KPP Generating Cities Meeting

Larry Holloway & James Ging

November 4, 2022

KPP ENERGY

Overview

- Winter Preparedness
  - James Ging, Director of Engineering Services
- Performance-Based Accreditation
  - Larry Holloway, Assistant General Manager, Operations
- Availability Reporting for DNR Non-Market Units
  - Larry Holloway, Assistant General Manager, Operations

Winter Preparedness

How can we be prepared for the next event

Locally –

- Winterize to the best of our ability
- Exercise your units
- Keep plenty of Fuel Oil on hand
- Be available and prepared to generate 24/7 especially when grid conditions are challenged

KPP-

- We will be more aggressive in bringing up generation at level EEA1
- Good contact list
- Communicate SPP transmission status

SPP Resource Advisory

External Email Grid Notice: SPP is issuing a Resource Advisory effective at 2 p.m. CT Wednesday, Aug. 31, 2022

SP bounce-109023-205503@spplist.spp.org on behalf of Southwest Power Pool <commu

To SPP Grid Notice

Reply | Reply All | Forward

Wed 8/31/2022 12:29 PM

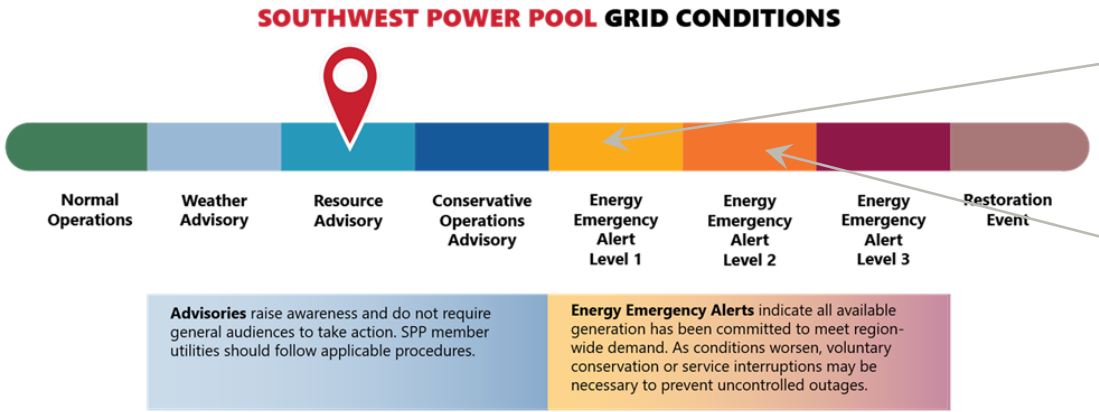
<=”” tdface="Calibri" color="Yellow" size="3">CAUTION: This email originated from outside of the SPP network. Do not click links or open attachments unless you recognize or can verify the sender, or were expecting an email from the sender. The original sender of this email is communication@spp.org

SPP is issuing a Resource Advisory for its entire 14-state Balancing Authority footprint in the eastern interconnection effective at 2 p.m. CT Wednesday, Aug. 31, 2022, with an anticipated end at 8 p.m. CT Wednesday, Aug. 31, 2022. **Resource Advisories do not require the public to conserve energy.**

This Resource Advisory is being declared due to high load, low wind and resource availability. As a result, the SPP Balancing Authority may use greater unit commitment notification timeframes, including making commitments prior to Day-Ahead Market and/or committing Resources in Reliability Status.

SPP issues Resource Advisories when extreme weather, significant outages, wind-forecast uncertainty and/or load-forecast uncertainty are expected in SPP's reliability coordination service territory. Generation and transmission operators have been provided instructions on applicable procedures, including to report any limitations, fuel shortages or concerns. SPP will send additional information if necessary. Resource Advisories do not require the public across our 14-state regional transmission organization (RTO) region to conserve energy. Individuals should contact their local utility for details specific to their area.

The following chart shows the relative severity of the Resource Advisory in effect from 2 p.m. CT Wednesday, Aug. 31, 2022, through 8 p.m. CT Wednesday, Aug. 31, 2022.



All BTM generation will be put online

Prepare for Non-Firm Load curtailment

Winter Preparedness

Fuel Oil Survey results
- All 11 generating cities responded
- 8 members have backup providers

Most seem to keep fuel on hand to generate a few days.
No member showed concern with their fuel oil vendors.

Consider keeping enough on hand to allow for transportation in extended event.
Consider long lines at the refinery.

Winter Preparedness

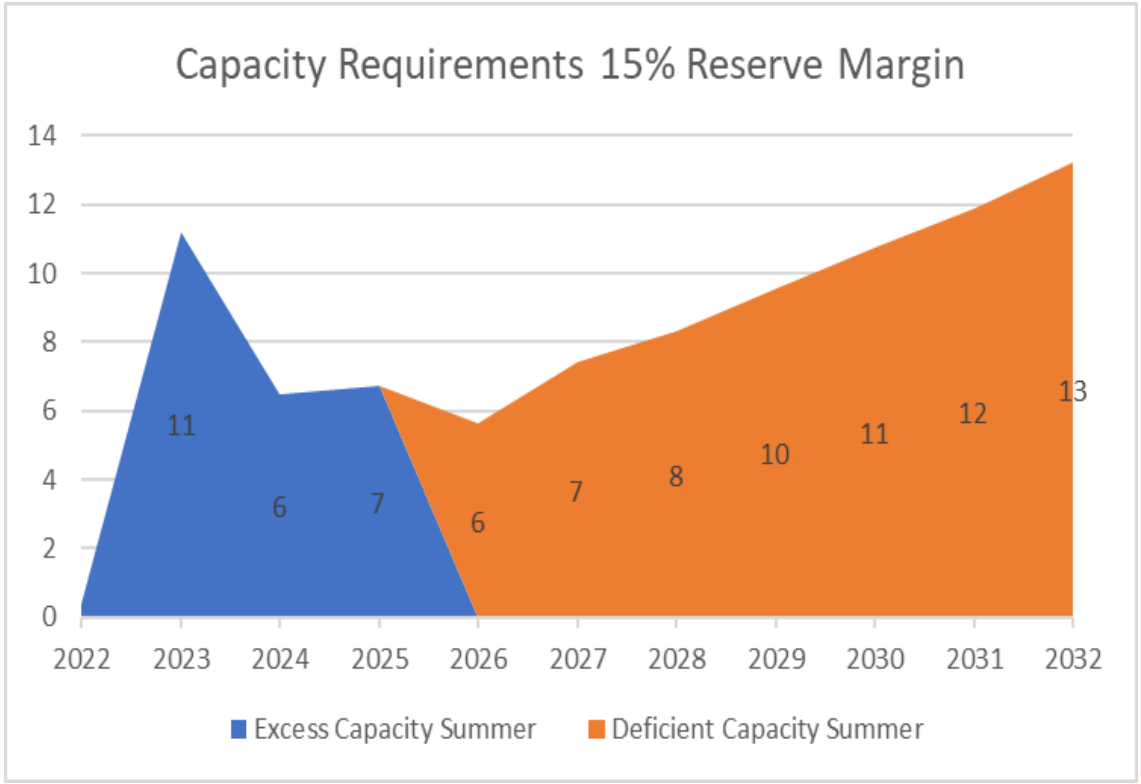
Primary Vendors

Hampel Oil
Great Bend CO-OP
Producers COOP
Lewis Oil Company
Farmers COOP
Robson Oil Co.
Mulvane COOP
Progressive Ag COOP
Security Oil

Secondary Vendors

Security Oil
Leiszler Oil Company
MFA Oil Company
Farmers Oil
Central Valley Ag
McAlister Oil Transport
Fleet Fuel

Resource Adequacy



2022- Wellington Steam plant, Loss of Mulvane Diesel

Performance-Based Accreditation

- Background
- NERC GADS
  - North American Electric Reliability Corporation Generation Availability Data System
- EFORd’
- Current proposals and implementation

Background

- There is growing concern about SPP's current thermal generation accreditation practices
  - Solar and Wind units are analyzed and accredited based on performance relative to peak hours
  - Thermal units are awarded accredited generation capacity based on testing every five years at temperatures within 10 degrees of design conditions
- Recent events have highlighted this concern
  - Retirements of thermal units
  - 2021 Winter Storm Uri events
  - Shortages of available generation during summer and shoulder months due to outages
  - Extended maintenance outages
- Other electric markets in the Midwest and Northeast have addressed this issue by integrating generation performance and availability into accreditation
  - These markets also have a capacity market and market participants sell and buy capacity in that market

Background (cont)

- SPP's groups working on performance-based accreditation
  - Improved Resource Availability Task Force (IRATF)
  - Supply Adequacy Working Group (SAWG)
  - Operating Reliability Working Group (ORWG)
  - Generation Testing Task Force (GTTF)
- There is broad consensus that the metrics to measure availability of conventional resources would be based on generation statistics
- NERC GADS is already in place for larger generation plants and NERC jurisdictional utilities to collect operating statistics for most conventional generating plants

NERC GADS

- GADS consists of very detailed generation reporting requirements
  - This is data originally developed by the electric industry itself under guidance of the Edison Electric Institute (EEI) in the early 1960s
  - GADS superseded the EEI data in 1982.
  - Today GADS is required for generating units subject to the NERC and 20 MW or larger
- GADS reporting requirements
  - Latest version (January 1, 2022) is 1130 pages long
  - It can be downloaded in pdf format at https://www.nerc.com/pa/RAPA/gads/DataReportingInstructions/2022_GADS_DRI.pdf

NERC GADS (continued)

- Types of GADS statistics you may be familiar with already
  - Capacity Factor (CF)
    - This is the MWH produced by a unit over a given period of time (usually a year) divided by the amount of energy the unit could have produced if it operated at 100 percent capability over the entire time period.
    - Example, a generating unit that has a capability of 1 MW produced 4,380 MWH over a period of 1 year (8,760 hours) CF = 4,380 / (8,760 hours * 1 MW) = 50%
  - Other common GADS statistics
    - Availability Factor (AF) - % of hours the unit was available to generate
    - Equivalent Availability Factor (EAF) - % of hours the unit was available to produce its rated capacity
    - Forced Outage Rate – Forced Outage Hours divided by hours the unit was in service and available (does not include planned outages or outages the were not the responsibility of the generator).

NERC GADS (continued)

- So what GADS statistic was adopted to track generation availability?
- In July 2022, the SPP BOD adopted EFORd' for generating units that do not currently report GADS statistics.
  - **Equivalent Forced Outage Rate demand (EFORd)**
    - This is a more complicated statistic to compile
    - EFORd attempts to track the hours a unit would have operated had it not been available due to a forced outage
      - For example, even if you needed the unit, it would not operate if out for planned maintenance – this would not be a "demand" period that you were out because of a forced outage

EFORd

$$\mathbf{EFORd} = \frac{\mathbf{FOHd + EFDHd}}{\mathbf{SH + FOHd}} \mathbf{x\ 100\%}$$

Where: FOHd = f x FOH
EFDHd = (EFDH – EFDHRS) if reserve shutdown events reported, or
= (fp x EFDH) if no reserve shutdown events reported – an approximation.
fp = (SH/AH)

NOTE: FOHd is the number of hours a unit was in a U1, U2, U3, or SF AND the unit would have operated had it been available. FOHd can be determined directly if periods of demand are recorded. Demand can be defined as the traditional demand for the generating unit for economic or reliable operation of the system, or it can be any other user-defined condition, such as specific weather condition, load level, or energy price. When FOHd is determined directly from recorded periods of demand, service hours (SH) in the above equation should include only those under the specified demand condition. If periods of demand are not recorded, FOHd may be estimated using the demand factor f. The demand factor is applicable to traditional demand for economic or reliable system operation.

$$f = \left(\frac{1}{r} + \frac{1}{T}\right) / \left(\frac{1}{r} + \frac{1}{T} + \frac{1}{D}\right)$$

r=Average forced outage deration = (FOH) / (# of FO occurrences)
D=Average demand time = (SH) / (# of unit actual starts)
T=Average reserve shutdown time = (RSH) / (# of unit attempted starts)

EFORd and EFORd’

For resources with at least 100 Service Hours per season:

$$EFORd = \frac{FOHd + EFDHd}{SH + FOHd}$$

For resources less than 100 Service Hours per season:

$$EFORd' = \frac{FOHd + EFDHd}{SH' + FOHd}$$

$$SH' = \left[\left(\frac{Actual\ Starts}{Attempted\ Starts}\right) * \left(\frac{Months\ of\ Operation}{4} * 100 - SH\right)\right] + SH$$

Why was EFORd' Adopted?

- The concern is that there are a lot of units that don't operate very often
  - How do you know it will actually work if it doesn't run often?
  - SPP compiled the following analysis based on the different equations

Weighted Average by Technology and fuel type for the summer season	Max Capacity (MW)	EFORd	EFORd'	EFOF	EFOF'
Coal	21,131	8.0%	7.9%	7.2%	7.5%
Nuclear	1,980	1.2%	1.2%	1.1%	1.3%
Gas (0-100 MW)	7,189	9.0%	7.1%	5.2%	5.5%
Gas (101+ MW)	11,983	11.1%	10.9%	7.8%	8.9%
Combined Cycles	9,441	3.3%	3.1%	2.8%	2.9%
Petroleum	1,053	12.0%	3.0%	2.4%	2.6%
Hydro	3,093	2.1%	1.9%	1.6%	1.7%

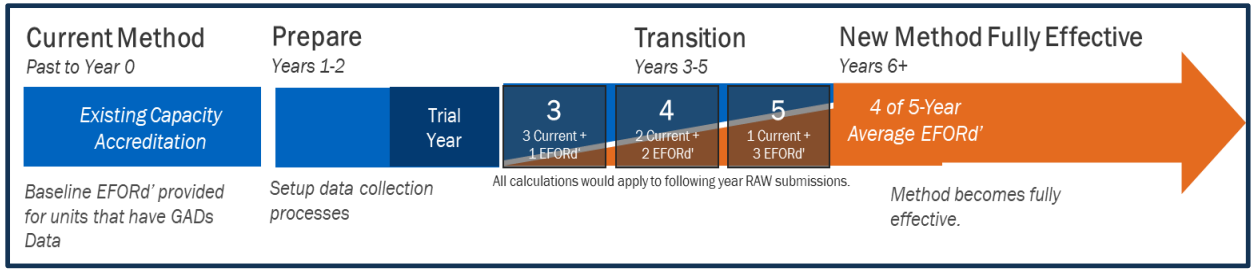
How will EFORd’ work?

- Basically, each unit, even our small DNR units, will track EFORd’
- The resulting EFORd’ number will be used to adjust the capacity we can use to meet our reserve margin
- For example, suppose we have a generator that has performed a capability test at 3 MW, but has an EFORd’ of 10%.
  - Today we would count that as 3 MW of capacity
  - With the move toward using EFORd’ as a performance adjustment that will change as follows
  - New Accredited capacity = 3 MW * (1 – 10%) = 2.7 MW.
- SPP has adopted a “shortened” reporting method for units that do not currently do GADS reporting.

Timetable and implementation

- The IRATF proposal was to collect data for the first two years – 2022 and 2023
- The worst year out of five would be disallowed
  - If you have a unit with a major outage in one year you can exclude that from your EFORd' calculation
- A five-year rolling average EFORd' is to be used to adjust capacity values
- The change would then be implemented over several years.

Proposed Timetable



Year	Period		Accreditation
2022	Prepare	Set up outage collection process Collect data	Current If problems w/ collection process, will need a default value to use.
2023	Prepare	Collect data	Current
2024	Transition	Collect data	[3 * Current (2023) + 1 * PBA (1 of 2, 2022-23)] / 4
2025	Transition	Collect data	[2 * Current (2024) + 2 * PBA (2 of 3, 2022-24)] / 4
2026	Transition	Collect data	[1 * Current (2025) + 3 * PBA (3 of 4, 2022-25)] / 4
2027	New Method	Collect data	PBA, best 4 of 5 (2022-26)

What will non-GADS reporting look like (proposed)?

EDST Plant Name	EDST Resource ID	Net Generating Capability (MW)	Year	Month	Hours from full forced outages	Number of full forced outage events	Hours from OMC full forced outages related to OMC	Equivalent derate Hours from partial forced outages	Equivalent derate Hours from partial forced outages related to OMC events	Attempted Starts	Actual Starts	Service Hours (SH)	Reserve Shutdown Hours (RSH)	Pumping Hours (PH)	Synchronous Condensing Hours (SCH)	Available Hours (Sum of SH, RSH, PH, SCH)
			2022	6												0
			2022	7												0
			2022	8												0
			2022	9												0
			2022	10												0
			2022	11												0
			2022	12												0
			2023	1												0
			2023	2												0
			2023	3												0
			2023	4												0
																0

Reserve Shutdown

- Reserve Shutdown(RS)
  - This is an event where a unit is available for load but is not synchronized due to lack of demand. *This type of event is sometimes referred to as an economy outage or economy shutdown*. If a unit is shut down due to any equipment related problems, whether or not the unit was needed by the system, report an Unplanned (Forced) Outage, Maintenance Outage, or Planned Outage. Do not report a Reserve Shutdown.
  - This is the common situation for our city units where they are available but are not being used for economic reasons.
  - Reserve Shutdown Hours (RSH) are hours in the reporting period when the unit is in reserve shutdown.
  - Note Reserve: Shutdown hours do not count against the unit, but they are not service hours (SH)
  - Reserve Shutdown may be used for maintenance work as long as the work can be stopped or completed in time to start the unit within a normal time frame.

Service Hours (SH)

- Service Hours (SH)
  - the number of hours the unit was synchronized to the system during the reporting period.
- Taken together Service Hours and Reserve Shutdown Hours show unit availability

Starts

- Service Hours (SH)
  - the number of hours the unit was synchronized to the system during the reporting period.
- Taken together Service Hours and Reserve Shutdown Hours show unit availability
- Attempted Starts are when you attempted to start the unit and it resulted in an actual unit start or start failure
- Start failure is when a unit fails to synchronize
  - Example: You attempt to start a diesel engine and find it won't start due to a missed procedure step. You correct the procedure step and start the unit and synchronize the unit – this is 1 actual unit start and 1 attempted start.
  - Example: You start a diesel engine but miss a step when attempting to synchronize the generator. You leave the engine running and repeat with the step and synchronize the generator – this is 1 actual unit start and 1 attempted start.
  - Example: You start a diesel engine but miss a step when attempting to synchronize the generator. The engine shuts down. You restart the engine and repeat with the step and synchronize the generator – this is 1 actual unit start and 2 attempted starts.
  - Note: actual and attempted starts do not count if the unit is being started as part of a testing procedure prior to considering it operable –such as part of returning from a planned or forced outage.

Outages -

- **Outage** - an outage exists whenever an active unit is not synchronized to the grid system and not in a reserve shutdown state.
- **Planned outage (PO)** - An outage that is scheduled well in advance and is of a predetermined duration, can last for several weeks, and occurs only once or twice a year.
- **Maintenance outage (MO)** - An outage that can be deferred beyond the end of the next weekend (defined as Sunday at 2400 hours or as Sunday turns into Monday), but requires that the unit be removed from service, another outage state, or Reserve Shutdown state before the next Planned Outage (PO)
- **Planned Outage Extension (PE)** – A planned outage extension as an extension of a Planned Outage (PO) beyond its estimated completion date.
- **Maintenance Outage Extension (ME)** – A maintenance outage extension as an extension of a maintenance outage (MO) beyond its estimated completion date.

Outages (Cont)

- **Startup Failure** - This is an outage that results when a unit is unable to synchronize within a specified startup time following an outage or reserve shutdown..
- **Unplanned (Forced) outage immediate (U1)** - This is an outage that requires immediate removal of a unit from service, another outage state, or a reserve shutdown state. This type of outage usually results from automatic control system trips or operator- initiated manual trips of the unit in response to unit alarms but can also occur while the unit is offline.
- **Unplanned (Forced) Outage Delayed (U2) -** This is an outage that does not require immediate removal of a unit from the in-service state, instead requiring removal within six hours. This type of outage can only occur while the unit is in service.
- **Unplanned (Forced) Outage Postponed (U3)** - This is an outage that can be postponed beyond six hours but requires that a unit be removed from the in- service state before the end of the next weekend (Sunday at 2400 or before Sunday turns into Monday). This type of outage can only occur while the unit is in service.
- **Outside Management Control Outages (OMC)** - There are outages from outside sources that can result in restricted generating capabilities or full outages in generating units.

Outside management Control Outage Examples

- These are outages that are outside the plant management control. The standard normally includes equipment or services that are “outside” of generating facility.
- Transmission limitations;
- Acts of nature such as ice storms, tornados, winds, lightning, etc.;
- Terrorist attacks, criminal activities, sabotage, etc.;
- Environmental limitations such as cooling pond levels, etc., that could not be prevented by operator action;
  - Note: this does not include plant environmental control equipment failure.
- Failure of fuel supplier to fulfill contractual obligations, such as firm gas transportation force majeure, etc.;
  - Note: this does not include fuel interruptions if interruptible fuel delivery is purchased.
- and Labor strikes, pandemics, etc;

- Basically, when the plant is not available for reasons unrelated to plant operator actions or plant equipment.

Outside Management Control Outages (Cont)

- Examples of OMC outages
- Ice storm takes out distribution circuits and transmission connections limiting output
- Transmission system limits generation operation
- Bad diesel provided by supplier

- Examples of outages that are NOT OMC
- Algae or moisture in diesel tank fouls fuel
- Equipment or operator failure in the plant
- Cooling tower freezes

Example

Generator performance in the month of June

- Generator rated at 3 MW capability
- Generator ran for 20 hours
- Starts were attempted 5 times, there was 4 actual starts
- I start failure required the unit to be repaired, this took 8 hours.
  - Of the 8 hours the unit was being prepared, it was fully unavailable for 6 hours and could have been ran at 50% for 2 hours
- The transmission system was being worked on so
  - The generator was told it could not operate for 16 hours and could only operate at 25% output for 8 hours
  - These were OMC outages
- The unit was removed from service for a planned maintenance outage for 24 hours

Calculating

- Hours in June = Period Hours for June = 720 hours
- 6 hours full forced outage
- 1 forced outage event
- Hours of full OMC outage = 16 hours
- 1 hour of equivalent derate hours from forced outage
  - 2 hours at 50%
- Equivalent Derate Hours from OMC = 8 * (1-25%) = 6 hours
- 5 start attempts 4 actual starts
- Service Hours = 20 hours
- Reserve Shutdown Hours =

Period hours =	720 hours
Minus force outage hours =	-6
Minus Equivalent derate forced outage	-1
Minus OMC outage hours	-16
Minus Equivalent OMC derate hours	-6
Service Hours	-20

- Total Reserve Shutdown Hours 671 hours

Filled out Form

EDST Plant Name	EDST Resource ID	Net Generating Capability (MW)	Year	Month	Hours from full forced outages	Number of full forced outage events	Hours from OMC full forced outages related to OMC events	Equivalent derate Hours from partial forced outages	Equivalent derate Hours from partial forced outages related to OMC events	Attempted Starts	Actual Starts	Service Hours (SH)	Reserve Shutdown Hours (RSH)	Pumping Hours (PH)	Synchronous Condensing Hours (SCH)	Available Hours (Sum of SH, RSH, PH, SCH)
		Capacity			FOH	#FO	OMC H	EFOH	OMC DH	AtS	AcS	SH	RSH	PH	SCH	AH
City	1	3	2022	6	6	1	16	1	6	5	4	20	671	0	0	691
			2022	7												0
			2022	8												0
			2022	9												0
			2022	10												0
			2022	11												0
			2022	12												0
			2023	1												0
			2023	2												0
			2023	3												0
			2023	4												0

What is the EFORd'?

Recall:

$$\mathbf{EFORd} = \frac{\mathbf{FOHd + EFDHd}}{\mathbf{SH + FOHd}} \mathbf{x\ 100\%}$$

Where: FOHd = f x FOH
EFDHd = (EFDH – EFDHRS) if reserve shutdown events reported, or
= (fp x EFDH) if no reserve shutdown events reported – an approximation.
fp = (SH/AH)

$$f = \left(\frac{1}{r} + \frac{1}{T}\right) / \left(\frac{1}{r} + \frac{1}{T} + \frac{1}{D}\right)$$

r=Average forced outage deration = (FOH) / (# of FO occurrences)
D=Average demand time = (SH) / (# of unit actual starts)
T=Average reserve shutdown time = (RSH) / (# of unit attempted starts)

$$EFORd' = \frac{FOHd + EFDHd}{SH' + FOHd}$$

$$SH' = \left[\left(\frac{Actual\ Starts}{Attempted\ Starts}\right) * \left(\frac{Months\ of\ Operation}{4} * 100 - SH\right)\right] + SH$$

The Calculation

Variable	Calculation Formula	Result
PH (period hours)	days of month * 24 hours/day DST	720.000
RSH	PH-FOH-EFOH-OMC H - OMCDH - SH	671.000
AH	SH + RSH + PH +SCH	691.000
r	FOH / #FO	6.000
T	RSH / AtS	134.200
D	SH / AcS	5.000
f	(1/r + 1/T) / (1/r + 1/T + 1/D)	0.465
fp	SH / AH	0.029
FOHd	*f* * FOH	0.217
EFDHd	fp * EFDH	0.029
SH'	[(AcS/AtS)*(1/4 *100 - SH)] + SH	24.000
EFORd'	(FOHd + EFDHd) / (SH' + FOHd)	0.010
Capacity		3.000
EFORd' Capacity	Capacity (1-EFORd')	2.970

Next Steps

- We will need to input this data for all DNR and Market Registered KPP City Generators starting in June 2022
  - Wellington ST and CT
  - Winfield ST and CT
  - Augusta N1, N2, N3, N4
  - Burlington 1A, 4A, 6
  - Clay Center D1, D2, D3, D4, D5, D8
  - Ellinwood 1, 2
  - Minneapolis D3, D5, D6
  - Mulvane 10, 11
- We would like you to attempt to backfill the information and then we can stop by and discuss it with each affected city

Questions?

Availability Reporting of Non-Market DNR Units

- This change only applies to KPP City Units that are used for DNRs and are NOT registered in the market
- Affected KPP Units:
  - Burlington 1A, 4A, 6
  - Ellinwood 1, 2
  - Minneapolis D3, D5, D6
  - Mulvane 10, 11
- SPP Operations has been tasked with “increasing their visibility” of Behind the Meter (BTM) units that are not registered in the market but are used as resources

Actual Requirements – Monthly Reporting

- Monthly reporting (by the 15th of the following month) for each hour and unit
  - Total available Capacity by unit by hour
  - Any limitations
    - Such as delivery point not allowing full dispatch, i.e. if full dispatch is limited by load
  - Must submit data by Additional reporting requirements following
  - Secure FTP (KPP will take care of this)

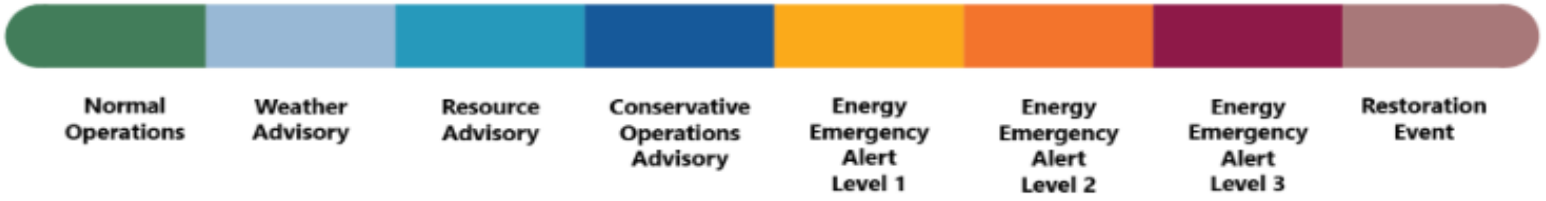
Actual Requirements – Advisory/Alert Status Reporting

- Effective within 2 hours of a Conservative Operations Advisory or and Energy Emergency Alert
  - Also applies when condition is changed or Advisory or Alert extended
- Planned Unutilized Capacity
  - Per unit capacity that is available and not planned to be dispatched
- Remaining Energy Available
  - If there is a limit based on fuel or operations need to express how much is available
- Maximum Daily Energy
  - Any MWH limits per unit – environmental or otherwise
- Start-up time
- All stats should be reported on a forecasted hourly basis for 1 week

How Would Advisory/Alert Status Reporting Work

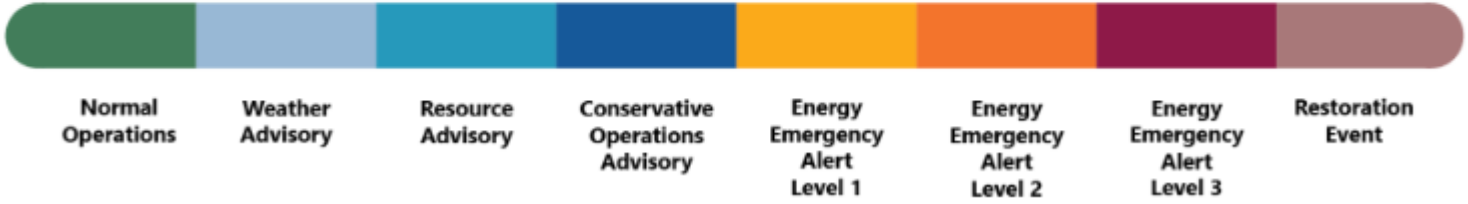
- Logically, this will require reporting to KPP when your units are not available or when they have limited energy production.
- KPP will coordinate with Tenaska to make sure we provide the data within 2 hours as required

SOUTHWEST POWER POOL GRID CONDITIONS



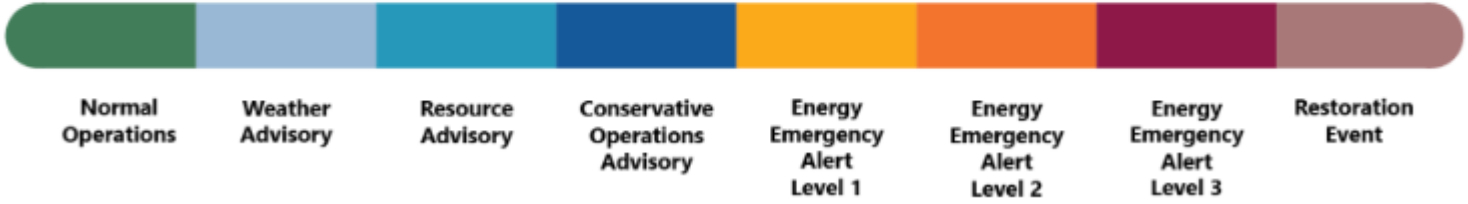
Advisories raise awareness and do not require general audiences to take action. SPP member utilities should follow applicable procedures. Energy Emergency Alerts indicate all available generation has been committed to meet region-wide demand. As conditions worsen, voluntary conservation or service interruptions may be necessary to prevent uncontrolled outages.

SOUTHWEST POWER POOL GRID CONDITIONS



- Normal Operations – SPP has enough generation to meet demand and reserves and forecasts no extreme or abnormal threats to reliability.
- Weather Advisory – Extreme weather is expected in SPP's region.
- Resource Advisory – Declared when sever weather conditions, significant outages, wind-forecast uncertainty and or load-forecast uncertainty in SPP's region.
- **Conservative Operations Advisory – SPP determines there is a need to operate its system conservatively based on weather, environmental, operational, terrorist, cyber or other events.**

SOUTHWEST POWER POOL GRID CONDITIONS



- **Energy Emergency Alert Level 1 – All available resources have been committed to meet obligations, and SPP is at risk of not meeting operating reserves.**
- **Energy Emergency Alert Level 2 – Declared when SPP can no longer provide expected energy requirements, or when SPP foresees or has implemented procedures up to, but excluding, service interruptions to maintain regional reliability.**
- **Energy Emergency Alert Level 3 – At this level, SPP is utilizing operating reserves such that it is carrying reserves below the required minimum and has initiated assistance through its Reserve Sharing Group. SPP foresees or has implemented firm load obligation interruptions.**
- **Restoration Event – Defined as a major or catastrophic grid outage which could be a total or partial regional blackout, island situation or system separation.**

Questions?