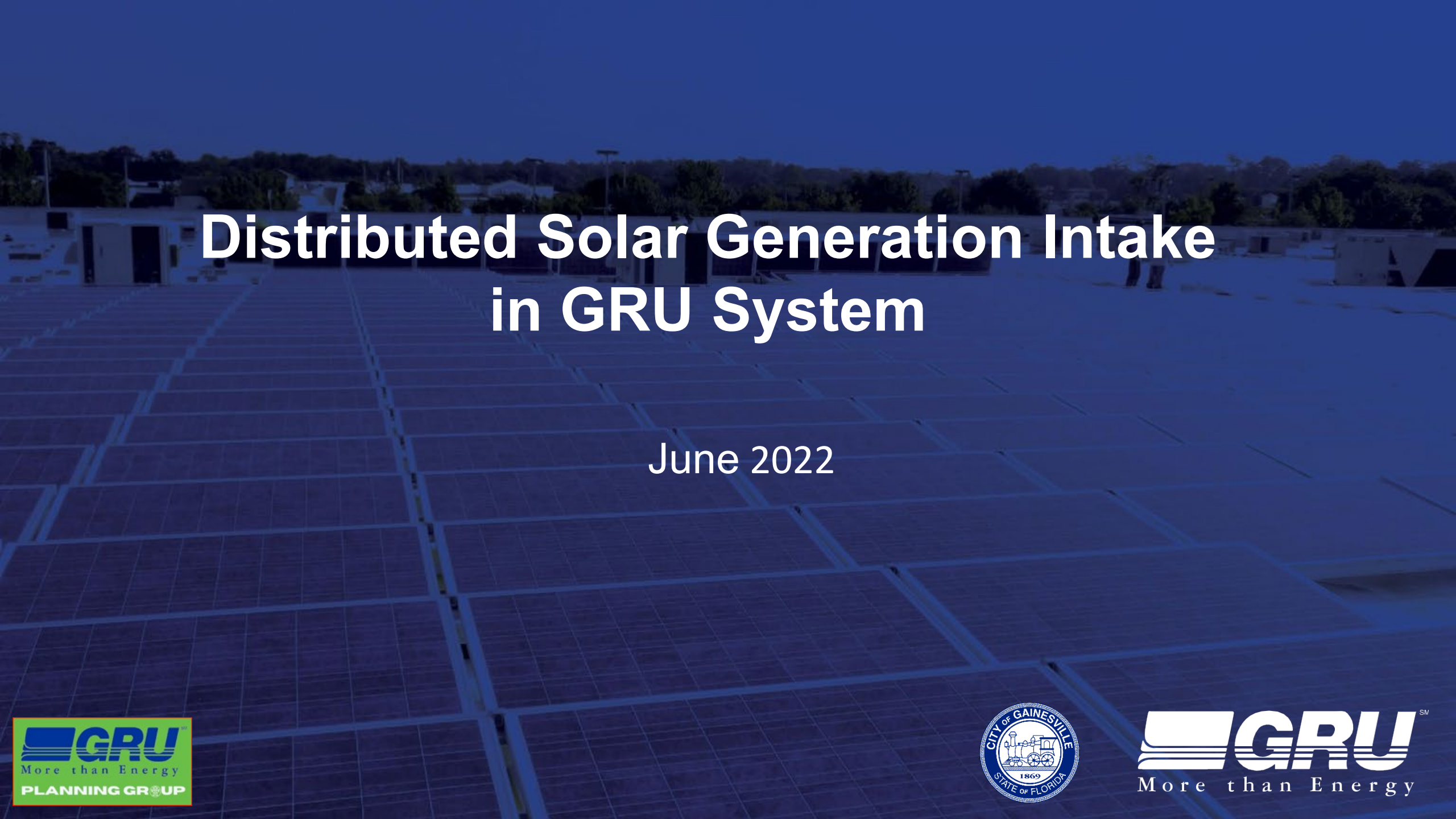

Distributed Solar Generation Intake in GRU System

June 2022

GRU More than Energy PLANNING GROUP

CITY OF GAINESVILLE STATE OF FLORIDA 1869

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Today's Discussion

1. **Why does GRU limit the total allowable connected Solar PV Generation to 2 MW (2,000 kW) per distribution circuit (feeder)?**

2. **What are the results of the third party Solar PV Hosting Capacity Study?**

3. **What are the legal requirements and limitations?**

4. **Conclusions**

1. Why does GRU limit the allowable connected total Solar PV Generation to 2 MW (2,000 kW) per distribution circuit (feeder)?

- **GRU Energy Delivery Service Guide – Section 8**
  - **<u>8.1 General</u>- (4) (e)** The maximum amount of PV generation (total aggregated output of all PV generation interconnected to GRU's system) that can be interconnected on any of GRU's feeders **shall not exceed 2 MW.**

1. Why does GRU limit the allowable connected total Solar PV Generation to 2 MW (2,000 kW) per distribution circuit (feeder)?

- **Based on a study that was performed in California approximately 11 years ago**
  - The California Commission's first iteration of Rule 21 was adopted in 1982. As initially adopted, Rule 21 was designed to meet the needs of small, non-utility-owned generating facilities, namely qualifying facilities, which included renewable, non-renewable, and cogeneration plants as defined by the Public Utility Regulatory Policies Act

- **Example:** Target requested to add 900 kW to Serenola circuit (feeder) 936, which already had a total of 1.4 MW of Solar PV connected. The request was finally accepted after an impact study was completed by UF
  - Results indicated that the total amount of Solar PV that Target can add is 700 kW
  - Existing transformer needs to be upgraded to meet the 90% equipment criteria of the AC rating
  - With the addition of Target's Solar PV of 700 kW, the total Solar PV Generation Connected to circuit (feeder) 936 is now 2.1 MW
  - More than 2.1 MW will cause an overvoltage during lightly loaded scenarios

2. What are the results of the third party Solar PV Hosting Capacity Study?

- **Introduction**
  - Current Solar PV generation
  - Distributed Solar PV can affect circuit (feeder)
  - Challenges
- **Modeling and Analysis Criteria**
- **Results**
- **Applying analysis results to the GRU system**

2. What are the results of the third party Solar PV Hosting Capacity Study?

- **Introduction: Current Solar PV generation at the distribution grid**

2. What are the results of the third party Solar PV Hosting Capacity Study?

- **Introduction:**

Challenges

- The existing GRU distribution system was designed to serve load and regulate voltage radially
- The system was not designed for bi-directional flow associated with generation or frequent large power fluctuations

Modeling and Analysis Criteria:

- Study included **64** distribution Feeders

Distributed Solar PV can affect

- Primary wires cable (main feeder, laterals)
- Loads (residential, commercial, industrial)
- Voltage regulation
- Protective devices (fuses, circuit breakers, relays, reclosers)
- SCADA EMS
- System Fault Current
- Power Flow (Reverse Power Flow)

2. What are the results of the third party Solar PV Hosting Capacity Study?

- **Modeling and Analysis Criteria:**

Modeling Criteria

- Settings from GRU system
- Voltage and imbalance
- Max Reserve Power Flow
- Thermal Capacity/Loading Limits

Incremental Hosting Capacity Analysis

- Section by section hosting capacity for load and generation
- Determined the maximum Solar PV or load that can be added to a section of circuit (feeder)
- Reviewed GRU distribution system constraints such as loading, high voltage, low voltage, delta voltage, and reverse flow

2. What are the results of the third party Solar PV Hosting Capacity Study?

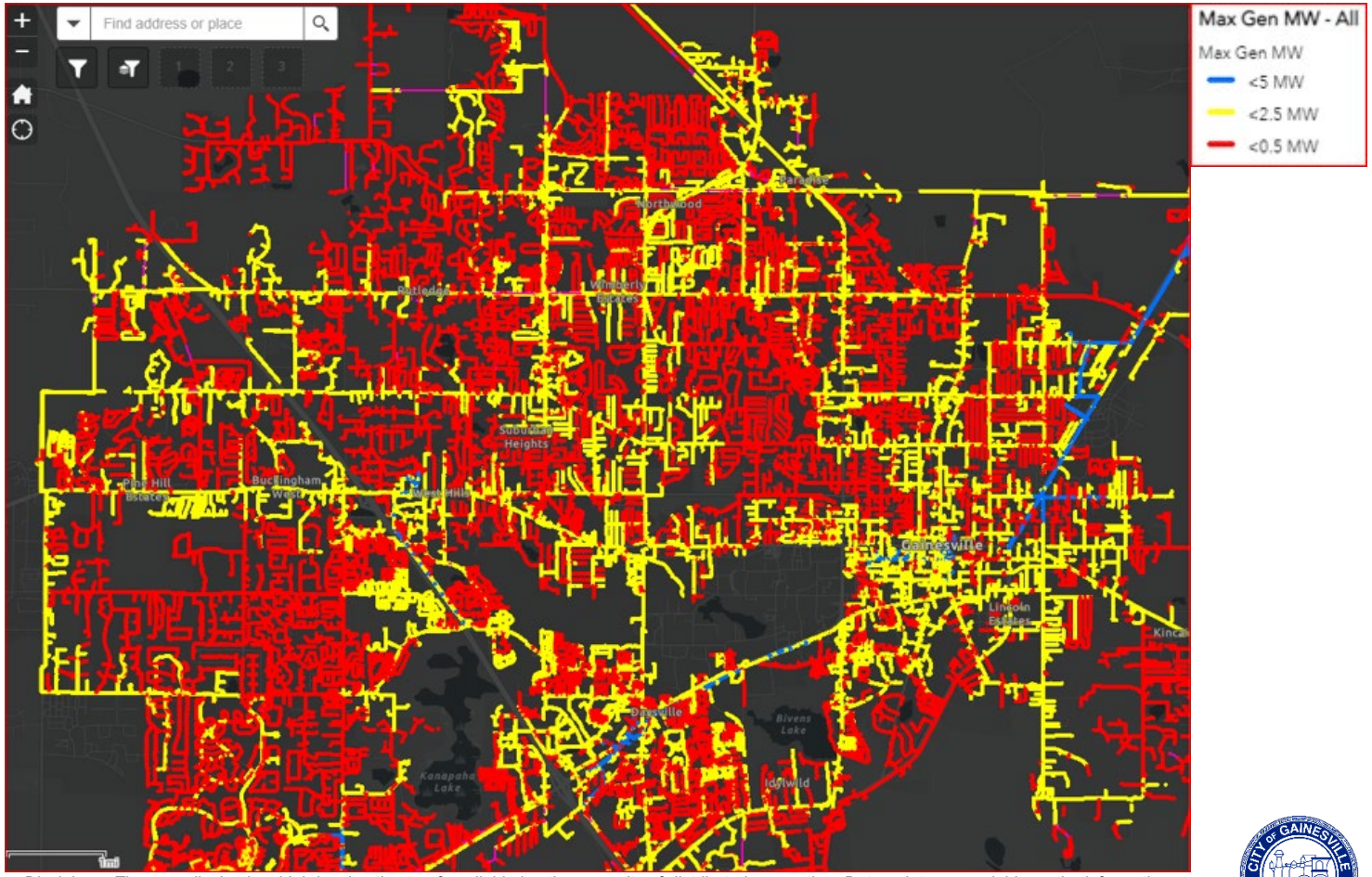
- **Results: Two Substation examples**

Substation Name	Transformer Name	Transformer Nameplate (MVA)	Circuit (feeder) #	Max Allowable Generation (MW)
KELLY WEST	T-30	33.6	280	-4.70
			282	3.19
	T-29	56	285	0.83
			286	1.97
			287	2.02
			288	1.01
			289	1.17

Substation Name	Transformer Name	Transformer Nameplate (MVA)	Circuit (feeder) #	Max Allowable Generation (MW)
IRONWOOD	T-411	33.6	1431	2.55
			1432	4.17
			1433	1.44

2. What are the results of the third party Solar PV Hosting Capacity Study?

- **Applying analysis results to the GRU system**



Disclaimer: The map display is a high-level estimate of available hosting capacity of distributed generation. Data points are variable as the information is continuously changing and may not be accurate. The map is being provided for informational purposes only.

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3. What are the legal requirements and limitations?

- Section 366.91(6), Florida Statutes, requires the City to develop a standardized interconnection agreement and net metering program.
- Section 366.91(2)(d) defines net metering as a metering and billing methodology whereby customer-owned renewable generation **is allowed to offset part or all of the customer's electricity consumption on site.**
- Section 27-37, Gainesville Code of Ordinances, establishes City's net metering program
- Section 27-36, Gainesville Code of Ordinances, adopts the Energy Delivery Service Guide

3. What are the legal requirements and limitations?

- **City Ordinance, Sec. 27-37 – Net Metering**
  - (a) *Intent.* It is the intent of this section to promote the use of customer-owned renewable generation **to offset part or all of the customer's electric consumption.**
  - (b) *Net-metering program availability.* The net-metering program is only available to the city's electric customer's who have constructed or are willing to construct customer-owned renewable generation, **at no cost to the city**, and are willing to execute an interconnection agreement in form and substance as provided by the city.

3. What are the legal requirements and limitations?

- **The GRU Energy Deliver Service Guide**
  - Energy Delivery Service Guide, Section 8, establishes the process and requirements for Solar PV interconnection
  - Section 8 is designed to protect GRU's distribution system while allowing solar interconnection as appropriate. Any studies or upgrades to GRU's transformers or distribution are at the expense of the customer-owned renewable generator.
  - Section 8 is consistent with the city code, and the Florida Statutes as interpreted by the Florida Public Service Commission
  - GRU Service Guide is a living document

Benchmarking GRU with utilities' best practices

- Jacksonville Electric Authority (JEA)
- Orlando Utility Commission (OUC)
- Florida Power & Light (FPL)
- Ocala Electric Utility (OEU)

2 MW Max

4. Conclusions

1. GRU Energy Delivery Service Guide follows utilities' best practices, City Ordinance, and PSC rules to allow PV solar in distribution circuits (feeders)
2. The Solar PV hosting capacity results indicated that some circuits (feeders) can only host <2.0 MW and some can host >2.0 MW
   - The customer must pay for an impact study to ensure that other customers and GRU equipment will not be negatively impacted. In addition, if it is determined that utility distribution system upgrades are required to connect the additional solar PV, the customer/developer must bear the upgrade expenses
3. Perform distribution planning study and hosting capacity study every 3 years
4. The 2019 ACE Study estimated a system hosting capacity between 40 and 75 MW of Solar PV Generation due to GRU's present dynamic generation capacity/recovery resources and NERC requirements of the Balancing Authority.

Q&A

Thank You

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Additional slide

1. Why does GRU limit the allowable connected total Solar PV Generation to 2 MW (2,000 kW) per distribution circuit (feeder)?

GRU Energy Delivery Service Guide – Section 8

- *Page 93 | **8.1 General - 4) (a)** Approval for interconnecting a proposed PV generator to GRU's electric distribution system will normally be granted if the aggregated PV generation does not exceed 15% of a protected line section's annual peak load as determined by GRU. The calculated amount of PV generation is based on the DC rating of the PV system.*
- *Page 93 | **8.1 General - 4) (b)** If the proposed PV generation causes the protected line section to exceed the 15% aggregated limit, then approval will not normally be granted. At the generator owner's request, GRU could initiate a system study funded by the generator owner to determine the possible impacts of the proposed generation to GRU electric distribution circuit. The review will take into consideration operation and engineering factors.*
- *Page 93 | **8.1 General – 4) (c)** If review of the PV installation determines that GRU's distribution system will be adversely impacted the approval of the project will be denied unless acceptable mitigation solutions are possible as determined by GRU.*
- *Page 93 | **8.1 General – 4) (d)** Net metering shall mean a metering and billing methodology whereby renewable generation is allowed to offset part or all of the onsite electricity consumption. Generation that is sized to exceed the customer's on site energy consumption will not be considered a net metering installation. The generation will be considered to be oversized if the kW DC rating of the PV generation is more than the average annual single account, on-site consumption (kWh) divided by 1393. (Note: Approximately 1 kW DC of PV generation will produce approximately 1393 kWh AC per year.) Also, the generation DC rating cannot exceed 90% of the utility transformer AC rating. In no event shall PV generation greater than 2 MW DC, at any one site, be allowed to interconnect under the net-metering program.*
- *Page 94 | **8.1 General- 4) (e)** The maximum amount of PV generation (total aggregated output of all PV generation interconnected to GRU's system) that can be interconnected on any of GRU's feeders **shall not exceed 2 MW.***

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