WECC

WECC Anchor Data Set (ADS) _ 2032 ADS

Validating Dispatch of: Phase Shifters, Pump Storage, Batteries

September 28, 2022

Jamie Austin,
Production Cost Data Subcommittee, (PCDS) Chair

Overview

- Status of the 2032 ADS
- Version 2.1
- Validate Operation of Phase Shifters, Pump Storage and Batteries

Validating the Operation of
Phase Shifters

2032 ADS _ Phase Shifter Settings

- Last reviewed in the 2029 ADS by Ron Schellberg, 5/16/2019
- The same settings apply to 2032 ADS – V2.1

Phase shifters that could be loosened (lower cost):

		Operation Goal
H Allen	18002-18001	600-1000
IV PFC	22357-22358	300
Weed Jct	45337-45335	2000+
Cal Sub	64025-64023	600-1000
AMPS	621001-621201	300
Crossover	630040-630041	2000+
Steam Plant	623001-623002	2000+
Rimrock	623005-623004	2000+

Phase shifter that could be tightened (higher cost):

		Operation Goal
Crystal	18452-26123	300
Silver Peak	64094-64096	300

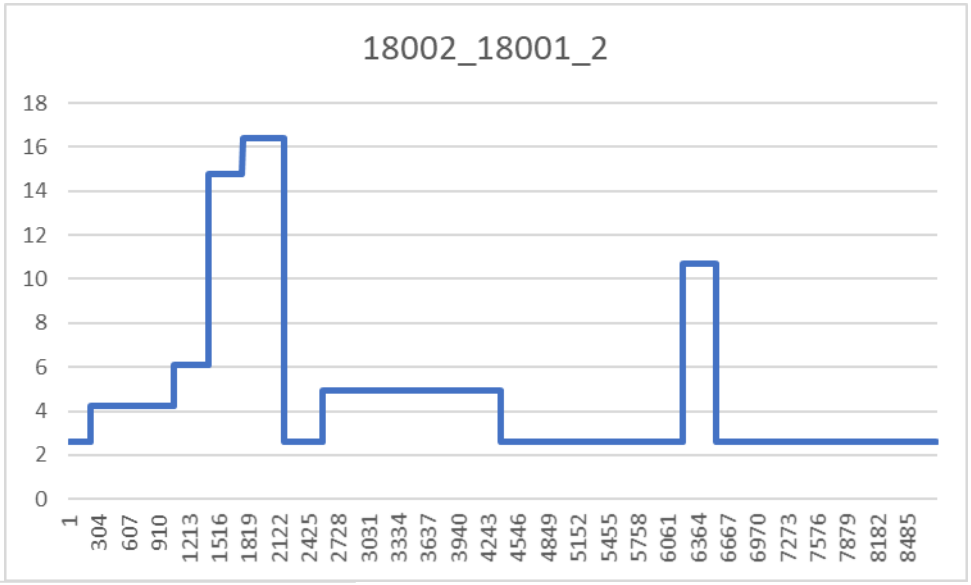
Seem to be missing these:

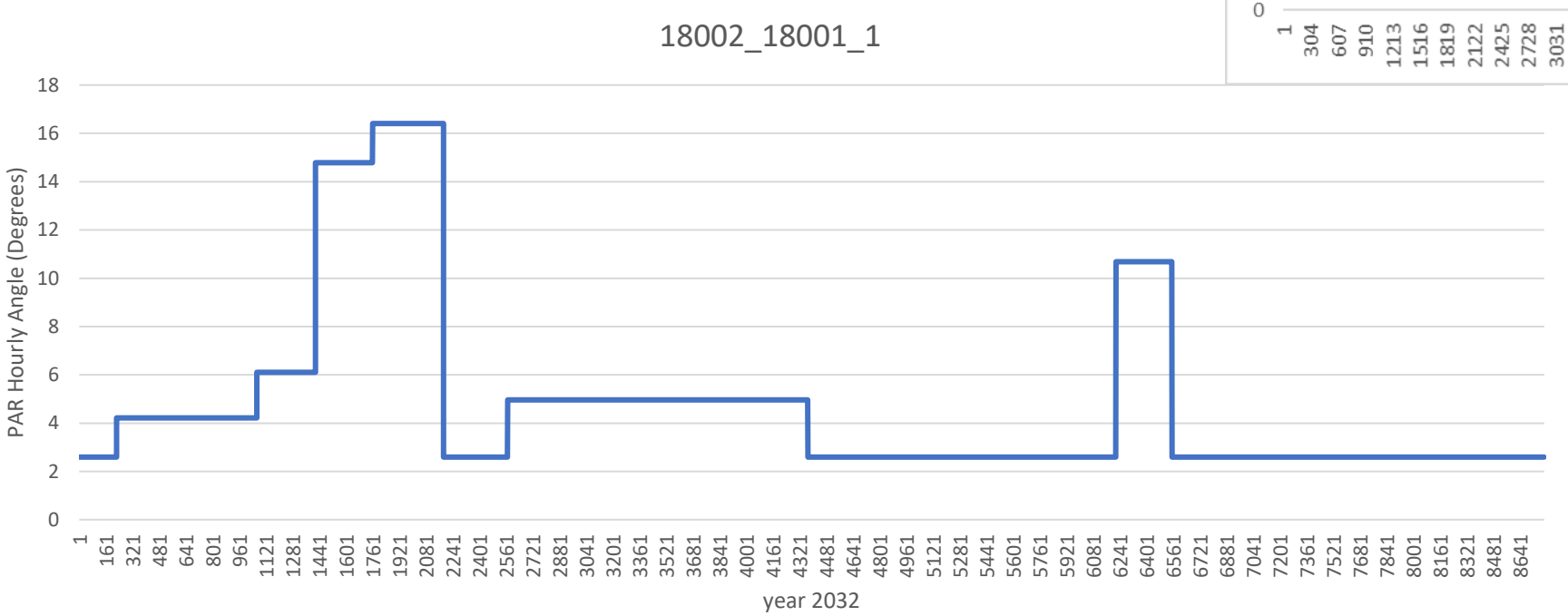
Pinto	66225-66225	600-1000
Sigurd	66345-66355	600-1000
San Juan	79060-79990	600-1000
Shiprock	79063-79061	600-1000

apparently in the 28hs1a case these are not modelled as phase shifters :-o

Harry Allen, NVE

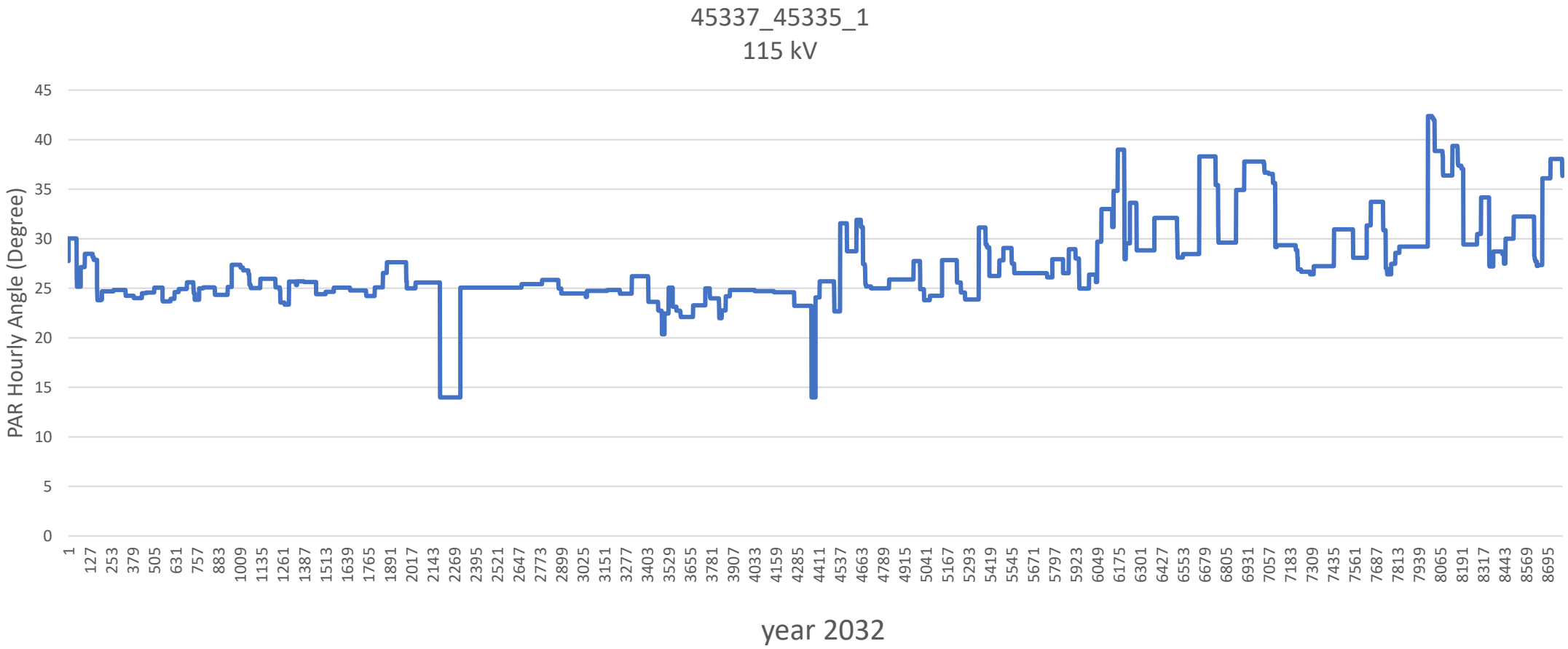
600 – 1000 Operations/yr





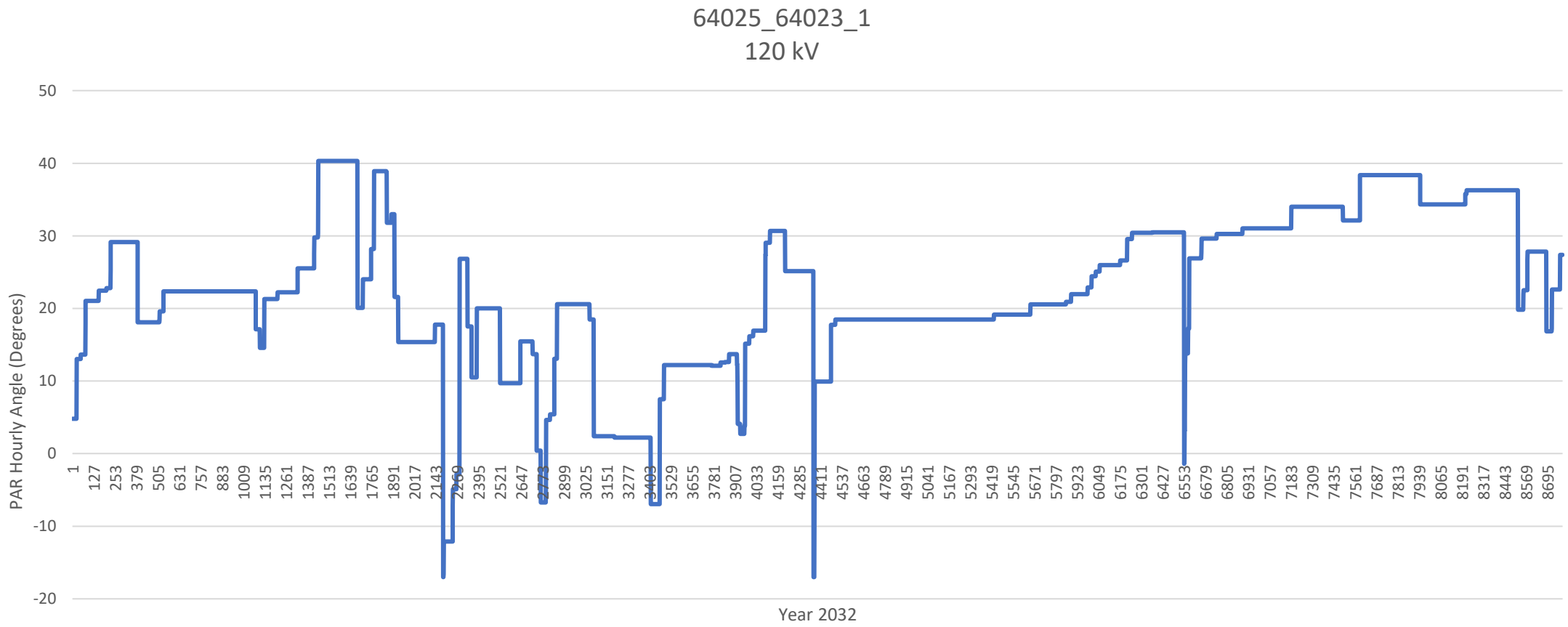
Weed Junction, PACW

Typical: 600 – 1000 Operations/yr



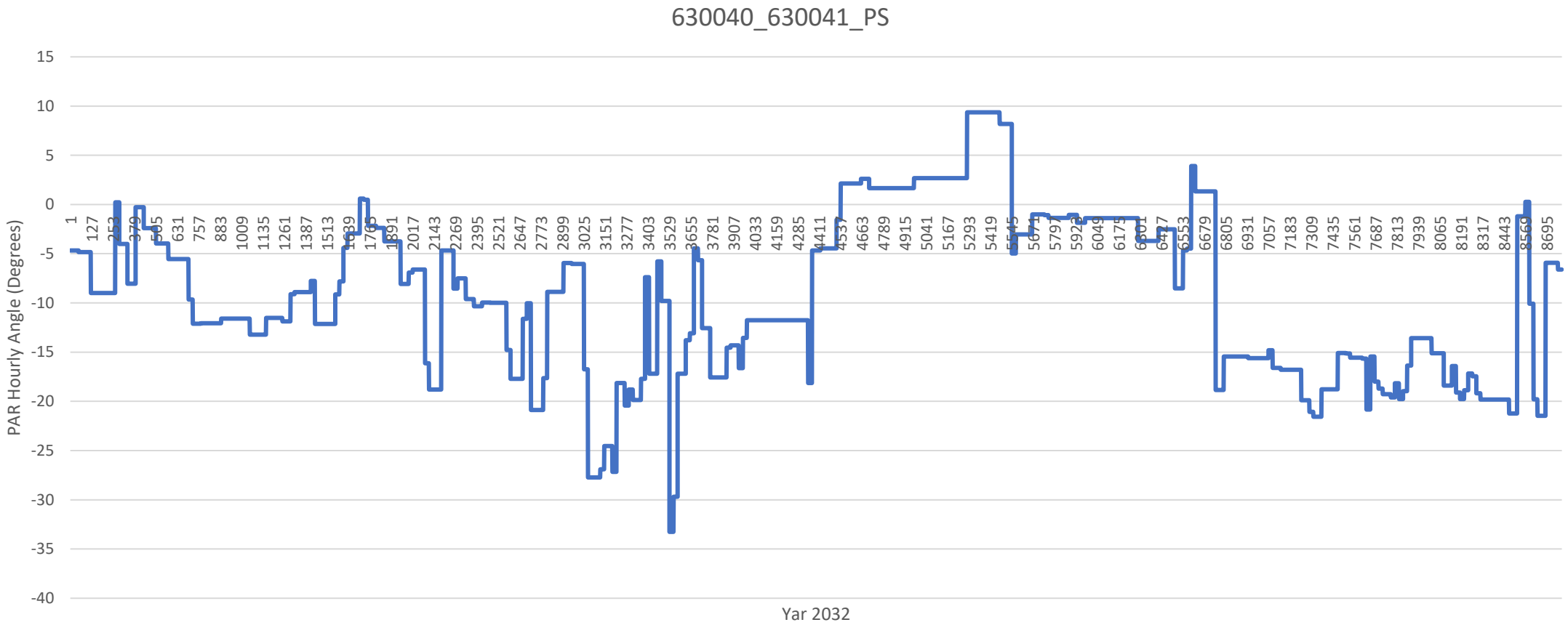
CAL SUB, NVE

600 – 1000 Operations/yr



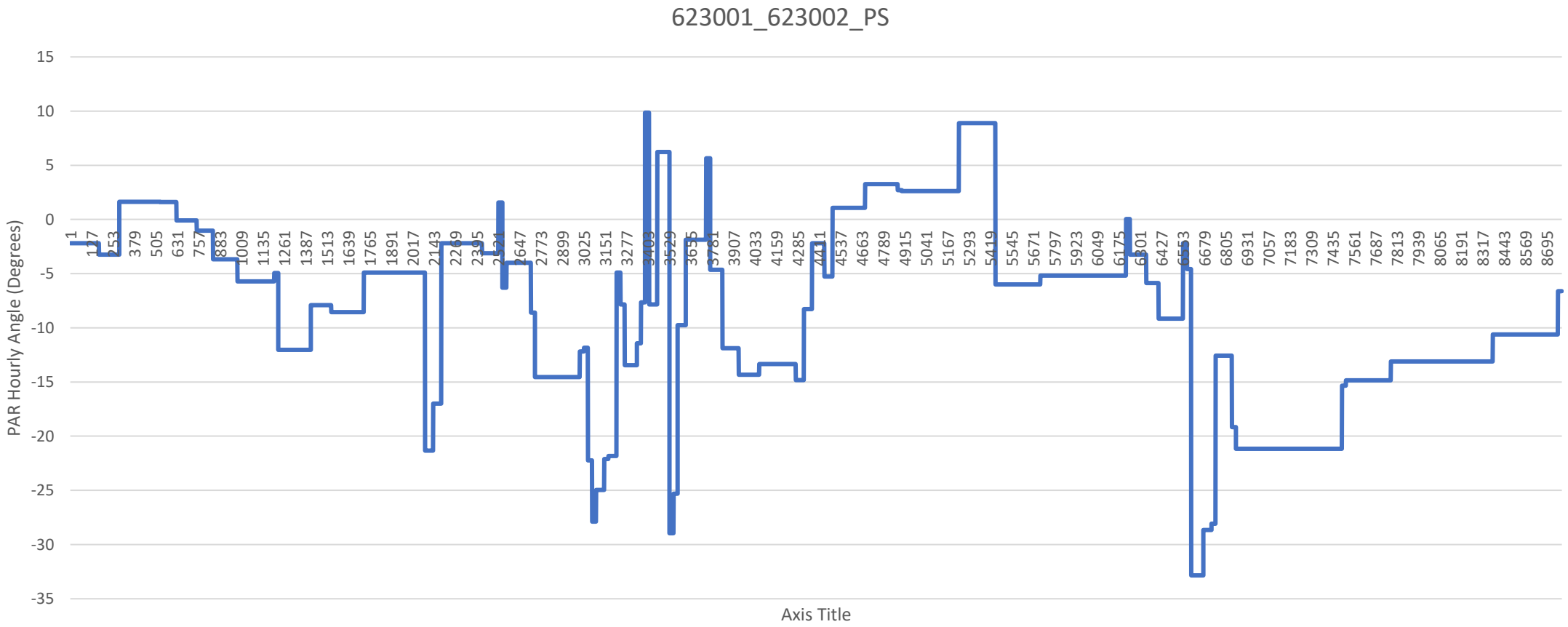
CROSSOVER, WAUW

2000+ Operations/yr



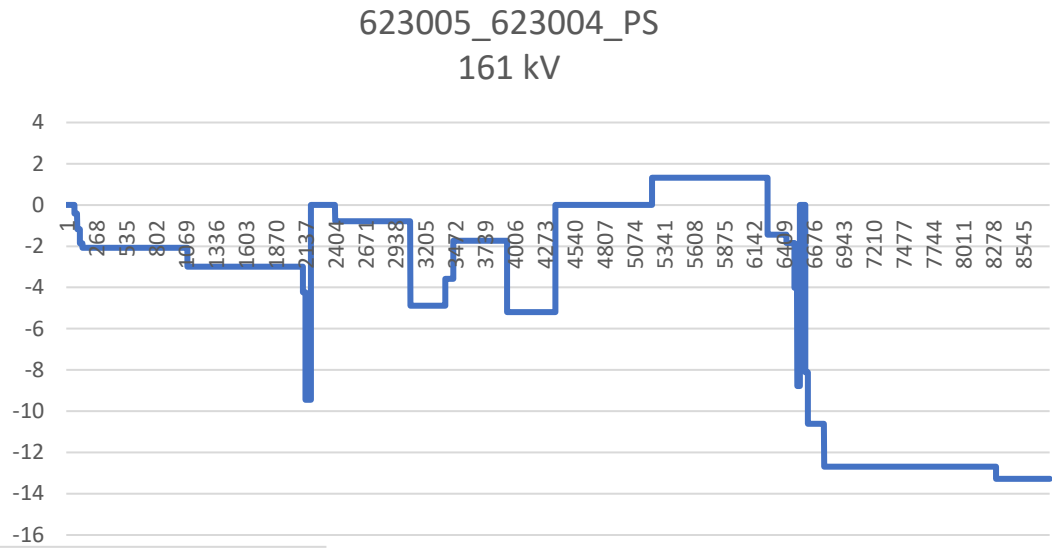
STEAMPLT, NWMT

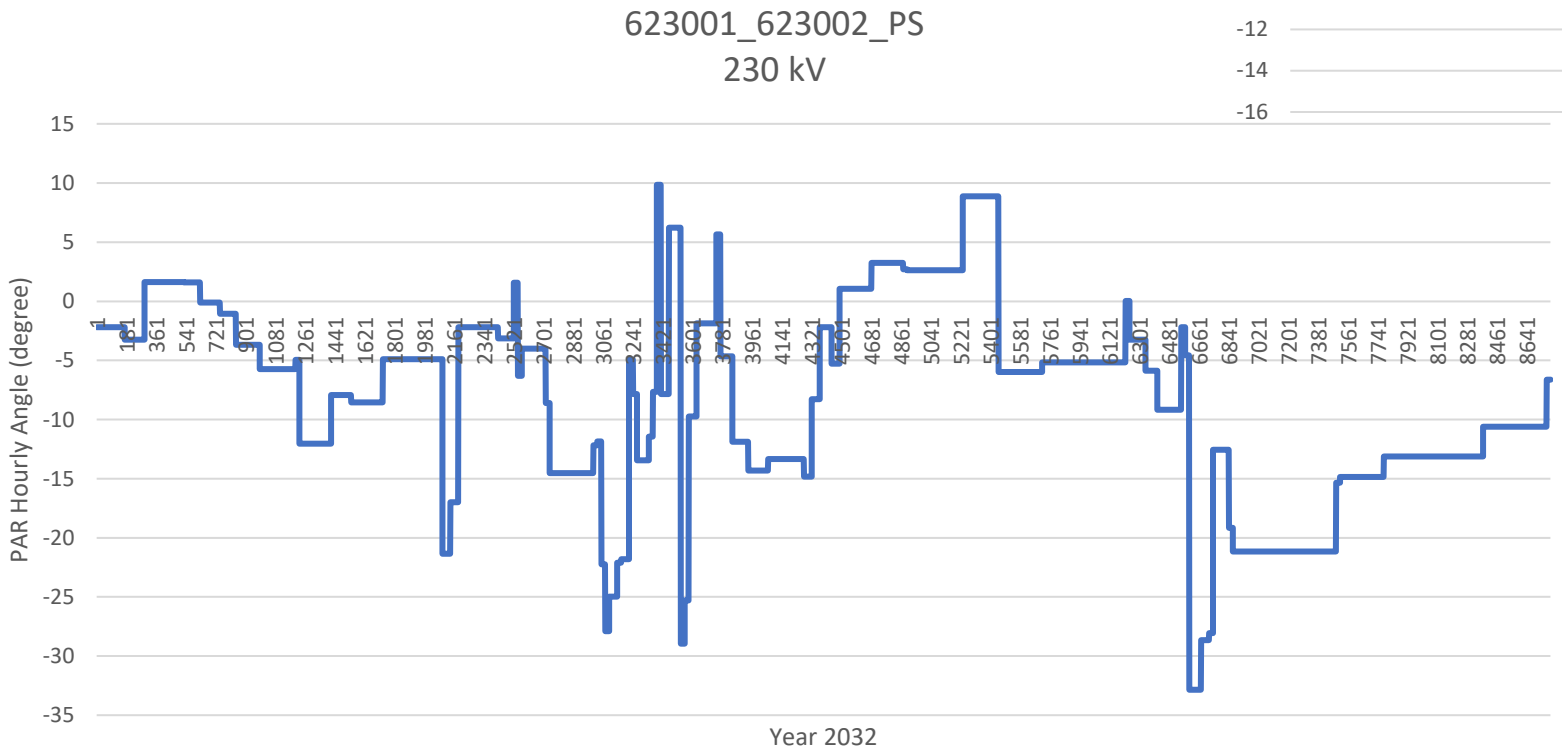
2000+ Operations/yr



BLG RIMROCK, NWMT

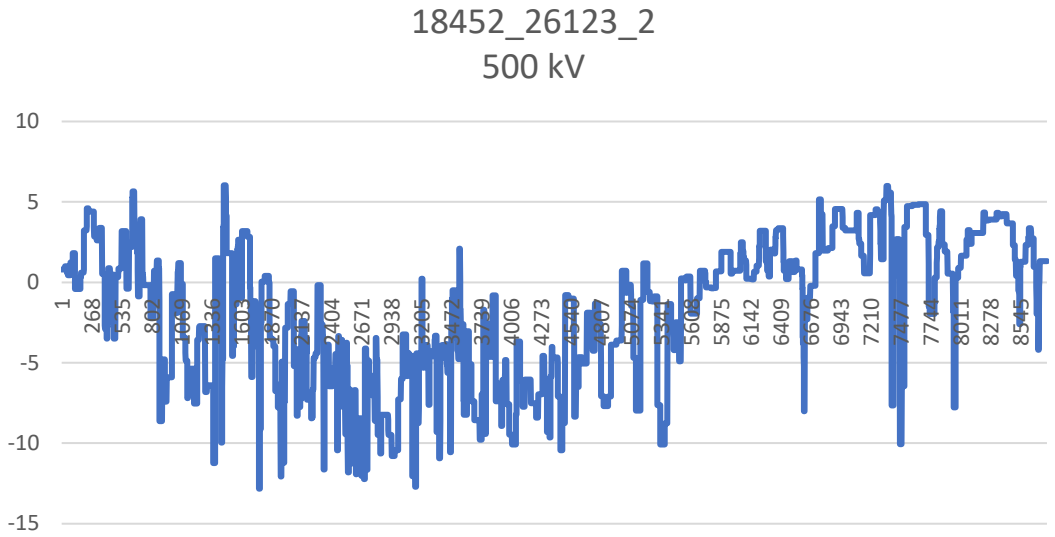
2000+ Operations/yr

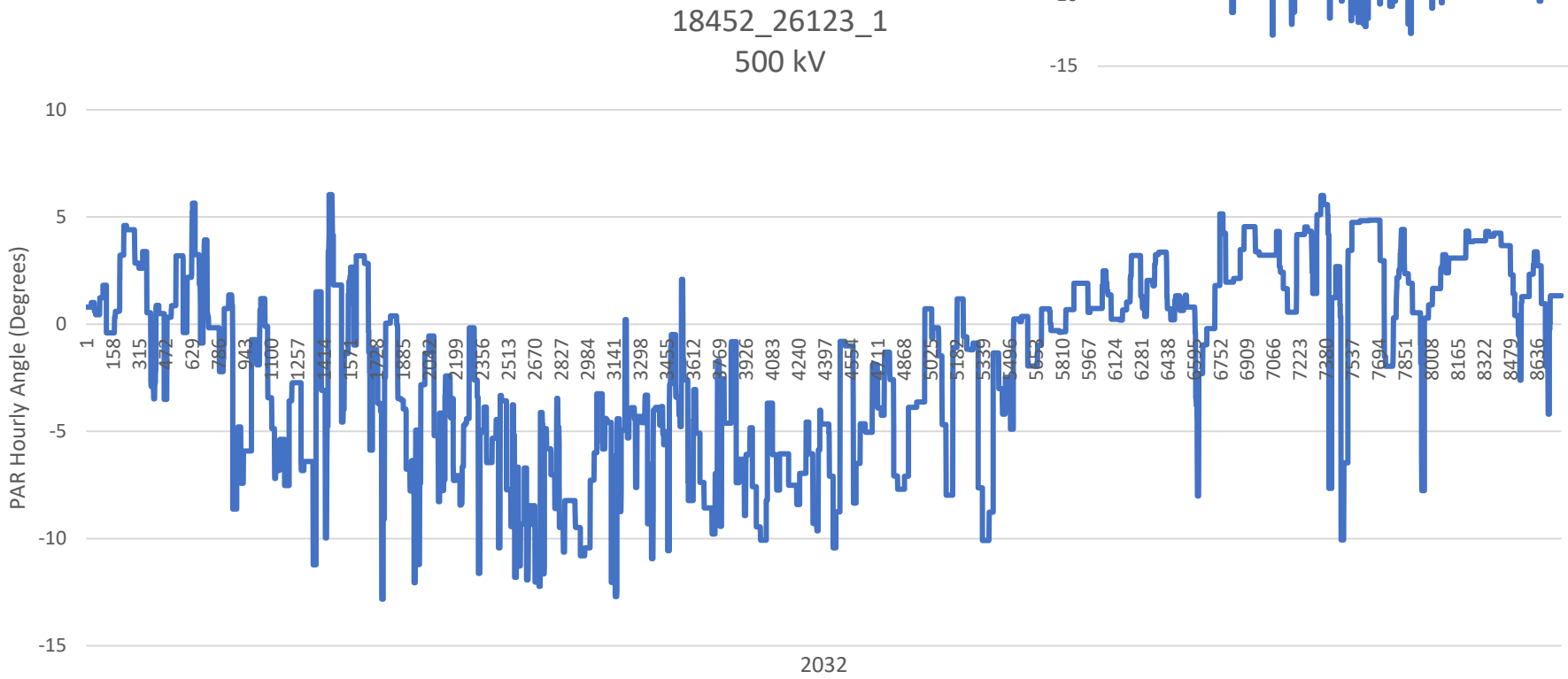




CRSTL 2PS, NVE

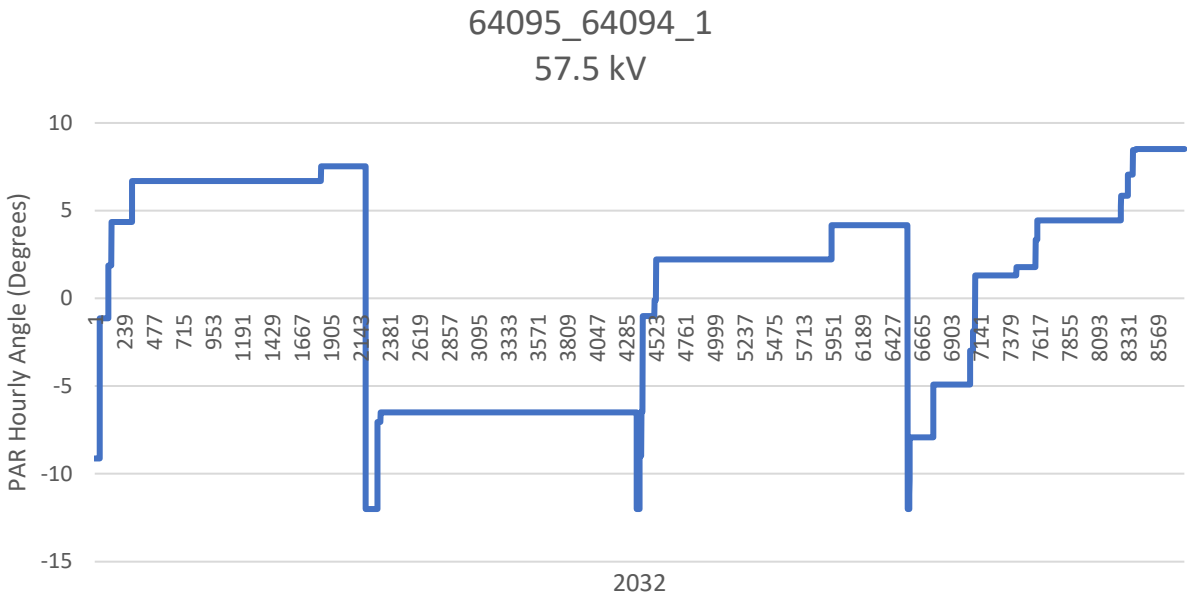
300 Operations/yr

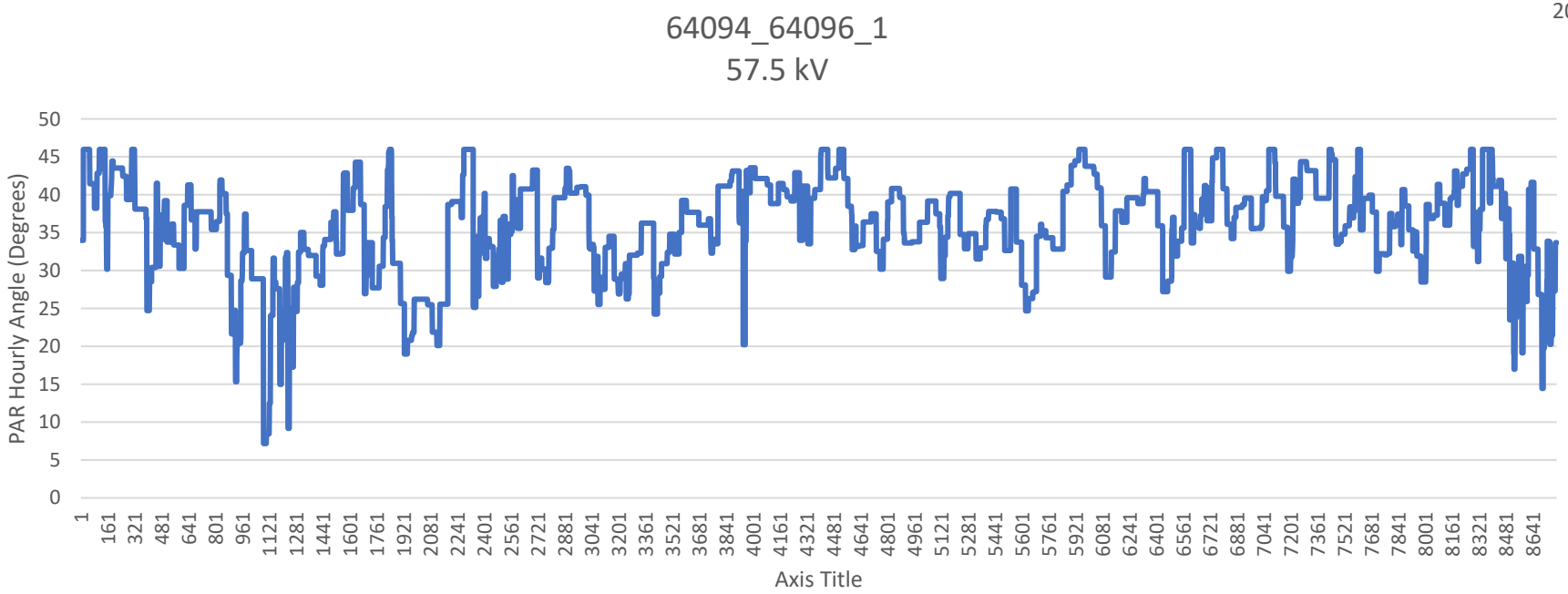




SLVER PK, NVE

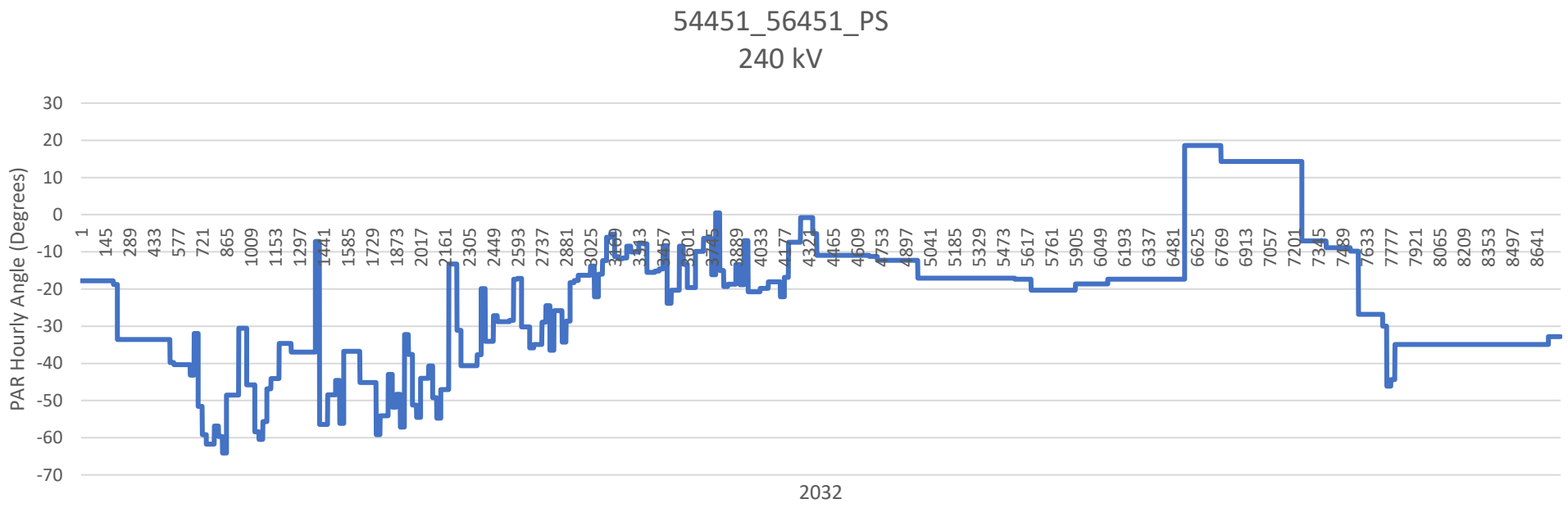
300 Operations/yr





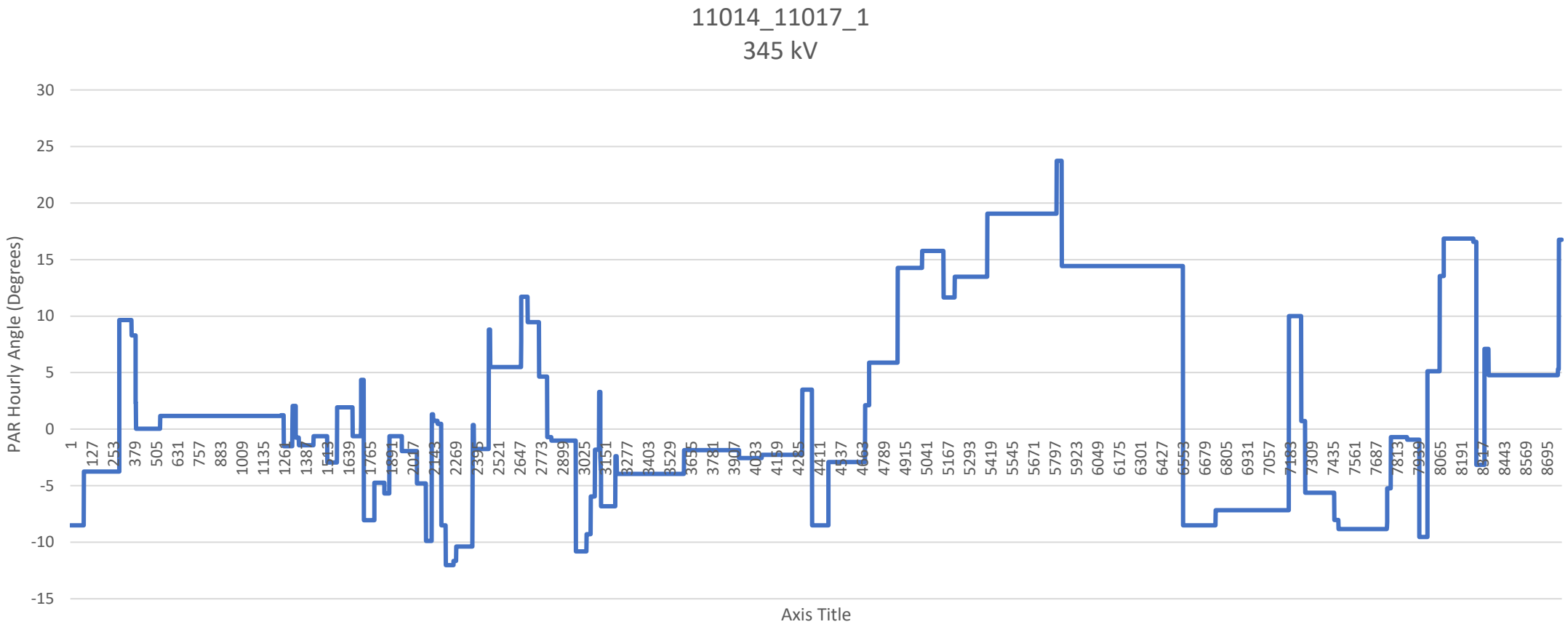
MATLB1, AESO

300 Operations/yr



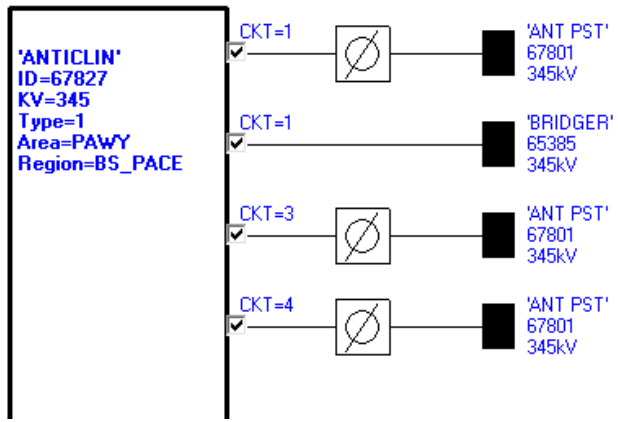
AROYO, EPE

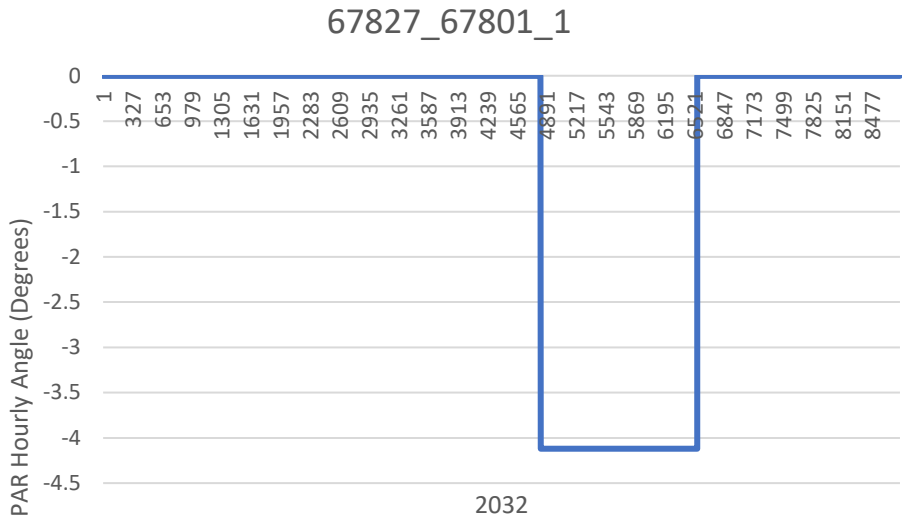
300 Operations/yr

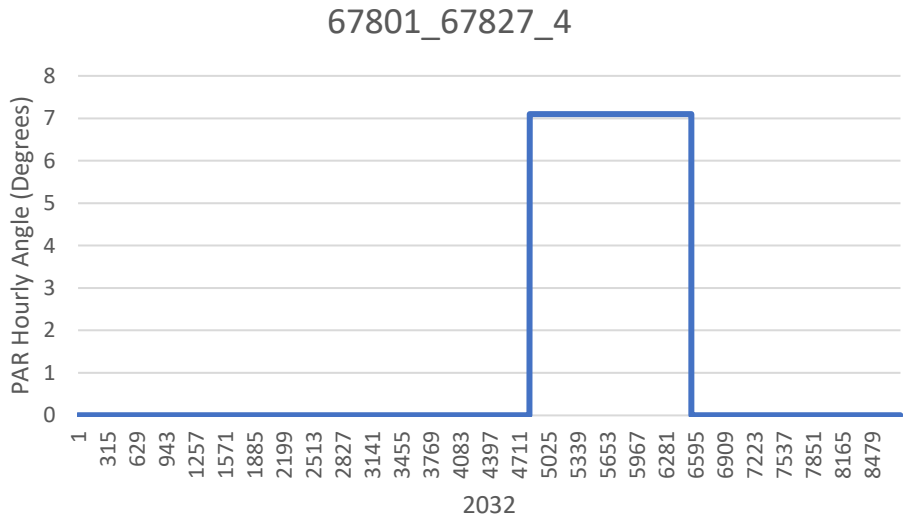


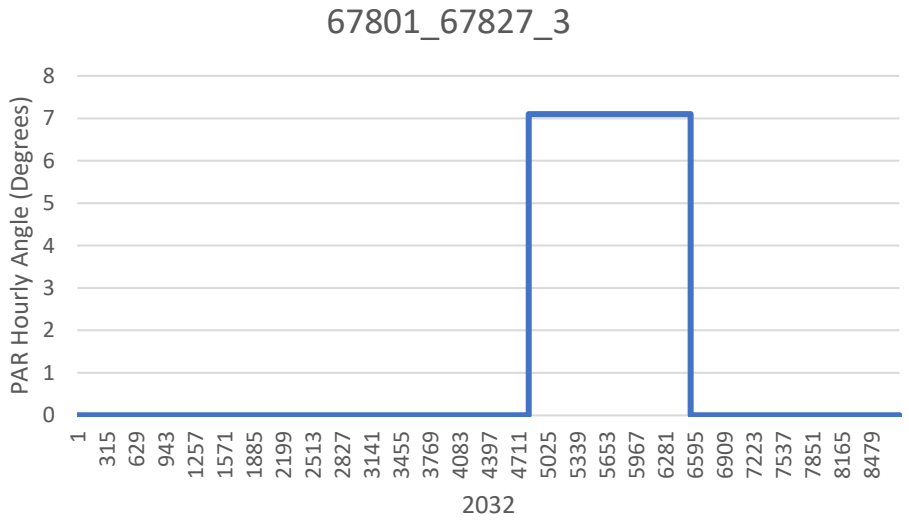
ANTCLIN, PACE

300 Operations/yr



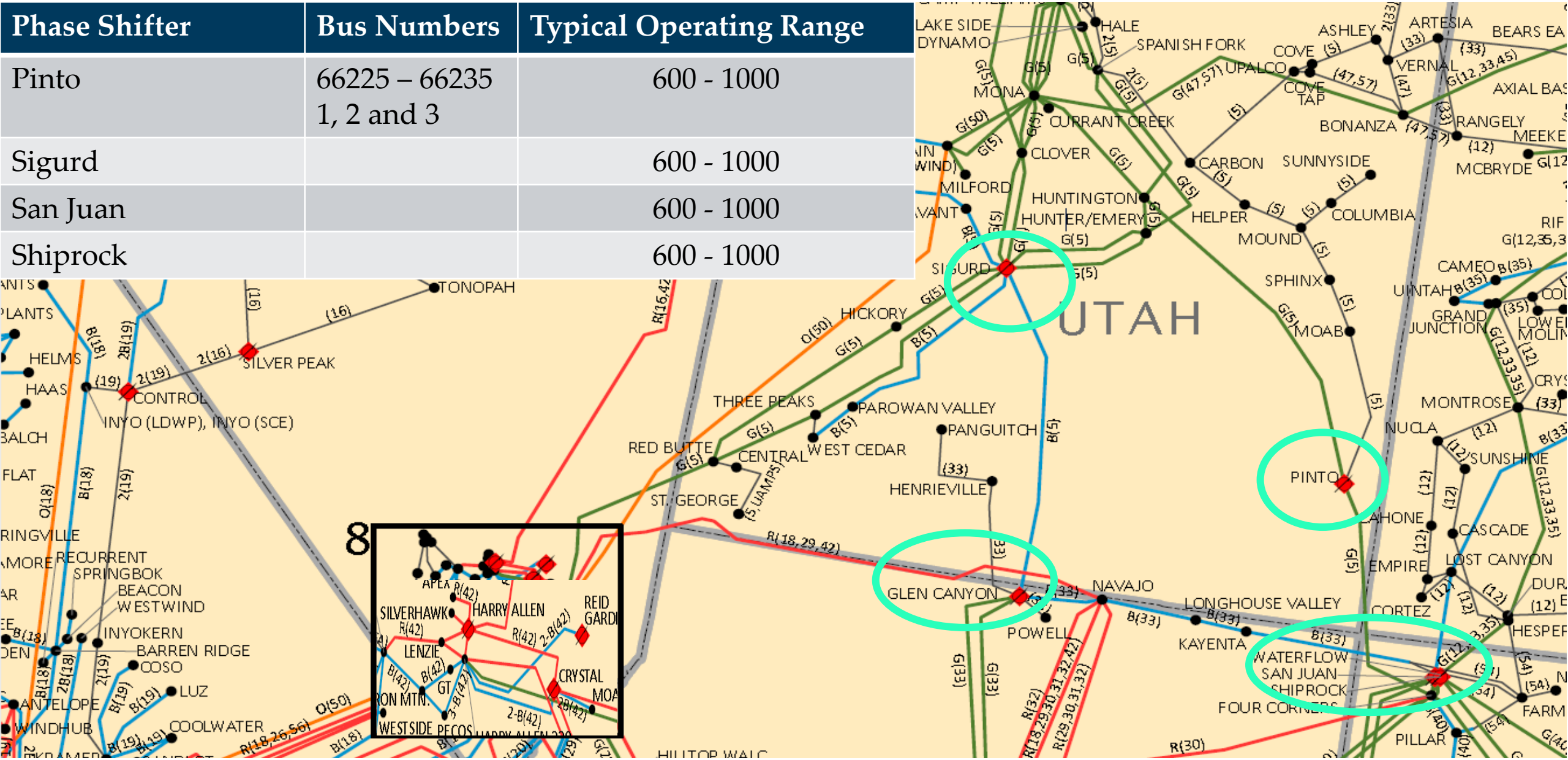






Continue to be missing, modeled as transformer in the WECC 2032 HS1

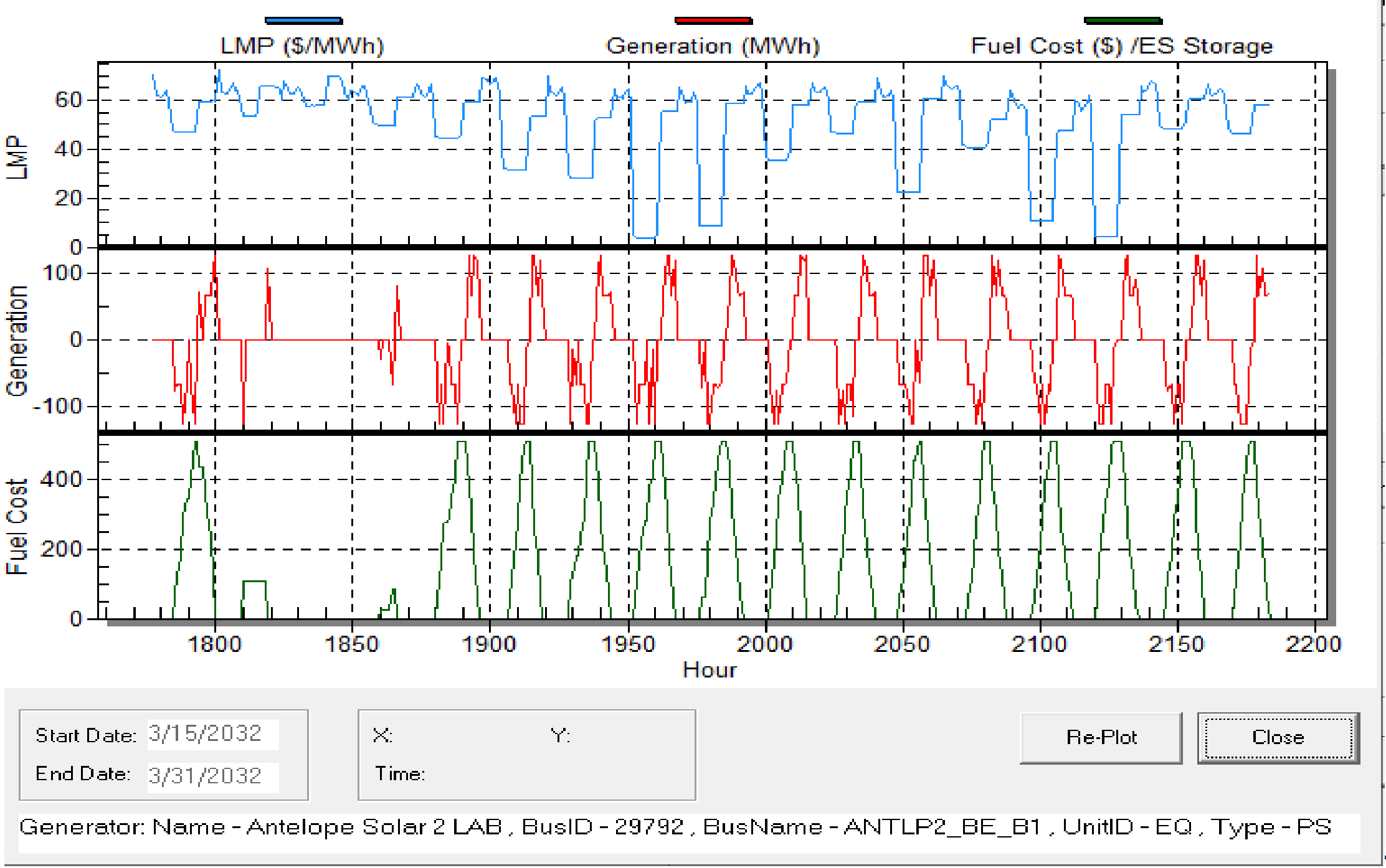
Phase Shifter	Bus Numbers	Typical Operating Range
Pinto	66225 – 66235 1, 2 and 3	600 - 1000
Sigurd		600 - 1000
San Juan		600 - 1000
Shiprock		600 - 1000



Phase Shifter Settings _ a Process Issue

- The nodal PCM model uses the power flow for network topology, and we haven't been diligent in making sure that all phase shifters are modeled properly; some are just modeled as transformers in the WECC power flow case.
  - The calculations for phase shifters are daily based, and the variables related to phase shifters are discrete. In order to effectively alleviate the line overloads, the ranking of phase shifter locations is conducted based on contingency analysis and sensitivity analysis.
  - Phase shifters are intended to regulate flows on the transmission and their usefulness is important to the dispatch.
- The Power Flow Case is a static look of system dispatch, depicting a single-hour operation; this is where phase shifter settings do not matter. However, phase shifter settings matter in the nodal PCM as operation changes from one-hour to the next; the nodal PCM dispatch is dynamic.

Validating the Operation of
Pump Storage and Batteries


LMP ($/MWh)
Generation (MWh)
Fuel Cost ($) /ES Storage
LMP
60
40
20
0
Generation
100
0
-100
Fuel Cost
400
200
0
1800
1850
1900
1950
2000
2050
2100
2150
2200
Hour
Start Date: 3/15/2032
End Date: 3/31/2032
X:
Y:
Time:
Re-Plot
Close
Generator: Name - Antelope Solar 2 LAB , BusID - 29792 , BusName - ANTLP2_BE_B1 , UnitID - EQ , Type - PS

- Storage Issues
  - 23 batteries (6.8 GW of capacity) modeled with just one-hour Storage Capability

PlantName	Generating Cap	Max Pond Size	Storage Hrs Pmax/Gcap
EdSan 2 Edwards 3	151	96	0.64
Agua Fria Battery (Bolster) (4HR)1BA25_P	25	25	1.00
BATT_381_P	381	381	1.00
Battery Storage - DJ+Wyodak0BA549_P	549	549	1.00
Battery Storage - Utah-N0BA200_P	200	200	1.00
BUENA VISTA ENERGY CENTER 1BA50_P	50	50	1.00
Chuckwalla SolarBA180_P	180	180	1.00
ConEd Mesquite 5-BA_P	60	60	1.00
Dodge Flat II1BA25_P	25	25	1.00
Dorman1BA10_P	10	10	1.00
Dry Lake Solar 1BA100_P	100	100	1.00
Front Range-Midway1BA50_P	50	50	1.00
Future Solar + 4HR Batteries 1BA200_P	200	200	1.00
Future Solar + 4HR Batteries 2BA400_P	400	400	1.00
Future Solar + 4HR Batteries 3BA500_P	500	500	1.00
Future Solar + 4HR Batteries 4BA500_P	500	500	1.00
Future Solar + 4HR Batteries 5BA900_P	900	900	1.00
Saint Solar + Storage (4HR)1BA100_P	100	100	1.00
Sandia Peak Grid Storage-11BA100_P	100	100	1.00
Utility Solar+Storage - Utah-N0BA12.5_P	12.5	12.5	1.00
Utility Solar+Storage - Utah-N0BA820_P	820	820	1.00
Utility Solar+Storage - Utah-S0BA1100_P	1100	1100	1.00
Utility Solar+Storage - Utah-S0BA174_P	174	174	1.00
Acorn I BESS_P	2	8	4.00
BS_AES Agua Fria BESS	200	800	4.00
Alamitos Energy Storage_P	100	400	4.00

GeneratorKey	GeneratorName	PCap	GCap	WeeklyEnergy	PCapM	GCapM	PlantID	PlantName	Pumping Price	Generating Price	ReserveContribution	RampU	RampDown	FOR
18326	Agua Fria Battery (Bolster) (4HR)1BA25	25	25	0	0	0	370	Agua Fria Battery (Bolster) (4HR)1BA25_P	0	200	1	1500	1500	
18307	BATT_381	381	381	0	0	0	351	BATT_381_P	0	200	1	22860	22860	
18313	Battery Storage - DJ+Wyodak0BA549	549	549	0	0	0	357	Battery Storage - DJ+Wyodak0BA549_P	0	200	1	32940	32940	
18315	Battery Storage - Utah-N0BA200	200	200	0	0	0	359	Battery Storage - Utah-N0BA200_P	0	200	1	12000	12000	
18308	BUENA VISTA ENERGY CENTER 1BA50	50	50	0	0	0	352	BUENA VISTA ENERGY CENTER 1BA50_P	0	200	1	3000	3000	
18310	Chuckwalla SolarBA180	180	180	0	0	0	354	Chuckwalla SolarBA180_P	0	200	1	10800	10800	
18304	ConEd Mesquite 5-BA	60	60	0	0	0	348	ConEd Mesquite 5-BA_P	0	200	1	3600	3600	
18311	Dodge Flat II1BA25	25	25	0	0	0	355	Dodge Flat II1BA25_P	0	200	1	1500	1500	
18327	Dorman1BA10	10	10	0	0	0	371	Dorman1BA10_P	0	200	1	600	600	
18312	Dry Lake Solar 1BA100	100	100	0	0	0	356	Dry Lake Solar 1BA100_P	0	200	1	6000	6000	
19321	EdSan 2 Edwards 3 BESS	151	151	0	0	0	321	EdSan 2 Edwards 3	0	200	1	6000	6000	
18323	Front Range-Midway1BA50	50	50	0	0	0	367	Front Range-Midway1BA50_P	0	200	1	3000	3000	
18328	Future Solar + 4HR Batteries 1BA200	200	200	0	0	0	372	Future Solar + 4HR Batteries 1BA200_P	0	200	1	12000	12000	
18329	Future Solar + 4HR Batteries 2BA400	400	400	0	0	0	373	Future Solar + 4HR Batteries 2BA400_P	0	200	1	24000	24000	
18330	Future Solar + 4HR Batteries 3BA500	500	500	0	0	0	374	Future Solar + 4HR Batteries 3BA500_P	0	200	1	30000	30000	
18331	Future Solar + 4HR Batteries 4BA500	500	500	0	0	0	375	Future Solar + 4HR Batteries 4BA500_P	0	200	1	30000	30000	
18332	Future Solar + 4HR Batteries 5BA900	900	900	0	0	0	376	Future Solar + 4HR Batteries 5BA900_P	0	200	1	54000	54000	
18333	Saint Solar + Storage (4HR)1BA100	100	100	0	0	0	377	Saint Solar + Storage (4HR)1BA100_P	0	200	1	6000	6000	
18322	Sandia Peak Grid Storage-11BA100	100	100	0	0	0	366	Sandia Peak Grid Storage-11BA100_P	0	200	1	6000	6000	
18317	Utility Solar+Storage - PV - Utah-N0BA12.5	12.5	12.5	0	0	0	361	Utility Solar+Storage - Utah-N0BA12.5_P	0	200	1	750	750	
18316	Utility Solar+Storage - PV - Utah-N0BA820	820	820	0	0	0	360	Utility Solar+Storage - Utah-N0BA820_P	0	200	1	49200	49200	
18318	Utility Solar+Storage - PV - Utah-S0BA1100	1100	1100	0	0	0	362	Utility Solar+Storage - Utah-S0BA1100_P	0	200	1	66000	66000	
18320	Utility Solar+Storage - PV - Utah-S0BA174	174	174	0	0	0	364	Utility Solar+Storage - Utah-S0BA174_P	0	200	1	10440	10440	
18319	Utility Solar+Storage - PV - Utah-S0BA258	258	258	0	0	0	363	Utility Solar+Storage - Utah-S0BA258_P	0	200	1	15480	15480	

Photovoltaic & Battery Energy Storage

- Systems that combine solar photovoltaic and battery energy storage technologies (PV-BES) are increasingly being proposed in utility Integrated Resource Planning.
- Consideration should be given to improve the modeling of the hybrid PV-BES in the ADS. PV-BES are designed to optimize the performance of a suite of generation and storage assets that are connected via the transmission network.

WECC

Electric Reliability and Security for the West

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