



# Energy Storage System Update

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STAKEHOLDER MEETING #2  
GPA INTEGRATED RESOURCE PLAN 2021

March 2021



# What is an Energy Storage System (ESS)?

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- A system of devices that enables electricity to be saved so that it can be used at a later time or for another purpose
- ESS Benefits
  - Enables clean energy (renewable energy integration)
  - Improves system reliability (frequency regulation/spinning reserve)
  - Reduces costs by displacing expensive diesel fuel use during peak hours (peak-shifting)



# GPA's ESS Project

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- Commissioned and fully operational as of March 1, 2021
- Utility-scale, Battery Energy Storage Systems (BESS)
- Designed and constructed by LG CNS
  - N.C. Macario and Associates
  - Dooall Construction
- Two sites:
  - Agana Substation
  - Talofofo Substation



# O&M Contract

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- 25-year O&M contract with LG CNS
- 20-year warranty
  - 95% minimum availability
  - 85% minimum AC-AC round-trip efficiency
  - Agana ESS: Frequency regulation within  $60 \pm 0.15$  Hz with 95% success rate
  - Talofofo ESS: Solar farm ramp-rate control within 250 kW/min with 97% success rate
  - 0.25% annual degradation allowed



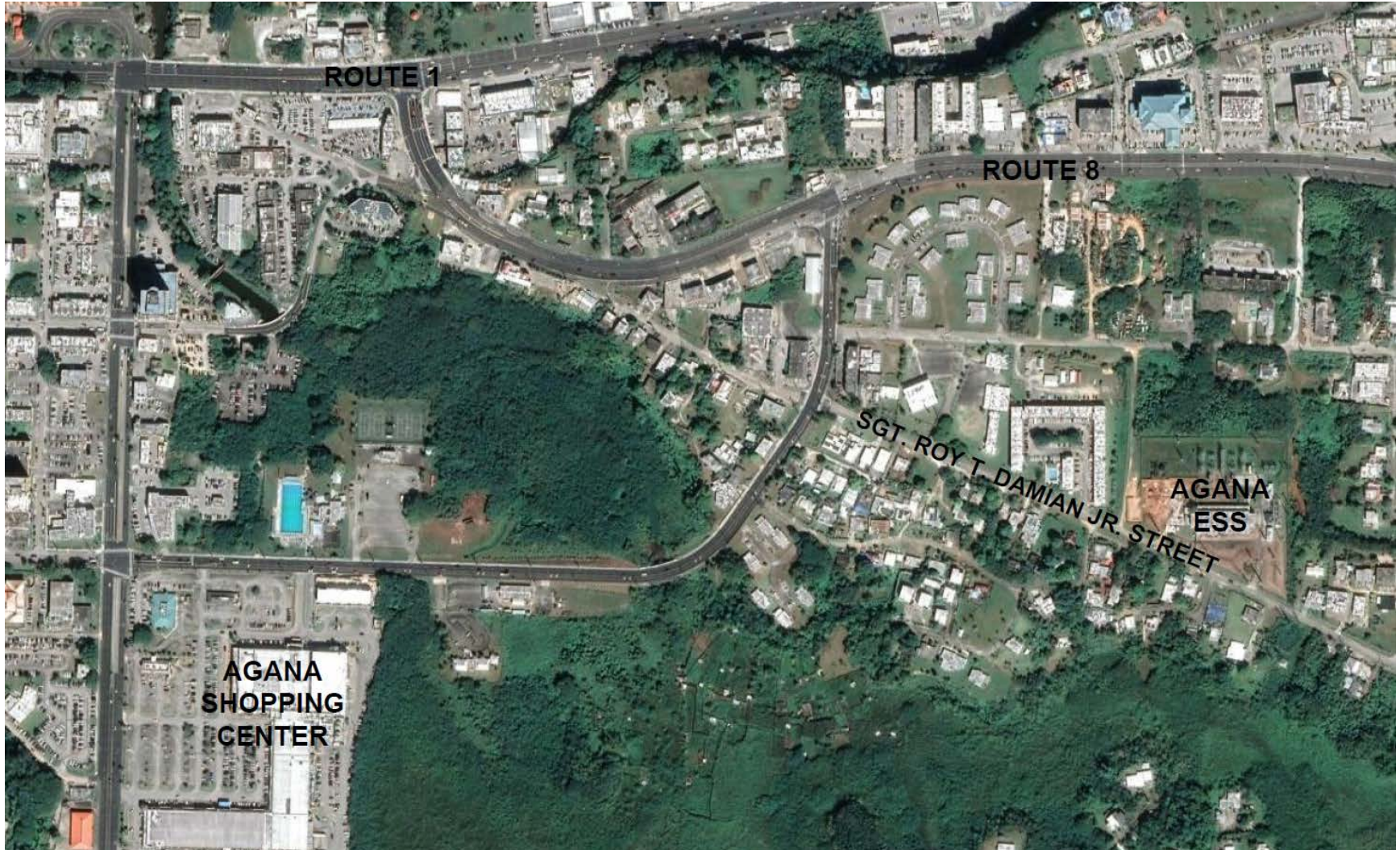
# Agana ESS

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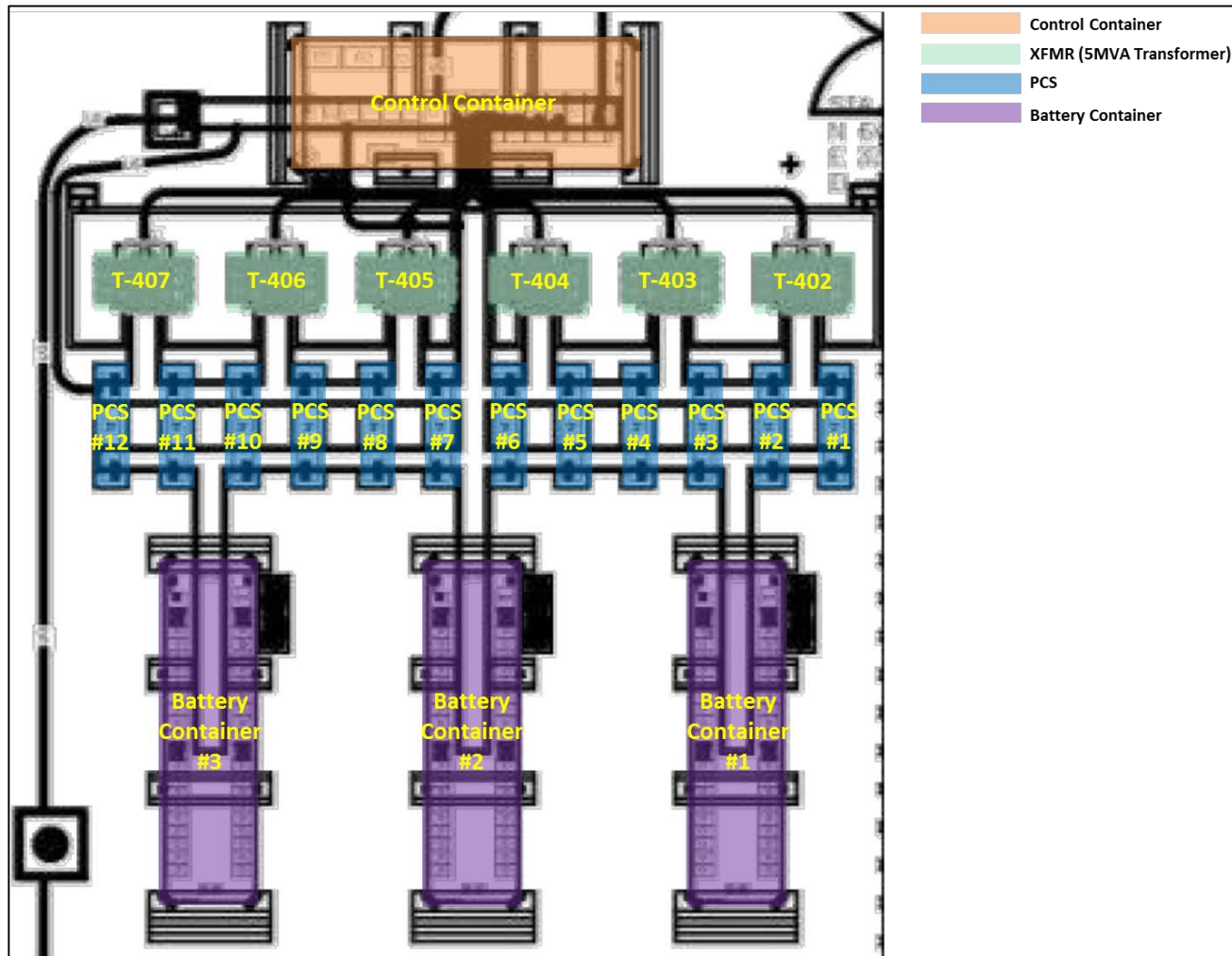
- Lithium-ion Battery Energy Storage System
- BESS Size
  - 24 MW / 6 MWh
  - Discharge or charge at constant 24 MW full capacity for 15 minutes at full state of charge
- Control Functions
  - Frequency Regulation
  - Spinning Reserve



# Agana ESS Site Location



# Agana ESS Site Layout





# Agana ESS Site Layout







# Talofofo ESS

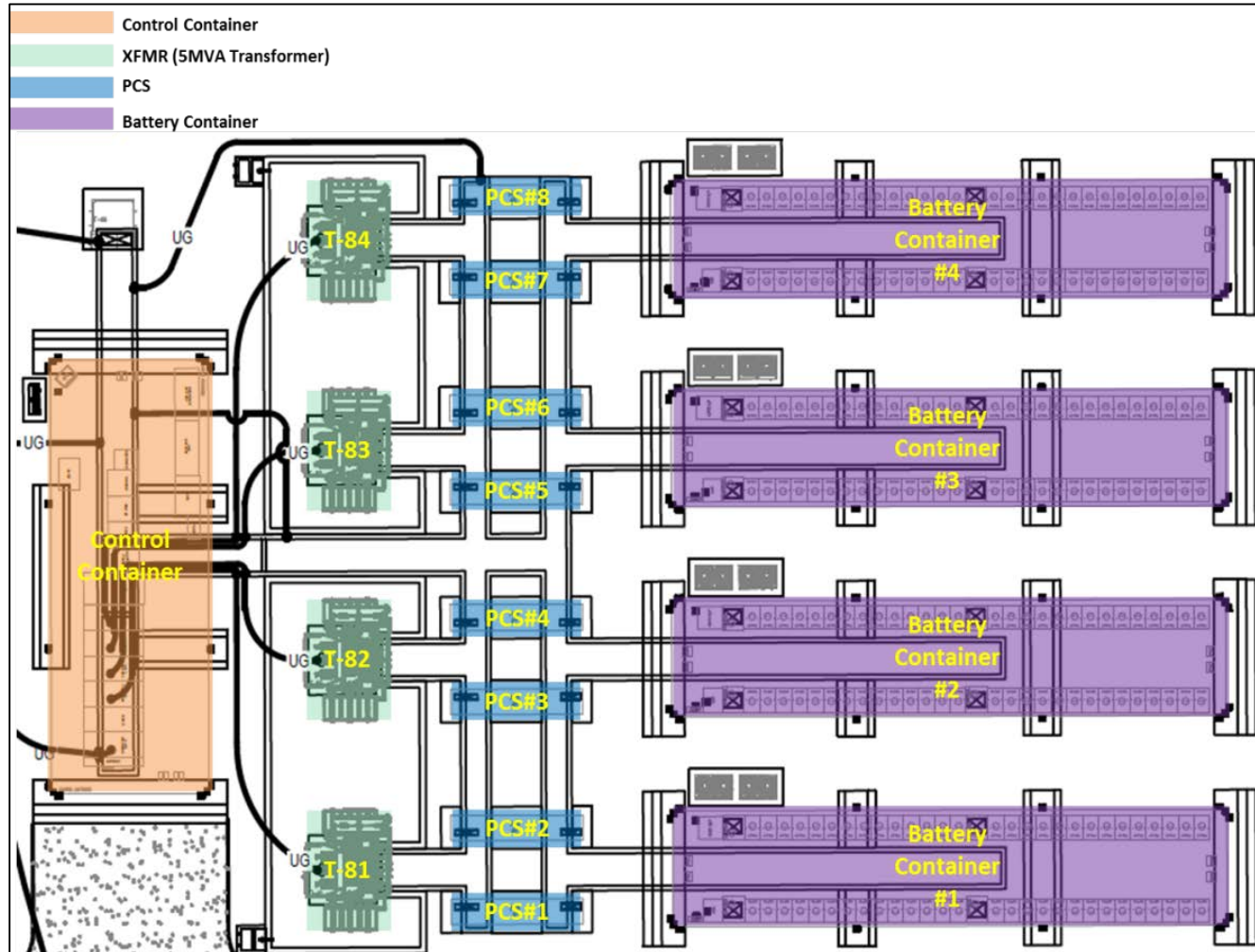
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- Lithium-ion Battery Energy Storage System
- BESS Size
  - 16 MW / 16 MWh
  - Discharge or charge at constant 16 MW full capacity for 1 hour at full state of charge
- Control Function
  - Ramp-Rate Control for Dandan Solar Farm

# Talofofo ESS Site Location



# Talofofu ESS Site Layout



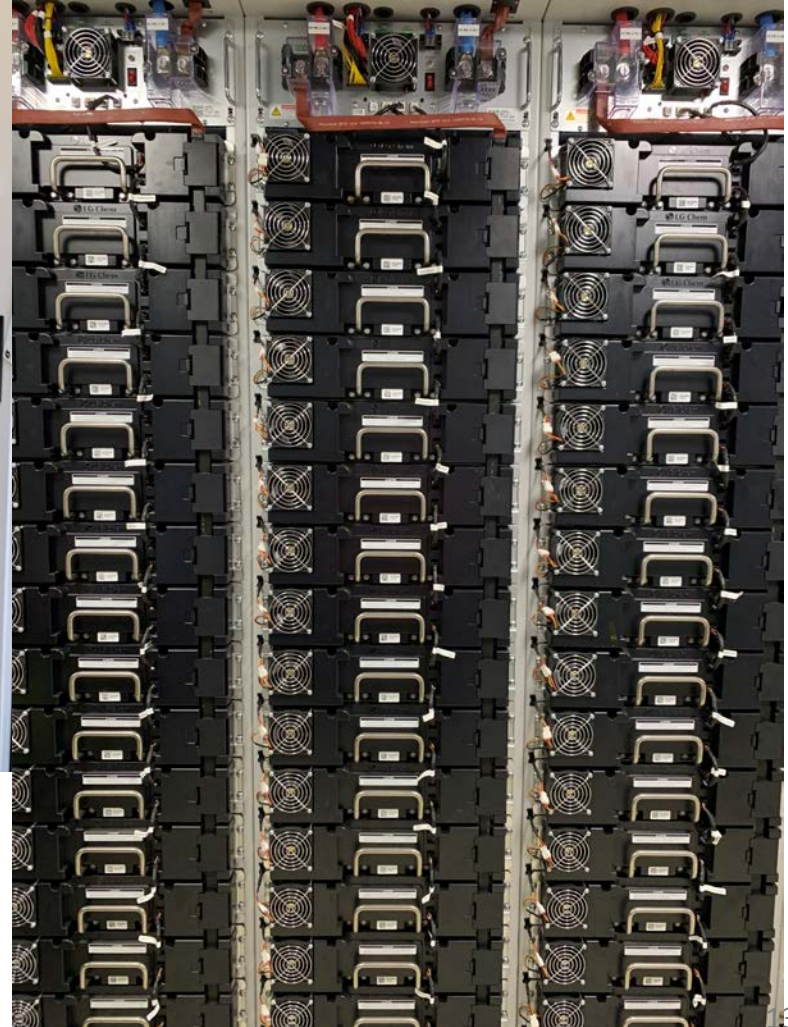


# Talofofo ESS Site Layout





# Battery Container & Battery Racks

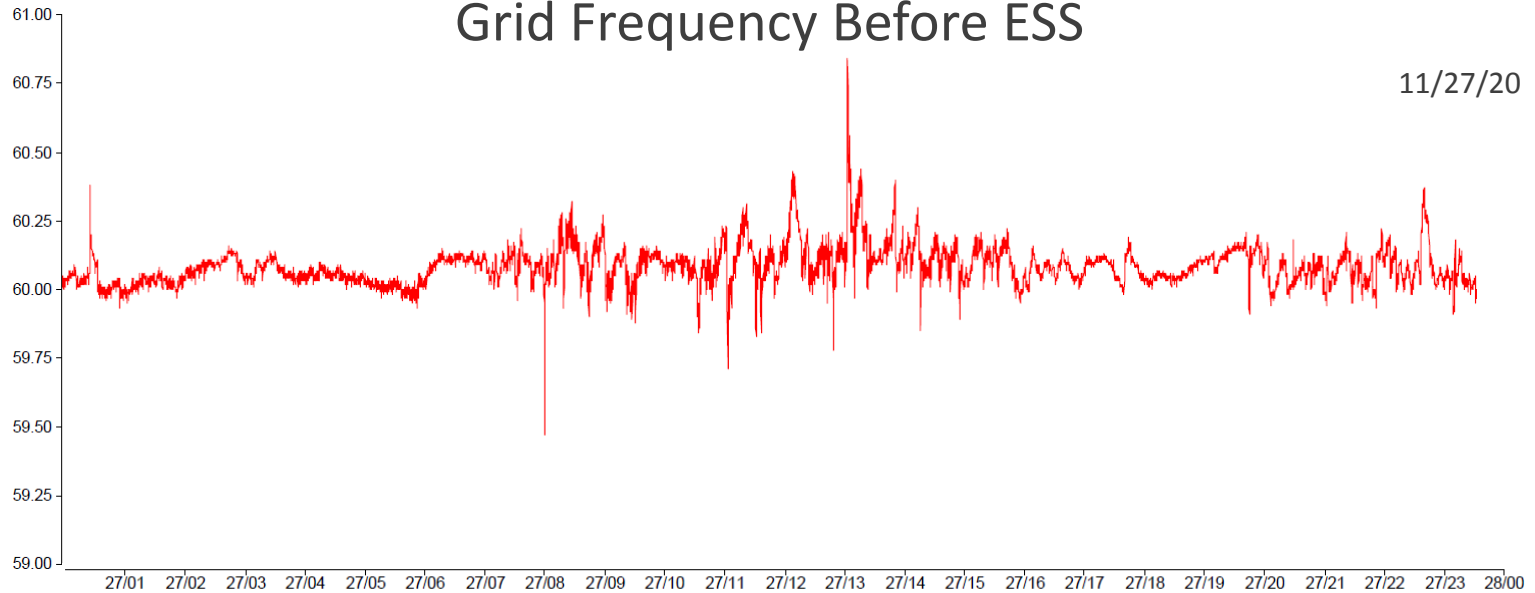


# Agana ESS Frequency Regulation



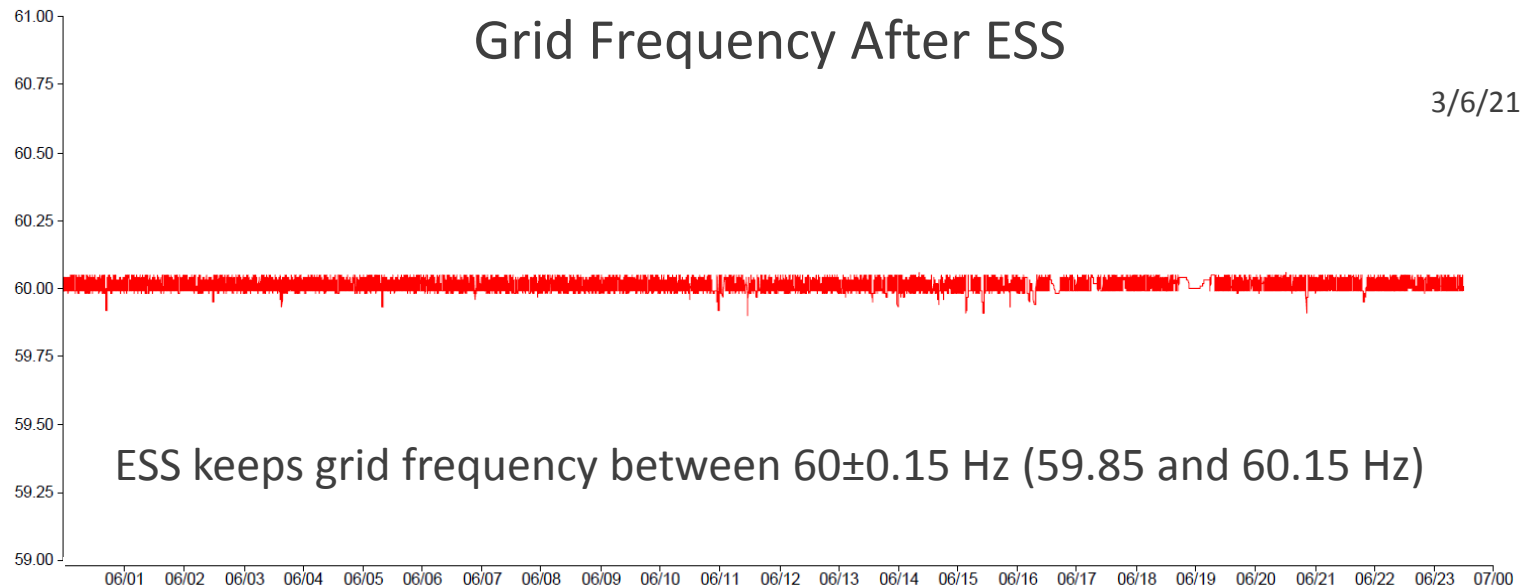
## Grid Frequency Before ESS

11/27/20



## Grid Frequency After ESS

3/6/21



ESS keeps grid frequency between  $60 \pm 0.15$  Hz (59.85 and 60.15 Hz)



# Agana ESS Spinning Reserve

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ESS provides significant reduction in customer outages for Piti 8&9 trips

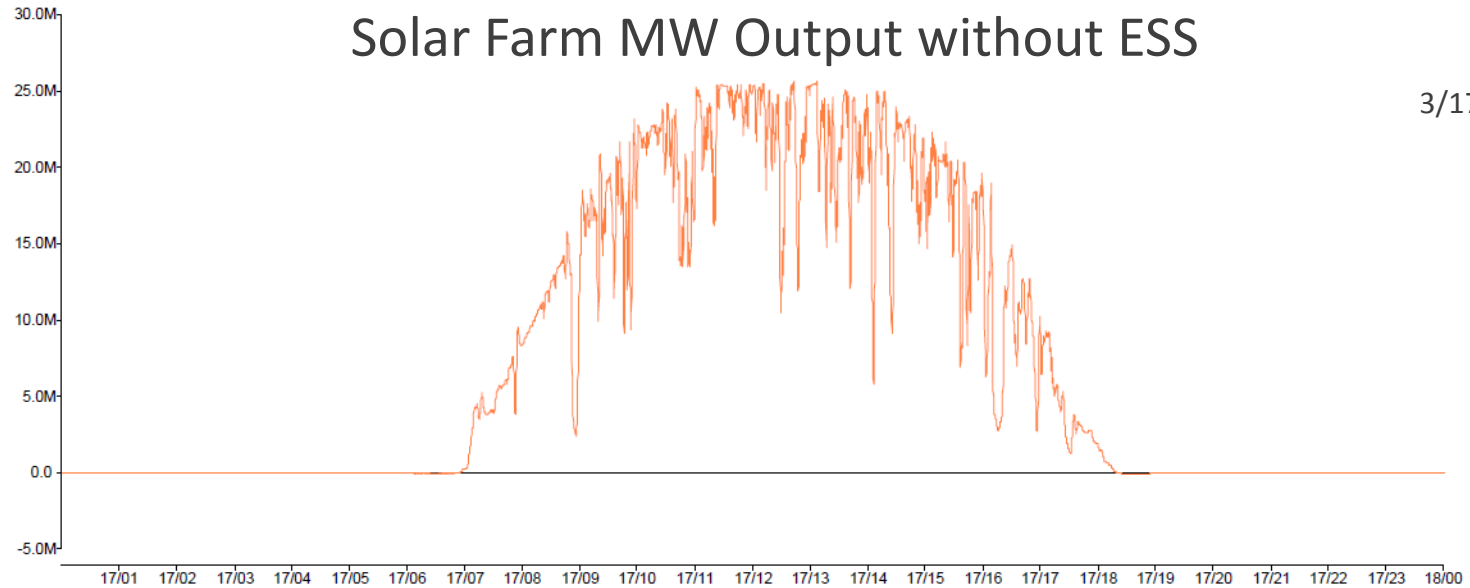
<b>Date</b>	<b>Unit(s) Tripped</b>	<b>Agana ESS Status</b>	<b>Feeders Tripped</b>
→ 2021 Mar 01	Piti 8&9	Online	5
2021 Jan 16	Piti 8	Offline	14
2021 Jan 15	Piti 8&9	Offline	11
2020 Jan 11	Piti 8	Offline	21
2020 Nov 09	Piti 8	Offline	14
2020 Oct 24	Piti 8	Offline	20



# Talofofu ESS PV Ramp-Rate Control

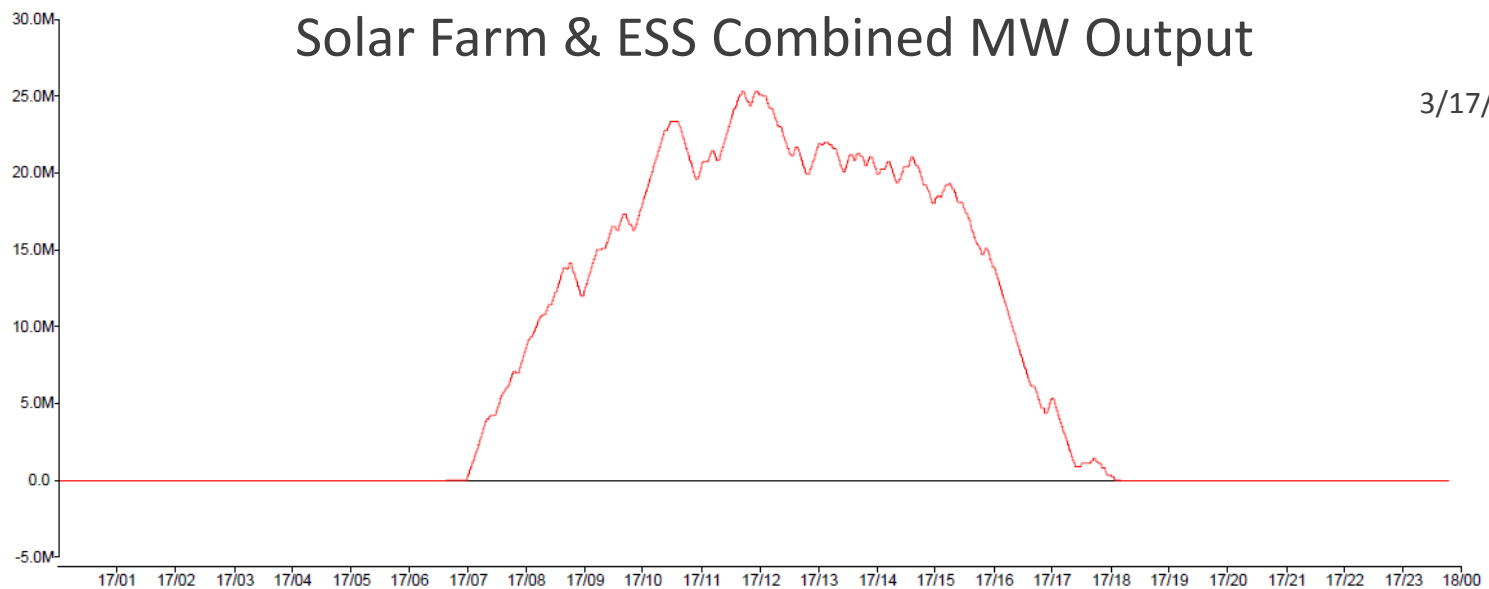
## Solar Farm MW Output without ESS

3/17/21



## Solar Farm & ESS Combined MW Output

3/17/21







# Conclusion

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## Agana and Talofofu Energy Storage Systems:

- Improve power reliability
- Reduce environmental impacts
- Increase customer satisfaction