GPA RESPONSES TO PUC RFI
GPA Docket 23-21

1. GPA indicates that it presently owns 27 bucket trucks. Please provide a listing indicating which trucks are presently operational, date each was purchased, the estimated useful life of each and whether required maintenance has been provided.

   GPA Response: Below is a summary of the bucket trucks and status. See Attachment 1 for complete bucket truck listing and information.

Bucket Truck, Reach (Ft)	Fleet Total	Down	Available
35	4	1	3
40	1		1
45	4	2	2
55	12	2	10
65	5	2	3
120	1		1
TOTAL	27	7	20

	Purchase Year										
Bucket Truck, Reach (Ft)	2006	2007	2009	2013	2016	2017	2018	2020	2022	Not Available	Total
35	2		2								4
40										1	1
45	2	1	1								4
55					3		3	3	3		12
65				2		3					5
120								1			1
Grand Total	4	1	3	2	3	3	3	4	3	1	27

2. GPA indicates that it received a single bucket truck price quote from Morrico at $337,440.00. GPA now indicates that it estimates the price for each truck at $500,000.00. Couldn't GPA order the trucks locally as the price quoted by Morico?

   GPA Response: GPA provided $500,000 as a budgetary estimate. GPA is presently discussing with FEMA the purchase option for the 5 bucket trucks that were provided during the typhoon restoration. This is an option for acquisition. Remaining bucket trucks not purchased through FEMA will be solicited through an Invitation for Bid which would be open to local vendors.

3. Please provide all evidence or materials upon which GPA estimated the cost of bucket trucks at $500,000 each.

GPA Response: GPA provided $500,000 as a budgetary estimate per truck. GPA previously provided a bucket truck quote from Morrico of $337,440.00. GPA attempted to purchase this bucket truck but it was sold to another party.

Attachment 2 is the most recent purchase order (31399-OP) for 45' reach bucket trucks with electric power take-off with battery for hydraulic system. The cost is $487,499 each. GPA obtained a grant of $250,000 which was applied to the cost of one bucket truck. Delivery is expected July 2023 (27 months after order).

Attachment 3 is a 2018 purchase order (26060-OP) for 3 each 55' reach bucket trucks at $257,299 each. Purchase order issued in December 2018. Trucks received in February 2020.

Attachment 4 is a recent quote from FEMA for the 5 bucket trucks received for restoration at $395,400.00 each. Trucks are presently on island pending decision on purchase. GPA requested FEMA for a purchase option of bucket trucks as they are still in good condition and are readily available.

4. GPA indicates that it "used 20-30 bucket trucks throughout its recent restoration efforts, which include the 9-12 additional bucket trucks provided on loan by FEMA and the Navy." Can GPA provide a more precise number of the bucket trucks that were actually used during the typhoon restoration? If GPA only used 20 bucket trucks during the restoration, which included the nine to twelve additional bucket trucks provided by FEMA and Navy, does this mean that GPA only used 8 of its own bucket trucks? Please provide clarification of these divergent numbers.

GPA Response: GPA received support though local Navy for 100' and 115' reach bucket trucks. In addition, Navy coordinated with its contractor DZSP to provide 55' reach bucket trucks starting June 11, 2023. Naval Base Guam high reach bucket trucks were temporarily used for 4 days for the 115KV and 34.5KV transmission line work while the Snohomish PUD bucket trucks were being transported via FEMA from Washington to Guam. DZSP supplied trucks initiated with 5 bucket trucks but the number of trucks decreased to just 2 most of the time and were not available on Sundays. The DZSP bucket truck support ended on June 30.

GPA also received 5 of 8 bucket trucks requested to FEMA on June 19. Navy requested bucket trucks from Hawaii arrived on June 16. It should be noted that one of the FEMA supplied trucks was not operational due to hydraulic system issues since arrival and is being evaluated for necessary repairs.

The number of bucket trucks changed daily based on the delivery/availability of loaned trucks and operating condition of the loaned and GPA-owned trucks. Several bucket trucks were turned in for servicing or repair during the storm and once repaired were returned to service. Some bucket trucks remained down are still pending repair.

5. Could it not be assumed that, in the event of another typhoon, either 9-12 bucket trucks, or some lesser number of bucket trucks, could be provided to GPA on loan by FEMA and the Navy? Isn't it preferable to borrow bucket trucks from FEMA and Navy rather than incurring the expense for additional bucket trucks?

GPA Response: GPA had hoped to receive FEMA assistance with bucket trucks sooner than it did. On May 31, GPA requested for 4 each 55' reach bucket trucks and on June 5 GPA requested for an additional 4 bucket trucks. Of these requested trucks GPA received 5 bucket trucks on June 19, over 25 days from COR 4 declaration after the storm. GPA never received the remaining 3 bucket trucks.

Although Navy provided trucks locally, this was only available from June 11 and was limited. Navy also provided 2 bucket trucks from Hawaii which arrived on June 16.

Availability of local trucks was not consistent and not immediate. While GPA was able to obtain additional labor through mutual aid from CNMI, Pohnpei and Washington, it was difficult to obtain delivery estimates of the requested bucket trucks including the transport of the Snohomish PUD bucket trucks.

Additionally, the onset of the 2023 El Nino places Guam, the Marianas, and Micronesia at greater risk of typhoons. During this El Nino, the National Weather Service projects 5 – 8 storms for Guam and CNMI, with 3 -5 of those storms reaching typhoon strength. The increased storm activity in the Marianas/Micronesia and increased weather-related emergencies in CONUS is likely to limit FEMA assistance and response.

6. GPA claims this was the fastest restoration from a typhoon in history. Yet GPA claims that "immediate access to additional bucket trucks prove challenging." Was GPA not able to meet this challenge? If GPA claims that it does not have sufficient bucket trucks, please provide materials, written reports, or any explanation or other written evidence indicating that GPA did not have sufficient bucket trucks to meet the challenges of restoration.

GPA Response: Compared to other similar category of typhoons, GPA's recovery after Typhoon Mawar is the fastest. Contributions to this quick recovery includes implementation of mitigation strategies such as pole hardening, increase in critical inventory items and levels, and investment in bucket trucks.

While GPA was able to perform restoration work with resources on hand, additional resources such as labor and bucket trucks will further reduce restoration times, reducing GPA revenue loss, commercial business disruption, and customer suffering and frustration. Investments in additional bucket trucks is a lower cost mitigation strategy compared to placing lines underground which can cost up to $1000 per foot.

7. Was the lack of bucket trucks a reason for slower restoration? If so, provide any written report or other evidence that supports such a conclusion.

GPA Response: The availability of the additional bucket trucks would have improved the restoration time. More linemen would be able to fix the overhead distribution lines that feed most of our customers. With over 700 miles of overhead distribution lines and associated materials on poles located over 20 feet above ground, having the bucket trucks to lift additional personnel and materials to address damages would improve restoration time.

8. In a prior docket where GPA sought to purchase bucket trucks, GPA Docket 15-23, GPA provided a Cost-Benefit analysis indicating that there would be a beneficial cost-benefit ratio with a purchase of new bucket trucks and the replacement of old trucks. Has GPA prepared any such analysis for this present request? If not, why not?

GPA Response: Provided on Attachment 5 is a simple BCA which considers 25 bucket trucks as the average number that supported the restoration of over 99% customers by July 14. This translates to the equivalent of 2 days of system recovery per bucket truck. The increase of bucket trucks by 10 would reduce the recovery period by 20 days. An estimated revenue loss is calculated based on the pending system recover balance and the average of non-fuel revenue from 2019 to 2021. Estimated KWH loss is calculated to determine the value of service amount. The estimated revenue loss plus the estimated value of service is the total avoided cost per event.

Over the last 30 years 5 major typhoons have landed on Guam. For this analysis, 1 major typhoon every 6 years is considered over the life of the bucket truck assumed for 20 years. The BCA is over 3. Reducing life of bucket truck or typhoon events by 1 yields a BCA of 2.

NOTE: Value of Service represents what electricity is worth for customers. The rate used in this study is from the "FEMA Technical Feasibility, Cost and Benefits of Underground Conversion of Selected Transmission & Distribution Lines – Guam" by ICF Consulting dated August 14, 2003. (see Attachment 5A).

9. PUC Commissioner Pedro Guerrero is concerned that after Mawar, the number of bucket trucks was not the issue in fixing the power lines, but that vegetation clearing was not given the attention it needed. He further indicates that 80% of the downed power lines were created by vegetation hitting the power line. Does GPA concur with Commissioner Guerrero's concerns? Are his concerns legitimate? If not, why not?

GPA Response: GPA agrees there are areas in which nearby vegetation damaged GPA lines. Vegetation management is challenging. GPA does conduct tree trimming to minimize line outages and damages but GPA is limited on accessing vegetation on private property. GPA power poles are typically installed four feet away from private property and trees or vegetation along private properties can impact power lines. GPA has expressed concerns about this and is considering options for the allowance of GPA to control vegetation on private property that can affect GPA power lines.

10. Is there a pressing or immediate need for bucket trucks? If so, please indicate such need and provide a justification. Isn't the timing of another typhoon event such as Mawar rather speculative

GPA Response: It has been over two decades since GPA had experienced a typhoon of this magnitude. Typhoon Mawar passed towards the northern part of the island which sustained the most damage as supported through NOAA National Weather Service Guam Assessment on Typhoon Mawar (see Attachment 6). Though damage from strong winds did impact the rest of the island, a direct hit or passing towards the center of the island will cause significantly more

damage through the rest of the island that would require additional resources to support repairs for extensive damages.

On June 29th, NOAA National Weather Service issued NOAA's Western North Pacific Tropical Cyclone (TC) Outlook for the remainder of 2023 (see Attachment 7) indicating Guam will likely see above-normal tropical cyclone activity based on the shift of El Nino from their prediction studies. During the 2002 El Nino period, Guam was impacted by three category 4 typhoons. In the 2015 El Nino period, Guam was impacted by one tropical storm, two category 4 typhoons, and one category 5 typhoon. While it may not be certain of when and how big a storm or typhoon may hit, this information initiates concern on readiness to recover based on recent experience.

11. Are there other, current issues, such as a lack of generation load capacity and load shedding, that are higher priorities for the allocation of $5M (rather than for the purchase of bucket trucks)?

GPA Response: GPA is also addressing generation issues and has approached the PUC on the repairs to the Yigo CT Generator Rotor damaged from Typhoon Mawar and a Hot Section Exchange. The damages to the Ukudu Power Plant and the delay of the commissioning is the main reason for GPA's recommendation for the extension request for the TEMES PMC for Cabras 1&2 also before PUC. GPA is also addressing the protest on the Yigo Diesels PMC bid and all protests that impact our ability to secure timely contracts and lower costs. GPA has been up front that the Ukudu Power Plant will allow for the additional reserves to meet demand and until then all our power production facilities are needed to support the IWPS.

12. In its Petition, GPA asks PUC to approve the purchase of ten (10) bucket trucks at a cost of up to $5M. Is this request consistent with the Contract Review Protocol? Wouldn't the proper approach under the Protocol be for the PUC to approve a procurement, and then have GPA come back to the PUC for subsequent approval of a price after the procurement has been completed?

GPA Response: GPA is seeking to expedite the acquisition of bucket trucks in anticipation of future storms/typhoons. This is primarily due to GPA's past purchases requiring over 12 months for delivery of new bucket trucks. An alternative to a bid, is through purchase with FEMA. Should GPA not be able to acquire all the bucket trucks through FEMA, GPA will solicit through an Invitation for Bid. GPA's request for approval would limit the purchase of bucket trucks based on quantity or cost.

GPA BUCKET TRUCK LIST (as of Aug 24, 2023)

	Official	Reach (ft.)	Official (Description)	Year	Operating Status	Reason Down	Estimated Remaining Useful Life (Yrs)
1	4506	35	Bucket Truck(GMC)	2006	Operational		3
2	6922	35	Bucket Truck(GMC)	2006	Operational		3
3	5527	35	Bucket Truck(International)	2009	Operational		3
4	5528	35	Bucket Truck(International)	2009	Non-Operational	Defective ECM. Outrigger leaking	3
5	3015	40	Bucket Truck(Kenworth)	1998	Operational		3
6	55	45	Bucket Truck(Freightliner)	2007	Operational		3
7	4587	45	Bucket Truck(Freightliner)	2007	Non-Operational	Engine issues(wont start, engine knocking)	
8	4739	45	Bucket Truck(Freightliner)	2008	Operational		3
9	5525	45	Bucket Truck(Freightliner)	2009	Non-Operational	Hydraulic Hose Replacement	3
10	4980	55	Bucket Truck(Freightliner 55ft)	2017	Operational		5
11	4981	55	Bucket Truck(Freightliner 55ft)	2017	Non-Operational	LoadTest schedule for 8/25/23	5
12	4982	55	Bucket Truck(Freightliner 55ft)	2017	Operational		5
13	6564	55	Bucket Truck(Freightliner 55ft)	2019	Operational		6
14	6725	55	Bucket Truck(Freightliner 55ft)	2019	Operational		6
15	6726	55	Bucket Truck(Freightliner 55ft)	2019	Non-Operational	Transmission issue (defective flex plate)	6
16	7017	55	Bucket Truck(Freightliner 55ft)	2020	Operational		10
17	7018	55	Bucket Truck(Freightliner 55ft)	2020	Operational		10
18	7019	55	Bucket Truck(Freightliner 55ft)	2020	Operational		10
19	7419	55	Bucket Truck(Freightliner 55ft)	2022	Operational		10
20	7420	55	Bucket Truck(Freightliner 55ft)	2022	Operational		10
21	7421	55	Bucket Truck(Freightliner 55ft)	2022	Operational		10
22	6184	65	Bucket Truck(International)	2014	Non-Operational	Electrical issues (defective ECM)	4
23	6185	65	Bucket Truck(International)	2014	Operational		4
24	5381	65	Bucket Truck(Altec 65ft)	2017	Operational		5
25	5382	65	Bucket Truck(Altec 65ft)	2017	Operational		5
26	5394	65	Bucket Truck(Altec 65ft)	2017	Non-Operational	Rear Brakes and Brake Hardware	4
27	7011	120	Bucket Truck(Freightliner 120ft)	2020	Operational		10

		2021	2020	2019	Average
Sales Revenue	000	$ 323,189	$ 332,476	$ 399,318	$ 351,661
Production Fuel	000	$ 180,807	$ 176,992	$ 238,870	$ 198,890
Total Non-Fuel	000	$ 142,382	$ 155,484	$ 160,448	$ 152,771
Sales, MWH	MWH	1,554,962	1,523,579	1,568,286	1,548,942
Avg. Non-Fuel Rate	$/KWH	0.09	0.10	0.10	0.10
Non Fuel Revenue per Day	000	$ 390	$ 426	$ 440	$ 419
Avg. KWH per Day	KWH	4,260,170	4,174,189	4,296,674	4,243,678

GPA Average Bucket Trucks	25	trucks
Total Restoration Period	50	days
Restoration Days per Bucket Truck	2	days/truck

Reduced Restoration Period with additional 10 Trucks	20	days
Adjusted Restoration Period	30	days

Recovery Period Start	5/25/2023
Customer Restore Complete	7/14/2023
Adjusted Customer Restore	6/24/2023

Value of Service Rate	$/KWH	0.7	*Represents residential customer rate*

Date Restored	System Restore	System Pending Restore	Esimated Daily Revenue Loss	Estimated KWH Loss	Estimated Value of Service
14-Jul	99%	1%	$ 4,186	42,437	29,705.74
13-Jul	98%	2%	$ 8,790	89,117	62,382.06
12-Jul	98%	3%	$ 10,464	106,092	74,264.36
11-Jul	97%	3%	$ 10,882	110,336	77,234.93

12918 N. Nebraska Ave.
Tampa, FL 33612
UEI: TK67EL9NPMD9
Cage Code: 3VCK4
FEIT: 42-1613127
DUNS: 094261935

POC: Kenneth Gutierrez
TO: Guam Power Authority

Sales Quote QUO004523
Date: 8/2/2023

Phone: 671-482-0560
E-Mail kgutierrez@gpagwa.com

Certs: SDVOSB, HUBZone SB

Qty.	Manufacturer	Item No.	Description	Unit Price	Total Price
1		120503	Versalift 2023 INTERNATIONAL HV507 CHASSIS VIN: 3HAEEMMN9PL733533	$395,400.00	$395,400.00
1		120503	Versalift 2023 INTERNATIONAL HV507 CHASSIS VIN: 3HAEEMMN5PL198636	$395,400.00	$395,400.00
1		120503	Versalift 2023 INTERNATIONAL HV507 CHASSIS VIN: 3HAEEMMN5PL199737	$395,400.00	$395,400.00
1		120503	Versalift 2022 FREIGHTLINER M2 106 CHASSIS VIN: 3ALDCXFC3NDNM1582	$395,400.00	$395,400.00
1		120503	Versalift 2022 FREIGHTLINER M2 106 CHASSIS VIN: 3ALDCXFC5NDNM1583	$395,400.00	$395,400.00

FOB: Destination
Delivery Time: 0 Days ARO

VERSALFIT VN-555-MHI S/N: WX220080
2023 INTERNATIONAL HV507 CHASSIS VIN:
3HAEEMMN9PL733533

VERALIFT VN-555-MHI S/N: WX220116
2023 INTERNATIONAL HV507 CHASSIS VIN:
3HAEEMMN5PL198636

VERASLIFT VN-555-MHI S/N: WX230158
2023 INTERNATIONAL HV507 CHASSIS VIN:
3HAEEMMN5PL199737

VERSALIFT VN-555-MHI S/N: WX220044
2022 FREIGHTLINER M2 106 CHASSIS VIN:
3ALDCXFC3NDNM1582

VERSALIFT VN-555-MHI S/N: WX220045
2022 FREIGHTLINER M2 106 CHASSIS VIN
3ALDCXFC5NDNM1583

Units are currently on the island of Guam in the posession of FEMA

Matt McHone, Rental Manager
O. (813)631-0000
F. (813)631-0008
matt@federalcontractscorp.com

12918 N. Nebraska Ave.
Tampa, FL 33612
UEI: TK67EL9NPMD9
Cage Code: 3VCK4
FEIT: 42-1613127
DUNS: 094261935

POC: Kenneth Gutierrez
TO: Guam Power Authority

Sales Quote QUO004523
Date: 8/2/2023

Phone: 671-482-0560
E-Mail kgutierrez@gpagwa.com

Certs: SDVOSB, HUBZone SB

Subtotal:	**$1,977,000.00**
Total Sales Tax:	$0.00
Total:	**$1,977,000.00**

Terms and Conditions:
- Quote valid for 30 days
- Terms: Net 30
- Unless otherwise specified, full dock or off-loading capabilities required to avoid additional charges.
- If using a purchase card, a credit card surcharge may apply.
- Certificate of Origin/MSO will not be released until payment in full has been received.

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10-Jul	97%	3%	$ 11,719	118,823	83,176.08
9-Jul	97%	3%	$ 12,138	123,067	86,146.66
8-Jul	97%	3%	$ 12,975	131,554	92,087.80
7-Jul	97%	3%	$ 13,812	140,041	98,028.95
6-Jul	97%	4%	$ 14,649	148,529	103,970.10
5-Jul	96%	4%	$ 16,742	169,747	118,822.97
4-Jul	95%	5%	$ 19,253	195,209	136,646.42
3-Jul	95%	5%	$ 20,928	212,184	148,528.72
2-Jul	95%	6%	$ 23,020	233,402	163,381.59
1-Jul	94%	6%	$ 24,695	250,377	175,263.89
30-Jun	94%	6%	$ 27,206	275,839	193,087.33
29-Jun	93%	7%	$ 28,880	292,814	204,969.63
28-Jun	92%	8%	$ 31,810	322,519	225,763.65
27-Jun	92%	8%	$ 35,158	356,469	249,528.24
26-Jun	91%	9%	$ 38,507	390,418	273,292.84
25-Jun	88%	12%	$ 51,063	517,729	362,410.07
24-Jun	86%	14%	$ 58,179	589,871	412,909.83
			$ 475,056		$ 3,371,602

Total Avoided Cost per Event: $ 3,846,658

Typhoon Events over Bucket Truck Life:

Bucket Truck Life	Typhoon Event Year	Avoided Costs
20 Years	2023	$ 3,846,658
	2029	$ 3,846,658
	2035	$ 3,846,658
	2041	$ 3,846,658
		$ 15,386,632

Cost of 10 Bucket Trucks: $ 5,000,000

BCA Ratio: 3.08

Bucket Truck Life	Typhoon Event Year
15 Years	2023
	2029
	2035

Cost of 10 Bucket Trucks:

BCA Ratio:

***Typhoon Occurrenct Assumptions:**

- 1 Cat 4 Typhoon every 6 years

Cat 4 Typhoons in last 30 years:

1. *Russ (Dec 1990)*
2. *Omar (Aug 1992)*
3. *Paka (Dec 1998)*
4. *Pongsona (Dec 2002)*
5. *Mawar (May 2023)*

Avoided Costs
$ 3,846,658
$ 3,846,658
$ 3,846,658

$ 11,539,974

$ 5,000,000

2.31

NOAA NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
UNITED STATES DEPARTMENT OF COMMERCE

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FOR IMMEDIATE RELEASE
July 14, 2023

NWS Guam Assessment on Typhoon Mawar: Timing, Characteristics & Impacts to Guam, 24-25 May 2023

- **Mawar clips northern Guam as a Cat-4 Typhoon with maximum sustained winds of 130-140 mph**
- **The southern periphery of Mawar's eye did make passage over northernmost AAFB and Ritidian Wildlife Refuge**
- **Damage and Impacts ranged from high-end Cat-4 (super typhoon-equivalent) in northern Guam; to Cat-2 to Cat-3 in central Guam; to tropical storm to Cat-1 in southern Guam**
- **Mawar's slow passage allowed 1.5-2 feet of rain to fall over much of Guam**

The center of Typhoon (TY) Mawar passed through the Rota Channel, with the southern portion of the calm eye briefly passing over the northern tip of Guam (AAFB-Ritidian) Wednesday, 24 May evening/late night through early Thursday morning, 25 May. **Closest Point of Approach (CPA) to Guam was roughly 5-8 PM Wednesday, 24 May.**

During Mawar's slow approach to Guam, Mawar weakened from a strong Cat-4 'super typhoon' (155 mph) Tuesday evening and early Wednesday morning, to a 140 mph Cat-4 'typhoon' by mid-Wednesday morning, 24 May. A Joint Typhoon Warning Center (JTWC) post-storm reassessment lowered the overall intensity, slightly, to a 130 mph Cat-4 typhoon around the time of CPA. As Mawar pulled away from Guam early Thursday, 25 May, Mawar began rapidly intensifying. Within 24 hours after its Guam passage, Mawar was a Cat-5 super typhoon with maximum sustained winds of 185 mph. Based on debris patterns (especially tree falls); a significant amount of damage was caused by west to southwest winds as an intensifying Mawar slowly departed the area.

Impacts: Damage and impacts from TY Mawar varied significantly from northern Guam to southern Guam. Villages in the north, closest to the center of Mawar, and thus its most intense winds, saw the most widespread and significant damage. Maximum sustained winds decreased farther to the south, thus villages of central and southern Guam experienced lesser conditions–still typhoon-force–but less damage overall.

Northwestern areas of Guam–portions of Dededo and Yigo–exhibited extensive damage with many wood and tin buildings and dwellings (those without reinforced concrete) showing

devastating levels of damage. Overall damage across northern Guam is consistent with Cat-4 winds. Damage in the far northwest suggests the presence of winds in the high Cat-4 (super typhoon-equivalent) range. By comparison, the eye of Mawar in northern Guam lasted around 20 minutes at AAFB, while the eye of Pongsona (2002) lasted 2 hours 30 minutes at AAFB. This assessment had to consider maximum sustained winds at the ocean surface, as forecast and reanalyzed by the JTWC, but also the representative over-land winds (ROL), which were experienced across the higher elevations of NW Guam.

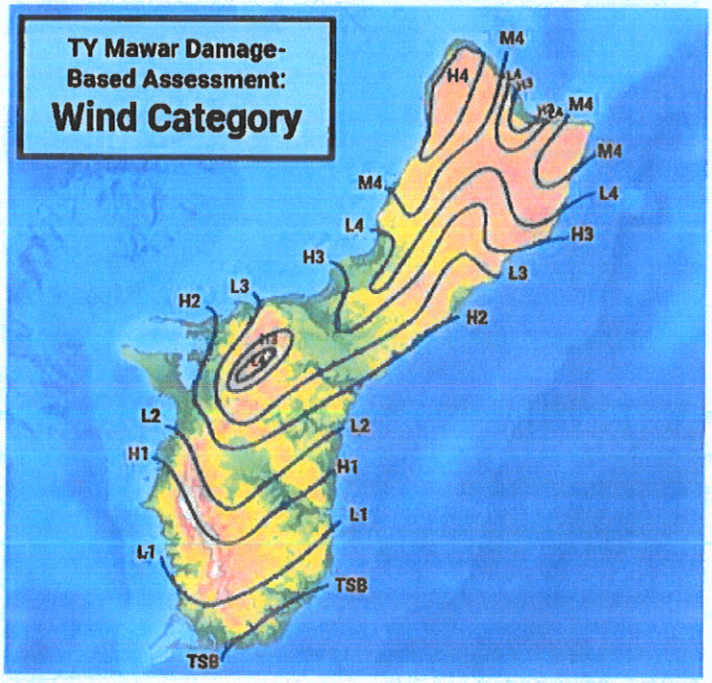
Background Info on Ground-Based Assessments:

A NWS Guam survey team traversed the island in the 2 weeks following Mawar to observe and categorize the general characteristics of Mawar's impacts on Guam based on the damage and impacts to vegetation, structures and infrastructure. This assessment sought to identify the first (approaching) and second (during/departing) wind, storm surge and significant rainfall. The determination of the wind over Guam was a challenge, since most wind sensors failed, and because Guam has a complex terrain that modifies the actual flow, as it would be, were the island's geography somewhat smoother. Additionally, wind sensor data may appear not to be physically sound and may ultimately be found to be erroneous. Thus, the damage characteristics to vegetation, structures and infrastructure are important inputs in determining the overall wind distribution across Guam. The direction of movement toward the island, which is oriented northeast—southwest, also played an important role in the overall wind damage distribution.

We are able to categorize storm damage as Typhoon (TY) Cat-1, the lowest category, up through TY Cat-5, the strongest. Historically, we have calculated typhoon sustained winds and gusts as Over Water Equivalent (OWE) wind, largely ignoring the effects of the island on the wind speed. The OWE wind more closely matches the JTWC intensity as it adjusts island winds to sea level. For Mawar, we were able to make another calculation called the Representative Over Land (ROL) wind, which is larger than the OWE. The ROL considers the island elevation, island terrain, and the level of damage to vegetation, structures and infrastructure. This assessment suggests that the extreme northwest part of Guam experienced some super typhoon-force sustained winds of 150 miles per hour as Mawar was intensifying and moving away from Guam.

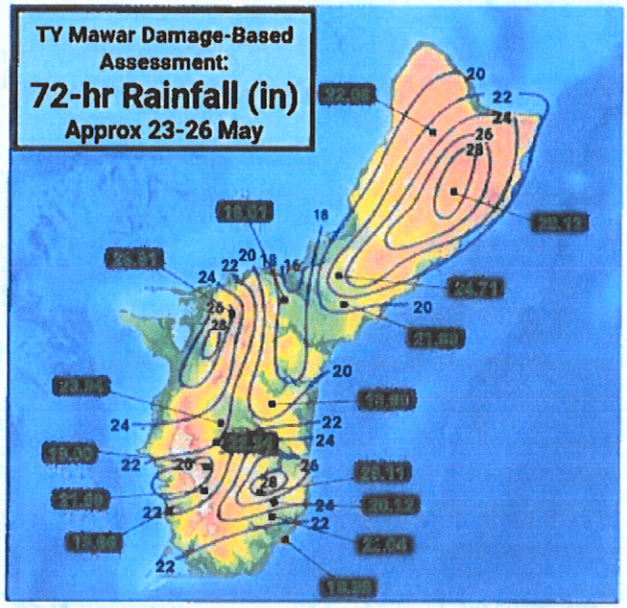
The Post Storm Report for Mawar can be found on the NWS Guam web page at https://www.weather.gov/gum/TropicalEventSummary. This report includes additional observational data (max winds and gusts, rainfall, and lowest pressures) across Guam and the CNMI, including island-specific impact narratives for all islands that were under a tropical cyclone watch or warning.

Tropical Cyclone Categories *Based on 1-minute average *over open waters* Maximum Sustained Winds (MSW) and 1-3 second Peak Gusts			
Tropical Storm Categories			
Tropical Storm "A"	Weak Tropical Storm	MSW: 30-49 mph	Gusts: 40-64 mph
Tropical Storm "B"	Severe Tropical Storm	MSW: 50-73 mph	Gusts: 65-94 mph
Typhoon Categories			
Typhoon Category 1	Minimal Typhoon	MSW: 74-95 mph	Gusts: 95-120 mph
Typhoon Category 2	Moderate Typhoon	MSW: 96-110 mph	Gusts: 121-139 mph
Typhoon Category 3	Strong Typhoon	MSW: 111-129 mph	Gusts: 140-164 mph
Typhoon Category 4	Very Strong Typhoon	MSW: 130-156 mph	Gusts: 165-198 mph
Typhoon Category 5	Devastating Typhoon	MSW: 157+ mph	Gusts: 199-246 mph
Super Typhoon: MSW: 150+ mph; Includes high-end Cat-4 and all Cat-5 typhoons **Damaging Winds:** MSW: 39 mph; Used for Tropical Storm/Typhoon Watch/Warning Issuance			

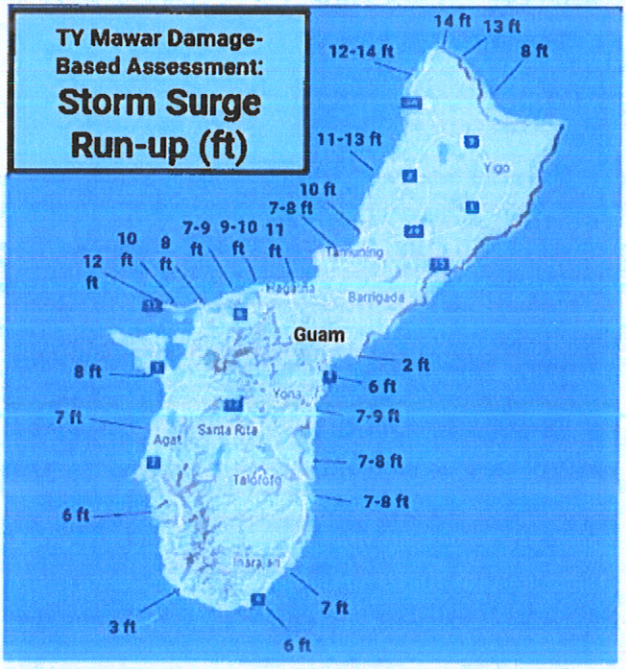


Wind Impacts: Typhoon intensities are based on 1-minute average winds over open waters. Land surfaces and topography greatly affect wind speeds and directions, resulting in frictional reduction of winds, but also localized increases in wind as winds funnel between and over topographical features. The wind categorization on this map seeks to represent the over land winds and gusts, as evidenced by the observed damage, and may not necessarily reflect the indicated 1-min average, open waters, intensity of TY Mawar. Additionally, smaller-scale features within tropical cyclone eyewalls can often lead to very localized areas of stronger winds, as may have been the case for NW Guam as Mawar began intensifying while moving away.

Rainfall: TY Mawar's slow passage around the north tip of Guam kept the torrential rains of the southern eyewall over much of Guam for a prolonged amount of time, resulting in much of the island receiving 1.5 to 2 feet of rain within a 72 hr (3-day) period. The bulk of rain fell within a 24 hr period from Wednesday morning, 24 May, through Thursday morning, 25 May. Rain observations are collected from various observational programs, including NWS, United States Geological Survey (USGS) and private collection sites.



Storm Surge, Wave Run-Up, and Coastal Inundation: A number of coastal areas were assessed to identify the vertical extent of salt-water run-up. These high water marks (HWMs) were the result of storm surge (rise in sea levels) and wind/wave stress as water pushed onto the coastal reefs and inundated low-lying coastal areas. The highest HWMs were found along the NW Guam coastline where HWMs reached as high as 12-14 feet. As noted earlier, a key contributor to these HWMs was the piling up of water on the reefs due to large ocean waves and winds forcing the water onto shore. The National Park Service also collected measurements and is post-processing their data before releasing it.



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FOR IMMEDIATE RELEASE
June 29, 2023

NOAA's Western North Pacific Tropical Cyclone (TC) Outlook for the remainder of 2023 is for: Above-normal activity for the Federated States of Micronesia (FSM), the Republic of the Marshall Islands (RMI), the Commonwealth of the Northern Mariana Islands (CNMI) and the Territory of Guam; and below-normal to normal activity for the Republic of Palau (ROP)

The United States-Affiliated Pacific Islands (USAPI) of the FSM, the RMI, the CNMI and Guam will likely see above-normal tropical cyclone (TC) activity for the remainder of 2023, while TC activity across the ROP is anticipated to be normal to below normal for the remainder of 2023.

Above-normal activity is consistent with the recent shift to El Niño as supported by the latest National Weather Service (NWS) Climate Prediction Center (CPC) ENSO Diagnostics Discussion. This is likely to result in considerably more regional activity than seen in the past three years. An eastward shift in the TC genesis region is predicted to keep TC activity near or below normal at the ROP, with more TCs passing to the north. TC activity will vary considerably east to west and north to south due to the large extent of the Micronesia region.

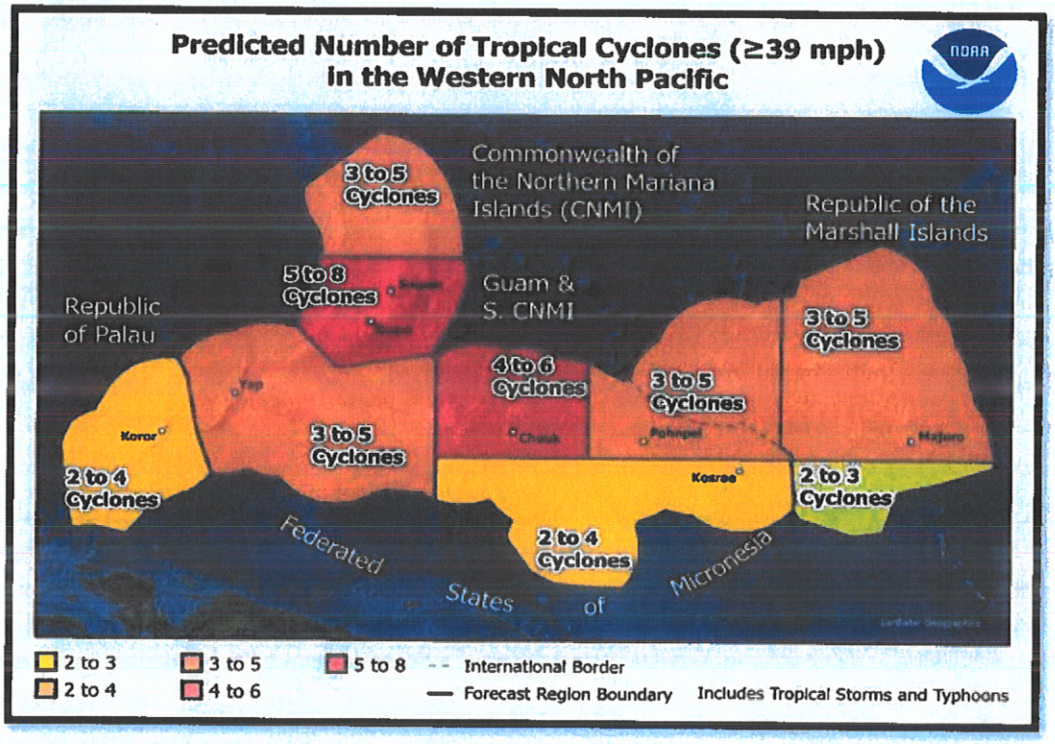

Figure 1: Predicted number of named storms (tropical cyclones of tropical storm (≥39 mph sustained winds) and typhoon (≥74 mph sustained winds) intensity) as listed in Table 1 on page 2.

REGION	NAMED STORMS (≥39 mph max sust'd)	TYPHOONS (≥74 mph max sust'd)
Marshall Islands (north of 6N)	3 to 5	2 or 3 (1 major)
Marshall Islands (south of 6N)	2 or 3	0 or 1
Pohnpei State (north of 6N)	3 to 5	2 or 3 (1 major)
Chuuk State (north of 6N)	4 to 6	2 to 4 (1 or 2 major)
Kosrae, Pohnpei, Chuuk States (south of 6N)	2 to 4	0 or 1
Yap State	3 to 5	2 or 3 (1 major)
Palau	2 to 4	1 or 2
Guam, Rota, Tinian and Saipan	5 to 8	3 to 5 (2 or 3 major)
Northern CNMI	3 to 5	2 or 3 (1 or 2 major)

Table 1: 2023 Tropical storm and typhoon activity outlook for various regions of Micronesia. The "Named Storms" column includes those systems which attain tropical storm, typhoon and super typhoon intensity.

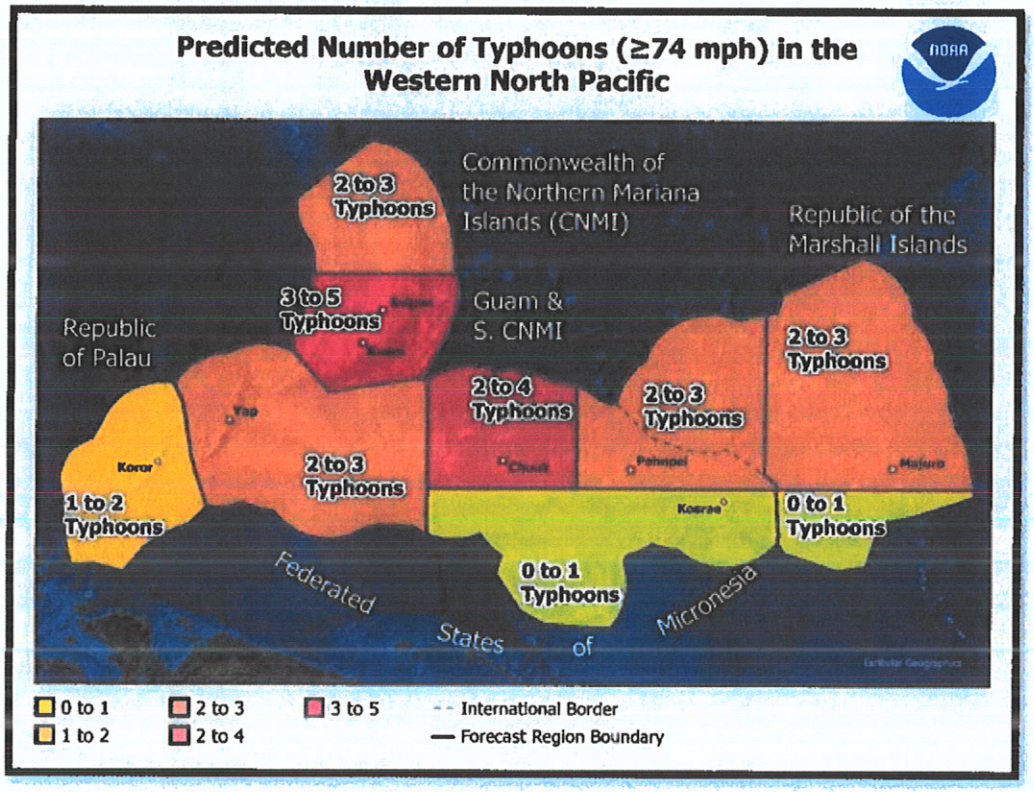

Figure 2: Predicted number of tropical cyclones of typhoon (≥74 mph sustained winds) intensity. (Listed in Table 1.)

This outlook is a general guide to the predicted, overall TC activity across the USAPI and does not indicate how many of these systems will actually make landfall. However, the outlook does provide a general idea of how many tropical storms and/or typhoons could affect a specific island or a group of islands across Micronesia, with peripheral effects such as strong damaging winds, torrential rainfall, and/or storm surge/inundation.

Although TC activity peaks around September-November for many regional locations, TCs can occur throughout the year across the western North Pacific. Therefore, there is no clearly defined 'typhoon season'. TC activity can fluctuate greatly from year to year, though **it only takes one to cause significant impacts**. Therefore, we always urge residents, visitors and mariners to maintain preparedness for TCs year-round. Please visit the Guam Homeland Security/Office of Civil Defense, the CNMI Homeland Security and Emergency Management, and FEMA's Ready.gov for more information on preparedness plans, tips and how to build emergency kits for use at home and at work.

The western North Pacific Ocean climate, and the factors that impact TC formation, typically change over a period of months. The International Research Institute for Climate and Society (IRI) at Columbia University, Palisades, New York and Climate Prediction Center (CPC) indicate El Niño conditions will continue to strengthen over the next several months. This outlook will be updated in August, if needed, to reflect any major changes to the current outlook.

With 2023's transition to an El Niño pattern, it's important to understand the relationship of interannual variability of TC activity based on the ENSO phase. When looking at location-based TC frequencies, TC activity shifts eastward from the La Niña pattern (Figure 3) to the El Niño pattern (Figure 4). In contrast to the below-average TC activity across the USAPI region in the La Niña years of 2020, 2021, and 2022, we anticipate considerably more TC activity across the region due to the recent transition to El Niño and the possibility of its strengthening to a strong El Niño event by Fall.

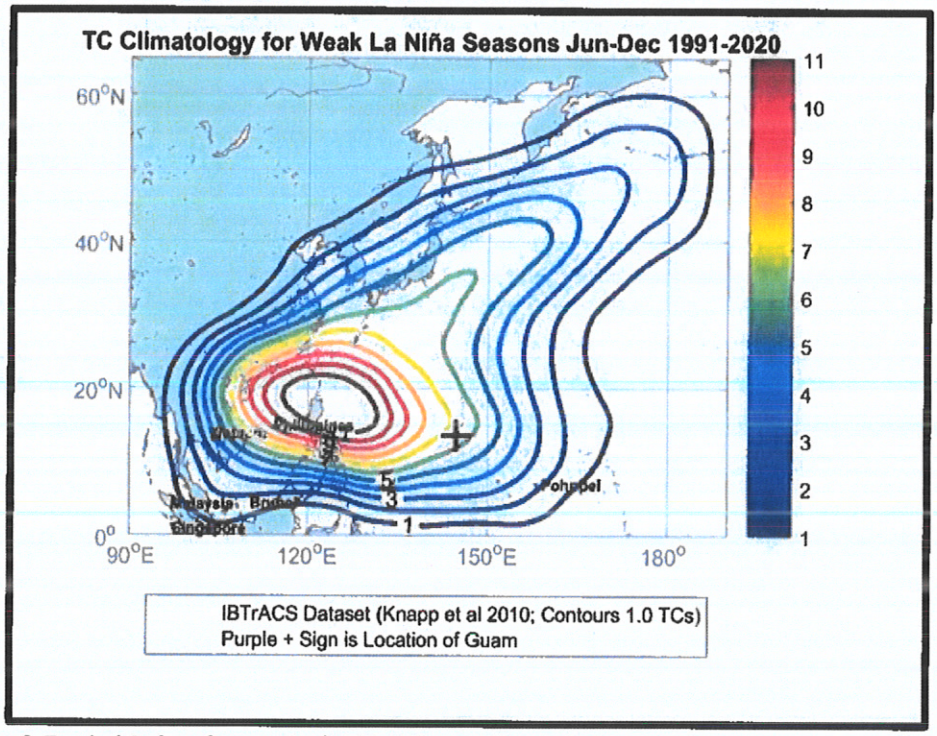

Figure 3: Tropical Cyclone frequencies (within 5 degrees (300 nm) of a point) for weak La Niña Seasons from 1991-2020, months June to December. The + symbol represents the location of Guam. Courtesy of H. Diamond at NOAA OAR.

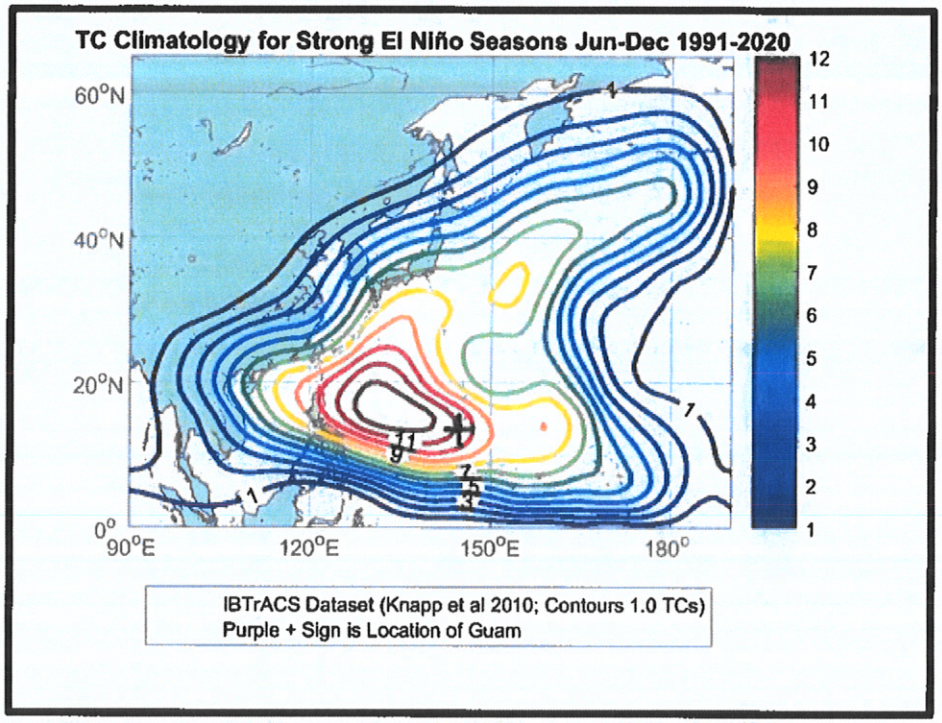

Figure 4: Tropical Cyclone frequencies (within 5 degrees (300 nm) of a point) for strong El Niño Seasons from 1991-2020, months June to December. The + symbol represents the location of Guam. Courtesy of H. Diamond at NOAA OAR.

The WFO Guam, in collaboration with the Joint Typhoon Warning Center (JTWC) and the Regional Specialized Meteorological Center (RSMC) Tokyo, Japan, continuously monitors weather conditions across the Marianas and Micronesia by using an array of observations, satellite data and output from complex numerical weather models that serve as the basis for TC track and intensity forecasts.

Follow us on Facebook and Twitter, @NWSGuam, and visit the WFO Guam web page at www.weather.gov/gum for updated weather information for Guam, the CNMI, Palau, the FSM and the Marshall Islands. The NWS provides weather, water and climate data, forecasts, warnings and impact-based decision support services for the protection of life and property and the enhancement of the national economy.

This outlook is a coordinated effort by NOAA's NWS Weather Forecast Office Guam, the Climate Prediction Center (CPC), NOAAs Office of Oceanic and Atmospheric Research (OAR) Air Resources Laboratory, the NWS Pacific Region Headquarters in Pearl Harbor, HI, and Mr. Chip Guard of Tropical Weather Sciences.

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APPENDIX 1 - VALUE OF ELECTRIC SERVICE (VOS)

One of the popular topics among utilities and regulators in the US and Europe in the late 1980s and early-mid 1990s was to determine whether utilities were holding the proper amount of reserves to satisfy their customers' concerns for reliable service. To do so, many utilities undertook to determine how much electricity was worth to those customers – also called "value of service" (VOS) or "value of lost load" (VOLL). A very high VOS would imply that customers were highly averse to the possibility of not having power, and therefore would want the utility to hold a high level of reserves sufficient to reflect their VOS. Correspondingly, a low VOS would imply that utilities could hold fewer reserves and that customers would be willing to accept the risk of more frequent outages.

Clearly, when power is not available to a customer, many of the activities that they would normally engage in come to a halt, as electricity is the lifeblood of the modern economy. Without power, homeowners are unable to run air conditioning, watch TV or operate computers, and the food in their refrigerator would spoil. Among commercial customers, the hospitals, restaurants, data centers, shopping malls, office buildings, and hotels are unable to operate except at minimal levels (unless they have backup generation). Industrial customers cannot produce their products for the market. VOS studies were designed to determine what customers thought it would cost them economically if they did not have electric power, whether that value changed depending on the type of customer, and how that value might change if the outage were an extended one.

Power is Valuable, but there are Limits. It is clear that the VOS is much greater than the rates that customers pay for power. Tariffs are designed to recover utilities' costs, plus a reasonable return, but bear no relationship to the VOS that customers attribute to having electricity. For example, one very large measure of the VOS, assuming that virtually all economic activity depends directly or indirectly on power, would be to simply divide the Gross Island Product of Guam by the number of kilowatt-hours (kWh) of power generated.

As mentioned this "macro" calculation for Guam yields an approximate value of $2.8 billion in Gross Island Product (GIP) divided by 1.76 billion kWh, or $1.59 per kWh, many times higher than GPA's tariffs. For the US as a whole, the comparable figures for 2002 were GNP of $10.589 trillion and 683 billion MWh, for an approximate value of $1.5 per kWh.[12] However, when we look on a sector-by-sector basis, utilities carrying out such research found that the VOS was in fact a good deal higher for specific sectors than the figure suggested by this ratio.

Utilities conducting these studies were also cognizant that the VOS is not limitless. Customers with an extremely high VOS could always install on-site generation as a backup against the possibility that there might be outages more frequently than they would like. Such customers might include those where there would be substantial physical damage to production lines or equipment if utility service were unexpectedly dropped, such as semiconductor producers and plastics extrusion manufacturers.

VOS versus Outage Length. In that context, a number of utilities undertook VOS studies, generally designed to study outages that ranged from very short term (e.g., just a momentary outage or voltage sag) to several hours. At most, they evaluated outages lasting several days, rather than several weeks (as might occur with a typhoon), since such lengthy outages were virtually non-existent on their systems and the intent of such studies was to assess reserve margins and reliability, not to conduct disaster planning.

[12] GNP figures from the Financial Forecast Center at http://www.nealideas.com/data/index.htm

The utilities universally found that the longer the outage, the lower the VOS. This makes sense, since customers find ways to adapt to the lack of electricity over time, and many of the damages (e.g., spoiled food, lost production lines) would happen in the first few hours or day, and not continue to grow on a linear basis. In our study, we have reflected this by distinguishing between an outage from a typhoon lasting up to two weeks, and one lasting two weeks or more. We could certainly have selected a different time period, but this period coordinated well with the actually record of the length of outages after Typhoon Pongsona on the 10 corridors that we evaluated.

No Notice versus Notification. Several utilities studied the impact of advanced notice on VOS, and they found that the more notice of an impending outage, the lower a customer's VOS. With notice, customers are able to shut down equipment that might otherwise be damaged; move foodstuffs to areas that are more likely not to experience outages or purchase less perishable inventory; safely shut down production lines; purchase candles and other means of lighting and cooking; move office locations; etc.

In one of the major studies of commercial and industrial customers that evaluated the "notice" phenomenon, the utility found that for a one-hour outage, the total costs were about 60% of those when there was no notice.[13] Since typhoons are well-advertised events, we would expect the near-term VOS to be lower than for an outage that was not anticipated. However, for a long-term outage of more than a day, whether there was advance notice would not make much difference except in preventing direct equipment and inventory damage.

Methods for Measuring Impacts. In their studies, there are a number of ways in which utilities have measured the VOS. The overall choices are:

- *$/kWh unserved* - the lost value of production, damage to equipment, spoiled food, etc., divided by the kWh not provided during the outage period
- *$/kWh/annual energy consumption* - the economic impact over a short period of time, divided by the customer's total annual energy use
- *$/peak kW*- the impact of an outage on required utility reserves, assuming that the outage takes place at the time of peak consumption
- *$/event* – the cost of the outage, without dividing it by any other unit

For our analysis, the $/kWh unserved is the best measure to use for determining VOS, since it is the best measure for assessing the impact of an *extended* outage.

VOS versus Economic Activity. Since VOS is to a large extent a measure of the impact of the loss of power on economic activity, it makes sense that the lower the level of such activity, the lower the VOS. On the other hand, inflation tends to increase VOS as the value of goods and services rises over time.

Guam's economy has been struggling in recent years. For example:

- According to "Guam Comprehensive Economic Development Strategy", April 2003:
  - Civilian employment fell from 72,460 in March 1999 to 62,050 in March 2002
  - Unemployment ranged from 11% to 15% in the same period, much higher than the Mainland

[13] Sullivan, Vardell and Johnson, "Power Interruption Costs to Industrial and Commercial Consumers of Electricity", IEEE Journal, November/December 1997. This was a study of customers of Duke Energy.

- Overall Gross Island Product (GIP) fell from $3.08 billion and $3.02 billion in 1997 and 1998 to $2.72, $2.77, and $2.77 billion in 1999, 2000, and 2001
- Per capita income was $12,869 in 1999 and $12,579 in 2001, about half of the level on the Mainland[14]
- The Guam economy is vulnerable, being largely dependent on tourism (about 60% of the economy) and federal expenditures, primarily the military (about 30%).[15] Thus, the cancellation of 45,000 visits due to Typhoon Pongsona was estimated by the Guam Visitors Bureau to cause a direct revenue loss of $47 million, not including economic multipliers.[16]

In estimating the VOS on Guam, we directly take the level of economic activity into account. After estimating the VOS below based on other utilities' studies, we inflated those values at 3% over a ten year period to account for inflation and economic growth since the studies were completed, and then discounted them at the ratio of Guam's per capita income to that of the Mainland.

Methods for VOS Studies. In this project, resources were not available to carry out an independent analysis of the VOS on Guam. Based on other utility studies, it is clear that there are several ways to conduct such studies, and the approach tends to vary according to the type of customer.

- **Customer surveys** provide the tool that researchers and utilities most prefer for the evaluation of reliability. The simplest form of survey directly asks consumers to estimate the costs they incur for given outage conditions. For residential customers, this is the most common method. However, a direct survey may be a weak instrument, particularly for commercial and industrial customers, because impacts may be intangible and monetary losses difficult to identify.
- Two additional types of surveys attempt to help the respondent quantify the VOS.
- **The Preparatory Action Method** asks consumers to choose from a list the mitigating actions that they would take to avoid an outage of varying durations. The cost of the actions is used as the cost of the outage.
- **The Contingent Ranking Methodology** presents consumers with a set of possible electrical service plans. The choices vary in rates, number of outages and duration of outages. The consumer ranks the different plans, and from the ranking the consumer's preferences and VOS can be inferred.

These types of surveys ask questions that consumers are not used to answering, so their results are at best a rough estimate of consumer costs.

A final means of estimating VOS is through **Regression Analysis**, in which analysts try to predict the outage costs for customers who are not surveyed on site from information that is available from utility customer representatives. To do so, the customer representatives must supply information on such factors as the manufacturing process; the equipment used; the size of the enterprise; and the reserve capacity available on-site. This complements on-site information from other firms on the level of electricity used; the operating hours; the type of backup equipment, if

[14] Guam Economic Report, August 2001, Bank of Hawaii
[15] Guam Comprehensive Economic Development Strategy, April 2003, Page 37. This ratio is a reversal of the percentages in the year 1960, when 75% of the economy was military-based, and 20% was tourism.
[16] Guam Visitors Board, "Visitor Statistics", December 2002

any; and the products manufactured. In one study, the analysts found that their models of the costs of outages of one hour in duration could explain 50-60% of the variation in customer outage costs using information on customer size, operating processes and equipment. This approach cost just 20% of conducting on-site surveys with all customers.[17]

For residential customers in particular, the uses to which power is applied are relatively uniform – e.g., lighting, cooking, heating, appliances – and the variation in load and load pattern is not that high. Thus, it is easier to generalize about this customer category than any other. To determine VOS, utilities either carried out a small survey or estimated the losses that a customer would incur for short-term outages such as food spoilage, need to stay with friends or in a hotel, and the inconvenience of not having television or being able to recharge cell phones.

Such a study was carried out in North Carolina in December 2002 to identify the impacts of an ice storm which cut power availability to nearly 80% of the homes in 36 counties, and put people out of their homes for an average of three days.[18] This study found that the median estimate of the value of lost food was $100. Further, 47% of customers said they would be willing to pay extra (some more than $10 per month) on their monthly bill to bury the power lines to avoid such outages in the future.

There is much greater variation among commercial and industrial customers, reflecting the tremendous diversity of such consumers. For these customers, the categories of loss from a power outage can be numerous. For example, industrial customers may experience losses due to:

- The value of lost production and revenue lost
- Labor costs to restart production
- Labor costs to make up lost production (e.g., overtime, extra shifts)
- Material costs to restart production
- Damage costs to materials
- Damage costs to the physical plant
- Cost of reprocessing materials
- Cost to operate backup equipment

On the other hand, such customers can also experience savings from an outage due to:

- Value of wages unpaid during an outage
- Value of materials unused
- Value of fuel unused
- Scrap value of damaged materials[19]

Using the VOS survey methods described above, utilities asked businesses to estimate these costs.

Ranges of VOS. The table below provides a summary, using the $/kWh of unserved energy measure, for the VOS for different customer categories, that utilities have carried out over the past few decades. As mentioned, it is worth noting a) the wide diversity in VOS estimates, even within a customer category; b) the great differences between customer categories; c) the vintage of these studies (some more than a decade old); and d) the decline of the VOS the longer the outage.

[17] Sullivan, Vardell and Johnson, pp. 6-10.
[18] Press release "Ice Storm Cost More than Lost Power and Heat", Odum Institute, RTI, January 13, 2003.
[19] Sullivan, Vardell and Johnson, p. 2.

Exhibit Appendix 1-1
Value of Service - $/kWh Unserved

Utility	1 hour – no notice	1 hour – with notice	3 hours	24 hours	24 hours +
Residential					
Duke 1992	$5.71	$2.19			
Finnish 1977 ($99)	$1.80		$1.60	$0.90	$0.90
Commercial					
Duke 1992	$53.30	$24.50			
Finnish 1977 ($99)	$13.10		$15.10	$10.40	$9.10
Industrial					
Duke 1992	$9.00	$4.19			
Finnish 1977 ($99)	$8.20		$5.50	$2.90	$2.40
London Electricity (2000)			$20.00*		
All Customers					
Kariuki and Allan (2000)			$18.30**		

* This figure appears to be above the cost for installing on-site generation, and is likely too high
** Figure is for weighted average of consumption for all hours, not 3 hours

The Finnish study mentioned in the table above led to establishing an overall VOS for these customers of $3,800 per MWh for a one-hour outage, and $1,800 per MWh for outages of longer than 24 hours. When the Power Pool in England and Wales started in 1989, they used this study to establish a VOS (after including inflation) of $4,300 per MWh at the time, and have increased it using the retail price index ever since.

VOS Ranges Selected for Guam Analysis. Clearly, the range of numbers is wide, and may well depend on the methodology that the utilities used. Based on all the factors described in this appendix, we selected the following "base" numbers for our analysis to measure the VOS for customers of GPA:

- Residential - $2.00 per kWh in the first day, $1.00 thereafter.
- Commercial - $20.00 per kWh in the first day, $10.00 thereafter
- Industrial - $5.50 per kWh in the first day, $2.75 thereafter

As described above, however, the studies on which these numbers were based are about a decade old, and the numbers need to be adjusted for a region's economics strength. Using a ten-year growth of 3% and a Guam per capita income of about half of the Mainland, the final, adjusted numbers we used for VOS on Guam were:

- Residential - $1.30 per kWh in the first day, $0.70 thereafter.
- Commercial - $13.40 per kWh in the first day, $ 6.70 thereafter
- Industrial - $3.70 per kWh in the first day, $1.80 thereafter

Conclusion

Given the range of numbers and factors affecting the VOS, and the lack of resources to carry out a VOS survey on Guam, we have estimated these numbers for different sectors. Even if one takes issue with the exact numbers, it is clear that the commercial sector values power more highly than the industrial, which is in turn higher than the residential sector. Further, the VOS declines as the outage grows longer. It is possible to test the sensitivity of the benefit-cost analysis to the level of VOS.