



# Business & Financial Conference

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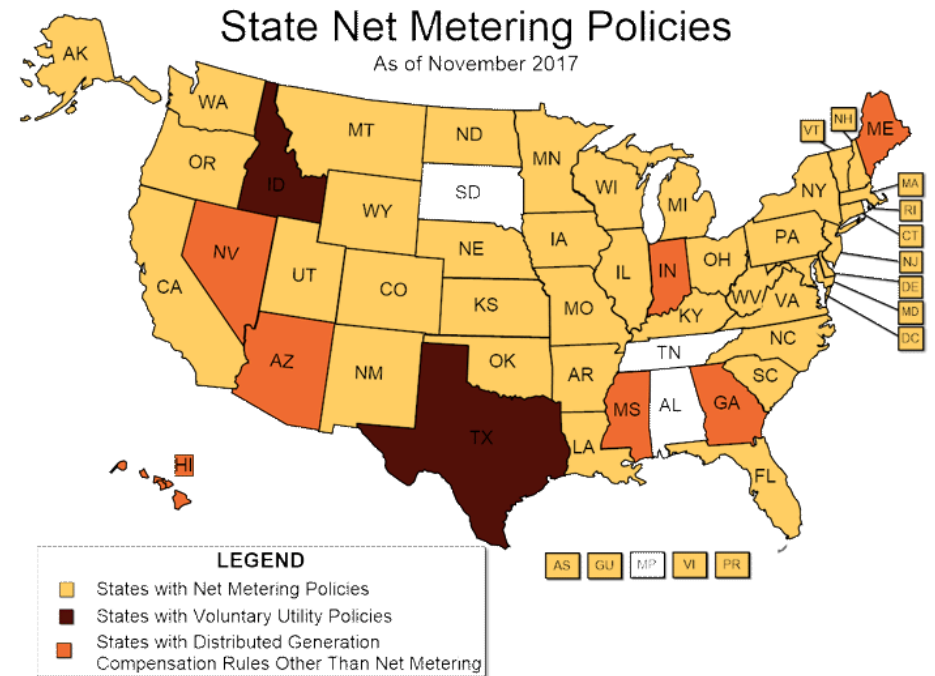


# Net Metering (NEM) Credit Recommendation: Value of Solar

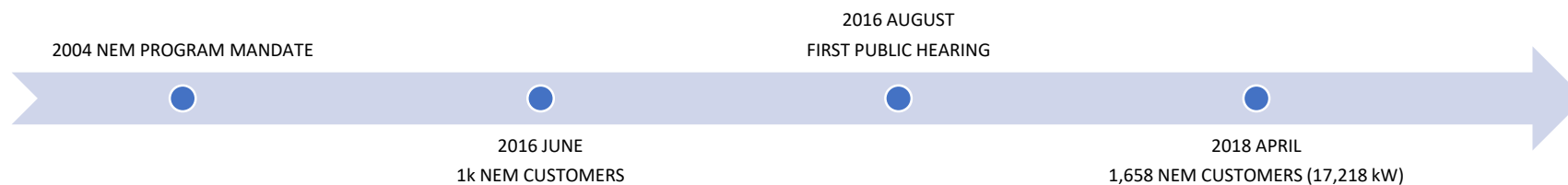
September 17, 2018



- Thirty Eight (38) States, Washington D.C., and Four (4) Territories Offer Net Metering and utilities in two additional states (Idaho and Texas adopted Net Metering (Full Retail Credit)).
- Arizona, Georgia, Hawaii, Indiana, Maine and Mississippi have compensation other than net metering.
- The Value of Solar (VOS) is an alternative to net metering. Customers buy from the grid at retail rate and sell to the grid at an established VOS rate. Only Minnesota and Austin Energy (Texas) has adopted a VOS rate.

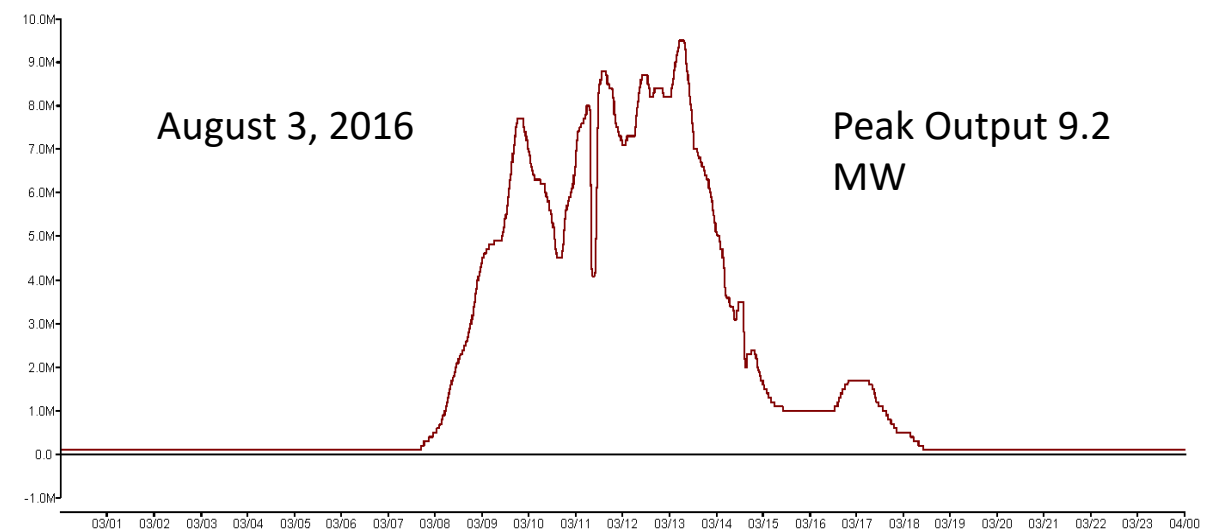


- Program Mandated in 2004. Guam has been crediting NEM customers full retail rate over the past 13 years. Excess credit carried over or paid out annually at full retail rate.
- PUC to evaluate program and credits provided when GPA has 1,000 NEM Customers which occurred in June 2016.
- As of April 2018, GPA has 1,658 NEM Customers (94.8% Residential), with 17,218 KW of capacity. The revenue impact on non-NEM ratepayers is estimated at \$3.1M annually.
- CCU/GPA conducted its first public hearing on NEM in August 2016 to gather input from stakeholders in order to prepare its filing to the PUC for changes in rate credits in order to achieve parity amongst all ratepayers.

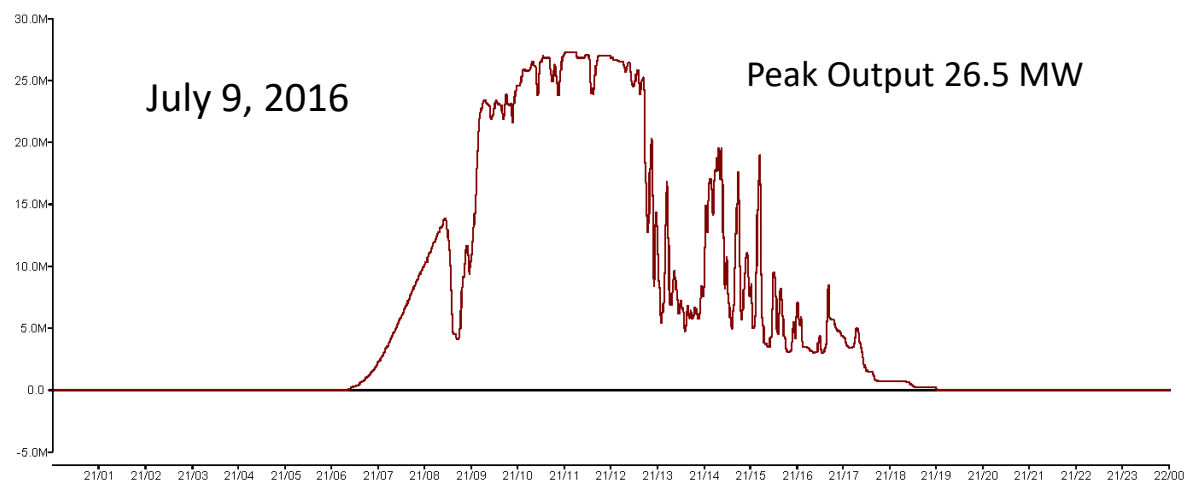


# Solar PV Energy Production Characteristics

# Utility Scale PV Output Look Like This ...



NEM does not eliminate  
need for capacity

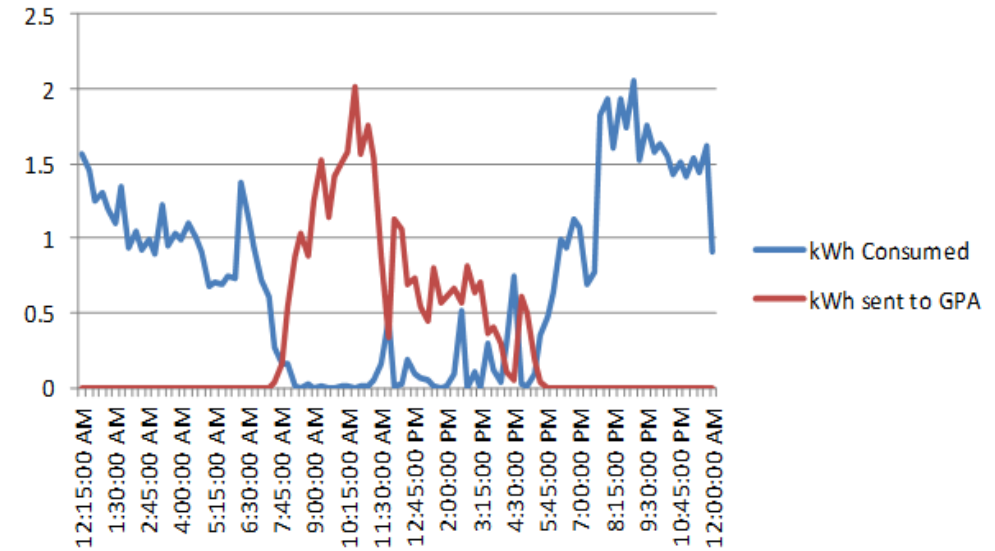
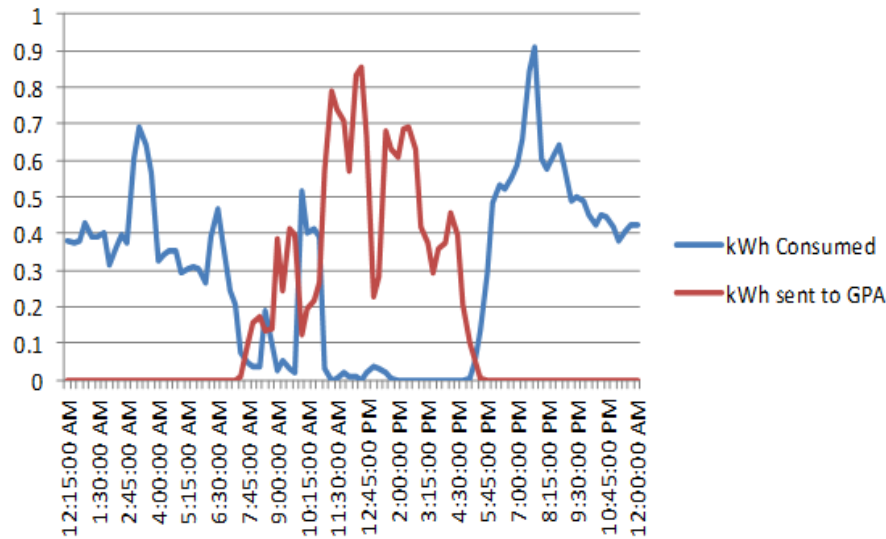


PV without adequate storage is not a capacity  
benefit. It is an energy benefit.



Date	14-Jun-16
PV System Size (KW)	5.00
GPA KWH 12 am to 7 am	11.05
GPA KWH 7 am to 6 pm	3.66
GPA KWH 6 pm to 12 am	<b>12.92</b>
Evening Peak	
GPA Total	27.63
NEM KWH 7 am to 6 pm	16.14
Net GPA KWH	11.49

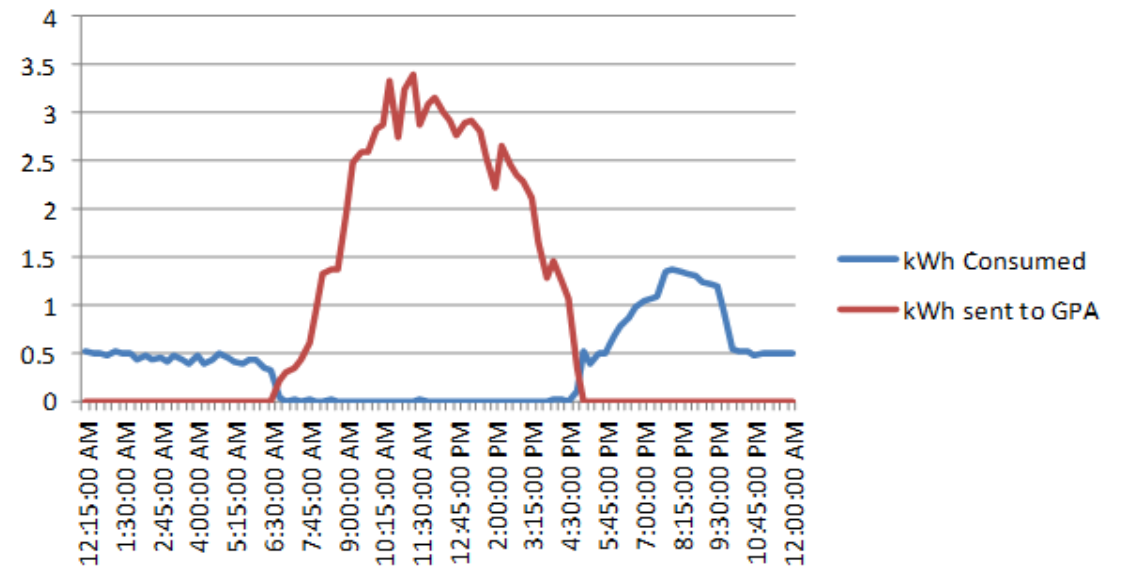
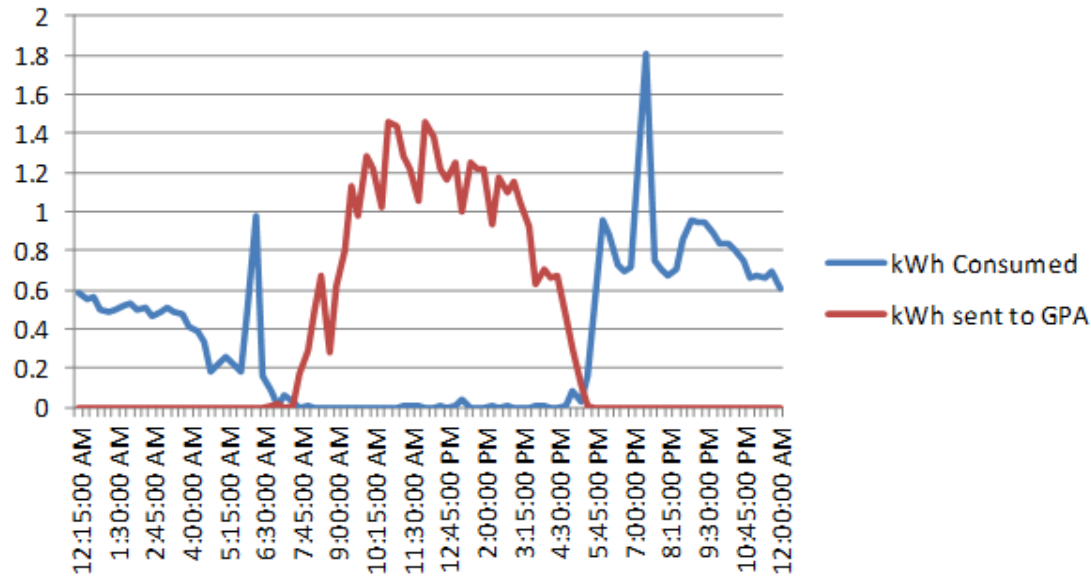
Date	14-Jun-16
PV System Size (KW)	12.40
GPA KWH 12 am to 7 am	28.90
GPA KWH 7 am to 6 pm	6.10
GPA KWH 6 pm to 12 am	<b>34.60</b>
Evening Peak	
GPA Total	69.60
NEM KWH 7 am to 6 pm	32.50
Net GPA KWH	37.10



# More NEM Profile Variations

Date	14-Jun-16
PV System Size (KW)	8.80
GPA KWH 12 am to 7 am	11.05
GPA KWH 7 am to 6 pm	1.90
GPA KWH 6 pm to 12 am	<b>20.10</b>
Evening Peak	
GPA Total	33.05
NEM KWH 7 am to 6 pm	34.50
Net GPA KWH	(1.45)

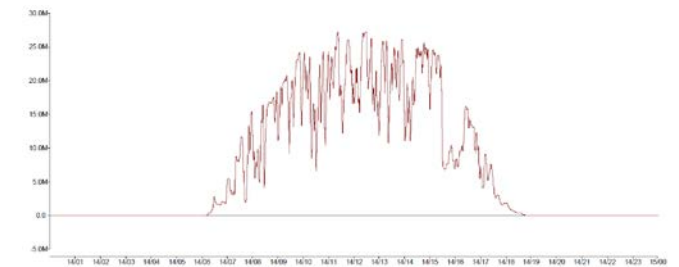
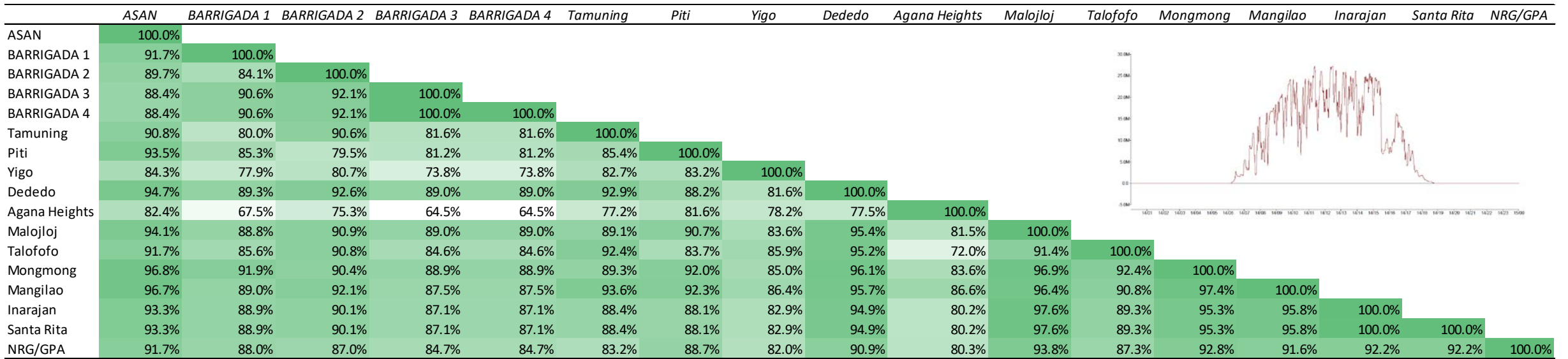
Date	14-Jun-16
PV System Size (KW)	15.30
GPA KWH 12 am to 7 am	11.40
GPA KWH 7 am to 6 pm	2.70
GPA KWH 6 pm to 12 am	<b>21.60</b>
Evening Peak	
GPA Total	35.70
NEM KWH 7 am to 6 pm	84.90
Net GPA KWH	(49.20)





## Solar PV production is intermittent throughout the Island Energy Storage Systems required to improve power quality

14 June 2016



**PV NEM and NRG/GPA systems swing together almost in unison**



# Does NEM Lower Guam Generation Capacity Requirements?

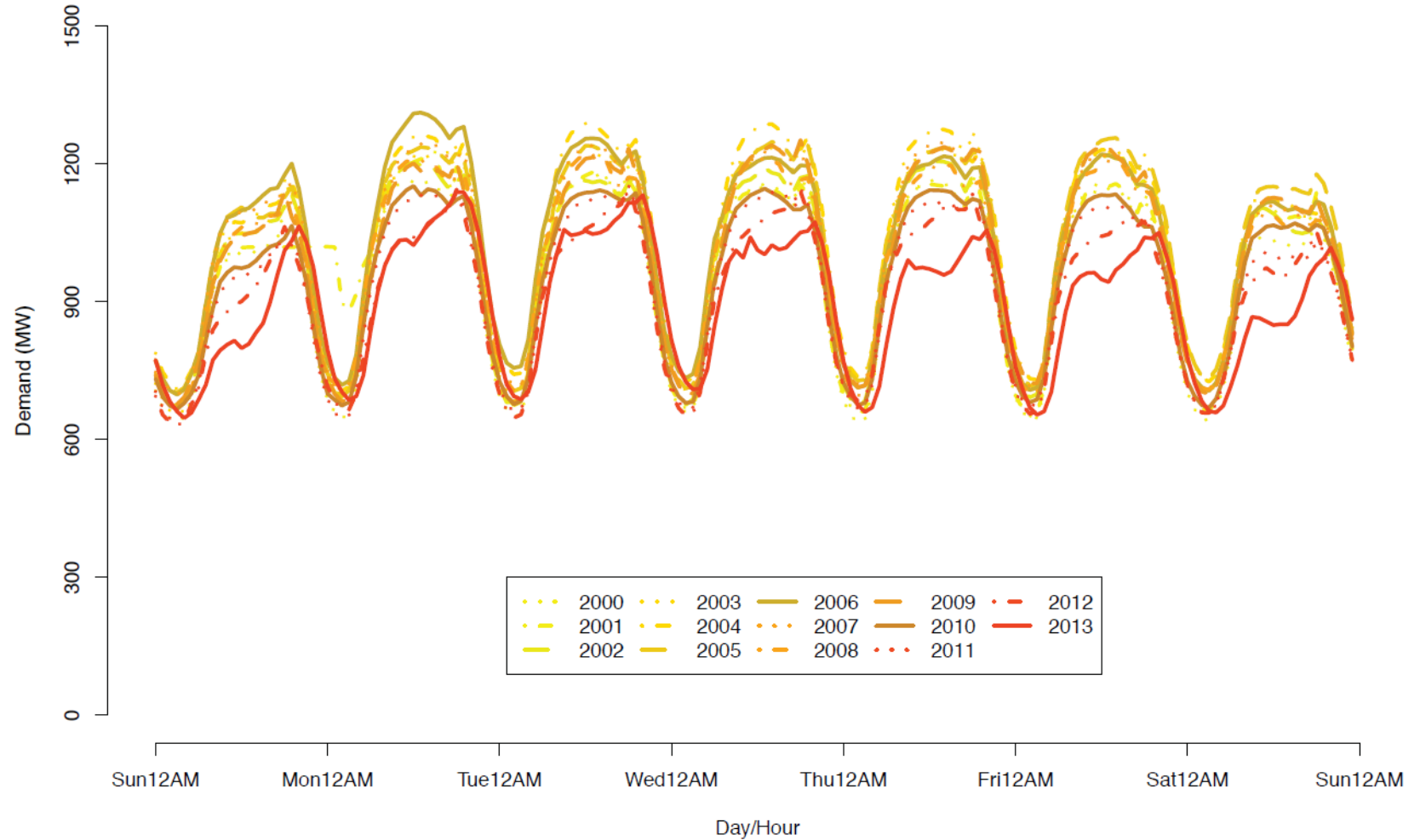
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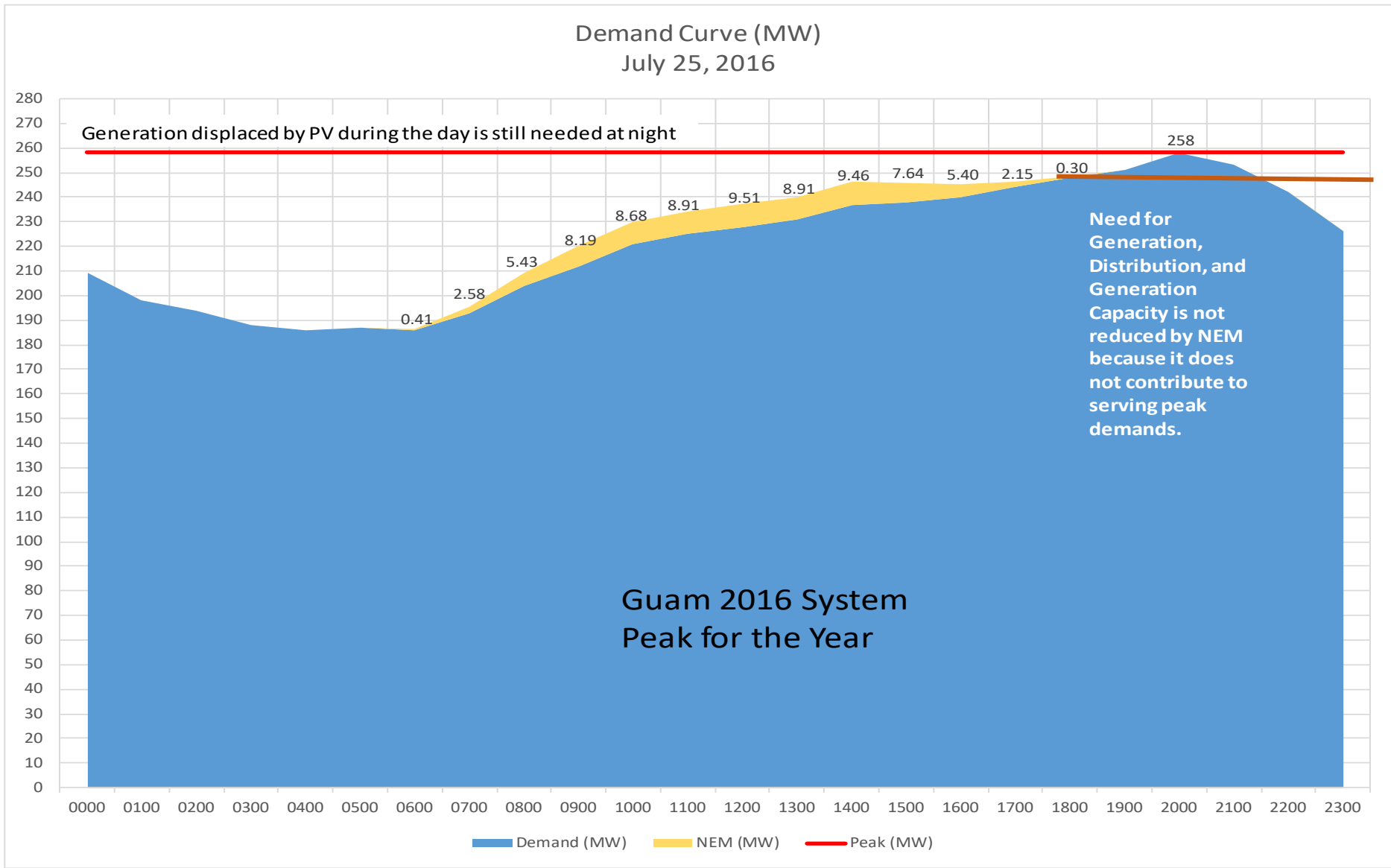
*No. Solar PV systems in Guam without adequate energy storage capacity does not reduce peak demand and therefore does not eliminate conventional capacity needs*

PV NEM saves Oahu Money by displacing conventional generation producing at 46% above average production costs at the system peak occurring midday when solar PV produces energy.

Guam's generation capacity requirements are set by peak demand. Guam's peak demand occurs at night. PV NEM without adequate storage does not reduce the amount of capacity needed by the system.

Demand at Week of Maximum Demand, by Hour



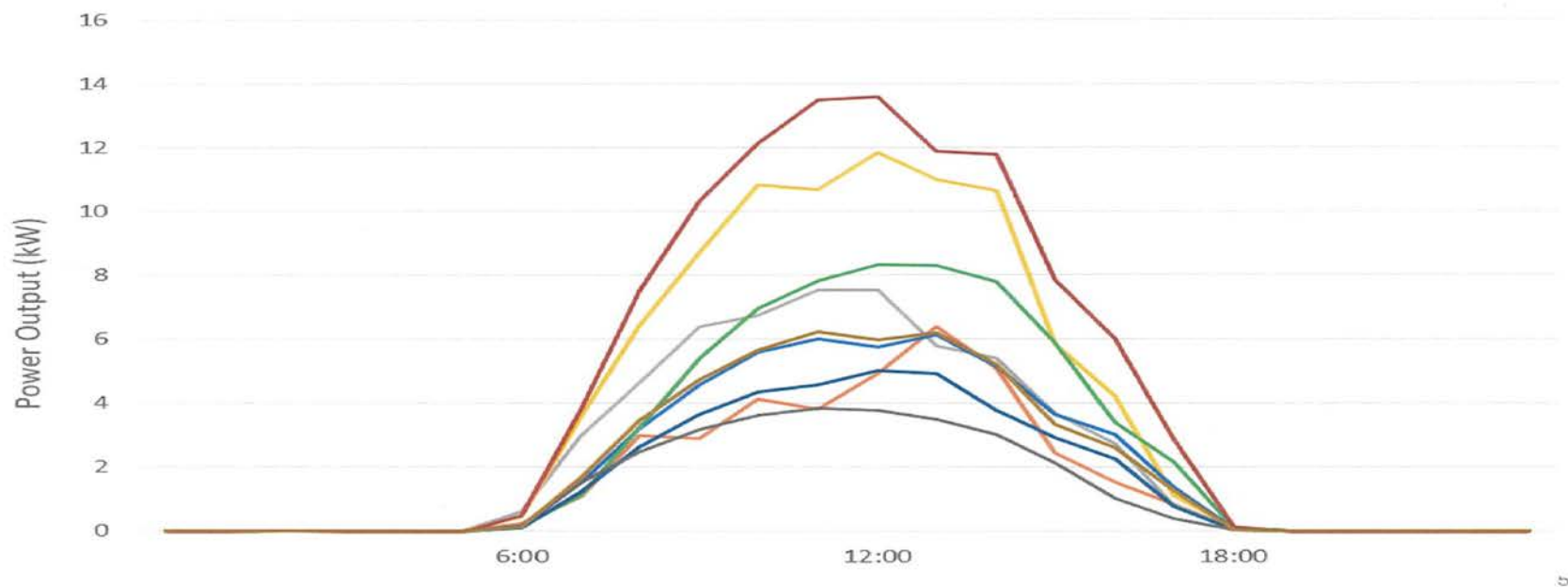


# NEM Peak Production not at GPA Peak Demand Period

Source: Clean Power Resource Report

## Nine Sampled Systems

2015 Peak Load Day: August 31



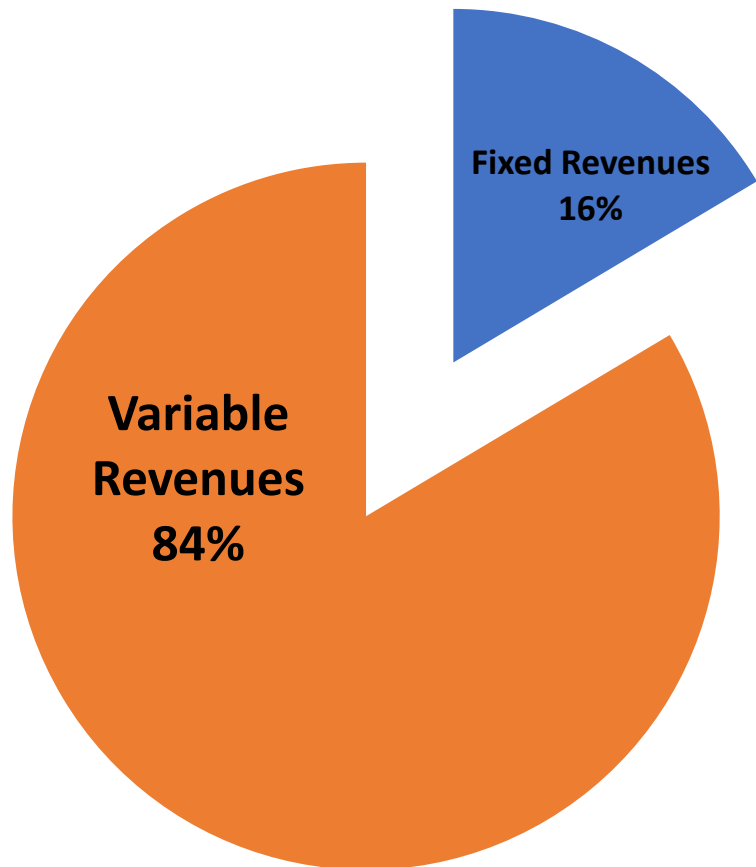
- Replacement for Net Metering Program
- Grandfathering existing registered NEM customers
  - Allow customers who own system to recover investment
  - Phase in VOS rates over an extended time period
- GPA files for PUC approval:
  - Reassessed VOS rates each LEAC for Avoided Energy Value
  - Reassessed VOS rates for other VOS components
    - Annually
    - Periodically over a set number of years
    - When GPA's generation mix changes

- NEM customers receive services from the grid including:
  - Use the grid to sell power (get credit at full retail rate for excess production)
  - Use the grid to energize their homes at night
  - Frequency regulation absorbed by grid for intermittencies
  - Reactive power supply
  - Voltage regulation
  - Stand-by power on overcast days when the sun does not shine
- Monthly fixed charge of \$15 does not recover cost to serve from grid
  - Most of GPA fixed cost is recovered in the energy use (kWh) rate component which is typically zero for NEM customers

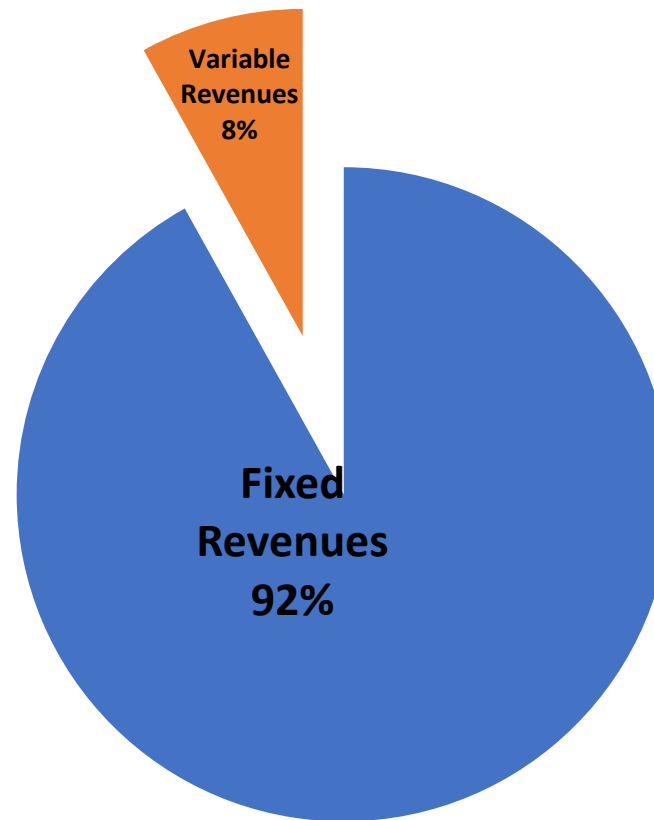
# Rate Structure & Fixed Cost Recovery



### Civilian Fixed vs Variable Revenues



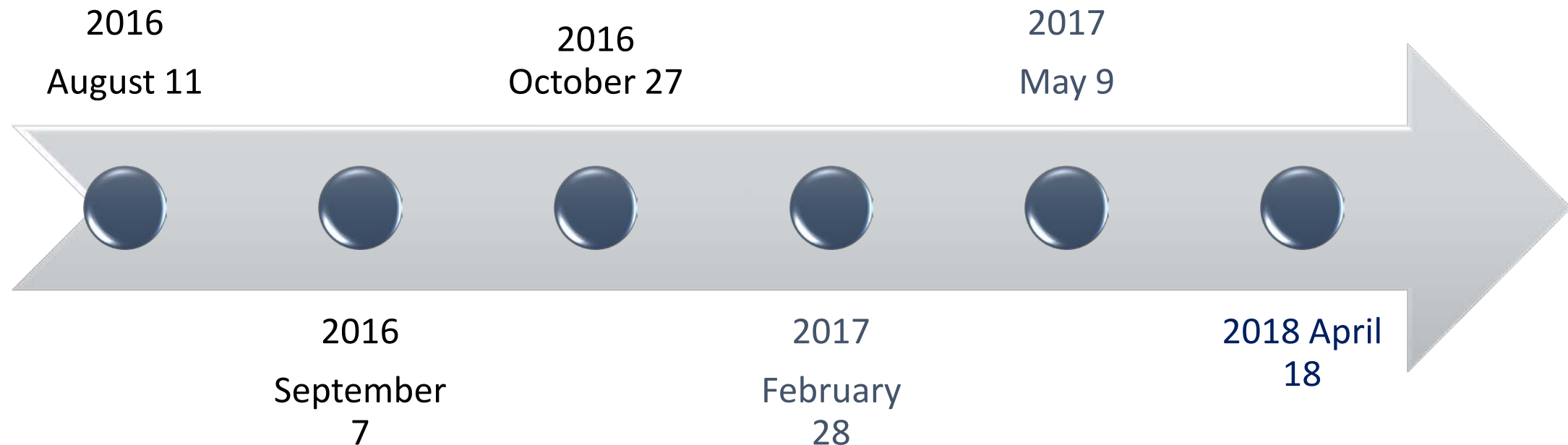
### Navy Fixed vs Variable Revenues



# GPA Rate Structure Should Move Towards Recovering More Fixed Costs Through Fixed Charges.

- Civilian rate structure
  - Most of GPA fixed costs recovered in the variable rate
- Navy rate structure
  - Most of GPA fixed costs recovered in the fixed rate
- Hawaii has moved to fixed cost recovery predominantly through its fixed rate

# Net Metering Public Meetings Held to Gather Input from Stakeholders



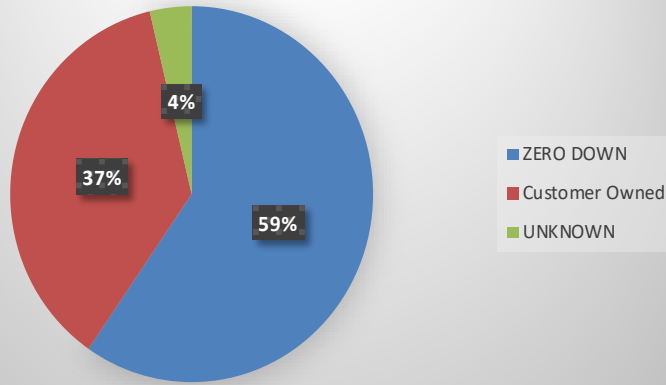
## Key Points from Public Meetings

- The B&V report provides all the gain to GPA and did not represent true value of solar
- NEM Owner wants to recover his investment. Asked for grandfathering until he does so. He said it will take 7 years to recover his \$60K investment
- NEM not meant to be money making business but a fair exchange of trade energy...some customers making money from units sized beyond their needs
- The applicability of NEM program to 3<sup>rd</sup> party providers need to be clarified
- PV provider wants NEM program to continue up to 20% penetration similar to Hawaii
- PV provider wanted more time to provide a report on Value of Solar and bring to GPA for information. Report was conducted and presented by Clean Power Research on April 18, 2018

## Key Points from Public Meetings (continued)

- Provider commented the NEM energy saves the utility cost on:
  - Maintenance cost for generations, poles, labor, lines, substations, transformers, etc.
  - Reduction of line losses because energy is near customers
  - Costs associated with fuel and fuel shipments
  - Helps GPA achieve energy portfolio reducing need for more renewable projects
  - Savings to environment; lessens carbon foot print
- Provider-GPA should consider subsidies for home energy storage systems
- Provider-GPA should consider grandfathering NEM customers through a phased approach

### Customer Count

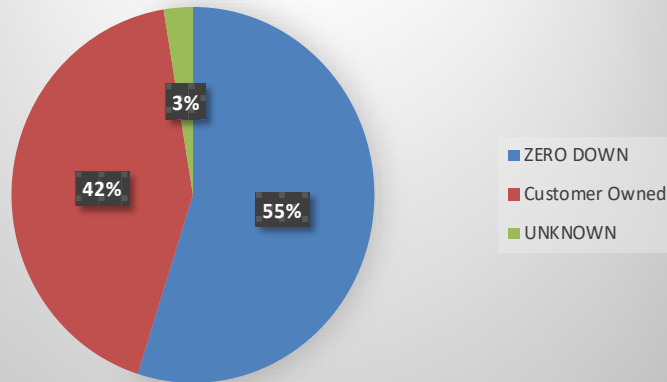


Description	Number of Customers
ZERO DOWN	979
Customer Owned	602
UNKNOWN	61
<b>Grand Total</b>	<b>1,642</b>

### March 2018

Customer Class	KW	NEM	Customers	Percent of Customer Class
R - Residential	14,119	1,562	43,756	3.6%
J - Small General Service Demand	1,647	32	987	3.2%
K - Small Government Demand	318	9	348	2.6%
L - Large Government Demand	23	1	45	2.2%
P - Large General Demand	241	3	116	2.6%
G - Small General Non Demand	666	33	4,127	0.8%
S - Small Government Non-Demand	79	7	681	1.0%
<b>Total</b>	<b>17,092</b>	<b>1,647</b>	<b>50,060</b>	

### kW Distribution



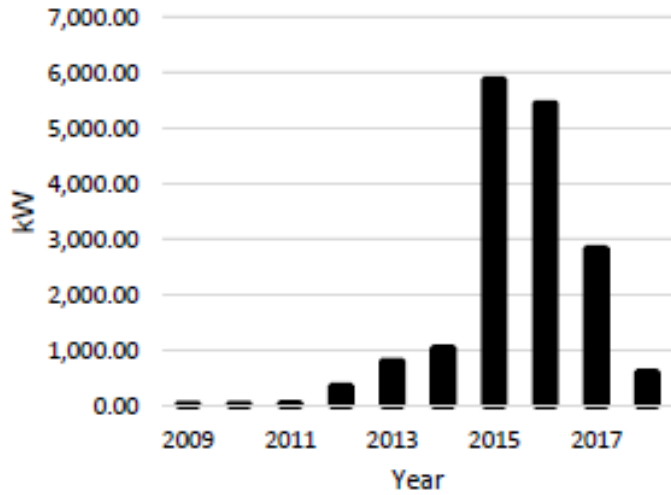
Description	kW
ZERO DOWN	9,326
Customer Owned	7,212
UNKNOWN	440
<b>Grand Total</b>	<b>16,978</b>

### Projected FY 2018 Non-Fuel Revenue Loss

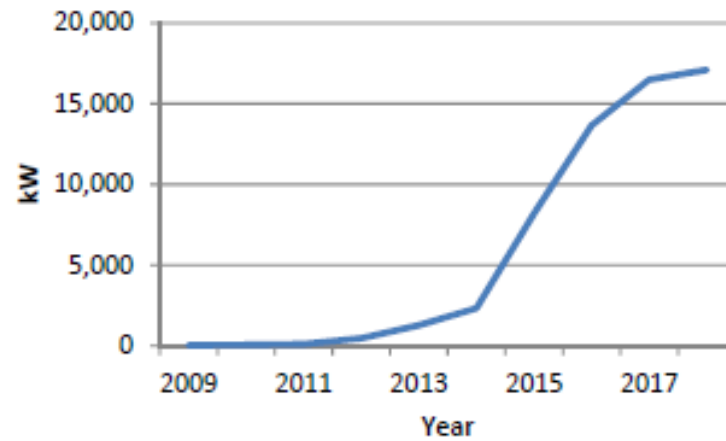
Customer Rate Class	Renewable Energy Capacity (kW)	Annual kWh Generated (@5.092 hours/day)*	Average Non-Fuel Yield \$/kWh	Estimated Annual Revenue Loss
R	13,693	25,447,071	0.09293	\$ 2,364,822
J	1,647	3,059,970	0.13112	401,226
K	318	590,618	0.13932	82,286
L	23	42,373	0.13525	5,731
P	241	447,331	0.11539	51,617
G	636	1,182,853	0.15084	178,417
S	79	146,447	0.15334	22,456
<b>Grand Total</b>	<b>16,636</b>	<b>30,916,662</b>		<b>\$ 3,106,555</b>

\*Estimated number of hours from NREL for Guam (13.4° North and 144° East).

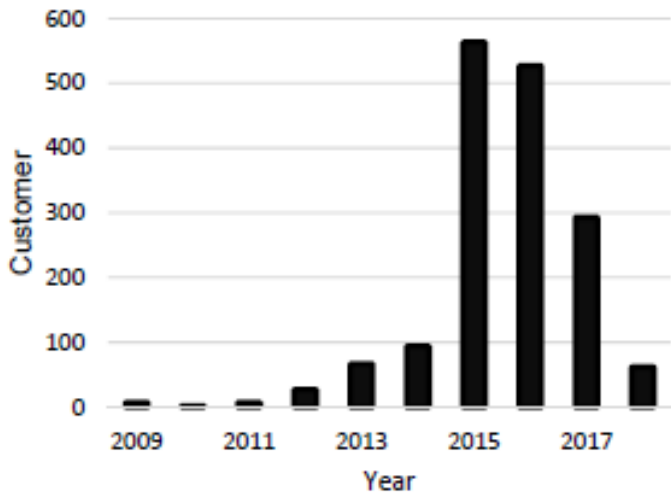
**Yearly Installed kW**



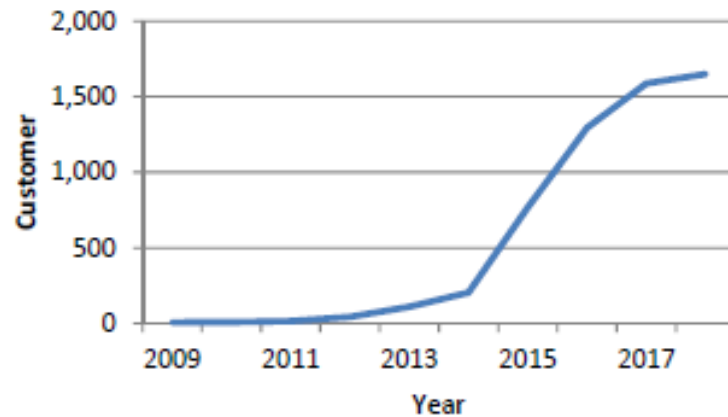
**Cumulative Installed kW**



**Yearly Connected Customer Count**

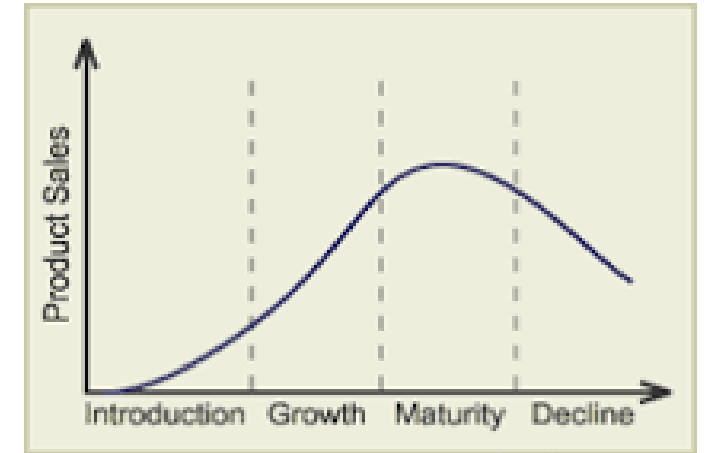


**Cumulative Connected Customer Count**



## NEM Market Analysis

- Product Lifecycle Stages
  - 2009 -2011 Introduction
  - 2012 – 2014 Growth
  - 2015 – 2016 Maturity
  - 2017 – Present Decline

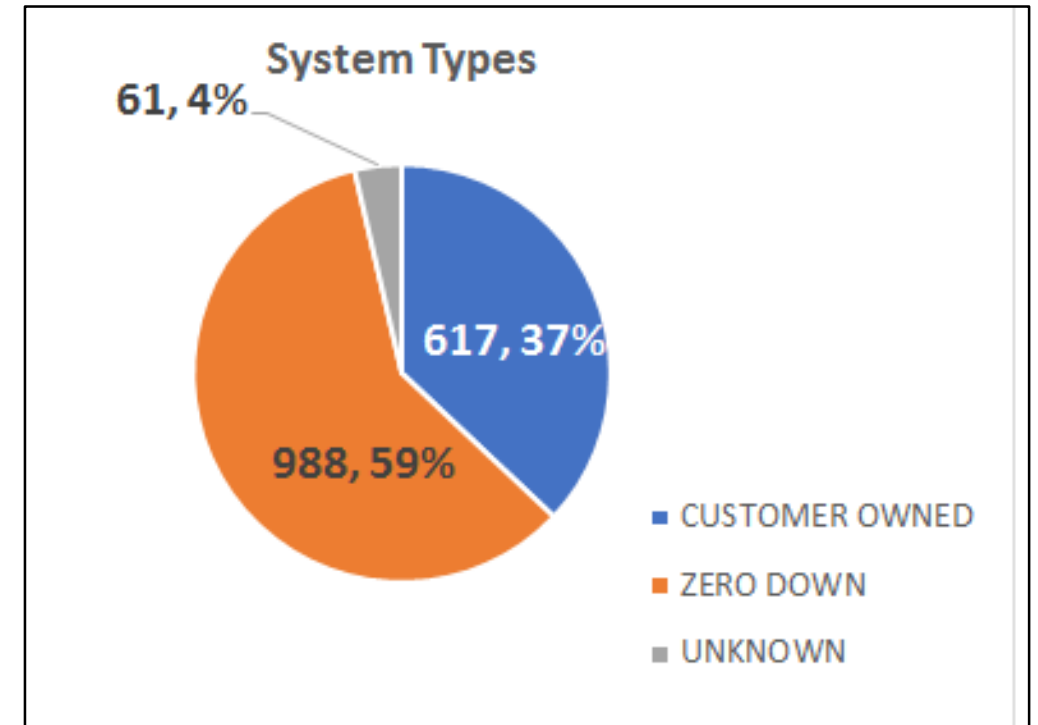


QuickMBA.com



## Market Share of Competitors

Firm	Count	Capacity (KW)	% of Installed System
Company A	747	6,882	40.3%
Company B	271	2,337	13.7%
Company C	229	2,426	14.2%
Company D	147	2,410	14.1%
Owner Installed	90	1,088	6.4%
Company E	29	470	2.7%
Company F	26	357	2.1%
Company G	13	100	0.6%
All Other Companies/Self Constructed Combined	35	576	3.4%
Unknown	62	449	2.6%
Totals:	1,649	17,095	100.0%





## GPA Utility Scale Projects

- 20-25 year Power Purchase Agreements
- Phase I
  - NRG, 26.5 MW, \$TBD/MWH

## GPA Utility Scale Projects

- Phase II
  - Hanwha, 60 MW<sub>ac</sub>, Fixed Tilt
    - Contract A: \$62.45/MWh (First Contract Year)
    - Contract B: \$65.99/MWh (First Contract Year)
    - 40 MW/65 MWh BESS
      - 25 MW Ramping Control
      - 15 MW Energy-Shifting
  - KEPCO/LG CNS, 60 MW<sub>ac</sub>, Fixed Tilt, \$85.5/MWH
    - 32 MW/32 MWh Ramping Control BESS

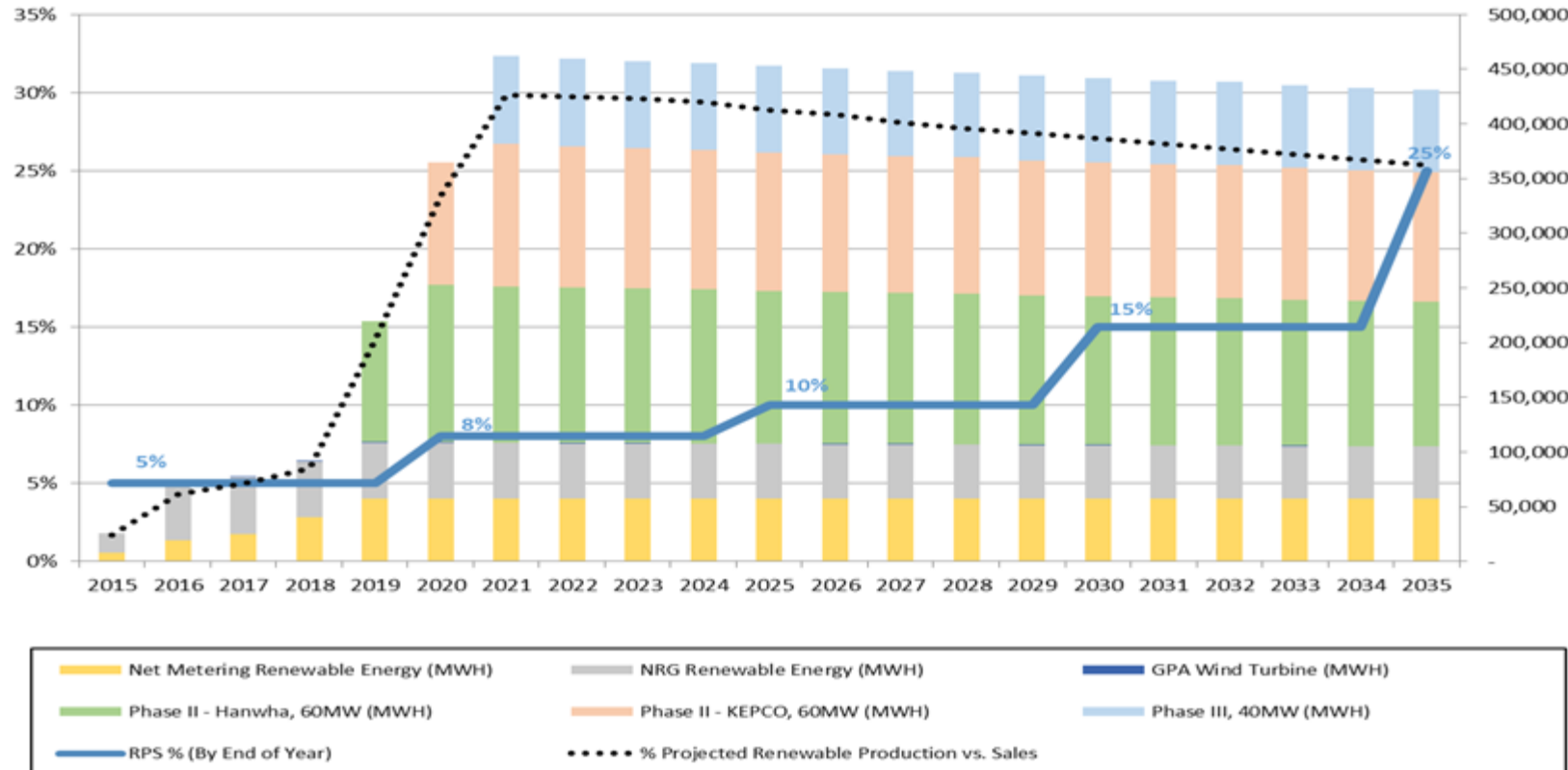
## GPA Utility Scale Solar Projects

- Phase III (Bid in Progress, Partnership with U.S. Navy)
  - South Finegayan
    - 20 MW
    - Full Energy-Shifting BESS (4-hours Min)
  - Naval Base Guam
    - 20 MW
    - Full Energy-Shifting BESS (4-hours Min)

Current LEAC Rate: \$TBD/MWh



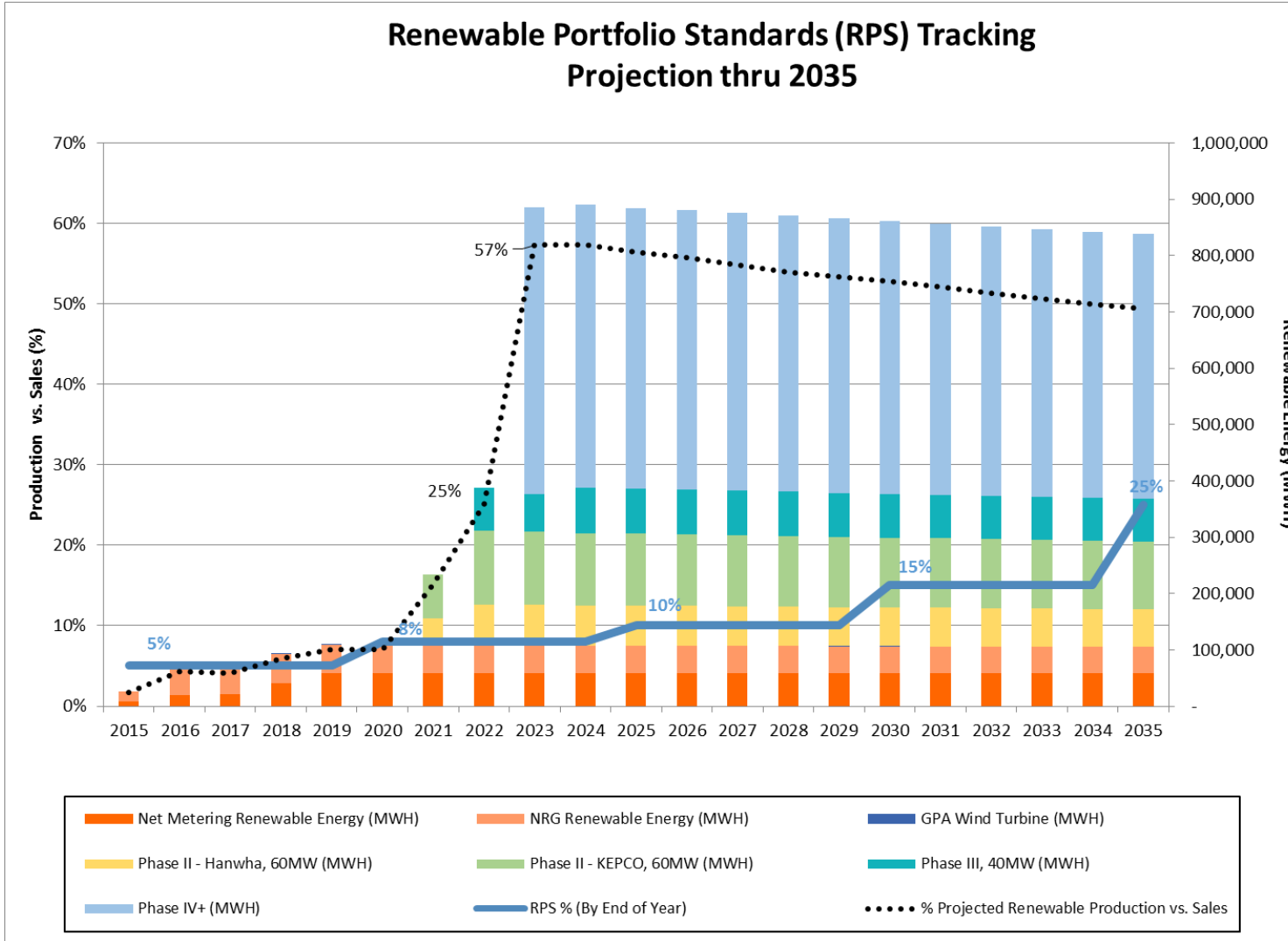
### Renewable Portfolio Standards (RPS) Tracking Projection thru 2035



Phase I, II, III,  
WTG, and NEM

**New Target:  
Phase IV:  
going to 50%**

- Avoided Cost VOS versus Market-Based VOS
  - Why should I pay more for NEM if I can get it less from someone else?



**New Target:  
Phase IV:  
going to 50%**

Phase IV: Bringing GPA to 50% Renewable Energy Supply



# GPA Value of Solar from an Avoided Cost Perspective

Cost Category	FY 2017	Cost per kWh Sold	GPA Avoided Cost (\$/kWh)
<b>Generation + IPP Costs</b>			
Other Production - Fixed O&M	\$ 17,783,917	\$ 0.0110	
IPP Costs - Fixed O&M	\$ 16,958,770	\$ 0.0105	
IPP Costs - Variable O&M	\$ 2,976,564	\$ 0.0018	\$ 0.0018
<b>Transmission &amp; Distribution</b>	\$ 11,703,969	\$ 0.0073	
<b>Admin and General</b>			
Payroll, benefits, retirement	\$ 12,862,412	\$ 0.0080	
Insurance	\$ 7,252,504	\$ 0.0045	
Contracts	\$ 4,024,943	\$ 0.0025	
Utilities	\$ 1,817,009	\$ 0.0011	
Office supplies & Others	\$ 844,349	\$ 0.0005	
Customer Accounting	\$ 4,756,213	\$ 0.0030	
Debt Service	\$ 56,937,000	\$ 0.0354	
CIPs/Others	\$ 26,731,639	\$ 0.0166	
<b>Total ( Base Rate Revenues)</b>	\$ 164,649,289	\$ 0.1023	
<b>Fuel Costs</b>			
Fuel Consumption, plus the under recovery of \$15.3 M)	\$ 181,683,506	\$ 0.1128	
Fuel Consumption, plus the under recovery of \$15.3 M)	\$ 165,692,714	\$ 0.1029	\$ 0.1029
Fuel Handling	\$ 7,128,512	\$ 0.0044	
Renewables	\$ 8,862,280	\$ 0.0055	
<b>Total</b>	346,332,795	\$ 0.2151	
Energy losses at 3.5%		\$ 0.0054	\$ 0.0054
Environmental cost		\$ 0.000039	\$ 0.000039
<b>Total Avoided Cost</b>			\$ <b>0.1102</b>
Average cost in 2017 per kWh		\$ 0.2151	\$ 0.2151
<b>Credit Beyond Avoided Cost</b>			\$ <b>0.1049</b>

# Energy Storage System (ESS) Cost Frequency Control

FY2019	
Total KWH Sales Projected:	1,610,093,011
ESS Annual Debt Service & O&M:	\$ 2,829,348
\$/kWh:	\$0.0018

GPA provides low cost energy storage

New 40 MW Energy Storage System Commissioning Oct 2019

## Only Minnesota and Austin Energy (Texas) adopted VOS Model

Cost Category	Minnesota	Austin Energy	Clean Power Research (MRE)	GPA Avoided Cost FY 2017	Comments
Fuel Cost	X	X	\$0.1260	\$0.1029	Close Agreement
Energy Losses	X	X	\$0.0054	\$0.0054	In Agreement
Plant O&M-Fixed	X	X			
Plant O&M-Variable	X	X		\$0.0018	Minor Cost Impact
Generation Capacity Cost	X	X	\$0.0490		No Capacity Avoided
Reserve Capacity Cost	X				
Transmission Capacity Cost	X	X			
Distribution Capacity Cost	X	X			
Environmental Cost	X	X		\$0.0001	Minor Cost Impact
Voltage Control Cost	X				
Solar Integration Cost	X				
Avoided Fuel Hedging Uncertainty Cost			\$0.0590		N/A - GPA Does Not Hedge
Avoided Mandated RPS Cost			\$0.0310		GPA meeting RPS at Savings not Cost
<b>Total:</b>			<b>\$0.2704</b>	<b>\$0.1102</b>	<b>Variance Subsidized by Non-NEM Ratepayers</b>



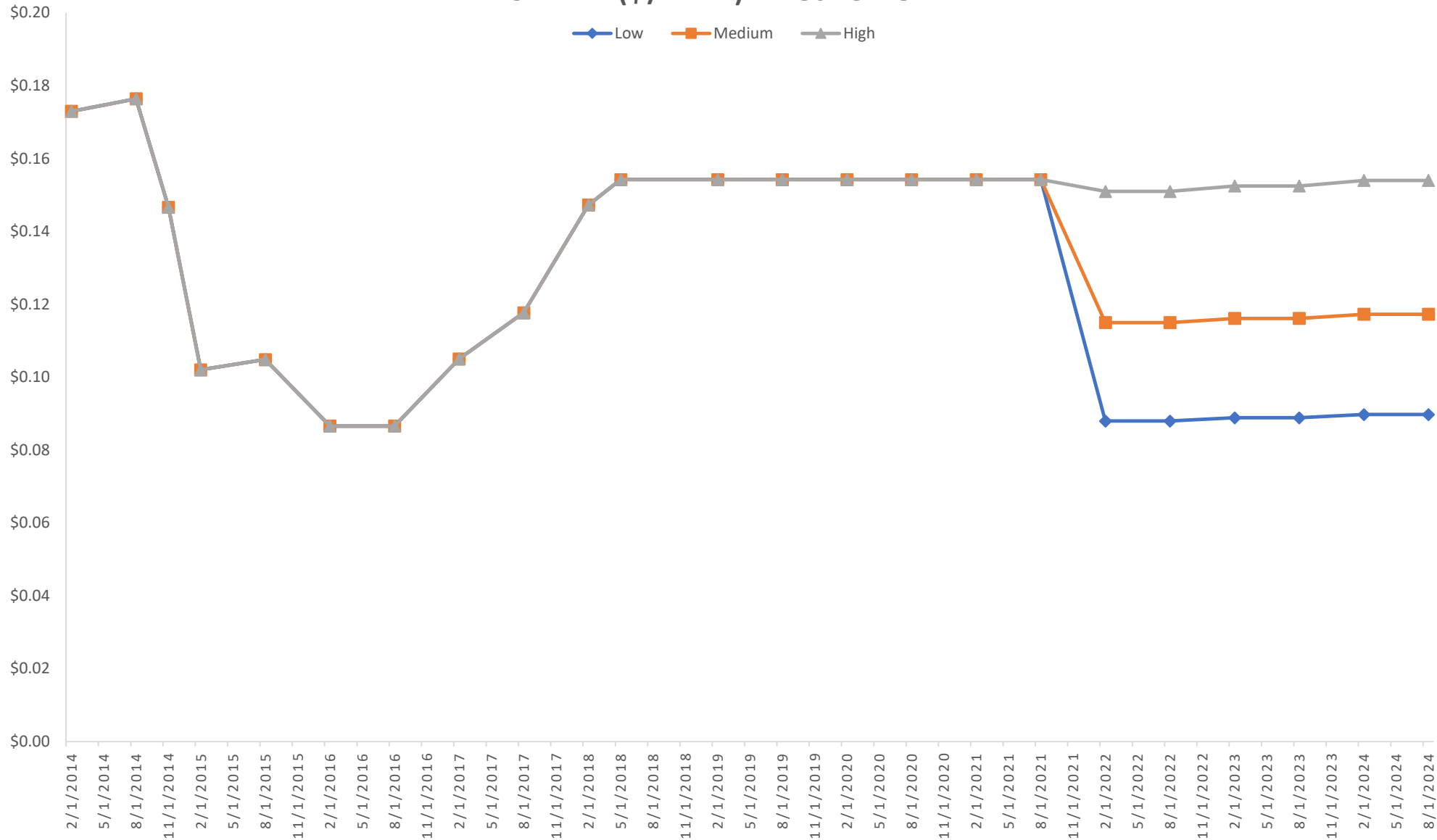


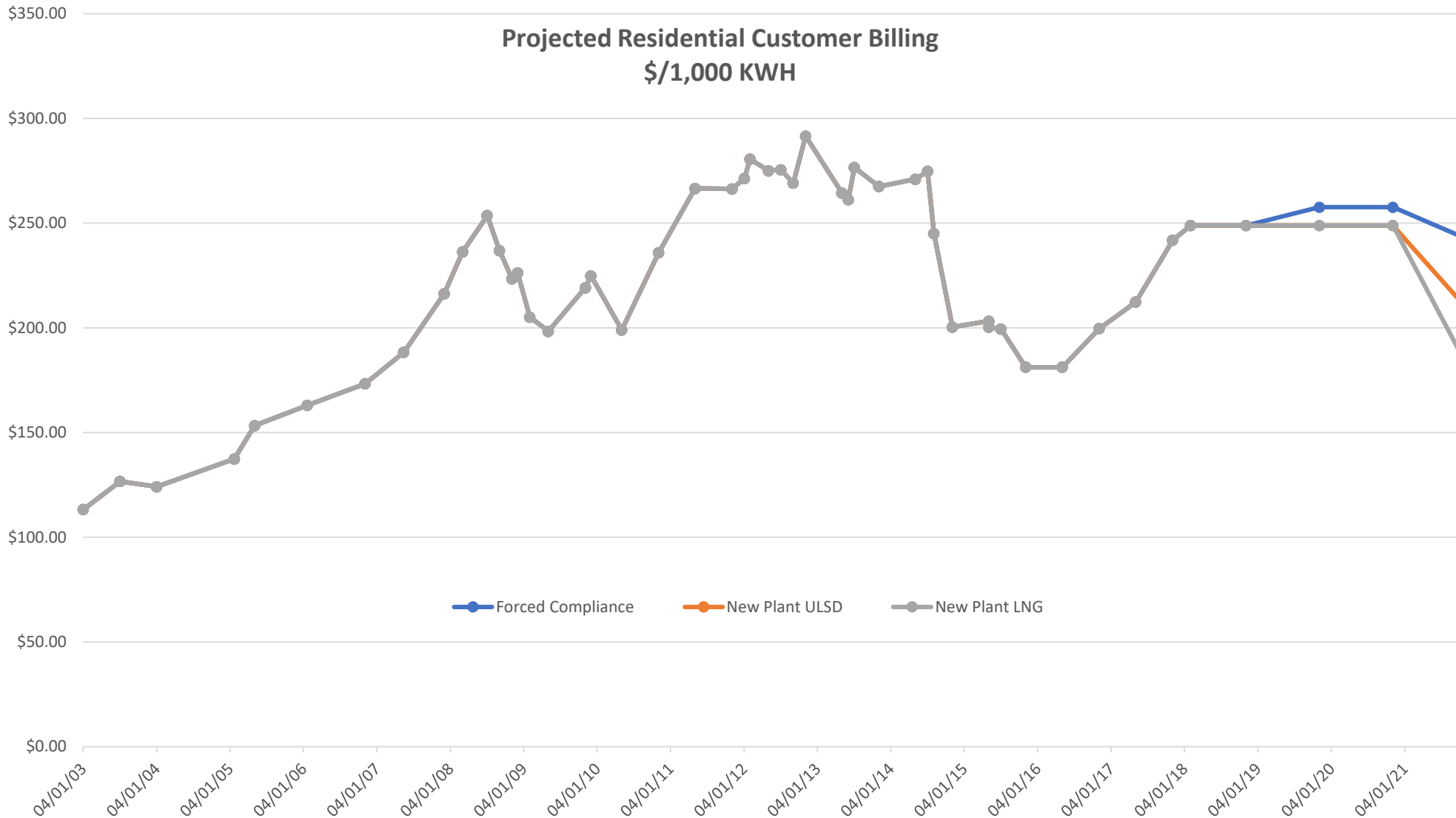
## Adjusted to GPA Actual Cost

Cost Category	Clean Power Research (MRE)	Revised CPR/MRE Based on Comments	GPA Avoided Cost FY 2017	Comments
Fuel Cost	\$0.1260	\$0.1029	\$0.1029	Adjusted based on LEAC for Similar FY 2017 Period
Energy Losses 4.6%	\$0.0054	\$0.0047	\$0.0047	In Agreement
Plant O&M-Variable			\$0.0018	GPA Determined Minor Cost Impact
Generation Capacity Cost	\$0.0490	\$0.0000	\$0.0000	No Capacity Avoided because does not Reduce Peak Demand
Environmental Cost			\$0.0001	GPA Determined Minor Cost Impact
Avoided Fuel Hedging Uncertainty Cost	\$0.0590	\$0.0000	\$0.0000	Not Applicable - GPA Does Not Hedge, Therefore No Cost
Avoided Mandated RPS Cost	\$0.0310	\$0.0000	\$0.0000	GPA meeting RPS at a Savings not a Cost
<b>Total:</b>	<b>\$0.2704</b>	<b>\$0.1076</b>	<b>\$0.1095</b>	



### LEAC RATE (\$/KWH) PROJECTION





## When Do Customer-Owned NEM Recover their Investment?

Value of Solar Payment Versus Simple Payback						
\$/Kwh Credit	\$0.10		\$0.12		\$0.27	
ITC Valid	2018-2019		2018-2019		2018-2019	
Solar PV All-In Cost (\$/W)	30.0% ITC		30.0% ITC		30.0% ITC	
	Simple Payback (years)	IRR (%)	Simple Payback (years)	IRR (%)	Simple Payback (years)	IRR (%)
1.00	6	18.8%	5	23.9%	2	53.0%
1.25	7	14.6%	6	18.8%	3	42.2%
1.50	8	11.6%	7	15.3%	3	35.0%
1.75	10	9.5%	8	12.7%	4	29.8%
2.00	11	7.8%	9	10.7%	4	25.9%
2.25	12	6.4%	10	9.1%	5	22.9%
<b>2.50</b>	<b>14</b>	<b>5.2%</b>	<b>11</b>	<b>7.8%</b>	<b>5</b>	<b>20.4%</b>
2.75	15	4.2%	12	6.6%	6	18.4%
3.00	17	3.4%	13	5.7%	6	16.7%
3.25	18	2.6%	14	4.8%	7	15.2%
3.50	20	1.9%	16	4.1%	7	13.9%
3.75	21	1.3%	17	3.4%	8	12.8%
<b>4.00</b>	<b>23</b>	<b>0.8%</b>	<b>18</b>	<b>2.8%</b>	<b>8</b>	<b>11.8%</b>
4.25	25	0.3%	19	2.2%	9	10.9%



# NEM Customer Owned Solar PV

At GPA Retail Rate Credit Recovers Investment in 5 to 8 Years

<b>GPA Residential Retail Rate Credit:</b>			
<b>Average \$/W Installed</b>	<b>\$3.25/Watt</b>	<b>Annual Savings</b>	<b>Simple Payback Years</b>
PV KW Capacity	7.69		
Annual Capacity Factor	20.0%		
Annual Kwh Production	13,473		
Average LEAC	\$0.147		
Average Base Rate	\$0.093		
<b>Total Average rate</b>	<b>\$0.240</b>		
Annual Energy Cost Avoided	\$3,233.49		
Installation Cost - No Tax Credit	\$24,993		<b>7.7</b>
15 Year Loan Annual Payment, 8%, 15 years	\$2,919	\$314.49	
With Tax Credit	\$17,495		<b>5.4</b>
15 Year Loan Annual Payment, 8%, 15 years	\$2,043	\$1,190.49	

# NEM Customer Owned Solar PV

At GPA 2018 LEAC Rate Credit Recovers Investment in 8 to 12 Years

<b>GPA 2018 LEAC Rate Credit:</b>			
<b>Average \$/W Installed</b>	<b>\$3.25/Watt</b>	<b>Annual Savings</b>	<b>Simple Payback Years</b>
PV KW Capacity	7.69		
Annual Capacity Factor	20.0%		
Annual Kwh Production	13,473		
Average LEAC	\$0.154		
Average Base Rate	\$0.000		
<b>Total Average rate</b>	<b>\$0.154</b>		
Annual Energy Cost Avoided	\$2,074.82		
Installation Cost - No Tax Credit	\$24,993		<b>12.0</b>
15 Year Loan Annual Payment, 8%, 15 years	\$2,919	-\$844.18	
With Tax Credit	\$17,495		<b>8.4</b>
15 Year Loan Annual Payment, 8%, 15 years	\$2,043	\$31.82	

# NEM Customer Owned Solar PV

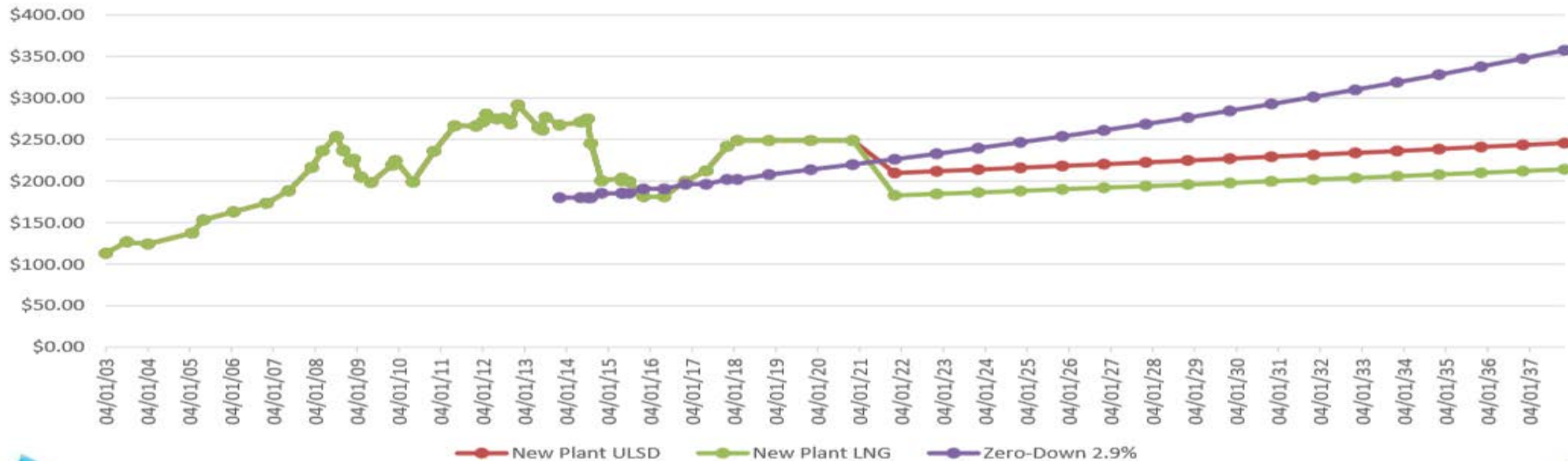
At GPA 2022 LEAC Rate Credit Recovers Investment in 10 to 16 Years

<b>GPA 2022 LEAC Rate Credit:</b>			
<b>Average \$/W Installed</b>	<b>\$3.25/Watt</b>	<b>Annual Savings</b>	<b>Simple Payback Years</b>
PV KW Capacity	7.69		
Annual Capacity Factor	20.0%		
Annual Kwh Production	13,473		
Average LEAC	\$0.120		
Average Base Rate	\$0.000		
<b>Total Average rate</b>	<b>\$0.120</b>		
Annual Energy Cost Avoided	\$1,616.75		
Installation Cost - No Tax Credit	\$24,993		<b>15.5</b>
15 Year Loan Annual Payment, 8%, 15 years	\$2,919	-\$1,302.25	
With Tax Credit	\$17,495		<b>10.8</b>
15 Year Loan Annual Payment, 8%, 15 years	\$2,043	-\$426.25	

# Zero Down 2.9% Escalator NEM Customers

Even at Full Retail Rate will incur losses over time  
 At Avoided LEAC Rate, will incur Even Higher losses

Monthly Billing for 1,000 KWH Residential Customers  
 Zero Down 2.9% Escalator NEM Customers will begin experiencing huge losses by 2022





- Net Metering was established 13 years ago in 2004. Substantial Changes has occurred on GPA delivery cost and more changes expected by 2022.
- Customer Owned NEM System recovers its investment within 5 to 8 years from installation at GPA full Retail Rate Credit.
- Customer Owned NEM System recovers its investment within 8 to 16 years from installation at GPA LEAC Avoided Cost Rate Credit.
- It appears Zero Down Customers with 2.9% escalators will incur higher cost over the life of their 25 year contract.

1. CCU approve a GPA filing as shown herein at its July/August 2018 Meeting
2. Recommend an implementation plan for billing NEM customers on net billing: Buy All/Sell All or similar billing models
3. GPA files with GPUC for adjustment of net metering credits from retail to avoided cost
4. For existing NEM Customers, implement a Grandfather phase-in approach over 5 to 8 years to the GPA avoided cost credit. Adjustments for LEAC, line loss and variable cost changes done annually.
5. For future NEM customers, credit set at GPA avoided cost