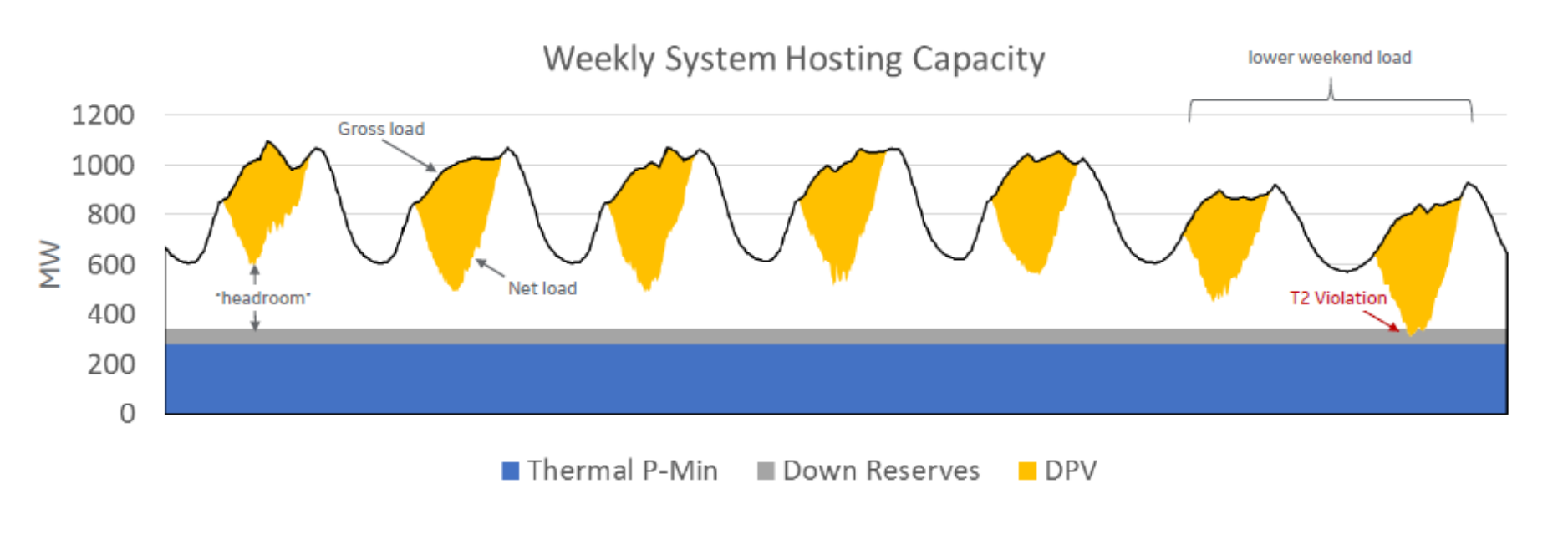
Key Considerations:

- Unlock value and capacity of existing infrastructure
- Customer demand for new technologies
- Leverage existing and new DERs for reliability
- Manage costs, affordable rates

Key Considerations in Near-Term Transition

Unlocking renewable integration capacity of existing infrastructure

- system-level hosting capacity limited during peak solar hours under certain conditions
- appears to be significant capacity outside of these periods
- further analysis necessary to identify analogs at the distribution level



Violation triggered during limited number of low load, high solar periods

Average annual headroom during mid-day ≈ 300 MW

Average annual headroom during evening ≈ 700 MW

Preliminary results from HNEI-GE Energy analysis in progress

Key Considerations in Near-Term Transition

Growing customer interest in DERs beyond rooftop solar

- facilitate integration of EVs, storage, advanced DSM technologies, microgrids, etc.

Leveraging existing and future DERs to support reliability

- reserve requirements increase with renewable additions
- new sources of grid services needed as traditional generation is displaced
- will require closer coordination of system operations with distribution system conditions

Managing costs to maintain affordable rates

- maximize customer value of investments
- identify opportunities to reduce costs with non-wires alternatives
- co-optimize resources between bulk power and distribution systems

Mahalo!

(Thank you)

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Assumptions for System Hosting Capacity Screening Analysis

Inputs & Assumptions

Type	Unit Name	Current P-Min	E3 P-Min	Must-Run	Must-Run P-Min
Coal	AES	63.0	63.0	1	63
CC	KALCC1	65.0	65.0	1	65
CC	KALCC2	65.0	65.0	0	0
CC	KALCC3	0.0	0.0	0	0
ST	KAHE1	23.8	4.0	1	4
ST	KAHE2	24.0	4.0	1	4
ST	KAHE3	24.1	5.0	1	5
ST	KAHE4	22.4	5.0	1	5
ST	KAHE5	38.8	21.0	1	21
ST	KAHE6	38.8	40.0	1	40
ST	WAIAU3	22.3	22.3	0	0
ST	WAIAU4	22.3	22.3	0	0
ST	WAIAU5	22.5	22.5	0	0
ST	WAIAU6	22.5	22.5	0	0
ST	WAIAU7	23.0	5.0	1	5
ST	WAIAU8	22.6	5.0	1	5
ST	WAIAU9	21.1	21.1	0	0
ST	WAIAU10	20.0	20.0	0	0
Bio-Diesel	AIRDSG	4.0	4.0	0	0
Bio-Diesel	CIPCT	41.2	41.2	0	0
Bio-Diesel	SCHOFIL1	4.6	4.6	0	0
Bio-Diesel	SCHOFIL2	4.6	4.6	0	0
Bio-Diesel	SCHOFIL3	4.6	4.6	0	0
Bio-Diesel	SCHOFIL4	4.6	4.6	0	0
Bio-Diesel	SCHOFIL5	4.6	4.6	0	0
Bio-Diesel	SCHOFIL6	4.6	4.6	0	0
Waste	HPOWER	63.0	63.0	1	63

Assumptions

280	System P-Min
60	Down Reserve Requirement (MW)
E3 P-Min	P-Min Assumption
605	Installed DPV

Results

12	Count of Violations
-29	Minimum Headroom
843	Maximum Headroom
433	Average Headroom

Key Assumptions:

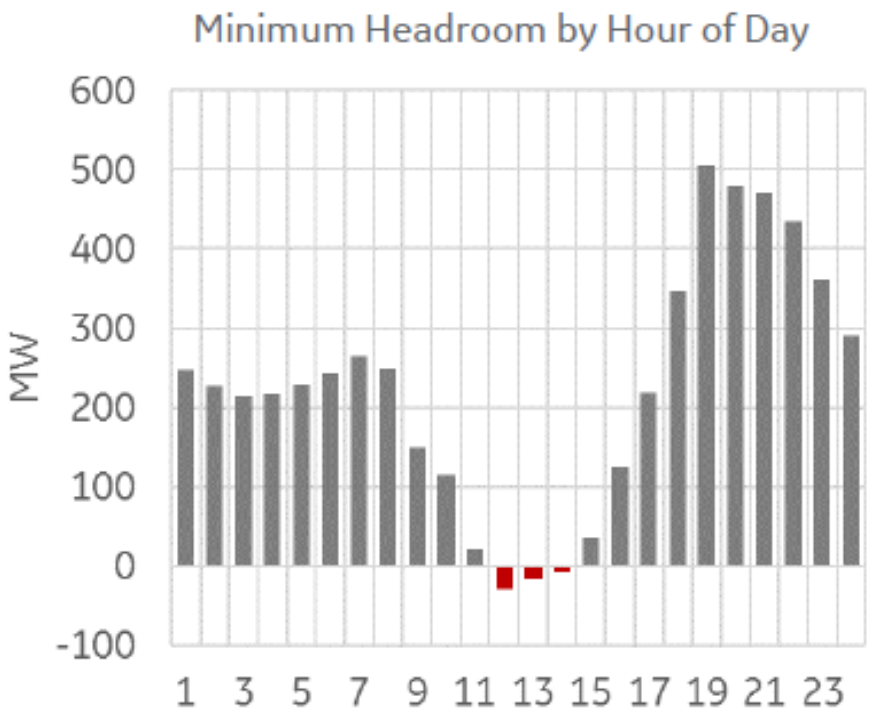
Gross Load Profile	... from PSIP assumptions
DPV Profile	... from HSIS, AWS Truepower
Must-Runs	... E3 report
P-Mins	... E3 report

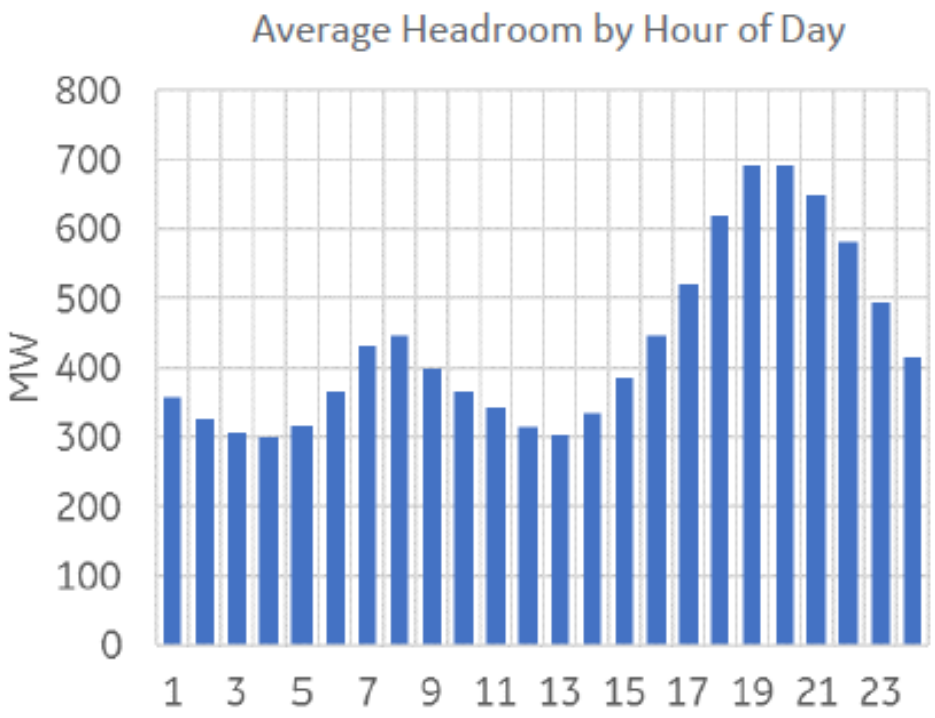
Methodology:

1. Create 10-min load and DPV solar data for 1-year*
2. Calculate headroom for each interval
= gross load – must run Pmins – down reserves – DPV
3. Increase DPV until number of violations (negative headroom) = 12

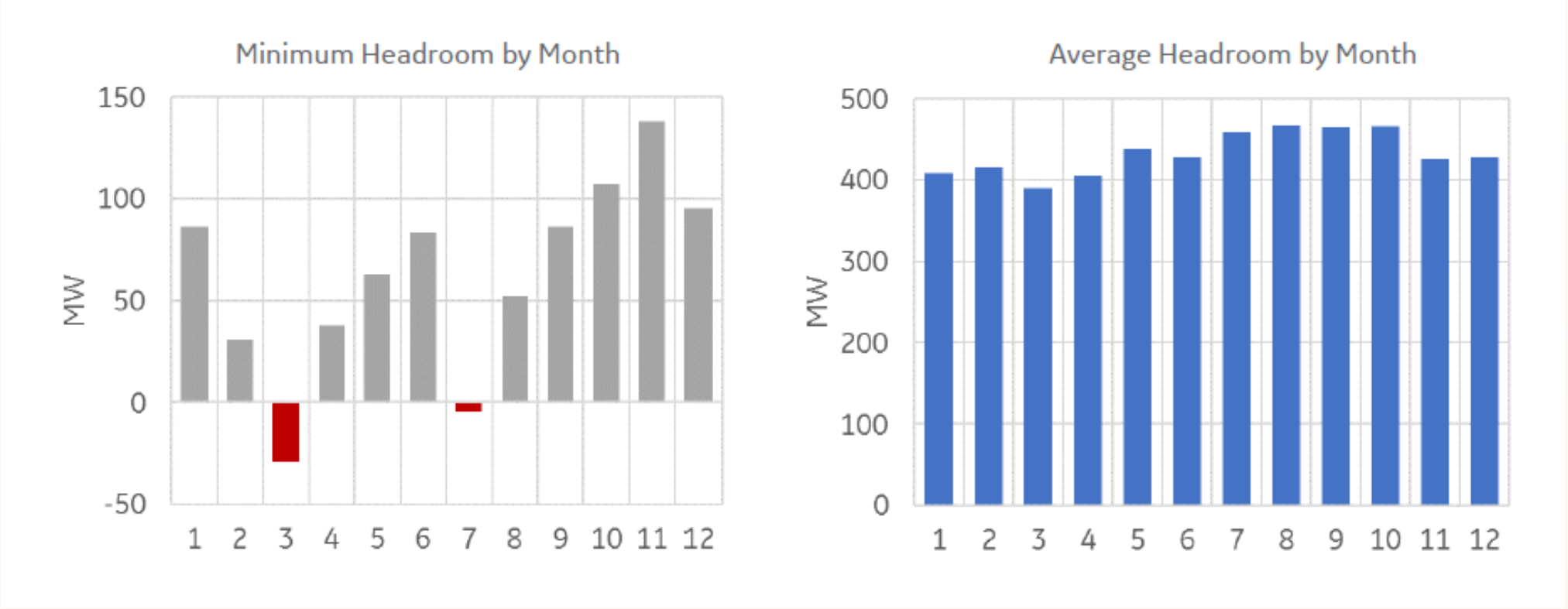
*Stochastics not included (yet), 1-year of chronological load and pv data, will evaluate stochastic, must-year data next

Summary Statistics for Headroom by Hour of Day





Summary Statistics for Headroom by Month



“Duration Curve” of Annual Available Headroom