

# NERC

NORTH AMERICAN ELECTRIC  
RELIABILITY CORPORATION

# GADS Solar Concepts

For GADS Solar reporting starting 2024

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GADS Solar Training  
Q4, 2023

**RELIABILITY | RESILIENCE | SECURITY**



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- Part 1 – Data Reporting Overview
- Part 2 – Configuration Data
- Part 3 – Performance Reporting
- Part 4 – Event Reporting
- Part 5 - Resources



- **Part 1 – Data Reporting Overview**
  - DRI Introduction
  - Reporting deadline concept (DRI Chapter 1)
  - Reporting file formats
  - Initial reporting deadlines
- Part 2 – Configuration Data
- Part 3 – Performance Reporting
- Part 4 – Event Reporting
- Part 5 - Resources



## **Generating Availability Data System (GADS) Solar Data Reporting Instructions (DRI)**

Who must report?

NERC registered entities with *Generator Owner* function

Solar plant with minimum 20 MW (100 MW in 2024)

What will be reported?

Configuration data

Performance data

Event data

[https://www.nerc.com/pa/RAPA/PA/Section1600DataRequestsDL/2024\\_GADS\\_Solar\\_DRI.pdf](https://www.nerc.com/pa/RAPA/PA/Section1600DataRequestsDL/2024_GADS_Solar_DRI.pdf)

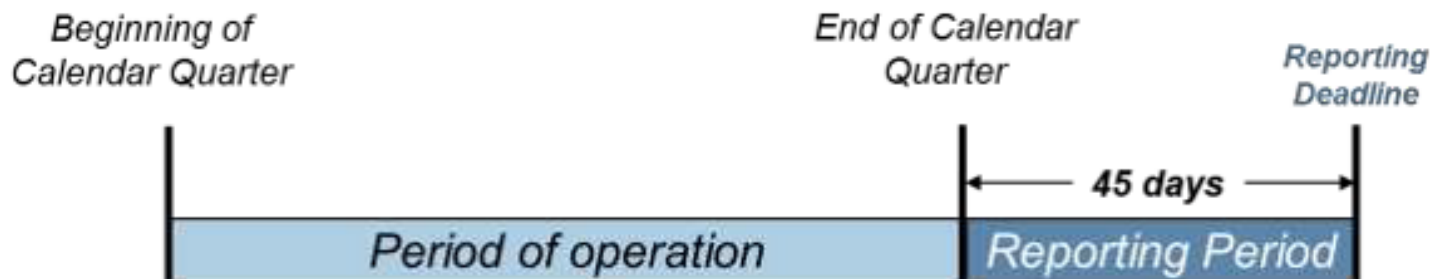


## History

- Conventional GADS – Since 1982
- Wind GADS – Since 2018
- 2018-2022 – GADS Solar Section 1600 process / board approval
- 2023 – Application Development / Training

## Phased-in Approach

1. Year one (2024) – Plants with a Plant Total Installed Capacity of 100 MW or more
2. Year two (2025) – Plants with a Plant Total Installed Capacity of 20 MW or more



**Figure 1.1: Timeline of Reporting Deadline**



- **Accepted file formats:**
  - XML or Excel based XML templates
- **Configuration Files:**
  - Configuration data **MUST** be imported before Event or Performance data imports
    - Plant
    - Inverter Group
    - Energy Storage Group
- **Performance Files**
  - Inverter Group
  - Energy Storage Group
- **Event Files**
  - Plant

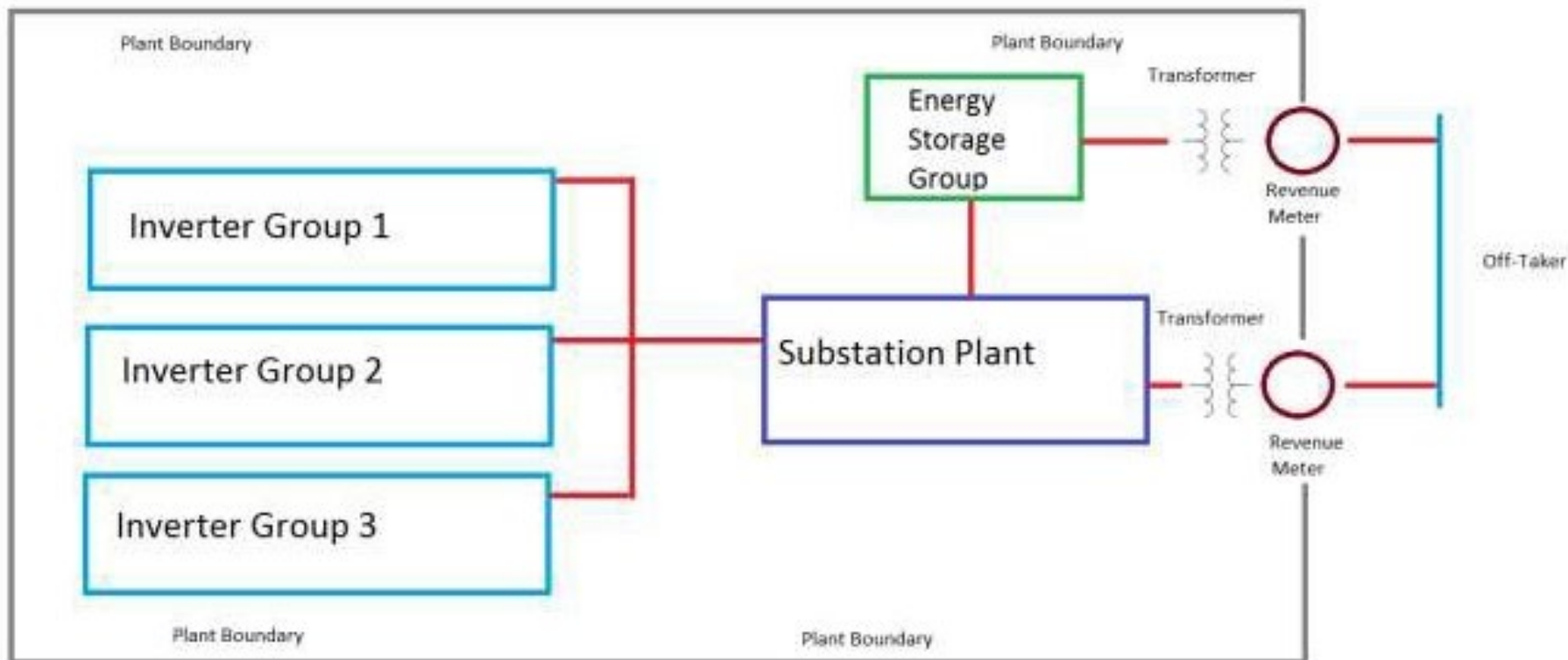


- **Configuration Files:**
  - August 15, 2024: Initial configuration files due
  - Configuration data **MUST** be imported before Event or Performance data imports
- **Performance Files**
  - August 15, 2024: Q1 and Q2 data due
- **Event Files**
  - August 15, 2024: Q1 and Q2 data due

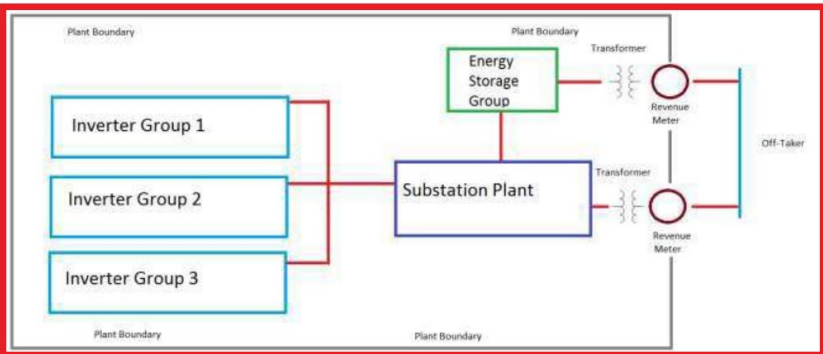




- Part 1 – Data Reporting Overview
- **Part 2 – Configuration Data**
  - Plant configuration data
    - Design data reported only once – at time of commercial operation ( or entry of plant configuration data in system)
  - Inverter Group configuration data
    - Design data reported once at Commercial Date, then at time of any changes to configuration
  - Energy Storage Group configuration data
    - Design data reported once, at time of commercial operation
- Part 3 – Performance Reporting
- Part 4 – Event Reporting
- Part 5 - Resources



**Figure 2.1: Example of Solar Plant Layout**

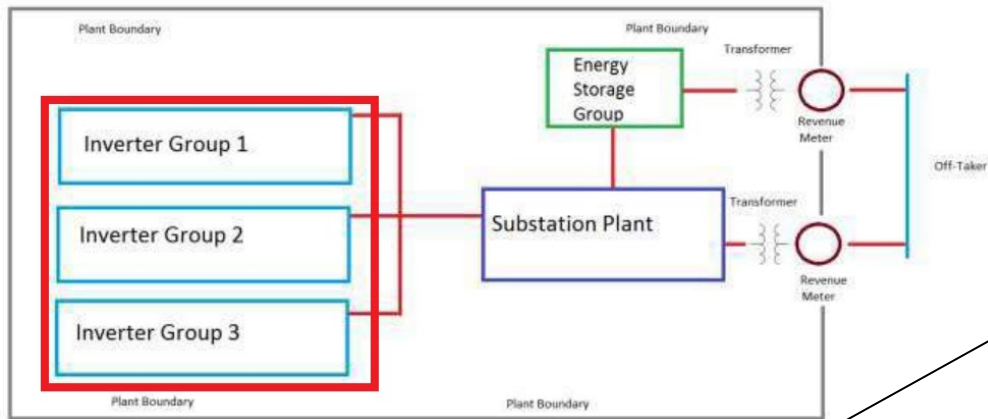


Plant Identifiers  
Plant Attributes  
Plant Tracking

Entity ID
Region
Plant ID
Plant Name
EIA Plant Code
ISO Resource ID
Country
Nearest City
State/Province
Time Zone
Plant Location Latitude
Plant Location Longitude
Elevation (m)
Solar Regime Environment
Global Horizontal Irradiance(kWh/m^2)
Inter-Annual Variance of Irradiance (%)
Plant Capacity at POI
On-site connected Energy Storage
Plant Ownership Status
Plant Effective Date
Plant Transfer to Entity ID

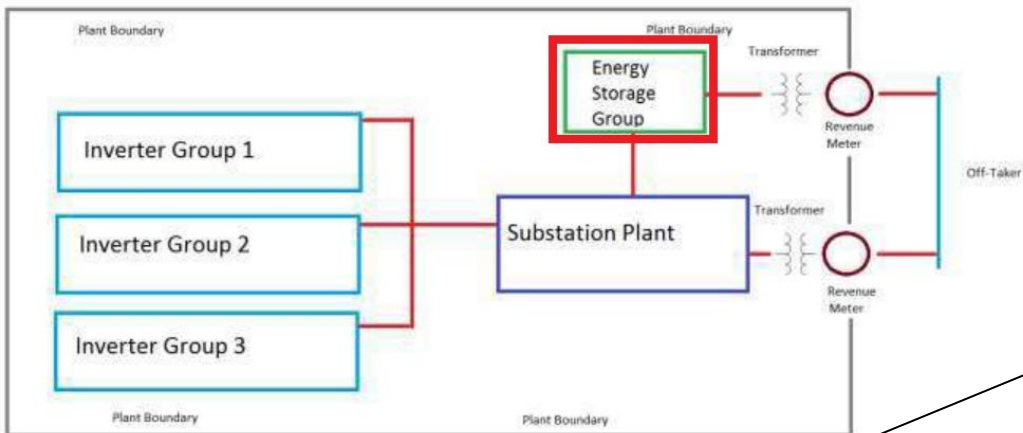


# Part 2: Inverter Group Configuration



Inverter Group Identifiers  
Inverter Group Attributes  
Inverter Group Tracking

Field Name
Entity ID
Plant ID
Inverter Group ID
Inverter Group Name
Commissioning Date
Inverter Group Installed Capacity (Single Inverter System Capacity * Number of Inverters) MW
Total Number of Inverters for Inverter Group
Single Inverter System Capacity (MW)
Single Inverter AC Nameplate (MW)
Inverter Manufacturer
Inverter Model
SCADA Manufacturer
SCADA Model
DC Input Type
Aggregate DC to AC Field Capacity Ratio
Panel Tracking Type
Panel Tilt Angle (degrees)
Minimum Irradiance (W/m^2)
Stowing Wind Speed (m/s)
Minimal Operating Temperature (C)
Maximum Operating Temperature (C)
Temperature Coefficient (%/degree C)
Nameplate Panel Efficiency (%)
Inverter Ownership Status
Inverter Effective Date
Inverter Transfer to Entity ID



Energy Storage Identifiers

Energy Storage Attributes

Energy Storage Tracking

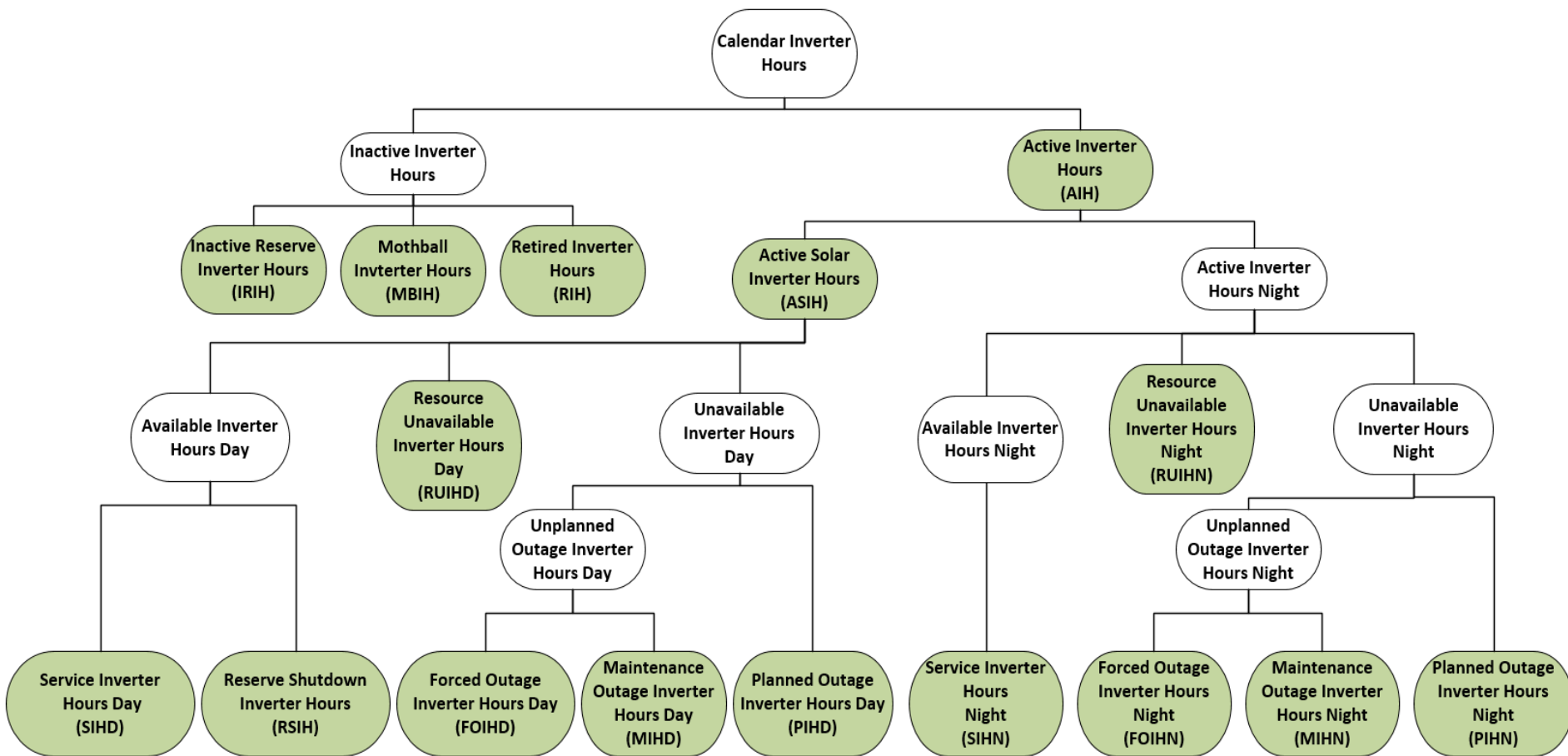
Field Name
Entity ID
Plant ID
Energy Storage Group ID
Energy Storage Group Name
Energy Storage Group EIA Code
Energy Storage Group ISO ID
Energy Storage Type
Energy Storage Capacity (MW) (Nameplate Capacity)
Energy Storage (MWh) (Nameplate Energy Capacity)
Energy Storage Connection (AC or DC)
Energy Storage Chargeable from Grid (Yes/No)
Energy Storage Manufacturer
Energy Storage Model
Storage Group Commissioning Date
Energy Storage Inverter Manufacturer
Energy Storage Inverter Model
Storage Group Ownership Status
Storage Group Effective Date
Storage Group Transfer to Entity ID



- Part 1 – Data Reporting Overview
- Part 2 – Configuration Data
- Part 3 – **Performance Reporting**
  - Inverter Hours
  - Inverter Group Performance
  - Energy Storage Group performance
- Part 4 – Event Reporting
- Part 5 - Resources

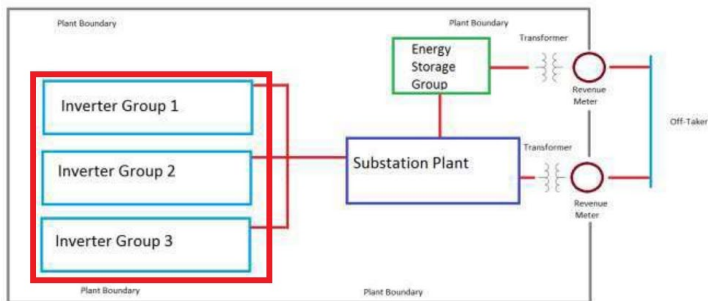


*Inverter Hours = Number of Inverters \* Hours*





# Part 3: Inverter Group Performance



Inverter Group Identifiers

Capacity & Generation measures

Summed Inverter Hours

Inactive Inverter Hours

Daytime Inverter Hours

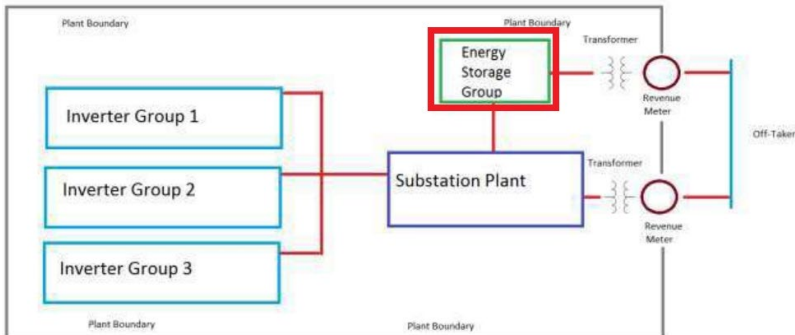
Nighttime inverter hours

Field Name
Entity ID
Plant ID
Inverter Group ID
Report Period (month)
Report Year
Inverter Group Availability Status
Gross Actual Generation (GAG) (MWh)
Net Actual Generation (NAG) (MWh)
Net Maximum Capacity (NMC) (MW)
Monthly Plane of Array (MWh/m <sup>2</sup> )
Performance Ratio
Expected Generation (MWh)
Active Solar Inverter Hours
Active Inverter Hours
Inactive Reserve Inverter Hours
Mothballed Inverter Hours
Retired Unit Inverter Hours
Service Inverter Hours Day
Reserve Shutdown Inverter Hours
Forced Outage Inverter Hours Day
Maintenance Inverter Hours Day
Planned Inverter Hours Day
Resource Unavailable Inverter Hours - Day
Service Inverter Hours Night
Forced Outage Inverter Hours Night
Maintenance Inverter Hours Night
Planned Inverter Hours Night
Resource Unavailable Inverter Hours - Night





# Part 3: Energy storage performance

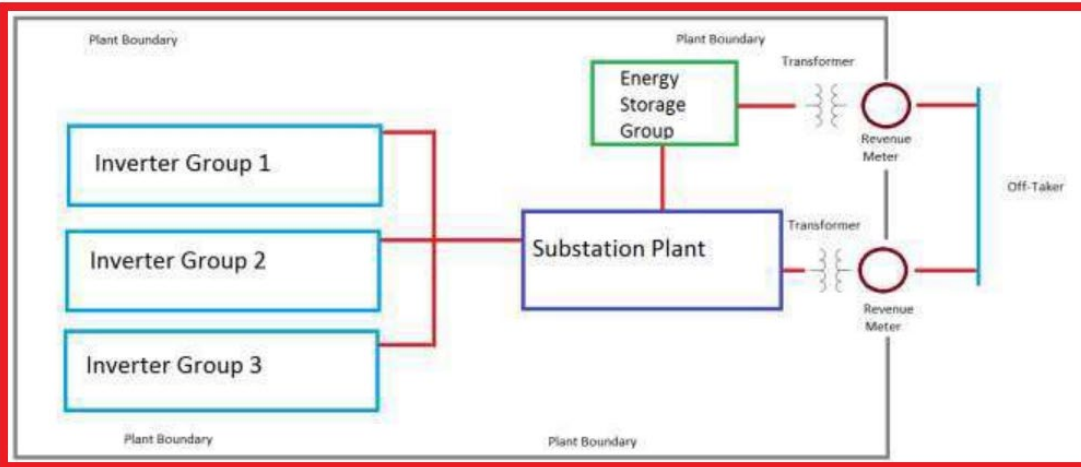


Energy Storage Group Identifiers  
Generation Measures  
Hours

Field Name
Entity ID
Plant ID
Energy Storage Group ID
Report Month (month)
Report Year
Storage Availability Status
Charge Generation (MWh)
Discharge Generation (MWh)
Charging Hours
Discharging Hours
Forced Outage Hours
Maintenance Outage Hours
Planned Outage Hours

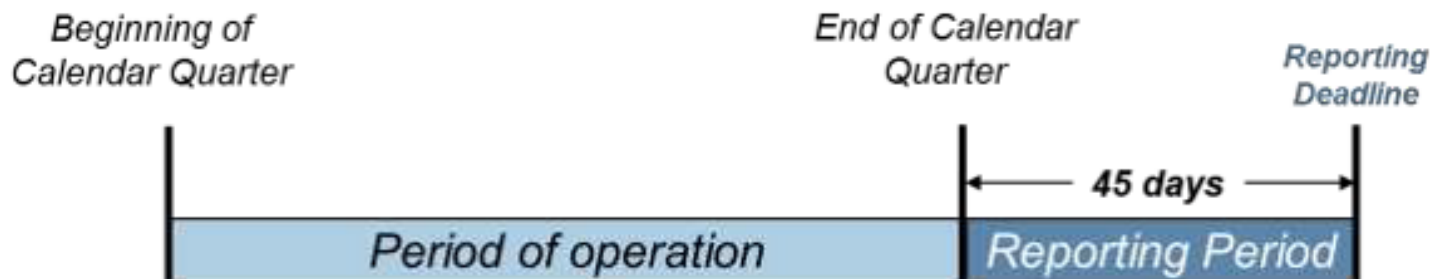


- Part 1 – Data Reporting Overview
- Part 2 – Configuration Data
- Part 3 – Performance Reporting
- **Part 4 – Event Reporting**
  - Plant level event reporting
    - When to report new events: any event happening after commercial operating date of the plant, or portion of the plant
    - Start/End thresholds
    - Potential Production MWh Loss – equipment out of service
    - Cause code vs contributing operating conditions
    - Examples
- Part 5 - Resources



Event Identifiers  
 Event Start/End  
 Event Attributes  
 Event Measures

- Entity ID
- Plant ID
- Event ID
- Time Zone
- Event Start Date/Time
- Event End date/Time
- Event Type
- Cause Code
- Contributing Operating Condition
- Description
- Potential MWh Production loss



**Figure 1.1: Timeline of Reporting Deadline**

## New Plants:

- Input configuration data first!
- Report any event happening after commercial operating date of the plant, or portion of the plant
- Follow reporting period calendar for reporting to NERC

Event Start Date/Time
Event End date/Time

- Event Start:

- An event starts when there is a loss of at least 20 MW of Plant Total Installed Capacity due to a forced outage.

- Event End:

- 95% of the Plant Total Installed Capacity that was unavailable due to the forced outage event has been returned to service.

AND

- Less than 20 MW of Plant Total Installed Capacity is unavailable due to a forced outage. (Plants over 400 MW)
- Reduction in Plant Total Installed Capacity due to reserve shutdown, inactive states, planned outages, and maintenance outages are not considered part of forced outages



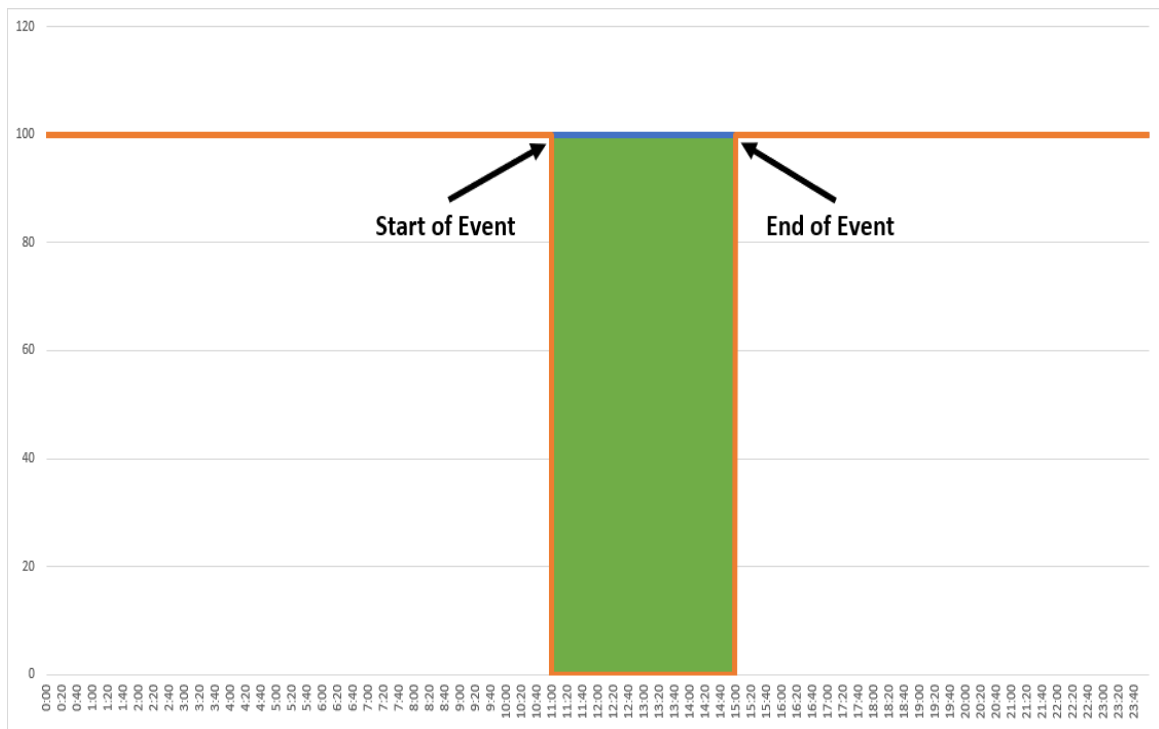
## Potential MWh Production loss

- Potential Production MWH Loss
  - The sum of the capacity lost due to forced outage(s) in all intervals during the event period - the MW loss during an interval multiplied by the duration of an interval.
  - The duration of the interval used to calculate Potential Production MWH Loss should be at the finest granularity available, the maximum observation interval should not exceed 5 minutes.



Cause Code
Contributing Operating Condition

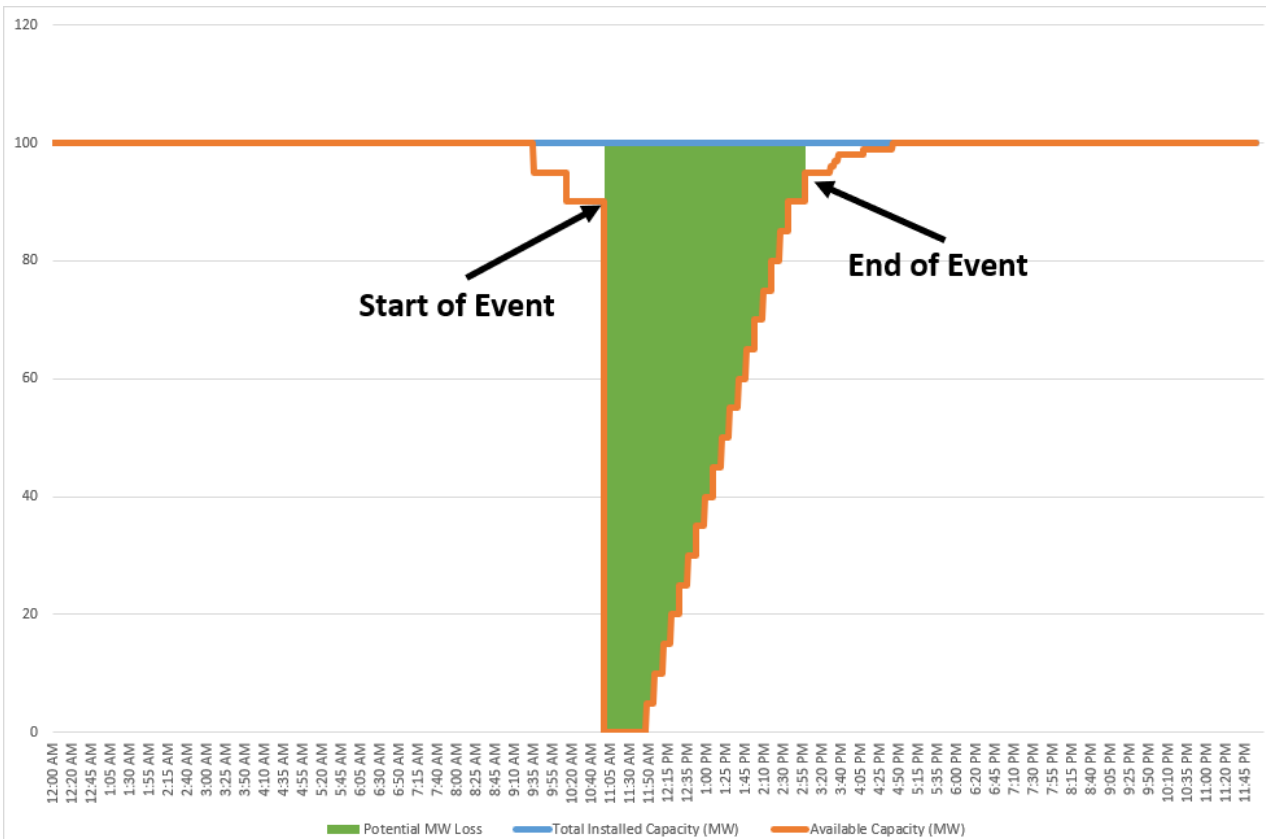
- Event Cause Codes
  - Cause codes indicate the equipment that has caused the outage. This could be equipment related or personnel related.
  - ***“What went out?”***
- Contributing Operating Condition
  - A required field for event reporting. It provides context for the conditions that led to the event or outage.
  - Will be used in analysis of events to distinguish the failure mode (“what failed”) from the failure mechanism (“conditions under which it failed”).
  - Does not take the place of the Cause Code but complements the overall detail and cause of the event.
  - ***“Was there any special circumstance that spurred the event?”***



*Report format  
still under  
development*

Entity ID	Plant ID	Event ID	Time Zone	Event Start Date/Time	Event End Date/Time	Event Type	Cause Code	Contributing Operating Condition	Description	Potential MWh Production Loss
1234	5678	18	CPT	11:00	15:00	FO	23612	0	remote power plant went out, causing grid disturbance, where protection devices tripped.	400



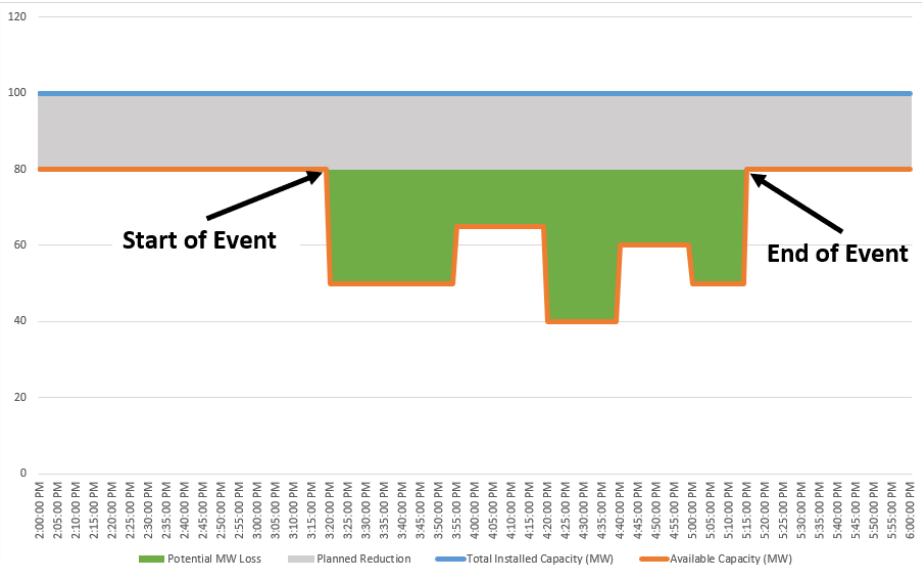


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still under  
development*

Entity ID	Plant ID	Event ID	Time Zone	Event Start Date/Time	Event End Date/Time	Event Type	Cause Code	Contributing Operating Condition	Description	Potential MWh Production Loss
1234	5678	22	CPT	11:00	15:00	FO	25050	9	Cold weather shut down inverters, however, Inverter settings were out of date. Updates allow inverters to run in colder weather. Installed updated settings on each inverter one at a time	240.83



# Part 4: Event Example 3 Multiple Inverter Outages during Planned Outage

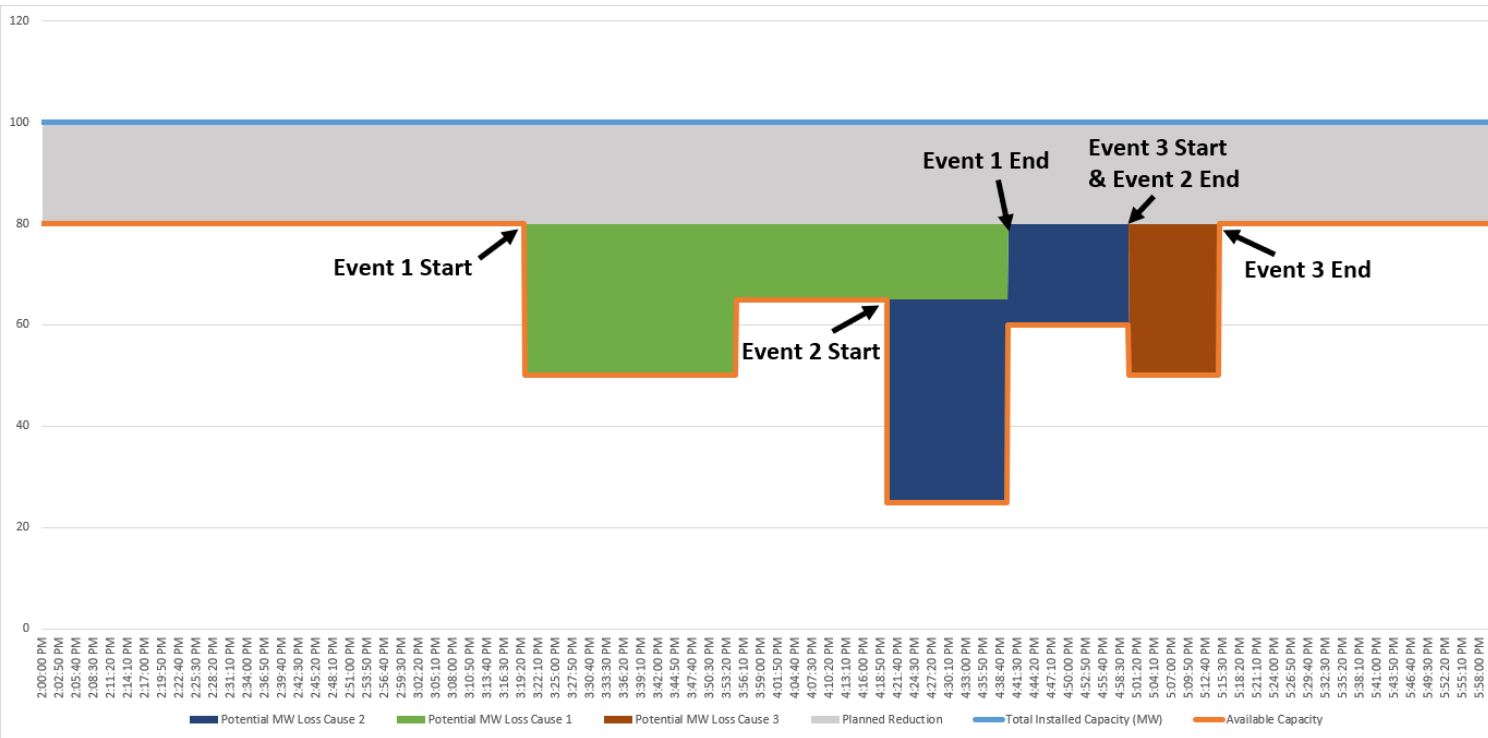


*Report format still under development*

Primary Cause Code	Entity ID	Plant ID	Event ID	Time Zone	Event Start Date/Time	Event End Date/Time	Event Type	Cause Code	Contributing Operating Condition	Description	Potential MWh Production Loss
24050	1234	5678	45	CPT	6:20	8:10	FO	24050	0	Section 1 had several inverter rows overheat. During repairs Section 2 had Cooling failure. While those were being repaired, Section 3 had a short circuit in a cabinet which resolved itself quickly.	51.25
25080	1234	5678	45	CPT	6:20	8:10	FO	25080	0	Section 1 had several inverter rows overheat. During repairs Section 2 had Cooling failure. While those were being repaired, Section 3 had a short circuit in a cabinet which resolved itself quickly.	51.25
25110	1234	5678	45	CPT	6:20	8:10	FO	25110	0	Section 1 had several inverter rows overheat. During repairs Section 2 had Cooling failure. While those were being repaired, Section 3 had a short circuit in a cabinet which resolved itself quickly.	51.25



# Part 4: Example 3b Multiple Inverter Outages during Planned Outage

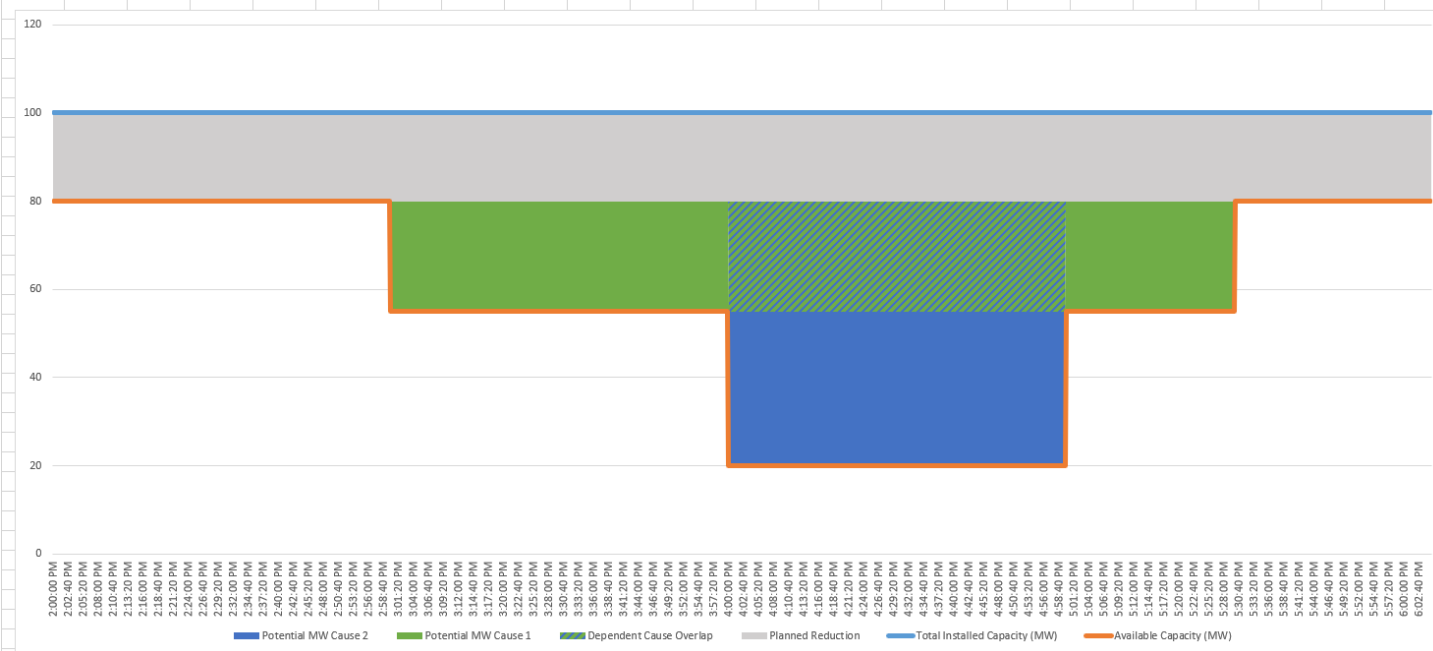


*Report format still under development*

Entity ID	Plant ID	Event ID	Time Zone	Event Start Date/Time	Event End Date/Time	Event Type	Cause Code	Contributing Operating Condition	Description	Potential MWh Production Loss
1234	5678	<b>45</b>	CPT	15:20	16:40	FO	<b>24050</b>	0	Section 1 had several inverter rows overheat.	28.75
1234	5678	<b>46</b>	CPT	16:20	17:00	FO	<b>25080</b>	0	Section 2 had Cooling failure.	15
1234	5678	<b>47</b>	CPT	17:00	17:15	FO	<b>25110</b>	0	Section 3 had a short circuit in a cabinet which resolved itself quickly.	7.5



# Example 4: overlapping outages/ events



*Report format  
still under  
development*

Entity ID	Plant ID	Event ID	Time Zone	Event Start Date/Time	Event End Date/Time	Event Type	Cause Code	Contributing Operating Condition	Description	Potential MWh Production Loss
1234	5678	<b>45</b>	CPT	15:00	17:30	FO	<b>24050</b>	0	Section 1 had several inverter rows overheat.	62.5
1234	5678	<b>46</b>	CPT	16:00	17:00	FO	<b>23600</b>	0	Transformer 2 failed, causing outage over large part of plant, overlapping some inverters already out due to Event 45	35

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NERC GADS page:

[https://www.nerc.com/pa/RAPA/gads/Pages/GeneratingAvailabilityDataSystem-\(GADS\).aspx](https://www.nerc.com/pa/RAPA/gads/Pages/GeneratingAvailabilityDataSystem-(GADS).aspx)

GADS Solar Data Reporting Instructions:

[https://www.nerc.com/pa/RAPA/PA/Section1600DataRequestsDL/2024\\_GADS\\_Solar\\_DRI.pdf](https://www.nerc.com/pa/RAPA/PA/Section1600DataRequestsDL/2024_GADS_Solar_DRI.pdf)

GADS Solar Training:

<https://www.nerc.com/pa/RAPA/gads/Pages/Training.aspx>

GADS User Group request: (first create ERO portal account, then email)

<https://eroportal.nerc.net/>

Email GADS Solar specific inquiries to: [gadssolar@nerc.net](mailto:gadssolar@nerc.net)

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# Questions and Answers