Generator Weatherization Workshop

September 3, 2020

TEXAS RE
Ensuring electric reliability for Texans

NERC and Texas RE Update

Mark Henry
Reliability Services, Texas Reliability Entity, Inc.

ERCOT/Texas RE Generator Winter Weatherization Workshop

September 3, 2020

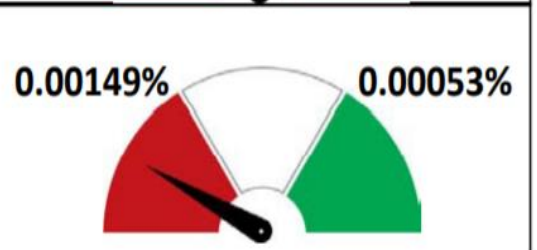
NERC Industry Metric on Events Caused by Gas-Fired Unit Forced Outages Due to Cold Weather or Gas Unavailability

Why is it important?

- Reduce risk to BPS reliability due to gas-fired unit outages during cold weather or gas unavailability

How is it measured?

- Firm load loss due to cold weather or gas unavailability
- MWh of potential production lost initiated by cold weather and gas unavailability

	2020 Status
Data (Annual Measurement) ▪ No firm load loss due to gas-fired unit outages during cold weather: *Zero is green, else is red* (Cold weather months: January – March and December of the same calendar year) *As of 6/30/2020, Metric status is Green.*	
Data (Annual Measurement) (Match with 4.4, year defined as Q3-Q2) ▪ No firm load loss due to gas unavailability: *Zero is green, else is red* *As of 6/30/2020, Metric status is Green.*	
Data (Compared to a 5-year rolling average) ▪ Percentage of winter period net MWh of potential production lost due to gas-fired unit outages during cold weather (Cold weather months: January – March and December of the same calendar year) *Five-year average: 0.0058%*	
Data (Compared to a 5-year rolling average) ▪ Percentage of annual net MWh of potential production lost due gas unavailability compared to a 5-year rolling average (Due to data availability, year defined as Q3-Q2) *Five-year average: 0.1513%*	

NERC Cold Weather Guideline Revision in Progress

Added: Schedule … "winterization" work to occur prior to the local NOAA First Frost Date. Un-doing winterization should wait until after NOAA Last Frost Day...

Updates to list of typical problem areas:

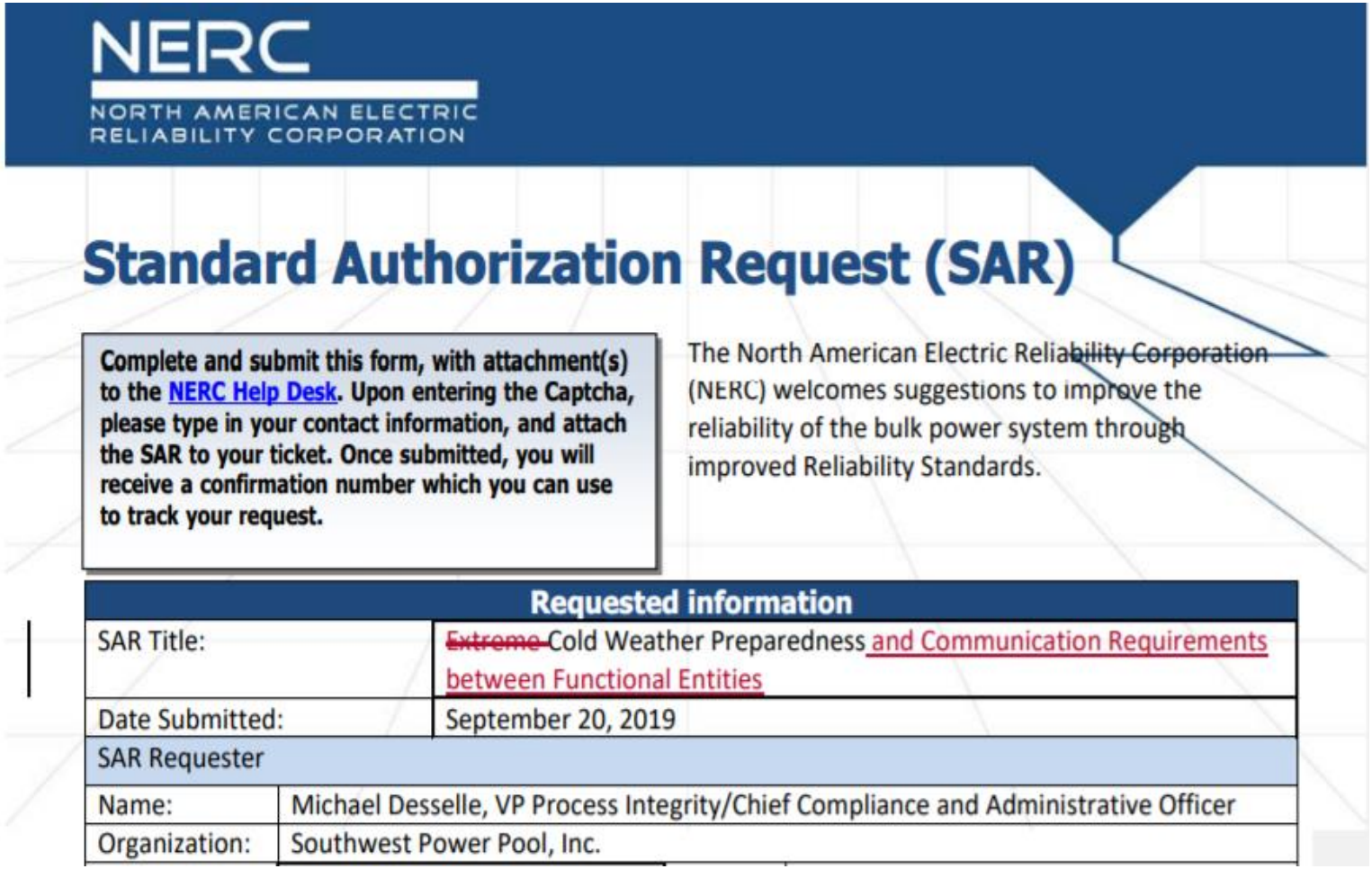
- Item 4.a: C*alibration of dew point monitoring*
- Item 10: Lube oil and greases for mechanical equipment in exposed locations
- Item 11: Exposed batteries and UPS systems
- Item 12: Heat tracing, insulation & temperature responsive ventilation (heaters, fans, dampers and louvers)

New Lesson Learned LL20200601 – "Unanticipated Wind Generation Cutoffs during a Cold Weather Event" and emphasis on communication of this risk of low temperature cutoffs

NERC Cold Weather Reliability Standard

NERC Project 2019-06: Cold Weather

- Third version posted and comments received May 21, 2020
- Fourth version up for NERC Standards Committee approval in late September with reposting this fall for additional comments



NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Standard Authorization Request (SAR)

Complete and submit this form, with attachment(s) to the NERC Help Desk. Upon entering the Captcha, please type in your contact information, and attach the SAR to your ticket. Once submitted, you will receive a confirmation number which you can use to track your request.

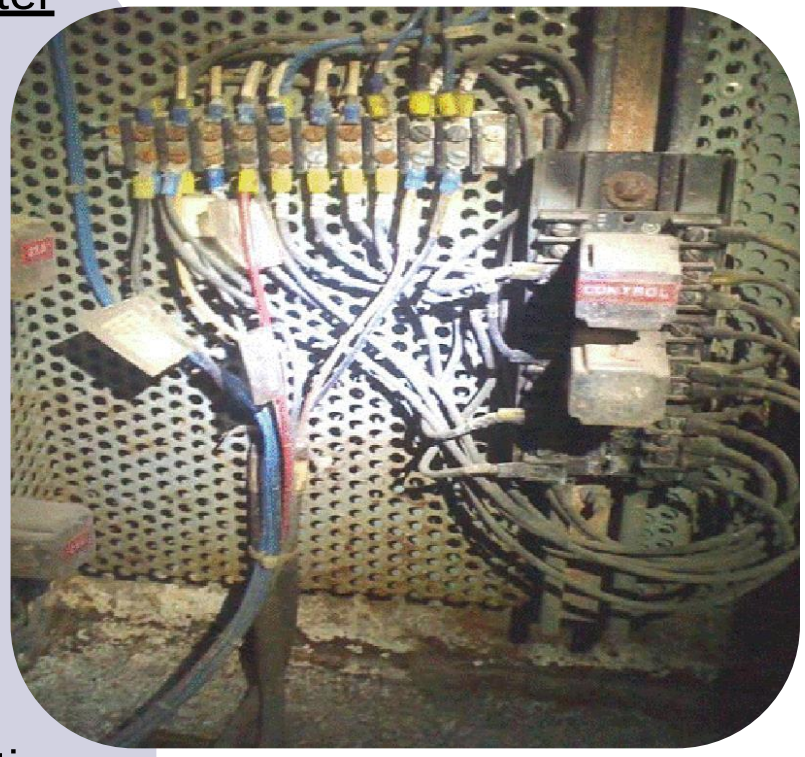
The North American Electric Reliability Corporation (NERC) welcomes suggestions to improve the reliability of the bulk power system through improved Reliability Standards.

Requested information	
SAR Title:	~~Extreme~~ Cold Weather Preparedness and Communication Requirements between Functional Entities
Date Submitted:	September 20, 2019
SAR Requester	
Name:	Michael Desselle, VP Process Integrity/Chief Compliance and Administrative Officer
Organization:	Southwest Power Pool, Inc.

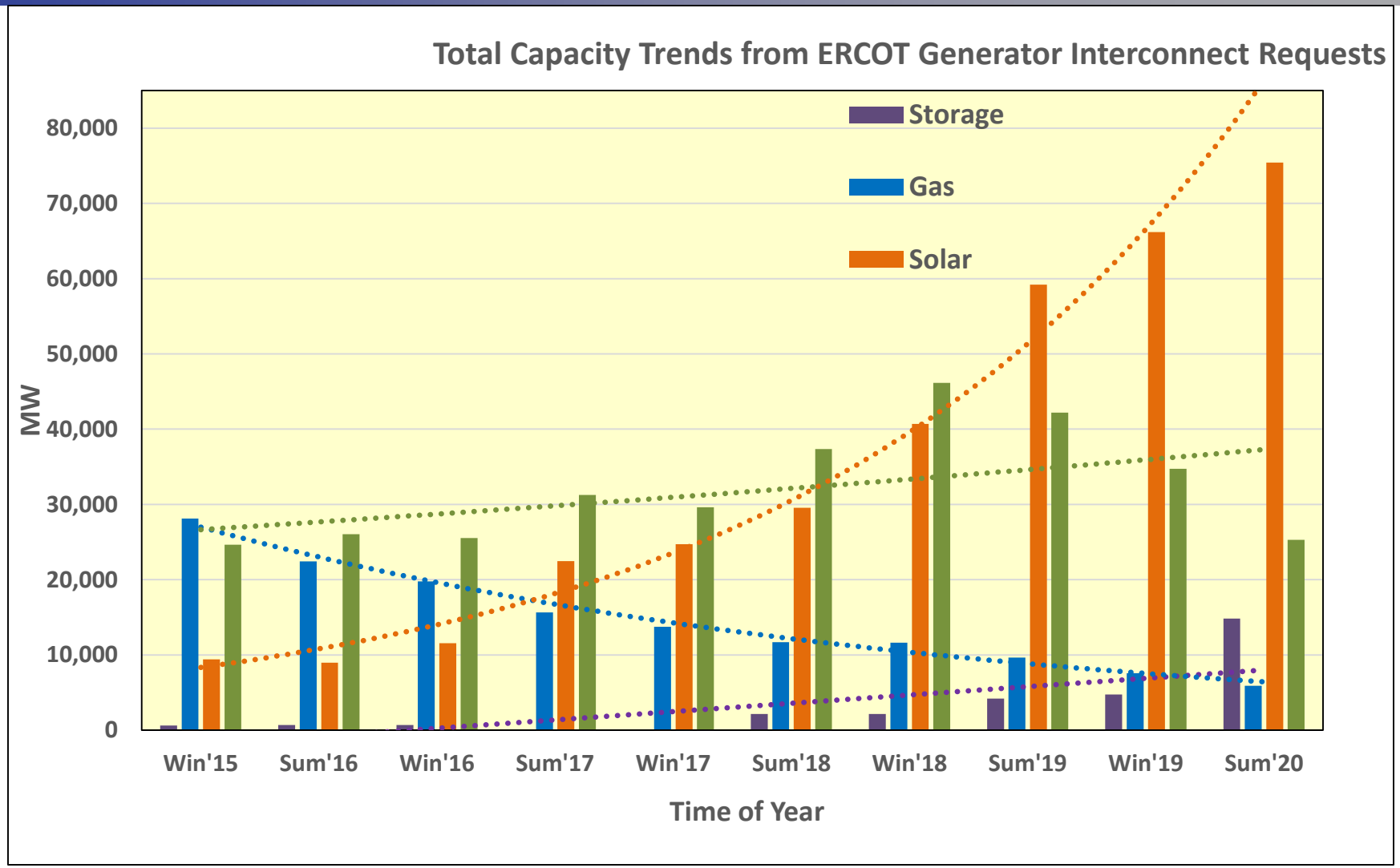
Human Performance Observations

Inadequate Generator Winter Preparedness

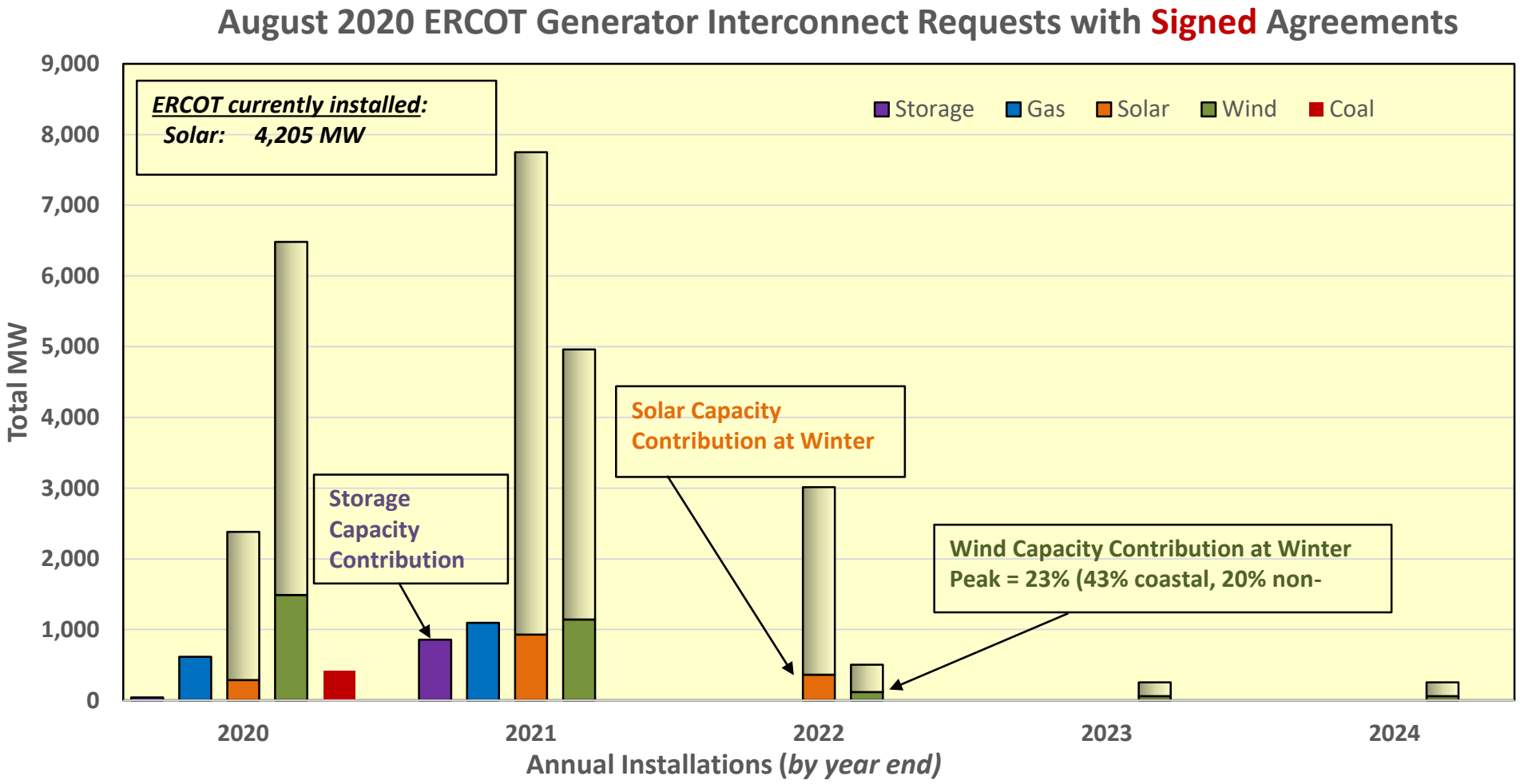
- How does Human Performance impact winter preparedness?
  - Design
  - Equipment selection
  - Installation
  - Maintenance
- Rule-based errors?
  - Inadequate work practices, procedures, and checklists
- Knowledge and skill-based errors?
  - As-left personnel errors
- Change management?
  - Work plans not accounting for field conditions
  - Project schedules too compressed
  - Scope changes



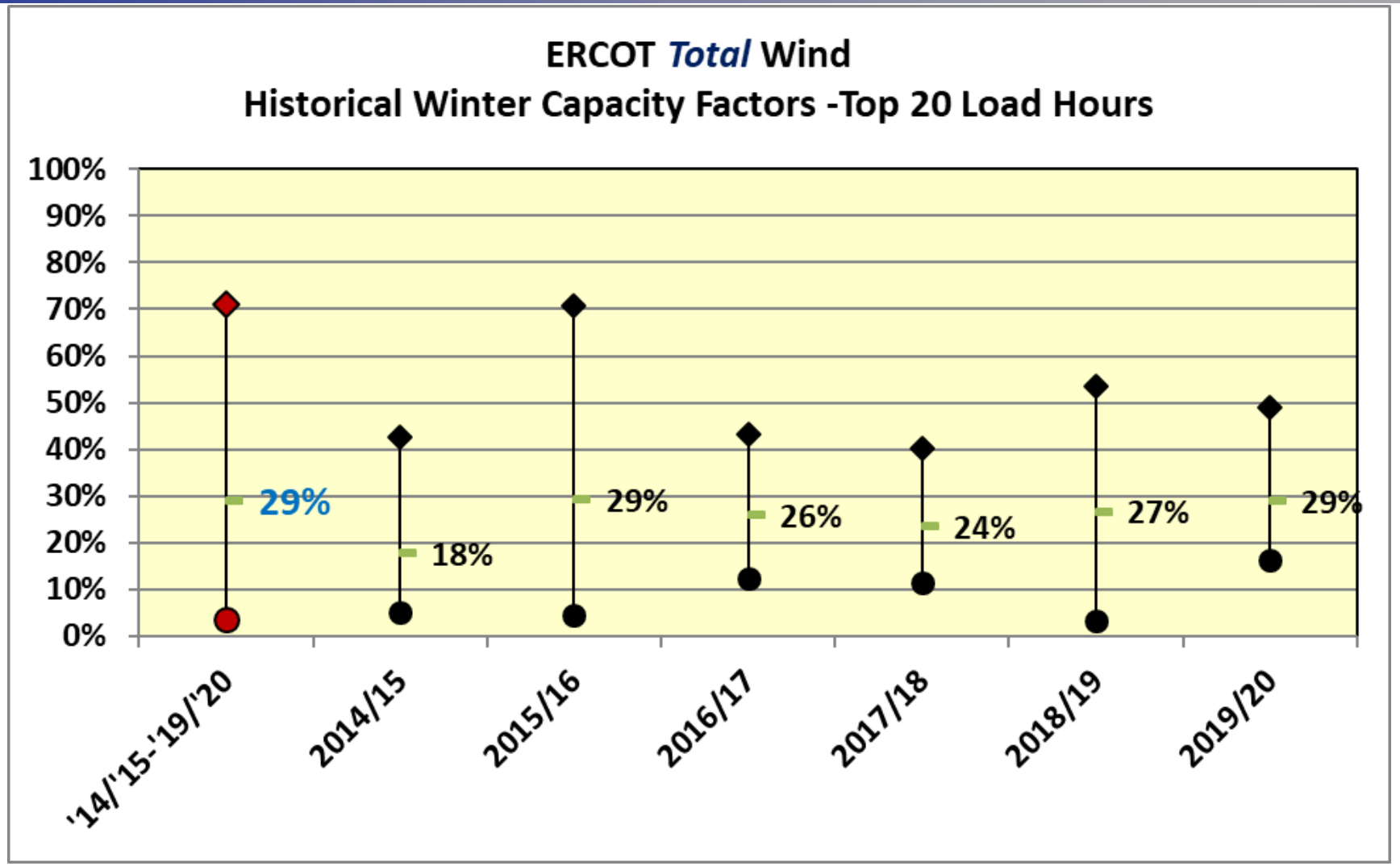
Meeting Winter Peak as Generation Mix Changes



Meeting Winter Peak as Generation Mix Changes



Wind Power *Winter* Capacity Contribution in Texas RE Region



TCEQ Enforcement Discretion … Power Emergency

NOTICE DATE: Some Future Winter Day

NOTICE TYPE: M-AMMDDYY-NN Operations …

INTENDED AUDIENCE: QSEs with Resources and Resource Entities …

LONG DESCRIPTION: The ERCOT Region is expecting ….. a power emergency. The Texas Commission on Environmental Quality (TCEQ) has communicated to ERCOT that, effective immediately, …TCEQ will exercise its enforcement discretion for exceedances of emission and operational limits of power generating facilities for generators that exceed air permit limits.

Any generating facility that expects to exceed its air permit limits to assist during these extreme temperatures shall provide a notice of this action to Kelly Cook (kelly.cook@tceq.texas.gov), Director of Critical Infrastructure Division for TCEQ. ……

See "Procedure for Requesting TCEQ Enforcement Discretion Relating to a Power Emergency in Texas for ERCOT, MISO, or SPP Regions," available at

https://www.tceq.texas.gov/assets/public/response/power-emergency/enforcement-discretion.pdf.

Contacts

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Bob Collins

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- 512-583-4986

RAPA@texasre.org

Questions?

Winterization at Silas Ray

Agenda

- About the facility
- Previous Issues
- Measure taken to correct the issue
- Pre Winter Checklist

There we are

Brownsville Public Utilities Board Silas Ray Power Station

- Location Brownsville, Texas
- 120 MW Facility:
  - 1 simple cycle Natural Gas fired Turbine and 1 Cogeneration Gas Turbine/ Steam Turbine
- Simple Cycle: 1 Gas Turbine GE-LM6000 Aeroderivative (50MW)
- Cogeneration:
  - 1 Gas Turbine Siemens Westinghouse-251B12 (50MW)
  - 1 Steam Turbine Westinghouse (20MW)
- Commissioned in the 1940's
- Ownership: 100%
- NERC Region: Texas RE
- Located on the border of Texas and Mexico

Notable weather Events

- January 17, 2018:
  - Unit 6, HRSG - Feed Water Control Valve froze
  - Unit 10 Staring Skid Tripping:
    - Temperature Issue required additional windbreaks to alleviate the problem.
  - Unit 10 SCR Ammonia Injection System:
    - Heater Temperature Issue required a windbreak at the blower intake location. Temperature and ammonia vaporization issues are a frequent concern.

Winterization Improvements

- O’Brien Boxes
  - Molded glass fiber reinforced polyester enclosures designed to withstand exposure to industrial and outdoor environments
  - Heat Trace installation on HRSG
- Wind Breaks/ Skid Covering
  - Windbreaks put in place to alleviate the northern winds and wind chill factor
- Thermaxx Jackets- WeatherMaxx Covers/ Valve windbreak
  - Quality Removable Insulation blankets for pipes, valves, and heavy equipment.

O’Brien Boxes

- Molded glass fiber reinforced polyester enclosures designed to withstand exposure to industrial and outdoor environments. Protects instrument from corrosion, chemical attack, mechanical abuse, and freezing and weather.
- We added O’Brien Boxes to all of the HRSG critical transmitters. As part of our Winterization checklist., we check for proper heater operation inside all boxes, verify that the thermometer on the box is functioning, and that the boxes are secured and damage free.
- Along with the HRSG Critical Transmitter, we also added heat trace to all HRSG Drum Level – Transmitters/tubing. As part of our Winterization checklist it gets tested and checked that all heat trace cables are secured to equipment.

O’Brien Boxes

Silas Ray Power Plant Critical Components Checklist 2019												
Item No.	Component Description	Critical Component (Y/N)	Tag #	Heat Trace Circuit Associated w Component	Amps (A)	Control	Breaker Status Inspection		Insulation Inspection on sensing line (signature)	Insulation Condition Comments	O'Brien Cabinet-Heater /Thermometer Working - inspected by (signature)	Condition Comments	Windbreak Installation (if required)
							Status (Closed/Open)	Signature					
1	HRSG - Box Heater 6C/PT-1A		9SGA-PT-A	Breaker # 1,2	N/A								
2	HRSG -Box Heater 6D/PT-1B		9SGA-PT-B	Breaker # 1,3	N/A								
3	HRSG -Box Heater 6E/PT-1C		9SGA-PT-C	Breaker # 1,4	N/A								
4	HRSG -Box Heater 4A/LT-1A		9SGA-LT-A	Breaker # 1,5	N/A								
5	HRSG -Box Heater 4B/LT-1B		9SGA-LT-B	Breaker # 1,6	N/A								
6	HRSG -Box Heater 4C/LT-1C		9SGA-LT-C	Breaker # 1,7	N/A								
7	HRSG -Heat Trace circuit #1		DWG# B001-PT1A-BPPA	Breaker # 3		TA4X140					N/A		
8	HRSG -Heat Trace circuit #2		DWG# B002-LT1A-BPPA	Breaker # 3		TA4X140					N/A		
9	HRSG -Heat Trace circuit #3		DWG# B003-LT1B-BPPA	Breaker # 3		TA4X140					N/A		
10	HRSG -Heat Trace circuit #4		DWG# B004-PT1B-BPPA	Breaker # 3		TA4X140					N/A		
11	HRSG -Heat Trace circuit #5		DWG# B005-PT/LT1C-BPPA	Breaker # 3		TA4X140					N/A		
UNIT 10 - NELSON SYSTEM 1													
12	Sprint Skid - Heat Trace circuit		#3			PLANT LIGHTING PANEL LP2-10E016							
13	MLO Skid - Heat Trace circuit#1		#5			PLANT LIGHTING PANEL LP2-10E016							
	MLO Skid - Heat Trace circuit#2		#5			PLANT LIGHTING PANEL LP2-10E016							
14	Hydraulic Starter Skid - Heat Trace Circuit #1		#8			PLANT LIGHTING PANEL LP2-10E016							
15	Hydraulic Starter Skid - Heat Trace Circuit #2		#8			PLANT LIGHTING PANEL LP2-10E016							
16	Hydraulic Starter Skid - Heat Trace Circuit #3		#8			PLANT LIGHTING PANEL LP2-10E016							

Heat Trace & Critical Component Checklist

Item No.	System	INSPECTION: PLANT LIGHTING PANEL LP2-	Breaker Condition	Fuses	Fuse Spares	Check and Tighten Loose Connections	Check and Repair/ Replace Broken wires	Check and Repair Corroded Elements	Inspected by	Inspection Date	TEST: Temperature ambient (F)	Heater Current (A)	Ground Current (mA)	"Self-Test"	Tested by	Test Time	Test date
UNIT 10 – NELSON SYSTEM [1]																	
60	**HRSG Transmitters Lines**	HRSG Heater Heat Trace Panel#3															
	Heat Trace circuit #1																
	Heat Trace circuit #2																
	Heat Trace circuit #3																
	Heat Trace circuit #4																
	Heat Trace circuit #5																

Item No.	Component Description	Critical Component (Y/N)	Tag #	Heat Trace Circuit Associated w Component	Amps (A)	Control	Breaker Status Inspection: Status (Closed/Open)	Breaker Status Inspection: Signature	Insulation Inspection on sensing line (signature)	Insulation Condition Comments	O'Brien Cabinet-Heater /Thermometer Working - inspected by (signature)	Condition Comments	Windbreak Installation (if required)
1	HRSG - Box Heater 6C/PT-1A		9SGA-PT-A	Breaker # 1,2	N/A								
2	HRSG -Box Heater 6D/PT-1B		9SGA-PT-B	Breaker # 1,3	N/A								
3	HRSG -Box Heater 6E/PT-1C		9SGA-PT-C	Breaker # 1,4	N/A								
4	HRSG -Box Heater 4A/LT-1A		9SGA-LT-A	Breaker # 1,5	N/A								
5	HRSG -Box Heater 4B/LT-1B		9SGA-LT-B	Breaker # 1,6	N/A								
6	HRSG -Box Heater 4C/LT-1C		9SGA-LT-C	Breaker # 1,7	N/A								

Wind Breaks

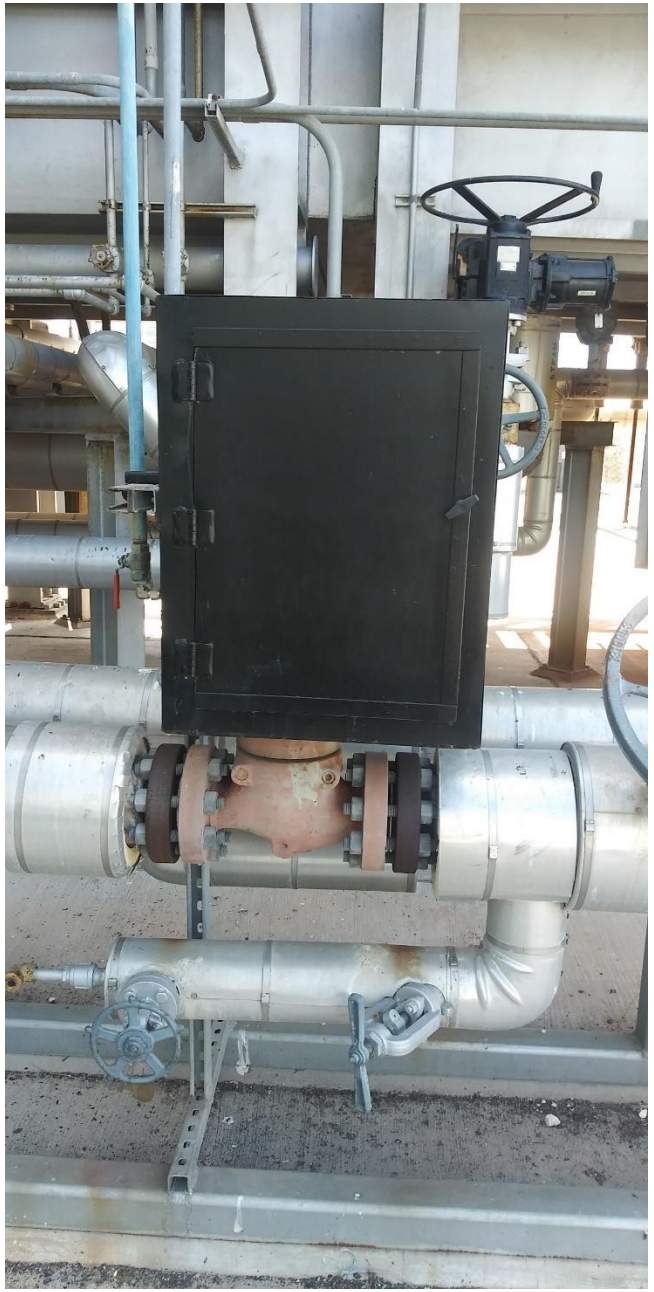
- We have added several Wind Breaks/ Skid Housing for the winter period on certain locations such as: Hydraulic Starter Skid , Gas Compressor Skid, Ammonia/SCR Skid, HRSG Penthouse, Circulating Water Pumps
- Within each Wind breaks, Heat Lamps can be place in the event additional heating is necessary.

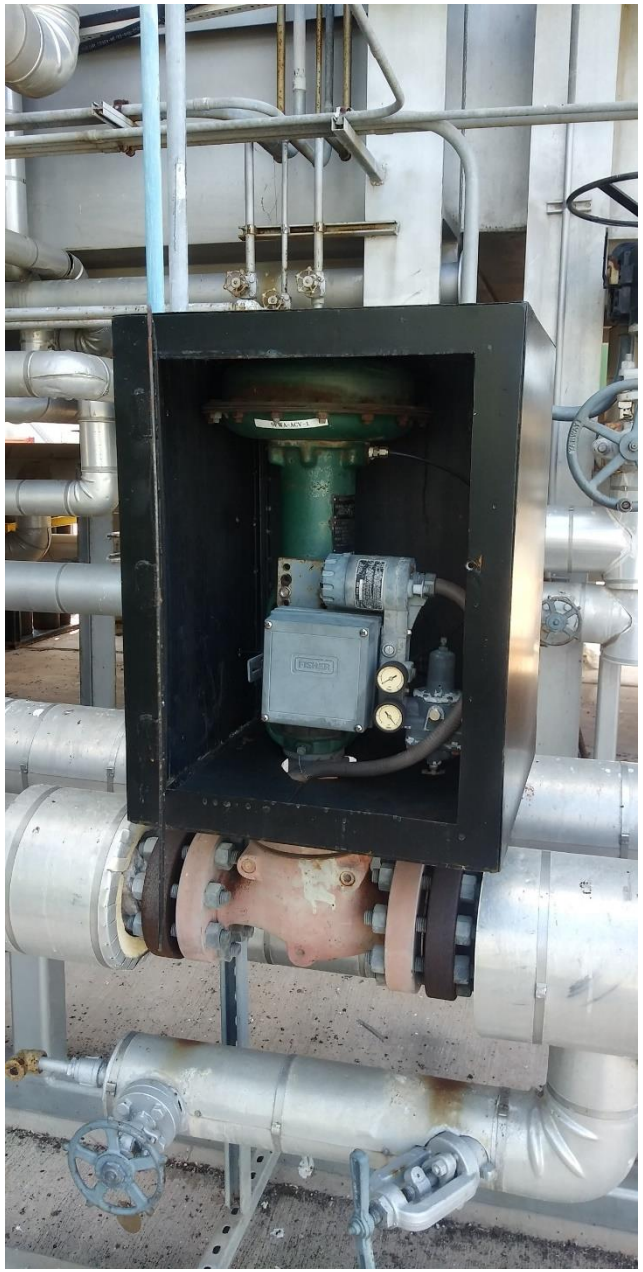

ShelterLogic

Feed Water Control Valve Cover

- January 17, 2018: Issues we noticed with our Feed Water Control Valve
  - The Valve was frozen stuck and wasn't responding.
  - How it was resolved at the time of the event. We wrapped the Valve with a tarp and put a heat lamp on the controller to defrost it. As the valve was defrosting, the operator had to manually bypass the valve.
  - We believe the controller froze due to the harsh weather conditions, but we also went ahead and checked the air dryers for condensation built up in the Instrument air.
- After this issue occurred we looked around and ending up ordering a Quality Removable Insulation blankets from Thermaxx Jackets- WeatherMaxx Covers. Which is weather resistant, waterproof, resistant to severe chemical and temperature exposure, flame retardant, and UV resistant.
- To factor out the idea of possible condensation build up we also have certain PM's associated to the Air Dryers. Such as filter replacement, desiccant replacement, and dew point monitor calibration.

Feed Water Control Valve





Pre Winter Season Checklist at Silas Ray

- Winter Preparedness Checklist
  - Overall checklist for Engineering Dept., Operations, & Maintenance
- Inventory List Checklist
  - Spare equipment for Winter emergency's
- Winterization Kit Checklist
  - Containers per Unit 9, Unit 10, & HRSG Penthouse
- Heater Verification Checklist
- Critical Component Checklist
  - HRSG box heater
  - HRSG heat trace circuit
  - Nelson Heat Trace
- Heat Trace Verification Checklist
  - All Heat Trace throughout the plant
- Provide training refresher on winter procedures to staff

References

- https://www.thermaxxjackets.com/products/weathermaxx-cover-2/
- https://www.obcorp.com/product/instrument-enclosures-protection/full-enclosures
- https://www.weather.gov/media/bro/wxevents/2018/pdf/2018January16to17Summary.pdf


Question

Winterization Lessons Learned - Air Liquide Bayport

THIS DOCUMENT IS PUBLIC

Houston, TX • 9-3-2020
Abdul Usmani • Air Liquide Large Industries

LARGE INDUSTRIES

Contents

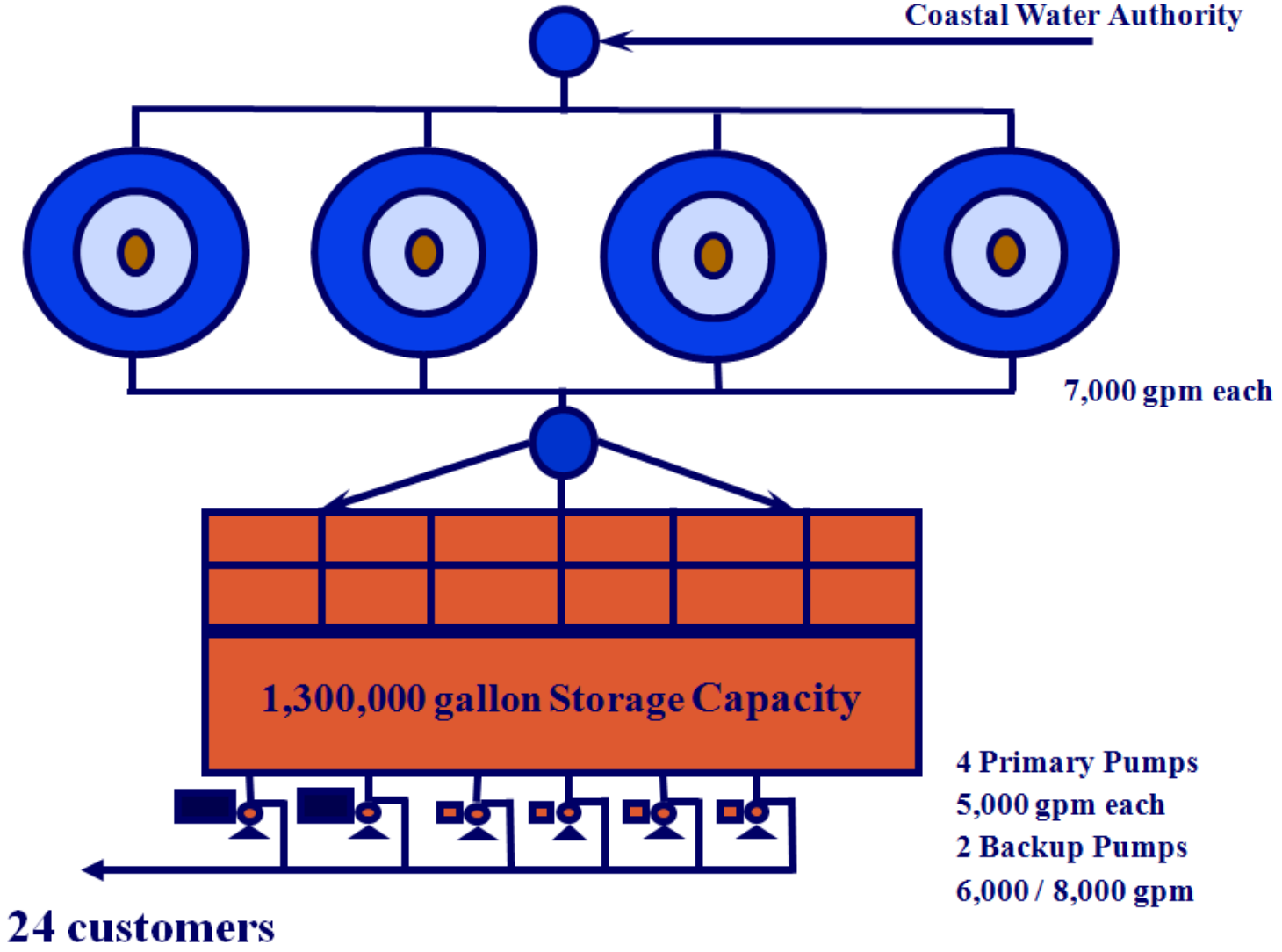
1 Air Liquide Bayport Site Overview
2 Previous Winterization Plan
3 Updated Winterization Plan
4 Spot Check Key Takeaways
5 Questions

Air Liquide Bayport Key Information

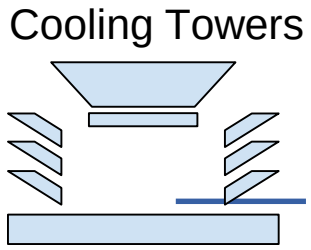
- **Air Liquide's Largest Production Facility in North America**
- **Water Systems**
  - 30 million GPD of treated river water
  - 6.2 million GPD of demineralized water
- **Steam Methane Reformer (2006)**
  - 100 million scfd Hydrogen production and 175 kpph steam
- **4 Cogen Units (1985) and 3 Aux Boilers**
  - 360MW power production
  - Over 3 million lbs/hr steam production capacity
  - 5 miles of steam pipeline
  - Condensate recovery and treatment
- **Bayport Air Separation Units - Plant 3A (1999) and Plant 4 (1990)**
- **~35 Customers in the Central Basin**

Bayport Site Overview

Industrial Water Treatment Plant



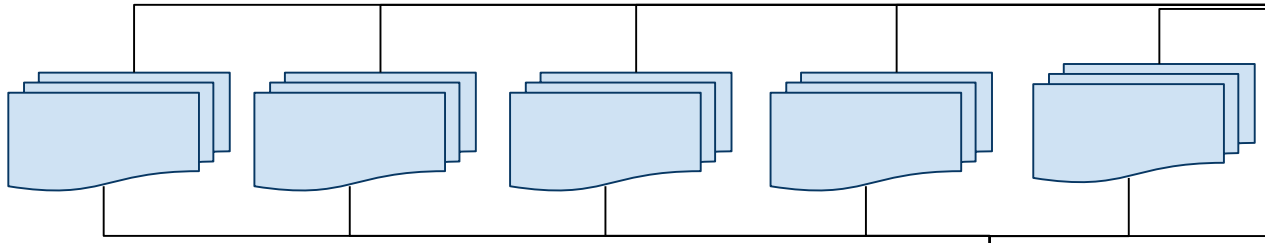
Bayport Water System



Clearwell

Treated Water Customers

5 Ion Exchange Trains
~ 950 gpm per Train



2 RO/EDI Trains
~ 500 gpm Each

RO + EDI units

2,100,000 gal Storage

8 DI Pumps

DI Customers

3 Deaerators

6 DA Pumps

Surge Tank

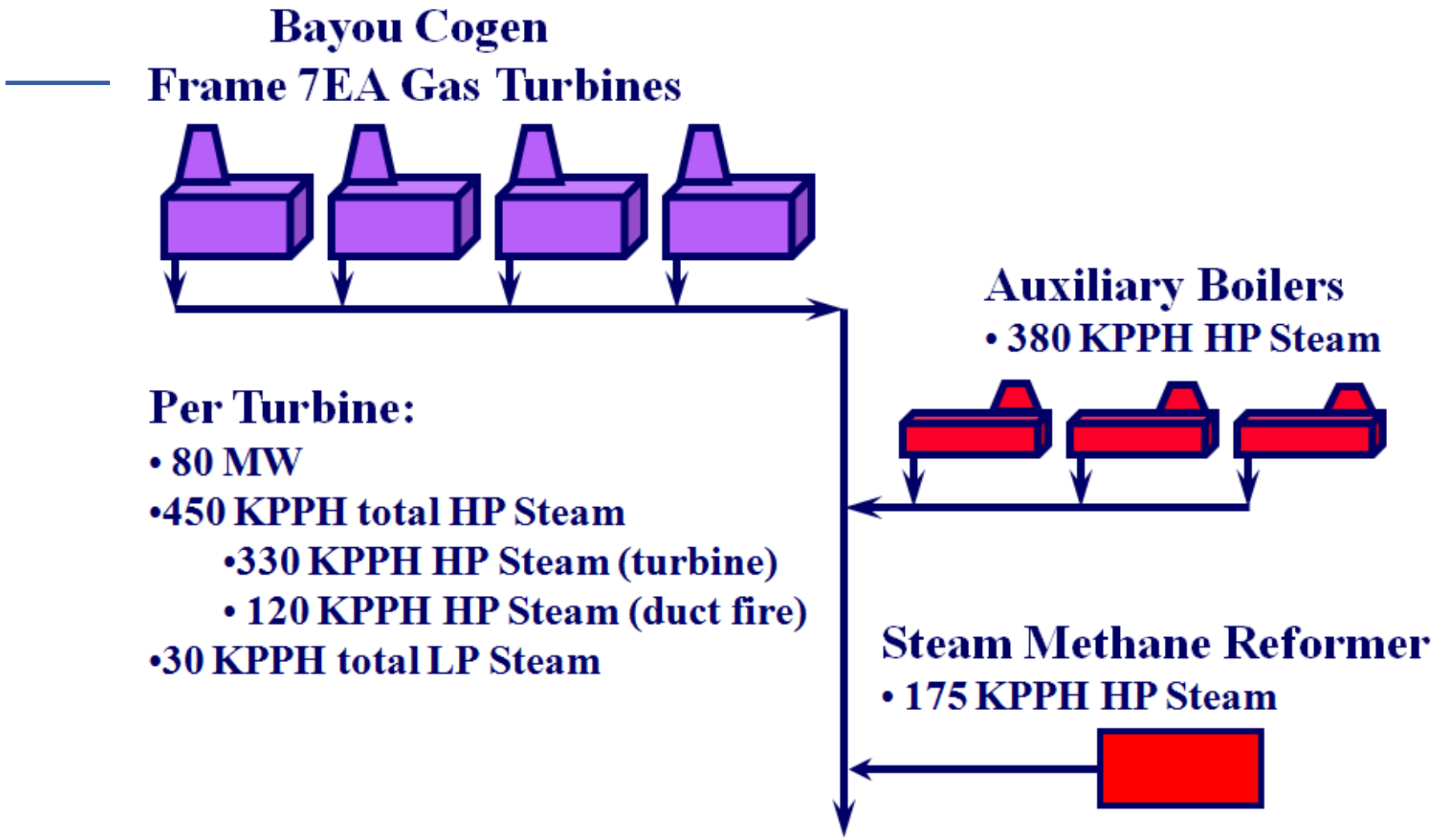
Fixed Filters

Return Condensate

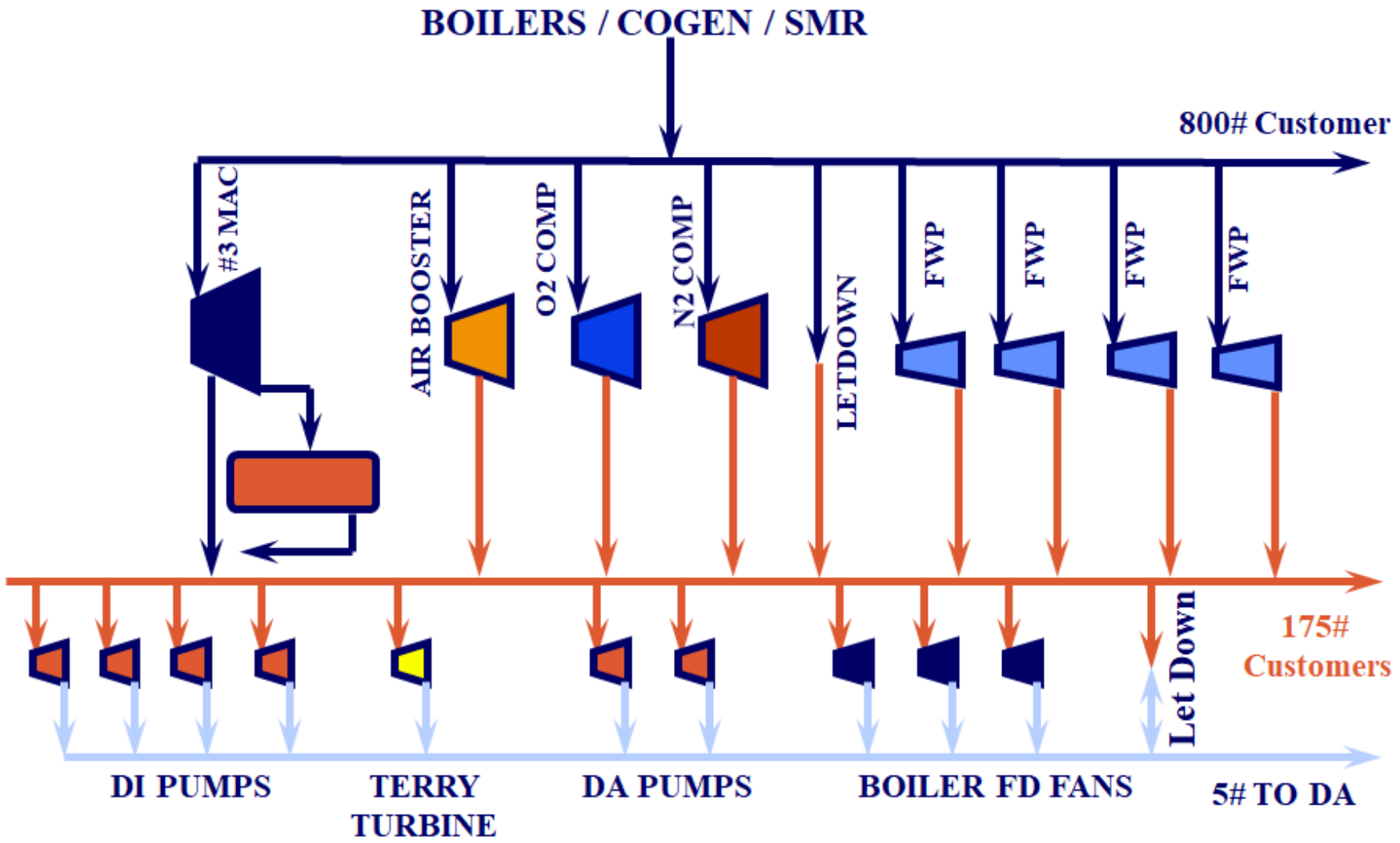
7 BFW Pumps

SMR
COGEN
AUXILIARY BOILERS

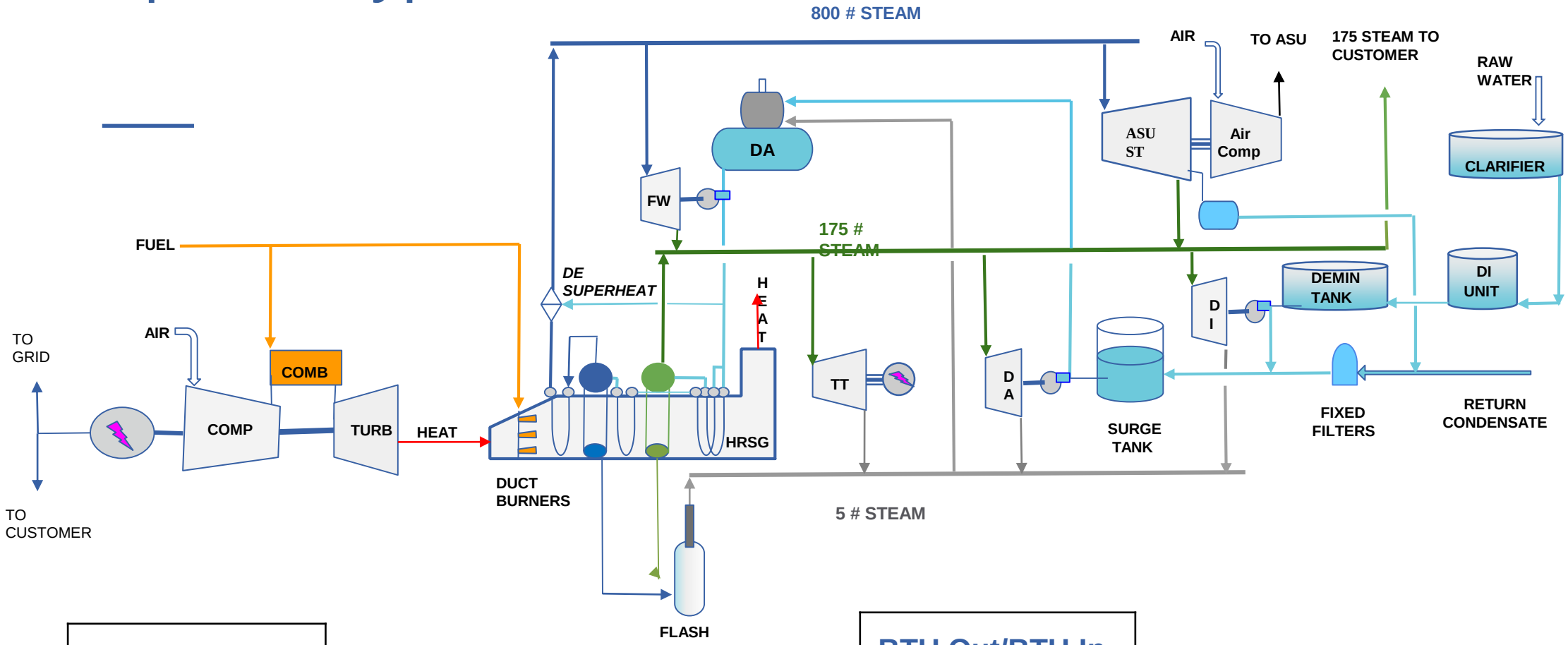
Bayport Steam Production



Bayport Steam System



Air Liquide Bayport Overview



BTU/KW Heat rate LHV
~8000-8500

BTU = GT fuel + D.B fuel

KW = GT+TT + ASU comp converted to fully condensing+DI+DA+FW pumps. No steam sales

BTU Out/BTU In Efficiency LHV
~80-85%

BTU Out = KW converted to BTU + ASU extraction steam sales BTU's

BTU In = GT fuel + D.B fuel

Winterization Plan Prior to 2018

- **Winterization plan was in place but vague in many areas**
- **Success of the winterization plan was highly dependent on prior knowledge at the plant**
- **Many critical areas of the facility were not explicitly part of the plan**
  - Ex. Instrument air system and Heat trace circuits

Winterization Plan After 2018

Winter readiness plan updated to include:

- **Critical heat trace testing and comparison to previous year**
- **Critical insulation inspection**
- **Instrument air system readiness testing to ensure adequate dryness**
- **Minimum Staffing requirements for the different phases of the winter weather plan**

Winterization Spot Check Takeaways

- **Ensure everything done in preparation is well documented and specified in procedures:**
  - **Specify the different tasks required for winter preparation for each craft**
  - **Develop a list of the critical areas in the plant that need to be addressed based on experience**
  - **Documentation, documentation, documentation!**

Questions?

Break

BASTROP ENERGY CENTER WINTER WEATHERIZATION PROCEDURE IMPROVEMENTS AND BEST PRACTICES


Texas
Fort Worth
Dallas
El Paso
Houston
N
Bastrop Energy Center
Combined Cycle Plant
567 Mw's
Cedar Creek Tx

BASTROP ENERGY CENTER

Total plant output is 567Mw's

Commissioning operating date : May 2002

Two GE 7FA Combustion Turbine/Generators

Two Aalborg Heat Recovery Generators with Duct Burners

One Toshiba Steam Turbine/Generator

Plant Controls System: Westinghouse Ovation/GE Mark VI

Added Peak fire Capabilities, providing an additional 12 Mw's

WEATHERIZATION PROCEDURE

- Plant Director
  - Ensure seasonal readiness PMs are safely performed and completed in advance of appropriate time for certification of readiness dates.
  - Insure seasonal readiness PMs are developed, as appropriate.
  - Ensure personnel receive annual orientation or refresher training in winter.
  - Shall consider arranging for accommodations for personnel.
  - Ensure that all Management of Change (MOC) activities are performed so changes maintain seasonal readiness of plant.

PROCEDURE UPDATES

- Severe Weather Coordinator

  - Coordinate and oversee Weatherization Plan activities.
  - Coordinate winter plant operator and maintenance training.
  - Maintain site specific severe weather readiness programs, processes, procedures, and implementation checklists. Incorporate lessons learned on an annual basis.
  - Provide and retain objective documentary evidence of compliance to support Plant Manager with certification of readiness.
  - Update Plant Director on repair status of critical components by November 15th which shall include a repair schedule of all uncompleted repairs.

SEVERE WEATHER STAFFING

- Forecasted temperatures to fall below 35F and any form of precipitation.
  - Management will evaluate weather conditions and determine if additional support is needed.
- Forecasted temperatures to fall below 32F for more than 8 hours in a 24-hour period.
  - Two maintenance personnel and one additional operator shall be scheduled to be on site during the duration of this period.
- Forecasted temperatures to fall below 26F.
  - Two maintenance personnel and one additional operator shall be scheduled to be on site during the duration of this period.
- Forecasted temperatures to fall below 20F.
  - Two maintenance personnel, one additional operator, Plant Manager, Operations Manager, Maintenance Manager, or Plant Engineer to be on site.

IDENTIFIED CRITICAL HEAT TRACE CIRCUITS

Winterization Critical List

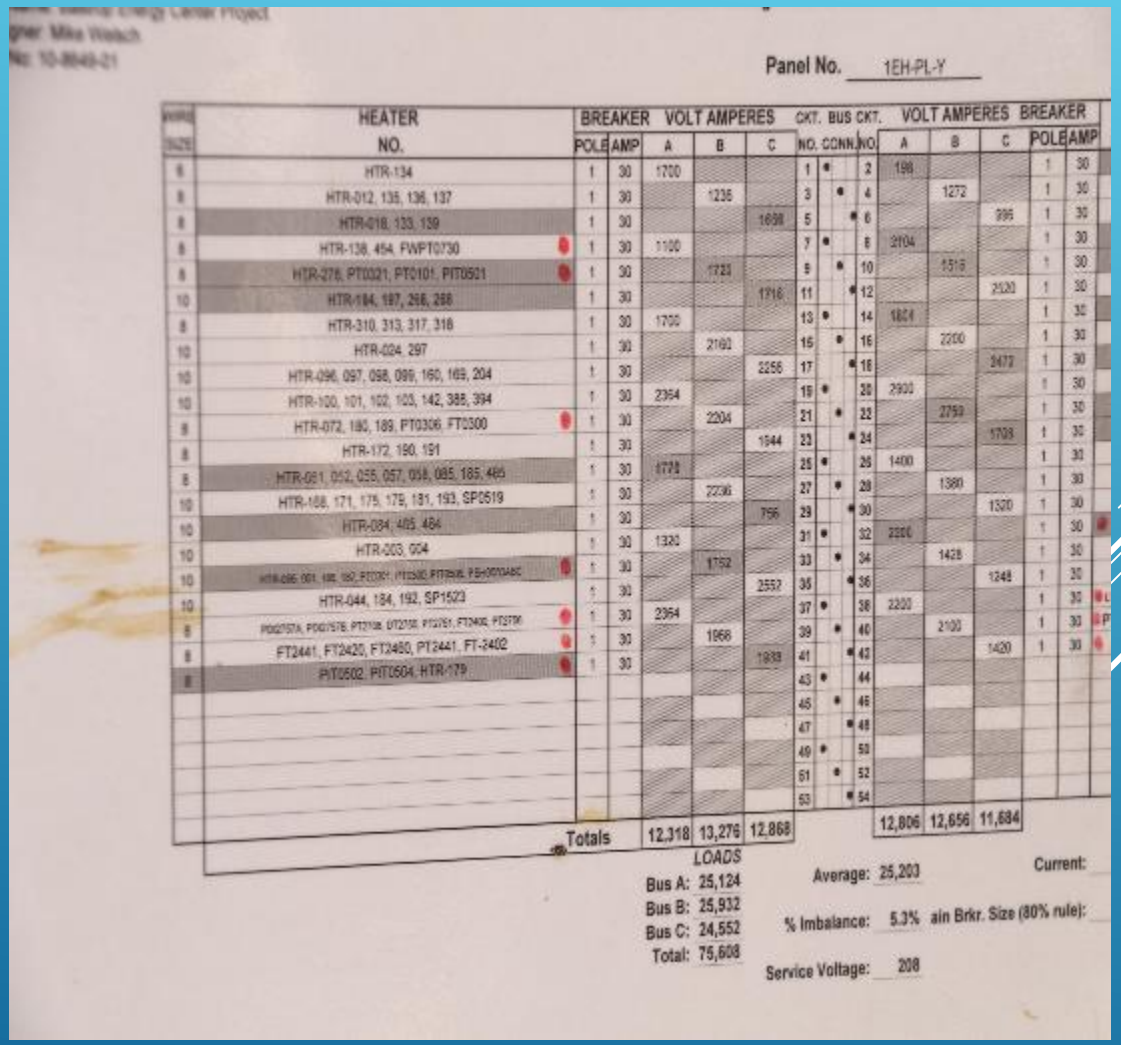
ID	Mainsaver Tag Number	Component	Description	Area	Critical	Heat trace panel	Heat trace breaker	Heat trace drawing	P&ID drawing	Location drawing	Control logic drawing	Drawing Number
33	BAS00-1AS-PT-0101	Transmitter, Pressure	CRH AUX LETDOWN PRESSURE	BOP	Yes	Y	9	8608-175	0-PD-4-AS.0-1			
34	BAS00-1AS-PT-0102	Transmitter, Pressure	HP STEAM AUX LETDOWN PRESSURE	BOP	Yes	Y	42	175	0-PD-4-AS.0-1			
35	BAS00-1AS-TV-0100	Valve, Control	AUX STEAM DESUPERHEATER SPRAY CONTROL VALVE	BOP	Yes	Y	27	8608-193	0-PD-4-AS.0-1			
48	BAS00-1BS-FT-0046	Transmitter, D/P	LP B/P STEAM SPRAY FLOW	BOP	Yes	Y	42		1-PD-4-BS.0-3			
57	BAS00-1BS-PIT-0508	Transmitter, Pressure	LP STEAM PRESSURE	STG	Yes	Y	42		1-PD-4-BS.0-3			
55	BAS00-1BS-PT-0011	Transmitter, Pressure	CRH STEAM PRESSURE	BOP	Yes	X	24	8608-168	1-PD-4-BS.0-4			
56	BAS00-1BS-PT-0042	Transmitter, Pressure	LP STEAM PRESSURE	BOP	Yes	Y	42		1-PD-4-BS.0-3			
58	BAS00-1BS-PT-0049	Transmitter, Pressure	LP BYPASS STEAM TO CONDENSER PRESS	BOP	Yes	X	15		1-PD-4-BS.0-3			
59	BAS00-1CC-LT-0353	Transmitter, Level	Closed Loop Cooling Stand Pipe Level	BOP	Yes	X	41	8608-082	1-PD-4-CC.0-1			
60	BAS00-1CC-PT-0354	Transmitter, Pressure	CLOSED COOLING WTR SUPPLY PRESS	BOP	Yes	X	39	8608-076	1-PD-4-CC.0-1			
61	BAS00-1CO-FT-0300	Transmitter, D/P	CONDENSATE PUMP DISC FLOW	BOP	Yes	Y	21		1-PD-4-CO.0-1			
62	BAS00-1CO-FT-0350	Transmitter, D/P	CONDENSER SPRAY CURTAIN FLOW	BOP	Yes	X	8		1-PD-4-CO.0-1			
63	BAS00-1CO-LSLL-0303	Switch, Level	Condenser Hotwell Level LO-LO	STG	Yes	Y	33	8608-186	1-PD-4-CO.0-1			
64	BAS00-1CO-LT-0302	Transmitter, Displacer	Condenser Hotwell Level	STG	Yes	Y	33	8608-187	1-PD-4-CO.0-1			
65	BAS00-1CO-PT-0300	Transmitter, Pressure	CONDENSER PRESSURE	BOP	Yes	Y	33		1-PD-4-CO.0-1			
66	BAS00-1CO-PT-0301	Transmitter, Pressure	CONDENSER PRESSURE	BOP	Yes	Y	33		1-PD-4-CO.0-1			
67	BAS00-1CO-PT-0306	Transmitter, Pressure	VAC COND PMP DISC PRESS ALARM	BOP	Yes	Y	21		1-PD-4-CO.0-1			
68	BAS00-1CO-PT-0320	Transmitter, Pressure	IP/CRH STM SUPPLY PRESS.	BOP	Yes	X	22		1-PD-4-CO.0-2			
70	BAS00-1CO-PT-0323	Transmitter, Pressure	AUX STEAM SUPPLY PRESSURE	BOP	Yes	X	22		1-PD-4-CO.0-2			
90	BAS00-1FW-FT-1750A	Transmitter, D/P	BFP A DISCH FLOW	HRSG1	Yes	X	34		1-PD-4-FW.1-1			
91	BAS00-1FW-FT-1750B	Transmitter, D/P	BFP B DISCH FLOW	HRSG1	Yes	X	34		1-PD-4-FW.1-2			
92	BAS00-1FW-FT-1751	Transmitter, D/P	FW TO HP BP SPRAY FLOW	HRSG1	Yes	X	34		1-PD-4-FW.1-1			
93	BAS00-1FW-FT-2750A	Transmitter, D/P	BFP A DISCH FLOW	HRSG2	Yes	Y	38		1-PD-4-FW.2-1			
94	BAS00-1FW-FT-2750B	Transmitter, D/P	BFP B DISCH FLOW	HRSG2	Yes	Y	38		1-PD-4-FW.2-2			
95	BAS00-1FW-FT-2751	Transmitter, D/P	FW TO HP BP SPRAY FLOW	HRSG2	Yes	Y	38		1-PD-4-FW.2-1			
98	BAS00-1FW-PT-1708	Transmitter, Pressure	BFP SUCTION PRESS	HRSG1	Yes	X	36		1-PD-4-FW.1-1			
99	BAS00-1FW-PT-1751	Transmitter, Pressure	BFP IP DISCH PRESS	HRSG1	Yes	X	36		1-PD-4-FW.1-1			
104	BAS00-1FW-PT-1756	Transmitter, Pressure	BFP HP DISCH PRESS	HRSG1	Yes	X	36		1-PD-4-FW.1-1			
105	BAS00-1FW-PT-2708	Transmitter, Pressure	BFP SUCTION PRESS	HRSG2	Yes	Y	37		1-PD-4-FW.2-1			
106	BAS00-1FW-PT-2751	Transmitter, Pressure	BFP IP DISCH PRESS	HRSG2	Yes	Y	37		1-PD-4-FW.2-1			
111	BAS00-1FW-PT-2756	Transmitter, Pressure	BFP HP DISCH PRESS	HRSG2	Yes	Y	37		1-PD-4-FW.2-1			
115	BAS00-1HR-FT-1400	Transmitter, D/P	HP STEAM SH SPRAY FLOW	HRSG1	Yes	X	36	EHT-0011	1-PD-4-HR.1-1			
116	BAS00-1HR-FT-1401	Transmitter, D/P	RH SPRAY FLOW	HRSG1	Yes	X	32		1-PD-4-HR.1-1			
117	BAS00-1HR-FT-1402	Transmitter, D/P	HP STEAM FLOW	HRSG1	Yes	X	37		1-PD-4-BS.0-1			
118	BAS00-1HR-FT-1420	Transmitter, D/P	HP DRUM FW FLOW	HRSG1	Yes	X	39		1-PD-4-HR.1-2			
119	BAS00-1HR-FT-1440	Transmitter, D/P	IP STEAM TO RH FLOW	HRSG1	Yes	Z	6	EHT-0012				
120	BAS00-1HR-FT-1441	Transmitter, D/P	LP STEAM FLOW	HRSG1	Yes	X	39					
121	BAS00-1HR-FT-1445	Transmitter, D/P	HRH B/P STM SPRAY FLOW	HRSG1	Yes	X	42		1-PD-4-BS.0-2			
122	BAS00-1HR-FT-1460	Transmitter, D/P	IP DRUM FW FLOW	HRSG1	Yes	X	39					
123	BAS00-1HR-FT-1480	Transmitter, D/P	LP DRUM FW FLOW	HRSG1	Yes	X	32					
124	BAS00-1HR-FT-2400	Transmitter, D/P	HP STEAM SH SPRAY FLOW	HRSG2	Yes	Y	37					
125	BAS00-1HR-FT-2401	Transmitter, D/P	RH SPRAY FLOW	HRSG2	Yes	Y	40					
126	BAS00-1HR-FT-2402	Transmitter, D/P	HP STEAM FLOW	HRSG2	Yes	Y	39					
127	BAS00-1HR-FT-2420	Transmitter, D/P	HP DRUM FW FLOW	HRSG2	Yes	Y	39					
128	BAS00-1HR-FT-2440	Transmitter, D/P	IP STEAM TO RH FLOW	HRSG2	Yes	S	23					
129	BAS00-1HR-FT-2441	Transmitter, D/P	LP STEAM FLOW	HRSG2	Yes	Y	39					
130	BAS00-1HR-FT-2445	Transmitter, D/P	HRH B/P STM SPRAY FLOW	HRSG2	Yes	X	8		1-PD-4-BS.0-2			
131	BAS00-1HR-FT-2460	Transmitter, D/P	IP DRUM FW FLOW	HRSG2	Yes	Y	39					
132	BAS00-1HR-FT-2480	Transmitter, D/P	LP DRUM FW FLOW	HRSG2	Yes	Y	40					
133	BAS00-1HR-LT-1420A	Transmitter, Level	HP DRUM LEVEL A	HRSG1	Yes	Z	11		1-PD-4-HR.1-2			

Reviewed by R. Ramthe 10/29/2019

CRITICAL HEAT TRACE LIST IDENTIFICATION

- Tag Number
- Component (Pressure, Temperature, D/P)
- Description
- Area location
- Heat traced (yes or no)
- Panel and breaker number
- P&ID number
- Drawing number

CRITICAL HEAT TRACE IDENTIFICATION IN FIELD



Panel No. 1EH-PL-Y

HEATER NO.	BREAKER POLE	BREAKER AMP	VOLT AMPERES A	VOLT AMPERES B	VOLT AMPERES C	CKT. NO.	BUS CONN.	CKT. NO.	VOLT AMPERES A	VOLT AMPERES B	VOLT AMPERES C	BREAKER POLE	BREAKER AMP
HTR-134	1	30	1700			1		2	198			1	30
HTR-012, 135, 136, 137	1	30		1236		3		4		1272		1	30
HTR-018, 133, 139	1	30			1638	5		6			396	1	30
HTR-138, 454, FWPT0730	1	30	1100			7		8	2104			1	30
HTR-276, PT0321, PT0101, PIT0501	1	30		1723		9		10		1518		1	30
HTR-184, 197, 266, 288	1	30			1716	11		12			2520	1	30
HTR-310, 313, 317, 318	1	30	1700			13		14	1824			1	30
HTR-024, 297	1	30		2160		15		16		2200		1	30
HTR-096, 097, 098, 099, 160, 169, 204	1	30			2256	17		18			3472	1	30
HTR-100, 101, 102, 103, 142, 388, 394	1	30	2364			19		20	2900			1	30
HTR-072, 180, 189, PT0306, FT0300	1	30		2204		21		22		2752		1	30
HTR-172, 190, 191	1	30			1944	23		24			1708	1	30
HTR-081, 082, 055, 057, 058, 085, 185, 465	1	30	1778			25		26	1400			1	30
HTR-168, 171, 175, 178, 181, 193, SP0519	1	30		2236		27		28		1380		1	30
HTR-084, 465, 484	1	30			756	29		30			1320	1	30
HTR-003, 004	1	30	1320			31		32	2200			1	30
[illegible]	1	30		1752		33		34		1428		1	30
HTR-044, 184, 192, SP1523	1	30			2552	35		36			1248	1	30
PDQ157A, PDQ157B, PT2108, PT2101, PT2751, FT2400, FT2700	1	30	2364			37		38	2220			1	30
FT2441, FT2420, FT2460, PT2441, FT-2402	1	30		1968		39		40		2100		1	30
PIT0502, PIT0504, HTR-179	1	30			1932	41		42			1420	1	30
						43		44					
						45		46					
						47		48					
						49		50					
						51		52					
						53		54					
Totals			12,318	13,276	12,868				12,806	12,656	11,684		

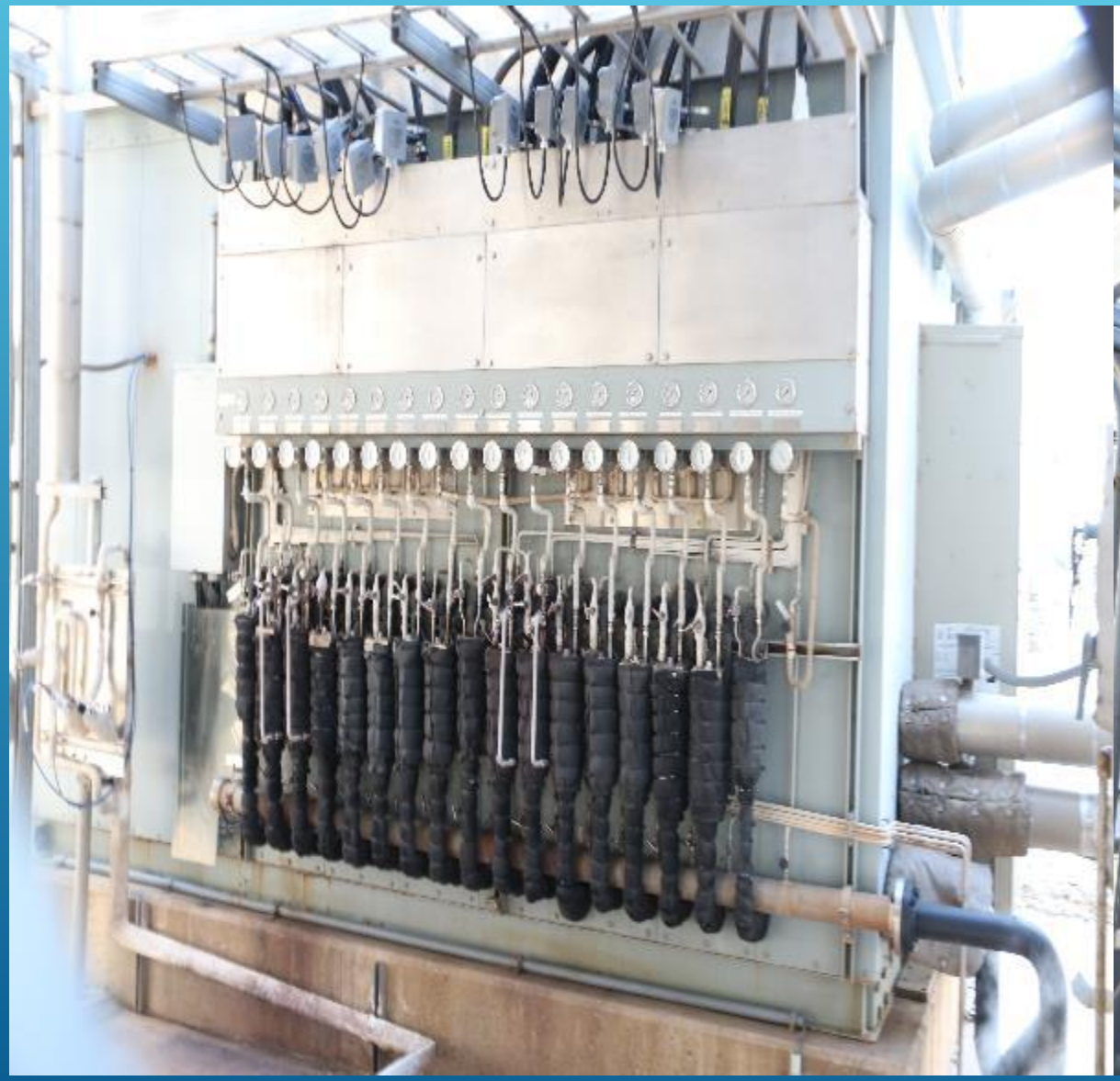
LOADS
Bus A: 25,124
Bus B: 25,932
Bus C: 24,552
Total: 75,608

Average: 25,203
% Imbalance: 5.3%
Service Voltage: 208
Current:
ain Brkr. Size (80% rule):

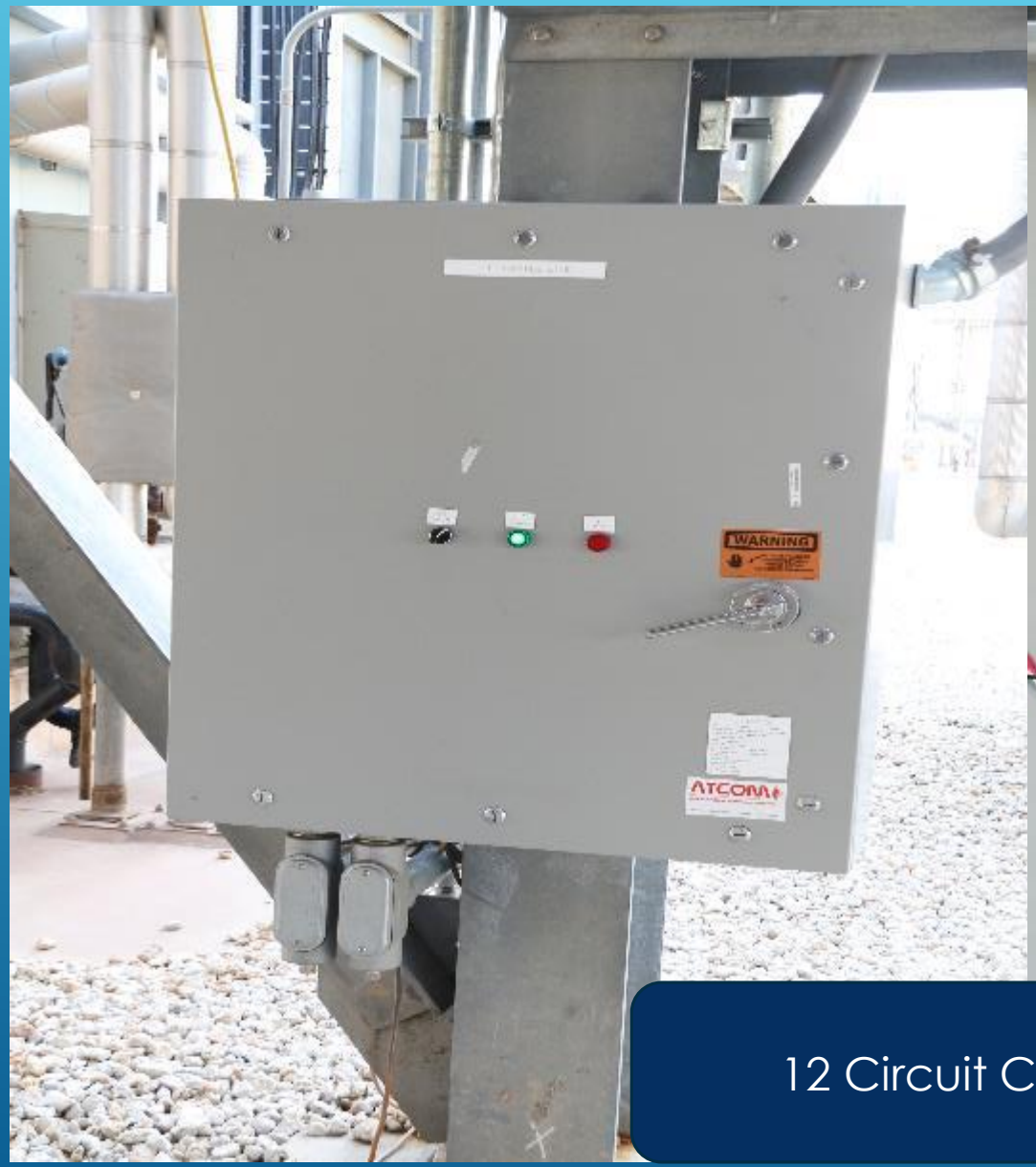
HEAT TRACE YEARLY INSPECTION

- 2018 – Outside Vender performed a comprehensive audit on the Bastrop Heat Trace System to establish a baseline.
  - Audit identified issues with HRSG sample line heat trace.
  - While the sample line heat trace was not considered critical heat trace, they shared the same breakers with many critical heat trace circuits.
  - Sample lines were upgraded and put on individual circuits.
- 2019 – Outside Vender Conducted a yearly Heat Trace Audit of all Heat Trace panels.
  - 14 circuits were identified and repaired

HRSG SAMPLE BUNDLE REPLACEMENT



HRSG SAMPLE BUNDLE REPLACEMENT



12 Circuit Control Panel

HRSG SAMPLE BUNDLE REPLACEMENT

Installation Price - $354,000

- 300’ Cooling Tower Water Treatment Tubing
- 1320’I HP Tubing
- 1150’ IP and LP Tubing
- 12- Circuit Control Panel and Power Distribution
  - Allow system to have continues runs for the sample line.
- Labor
- Misc. Materials

HRSG SAMPLE BUNDLE REPLACEMENT DESIGN

Heat Trace Design Temperature -(-20°F)
Maintain Temp (Freeze) - 40°F
Maximum Exposure Temp -1050F, 750F, 400F
Insulation Type - Insulation Blankets
Operating Voltage - 277 Volts

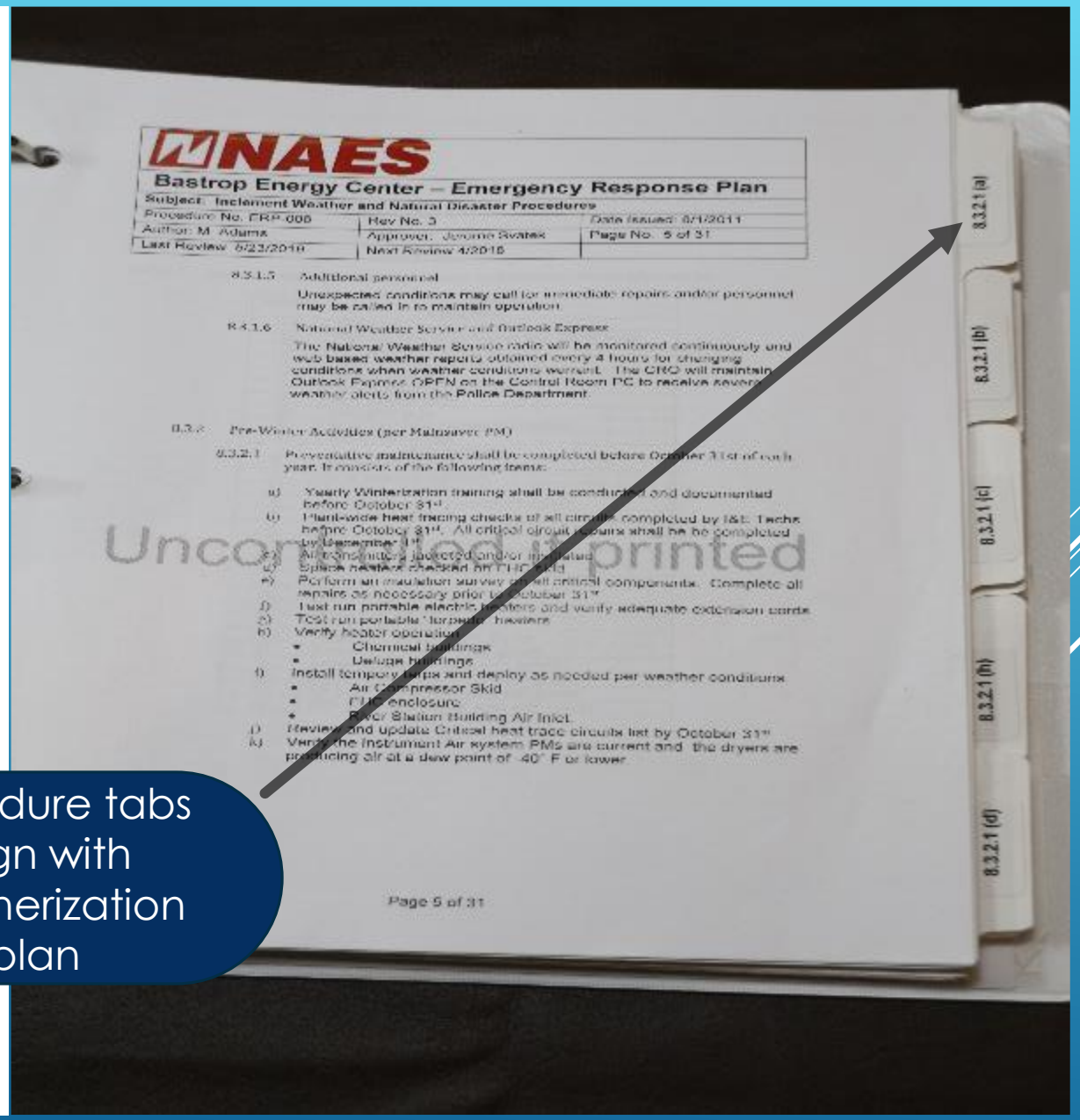
WEATHERIZATION PLAN ORGANIZATION

8.3.2 Pre-Winter Activities (per Mainsaver PM)

8.3.2.1 Preventative maintenance shall be completed before October 31st of each year. It consists of the following items:

a) Yearly Winterization training shall be conducted and documented before October 31st.
b) Plant-wide heat tracing checks of all circuits completed by I&E Techs before October 31st. All critical circuit repairs shall be be completed by December 1st.
c) Perform an insulation survey on all critical components. Complete all repairs as necessary prior to October 31st. Outstanding repairs not completed shall be priority to be completed by December 1st.
d) Test run portable "torpedo" heaters
e) Verify heater operation
   - Chemical buildings
   - Deluge buildings
   - Space heaters checked on EHC skid
   - CEM's buildings
   - Fire pump house
   - Warehouse buildings
f) Install tempory tarps and deploy as needed per weather conditions.
   - Air Compressor Skid
   - EHC enclosure
   - River Station Building Air Inlet.
g) Review and update Critical heat trace circuits list by October 31st
h) Verify the Instrument Air system PMs are current and the dryers are producing air at a dew point of -40° F or lower.
i) Confirm MPW has completed winterization checks on demineralizer system.

Page 5 of 31



Procedure tabs align with weatherization plan

BASTROP WINTERIZATION SPOT CHECK

- Information is organized
- ERCOT spot checks are less stressful
- Tool to identify missing or incomplete preparation

BASTROP WINTERIZATION IMPROVEMENTS

Installed Building over Chemical Areas

BASTROP WINTERIZATION IMPROVEMENTS

Spray on Insulated Walls

Local Heaters

BASTROP WINTERIZATION IMPROVEMENTS

Moved Drum Level Transmitters closer to the HRSG

BASTROP WINTERIZATION IMPROVEMENTS

Cooling Tower Bypass

- Normal Operation – Valve closed
- Cold Weather Event – Valve is used to control the basin temperature to prevent icing on cooling tower media.

BASTROP WINTERIZATION IMPROVEMENTS

Transmitter Box Local Temperature Gauge

Questions?

COLORADO BEND II EXELON POWER

- Commercial Date 6/23/2017
- 2x1 Configuration
- 7HA.02 GE Gas Turbines
- D602 GE Steam Turbine
- Total Output 1,200 MW

COLORADO BEND II FREEZE PROTECTION PLAN

- Driven from our Winter Readiness Matrix
- Corporate Seasonal Readiness Procedure
- Site specific Winter Readiness Procedure

For Example:

- System Readiness Review due by mid September
- Inventory Cold Weather Material by Nov 1
- Ensure Winter PMs are completed by Oct 1

- Training Material
  1. Lessons Learned, Winter Expectations and Heat Trace Rounds

- Created a SUN for all to sign

SHIFT UPDATE NOTICE

Title: Winter Readiness

DATE: 10/08/2019

Document (if applicable): N/A

Description: CBECII Winter Readiness Training and Discussion

Please review and sign the Winter Readiness Training and Discussion material.

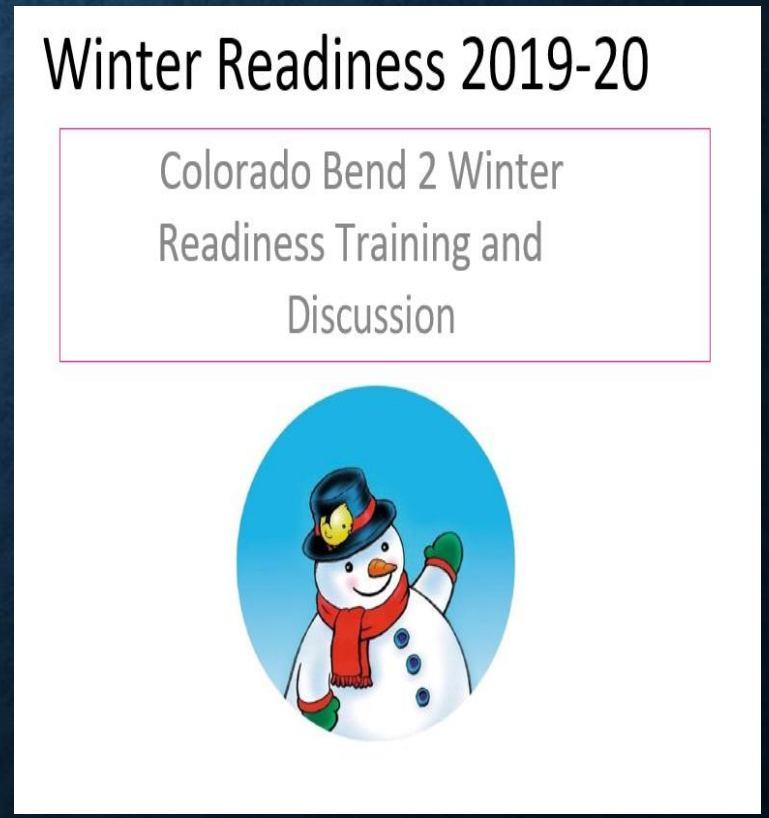
_____ ********** - Ops Foreman

_____ ********** – Ops Manager

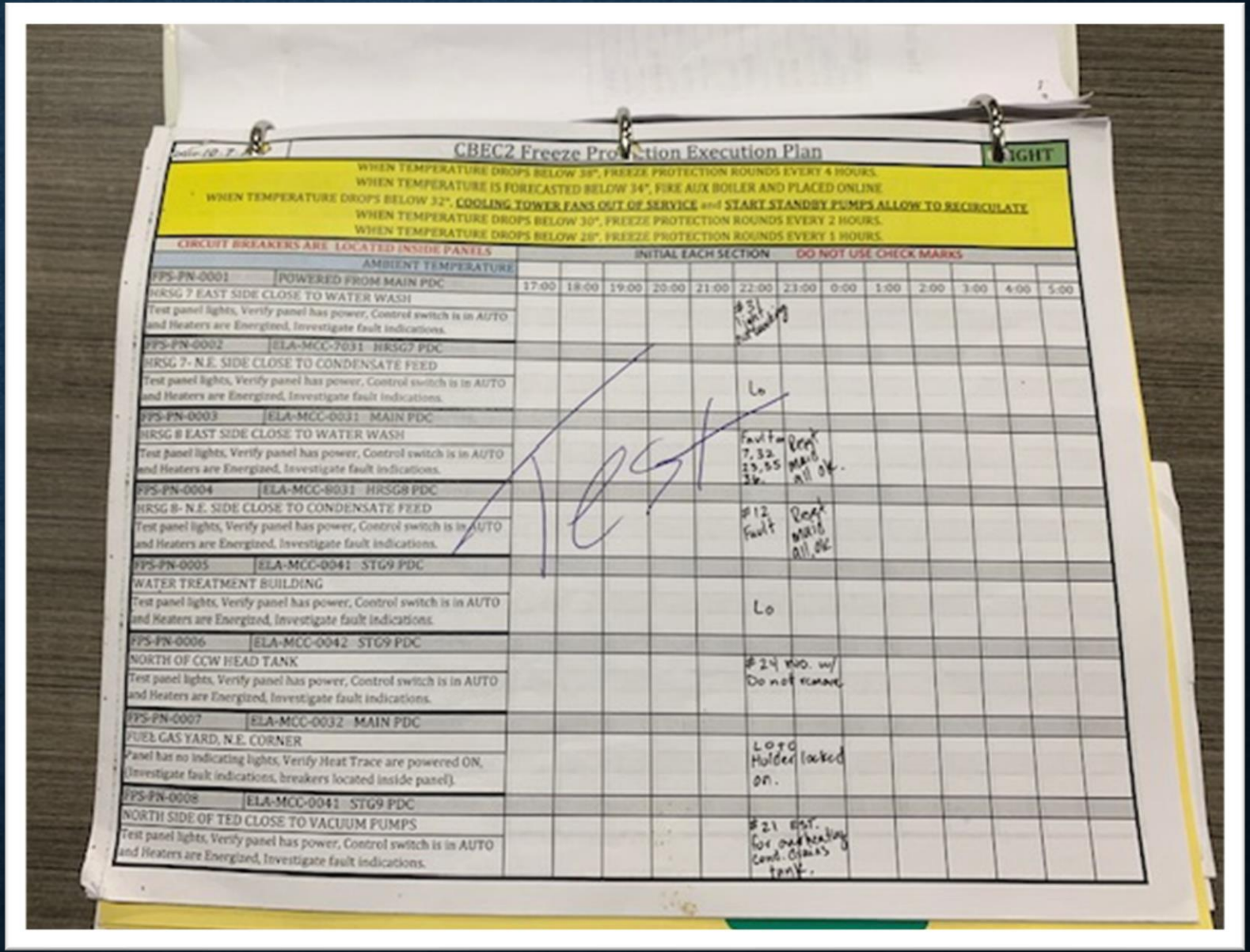
SUN SIGN-OFF SHEET

The following Operations Personnel have reviewed this S.U.N.

Last Name	First Name	Station	Date	Signature
A*******	H*******	CBEC 2		
B********	O*******	CBEC 2		
B********	C*****	CBEC 2		
B*******	F********	CBEC 2		
B*******	C*******	CBEC 2		
B*****	R******	CBEC 2		
C******	R******	CBEC 2		
C******	M*******	CBEC 2		
F*****	S******	CBEC 2		
H******	R******	CBEC 2		
L****	N*******	CBEC 2		
O******	S*******	CBEC 2		
O******	L*******	CBEC 2		
W****	J*******	CBEC 2		
W******	B*******	CBEC 2		
Y******	W******	CBEC 2		



- Test Exercise for Heat Trace
- Great for training new employees



OPERATIONS FREEZE PROTECTION PANEL CHECKS

- PANEL INSPECTION EXPECTATIONS
- PANEL LOCATIONS IDENTIFIED
- PANEL POWER SOURCE IDENTIFIED
- FREQUENCY INCREASES AS TEMPERATURES DECRESE

Date:_____

CBEC2 Freeze Protection Execution Plan

DAYS

WHEN TEMPERATURE DROPS BELOW 38°, FREEZE PROTECTION ROUNDS EVERY 4 HOURS.
WHEN TEMPERATURE IS FORECASTED BELOW 34°, FIRE AUX BOILER AND PLACED ONLINE
WHEN TEMPERATURE DROPS BELOW 32°, **COOLING TOWER FANS OUT OF SERVICE** and **START STANDBY PUMPS ALLOW TO RECIRCULATE**
WHEN TEMPERTURE DROPS BELOW 30°F - VERIFY TEMP GAUGES ON O'BRIEN ENCLOSURE(S) ARE ABOVE FREEZING - EVERY 4 HOURS
WHEN TEMPERATURE DROPS BELOW 30°, FREEZE PROTECTION ROUNDS EVERY 2 HOURS.
WHEN TEMPERATURE DROPS BELOW 28°, FREEZE PROTECTION ROUNDS EVERY 1 HOURS.

CIRCUIT BREAKERS ARE LOCATED INSIDE PANELS		INITIAL EACH SECTION DO NOT USE CHECK MARKS												
ENTER AMBIENT TEMPERATURE →														
FPS-PN-0001	POWERED FROM MAIN PDC	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00
HRSG 7 EAST SIDE CLOSE TO WATER WASH														
Test panel lights, Verify panel has power, Control switch is in AUTO and Heaters are Energized, Investigate fault indications.														
FPS-PN-0002	ELA-MCC-7031 HRSG7 PDC													
HRSG 7- N.E. SIDE CLOSE TO CONDENSATE FEED														
Test panel lights, Verify panel has power, Control switch is in AUTO and Heaters are Energized, Investigate fault indications.														
FPS-PN-0003	ELA-MCC-0031 MAIN PDC													
HRSG 8 EAST SIDE CLOSE TO WATER WASH														
Test panel lights, Verify panel has power, Control switch is in AUTO and Heaters are Energized, Investigate fault indications.														
FPS-PN-0004	ELA-MCC-8031 HRSG8 PDC													
HRSG 8- N.E. SIDE CLOSE TO CONDENSATE FEED														
Test panel lights, Verify panel has power, Control switch is in AUTO and Heaters are Energized, Investigate fault indications.														
FPS-PN-0005	ELA-MCC-0041 STG9 PDC													
WATER TREATMENT BUILDING														
Test panel lights, Verify panel has power, Control switch is in AUTO and Heaters are Energized, Investigate fault indications.														
FPS-PN-0006	ELA-MCC-0042 STG9 PDC													
NORTH OF CCW HEAD TANK														
Test panel lights, Verify panel has power, Control switch is in AUTO and Heaters are Energized, Investigate fault indications.														
FPS-PN-0007	ELA-MCC-0032 MAIN PDC													
FUEL GAS YARD, N.E. CORNER														
Panel has no indicating lights, Verify Heat Trace are powered ON, (Investigate fault indications, breakers located inside panel).														
FPS-PN-0008	ELA-MCC-0041 STG9 PDC													
NORTH SIDE OF TED CLOSE TO VACUUM PUMPS														
Test panel lights, Verify panel has power, Control switch is in AUTO and Heaters are Energized, Investigate fault indications.														

OPERATIONS OBRIEN BOX CHECKS

- LOCAL INSPECTIONS START AT 38°
- CHECKING BOX INTERNAL TEMPERATURE
- FREQUENCY INCREASES AS TEMPERATURES DECREASE

Date:_____

CBEC2 Freeze Protection Execution Plan (O'Brien Boxes)

DAYS

WHEN TEMPERATURE DROPS BELOW 38°, FREEZE PROTECTION ROUNDS EVERY 4 HOURS.
WHEN TEMPERATURE IS FORECASTED BELOW 34°, FIRE AUX BOILER AND PLACED ONLINE
WHEN TEMPERATURE DROPS BELOW 32°, **COOLING TOWER FANS OUT OF SERVICE** and **START STANDBY PUMPS ALLOW TO RECIRCULATE**
WHEN TEMPERTURE DROPS BELOW 30°F - VERIFY TEMP GAUGES ON O'BRIEN ENCLOSURE(S) ARE ABOVE FREEZING - EVERY 4 HOURS
WHEN TEMPERATURE DROPS BELOW 30°, FREEZE PROTECTION ROUNDS EVERY 2 HOURS.
WHEN TEMPERATURE DROPS BELOW 28°, FREEZE PROTECTION ROUNDS EVERY 1 HOURS.

		INITIAL EACH SECTION DO NOT USE CHECK MARKS												
ENTER AMBIENT TEMPERATURE														
		5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00
U7-01	HRSG 7 TOP DECK (NORTH LP DRUM)													
O'BRIEN BOX ID# 206		SLP-PIT-7849												
U7-02	HRSG 7 TOP DECK (SOUTH WEST HP DRUM)													
O'BRIEN BOX ID# 213		SHP-PIT-7646												
U7-03	HRSG 7 TOP DECK (HP STEAM OUTLET)													
O'BRIEN BOX ID# 224		HP-PT-7725-01												
U7-04	HRSG 7 TOP DECK (HP STEAM OUTLET)													
O'BRIEN BOX ID# 221		SHP-PIT-7708-01												
U7-05	HRSG 7 TOP DECK (SRH STEAM OUTLET)													
O'BRIEN BOX ID# 216		SRH-PIT-7737-01												
U7-06	HRSG 7 TOP DECK (NORTH EAST HP DRUM DOG HOUSE													
O'BRIEN BOX ID# 230		SIP-FIT-7791-01, SIP-FIT-7791-02												
U7-07	HRSG 7 TOP DECK (SOUTH EAST IP DRUM DOG HOUSE													
O'BRIEN BOX ID# 233		SIP-PIT-7785-01												
U7-08	HRSG 7 TOP DECK (SOUTH EAST IP DRUM DOG HOUSE													
O'BRIEN BOX ID# 237		SIP-PIT-7734-01, SIP-PIT-7737-01, SIP-PIT-7740-01												
U7-09	HRSG 7 TOP DECK (EAST LP DRUM DOG HOUSE)													
O'BRIEN BOX ID# 243														
U7-10	BYPASS DECK U7													
O'BRIEN BOX ID# 201		BFW-PIT-7300-02, IE-01, BFW-PIT-7300-03												
U7-11	BYPASS DECK U7													
O'BRIEN BOX ID# 177		BFW-FIT-7203-04, IE-05, BFW-PIT-7203-03												
U7-12	BYPASS DECK U7													
O'BRIEN BOX ID# 197		BFW--PIT-7401-03, IE-02, BFW--PIT-7401-02												
U7-13	BYPASS DECK U7													
O'BRIEN BOX ID# 183		BFW-FIT-7204-04, IE-06, BFW-PIT, 7204-03												
U7-14	BYPASS DECK U7													
O'BRIEN BOX ID# - NO LABLE		BFW-FIT-7500-04												
U7-15	BYPASS DECK U7													
O'BRIEN BOX ID# 191		BFW-FIT-7303-04, IE-04												
U7-16	BYPASS DECK U7													
O'BRIEN BOX ID# 189		BFW-PIT-7303-03, IE-03, BFW-PDIT-7303-02												
		INITIAL EACH SECTION DO NOT USE CHECK MARKS												

INSTRUMENT DEVICE ID #	BRACE - O'BRIEN BOX HEAT TRACE ID #	INSTRUMENT ENCLOSURE ID #	CBEC 2 FREEZE PROTECTION OBRIEN BOX ID #	OBRIEN BOX HEATER FREEZE PROTECTION PANEL NUMBER	OBRIEN BOX HEATER CIRCUIT BREAKER
SHP-PIT-7104-01	88	IE-22	U7-34	FPS-PN-001	10
SHP-PIT-7104-02	88	IE-22	U7-34	FPS-PN-001	10
BFW-PIT-7102-06	94	IE-16	U7-35	FPS-PN-001	15
BFW-PIT-7102-07	94	IE-16	U7-35	FPS-PN-001	15
SHP-PIT-7108-07	82	IE-20	U7-36	FPS-PN-001	4
SRH-PIT-7101-03	85	IE-21	U7-37	FPS-PN-001	10
SRH-PIT-7101-04	85	IE-21	U7-37	FPS-PN-001	10
SLP-PIT-7101-05	75	IE-25	U7-38	FPS-PN-001	7
SHP-PIT-7108-02	75	IE-25	U7-38	FPS-PN-001	7
SHP-FIT-7108-06	80	NONE	U7-39	FPS-PN-001	3
SHP-FIT-7108-05	80	NONE	U7-39	FPS-PN-001	3
BFW-PIT-7206-02	96	NONE	U7-40	FPS-PN-001	12
BFW-FIT-7206-03	98	NONE	U7-41	FPS-PN-001	12
WWC-PIT-7125-03	19	IE-138	U7-42	FPS-PN-002	8
WWC-FIT-7125-05	19	IE-138	U7-42	FPS-PN-002	8
BFW-FIT-7304-03	54	NONE	U7-43	FPS-PN-001	2
BFW-PIT-7304-02	56	NONE	U7-44	FPS-PN-001	2
SLP-PIT-8852-01	202	NONE	U8-01	FPS-PN-004	24
SLP-PIT-8849-01	202	NONE	U8-01	FPS-PN-004	24
SLP-PIT-8855-01	202	NONE	U8-01	FPS-PN-004	24
BFW-PIT-8783-01	243	NONE	U8-02	FPS-PN-004	
SIP-PIT-8734-01	235	NONE	U8-03	FPS-PN-004	15
SIP-PIT-8737-01	235	NONE	U8-03	FPS-PN-004	15
SIP-PIT-8740-01	235	NONE	U8-03	FPS-PN-004	15
SIP-PIT-8785-01	231	NONE	U8-04	FPS-PN-004	15
SIP-FIT-8791-01	223	NONE	U8-05	FPS-PN-003	21
SIP-FIT-8791-02	223	NONE	U8-05	FPS-PN-003	21
SRH-PIT-8732-01	213	NONE	U8-06	FPS-PN-003	16
SHP-PIT-8708-01	216	NONE	U8-07	FPS-PN-003	15
SHP-PIT-8725-01	219	NONE	U8-08	FPS-PN-003	15
SHP-PIT-8646-01	208	NONE	U8-09	FPS-PN-003	22
SHP-PIT-8649-01	208	NONE	U8-09	FPS-PN-003	22
SHP-PIT-8652-01	208	NONE	U8-09	FPS-PN-003	22
BFW-PIT-8300-02	177	IE-01	U8-10	FPS-PN-004	9
BFW-FIT-8300-03	177	IE-01	U8-10	FPS-PN-004	9
BFW-PIT-8203-03	182	IE-31	U8-11	FPS-PN-004	1
BFW-FIT-8203-04	182	IE-31	U8-11	FPS-PN-004	1
BFW-PIT-8401-03	188	IE-32	U8-12	FPS-PN-004	10

CREATED UNIT SPECIFIC OBRIEN BOX IDENTIFICATION NUMBERS TO QUICKLY LOCATE IN CASE OF EMERGENCY

LIST ALL HEAT TRACE CIRCUITS, FREEZE PROTECTION PANELS, CIRCUIT BREAKERS, AND LOCATIONS.

HEAT TRACE CIRCUIT LOCATIONS AND INSTRUMENT DESCRIPTIONS

TEAM DECIDED WHICH CIRCUITS WERE CRITICAL AND COULD LEAD TO A PLANT TRIP.

LOCATION	DESCRIPTION	CRITICAL
GROUND LEVEL U7 (EAST SIDE BLOWDOWN TK)	HP BYPASS TO CRH PRESSURE TRANSMITTER "A"	CRITICAL TRANSMITTER
GROUND LEVEL U7 (EAST SIDE BLOWDOWN TK)	HP BYPASS TO CRH PRESSURE TRANSMITTER "B"	CRITICAL TRANSMITTER
GROUND LEVEL U7 (EAST SIDE BLOWDOWN TK)	BFW-PP-7002 SUCTION PRESSURE TRANSMITTER "A"	NORMAL CIRCUIT
GROUND LEVEL U7 (EAST SIDE BLOWDOWN TK)	BFW-PP-7002 SUCTION PRESSURE TRANSMITTER "B"	CRITICAL TRANSMITTER
GROUND LEVEL U7 (EAST SIDE BLOWDOWN TK)	HRSG HP STEAM OUTLET PRESSURE	NORMAL CIRCUIT
GROUND LEVEL U7 (EAST SIDE BLOWDOWN TK)	HRH OUTLET PRESSURE TRANSMITTER "A"	NORMAL CIRCUIT
GROUND LEVEL U7 (EAST SIDE BLOWDOWN TK)	HRH OUTLET PRESSURE TRANSMITTER "B"	NORMAL CIRCUIT
GROUND LEVEL U7 (EAST SIDE, EYE WASH)	LP STEAM HEADER PRESSURE	NORMAL CIRCUIT
GROUND LEVEL U7 (EAST SIDE BLOWDOWN TK)	HRSG HP STEAM OUTLET PRESSURE	NORMAL CIRCUIT
GROUND LEVEL U7 (EAST SIDE BLOWDOWN TK)	HRSG HP STEAM OUTLET FLOW TRANSMITTER "B"	CRITICAL TRANSMITTER
GROUND LEVEL U7 (EAST SIDE BLOWDOWN TK)	HRSG HP STEAM OUTLET FLOW TRANSMITTER "A"	CRITICAL TRANSMITTER
GROUND LEVEL U7 (EAST SIDE BLOWDOWN TK)	BOILER FEEDWATER DESUPERHEATER PRESSURE	NORMAL CIRCUIT
GROUND LEVEL U7 (EAST SIDE BLOWDOWN TK)	BOILER FEEDWATER DESUPERHEATER FLOW	CRITICAL TRANSMITTER
GROUND LEVEL U7 (WEST SIDE BLOWDOWN SUMP)	U7 WASTE WATER DISCHARGE PRESSURE	CRITICAL TRANSMITTER
GROUND LEVEL U7 (WEST SIDE BLOWDOWN SUMP)	U7 WASTE WATER DISCHARGE FLOW	CRITICAL TRANSMITTER
GROUND LEVEL U7 WEST SIDE PERFORMANCE HTR	HRH DESUPERHEATER FLOW	CRITICAL TRANSMITTER
GROUND LEVEL U7 WEST SIDE PERFORMANCE HTR	HRH DESUPERHEATER FLOW	CRITICAL TRANSMITTER
HRSG 8 TOP DECK (NORTH LP DRUM)	LP DRUM PRESSURE TRANSMITTER "B"	CRITICAL TRANSMITTER
HRSG 8 TOP DECK (NORTH LP DRUM)	LP DRUM PRESSURE TRANSMITTER "A"	CRITICAL TRANSMITTER
HRSG 8 TOP DECK (NORTH LP DRUM)	LP DRUM PRESSURE TRANSMITTER "C"	CRITICAL TRANSMITTER
HRSG 8 TOP DECK (EAST LP DRUM DOG HOUSE)	IP FEEDWATER PRESSURE	NORMAL CIRCUIT
HRSG 8 TOP DECK (SOUTH EAST IP DRUM DOG HOUSE)	IP DRUM PRESSURE TRANSMITTER "A"	CRITICAL TRANSMITTER
HRSG 8 TOP DECK (SOUTH EAST IP DRUM DOG HOUSE)	IP DRUM PRESSURE TRANSMITTER "B"	CRITICAL TRANSMITTER
HRSG 8 TOP DECK (SOUTH EAST IP DRUM DOG HOUSE)	IP DRUM PRESSURE TRANSMITTER "C"	CRITICAL TRANSMITTER
HRSG 8 TOP DECK (SOUTH EAST IP DRUM DOG HOUSE)	IP DRUM OUTLET PRESSURE	NORMAL CIRCUIT
HRSG 8 TOP DECK (NORTH EAST HP DRUM DOG HOUSE	IP STEAM FLOW TRANSMITTER "A"	CRITICAL TRANSMITTER
HRSG 8 TOP DECK (NORTH EAST HP DRUM DOG HOUSE	IP STEAM FLOW TRANSMITTER "B"	CRITICAL TRANSMITTER
HRSG 8 TOP DECK (SRH STEAM OUTLET)	HRSG HRH OUTLET STEAM PRESSURE	CRITICAL TRANSMITTER
HRSG 8 TOP DECK (HP STEAM OUTLET)	HRSG HP OUTLET STEAM PRESSURE	NORMAL CIRCUIT
HRSG 8 TOP DECK (HP STEAM OUTLET)	HP STEAM OUTLET ERV PRESSURE	CRITICAL TRANSMITTER
HRSG 8 TOP DECK (SOUTH WEST HP DRUM DOG HOUSE	HP DRUM PRESSURE TRANSMITTER "A"	CRITICAL TRANSMITTER
HRSG 8 TOP DECK (SOUTH WEST HP DRUM DOG HOUSE	HP DRUM PRESSURE TRANSMITTER "B"	CRITICAL TRANSMITTER
HRSG 8 TOP DECK (SOUTH WEST HP DRUM DOG HOUSE	HP DRUM PRESSURE TRANSMITTER "C"	CRITICAL TRANSMITTER
BYPASS DECK U8	IP ECONOMIZER FEEDWATER PRESSURE	NORMAL CIRCUIT
BYPASS DECK U8	IP ECONOMIZER FEEDWATER FLOW	NORMAL CIRCUIT
BYPASS DECK U8	HP BYPASS DESUPERHEATER PRESSURE	CRITICAL TRANSMITTER
BYPASS DECK U8	HP BYPASS DESUPERHEATER FLOW	NORMAL CIRCUIT
BYPASS DECK U8	BFW TO PERFORMANCE HEATER PRESSURE	CRITICAL TRANSMITTER

INSTRUMENT DEVICE ID #	BRACE - O'BRIEN BOX HEAT TRACE ID #	INSTRUMENT ENCLOSURE ID #	CBEC 2 FREEZE PROTECTION OBRIEN BOX ID #	OBRIEN BOX HEATER FREEZE PROTECTION PANEL NUMBER	OBRIEN BOX HEATER CIRCUIT BREAKER	LOCATION	DESCRIPTION	CRITICAL
SLP-PIT-7849-01	206	NONE	U7-01	FPS-PN-002	21	HRSG 7 TOP DECK (NORTH LP DRUM)	LP DRUM LEVEL TRANSMITTER "A"	CRITICAL TRANSMITTER
SHP-PIT-7646-01	213	NONE	U7-02	FPS-PN-001	22	HRSG 7 TOP DECK (SOUTH WEST HP DRUM)	HP DRUM PRESSURE TRANSMITTER "A"	CRITICAL TRANSMITTER
SHP-PT-7725-01	224	NONE	U7-03	FPS-PN-001	11	HRSG 7 TOP DECK (HP STEAM OUTLET)	HP STEAM OUTLET ERV PRESSURE	NORMAL CIRCUIT
SHP-PIT-7708-01	221	NONE	U7-04	FPS-PN-001	6	HRSG 7 TOP DECK (HP STEAM OUTLET)	HP STEAM OUTLET PRESSURE	NORMAL CIRCUIT
SRH-PIT-7737-01	216	NONE	U7-05	FPS-PN-001	11	HRSG 7 TOP DECK (SRH STEAM OUTLET)	HOT REHEAT OUTLET STEAM PRESSURE	NORMAL CIRCUIT
SIP-FIT-7791-01	230	NONE	U7-06	FPS-PN-002	11	HRSG 7 TOP DECK (NORTH EAST HP DRUM DOG HOUSE)	IP STEAM OUTLET FLOW TRANSMITTER "A"	CRITICAL TRANSMITTER
SIP-FIT-7791-02	230	NONE	U7-06	FPS-PN-002	11	HRSG 7 TOP DECK (NORTH EAST HP DRUM DOG HOUSE)	IP STEAM OUTLET FLOW TRANSMITTER "B"	CRITICAL TRANSMITTER
SIP-PIT-7785-01	233	NONE	U7-07				IP STEAM OUTLET PRESSURE	NORMAL CIRCUIT
SIP-PIT-7734-01	237	NONE	U7-08				IP DRUM PRESSURE TRANSMITTER "A"	CRITICAL TRANSMITTER
SIP-PIT-7737-01	237	NONE	U7-08				IP DRUM PRESSURE TRANSMITTER "B"	CRITICAL TRANSMITTER
SIP-PIT-7740-01	237	NONE	U7-08				IP DRUM PRESSURE TRANSMITTER "C"	CRITICAL TRANSMITTER
BFW-PIT-7783-01	243	NONE	U7-09				IP FEEDWATER PRESSURE	CRITICAL TRANSMITTER
BFW-PIT-7300-02	201	IE-01	U7-10				IP ECONOMIZER FEEDWATER PRESSURE	NORMAL CIRCUIT
BFW-FIT-7300-03	201	IE-01	U7-10				IP ECONOMIZER FEEDWATER FLOW	CRITICAL TRANSMITTER
BFW-FIT-7203-04	177	IE-05	U7-11				BFW-PP-7001 MIN FLOW TO LP DRUM	CRITICAL TRANSMITTER
BFW-PIT-7203-03	177	IE-05	U7-11				BFW-PP-7001 MIN FLOW - PRESSURE TO LP DRUM	CRITICAL TRANSMITTER
BFW-PIT-7401-03	197	IE-02	U7-12				BFW TO PERFORMANCE HEATER PRESSURE	NORMAL CIRCUIT
BFW-FIT-7401-02	197	IE-02	U7-12				PERFORMANCE HEATER FEEDWATER FLOW	CRITICAL TRANSMITTER
BFW-FIT-7204-04	183	IE-06	U7-13				BFW-PP-7002 RECIRC.TO LP DRUM FLOW	CRITICAL TRANSMITTER
BFW-PIT-7204-03	183	IE-06	U7-13				BFW-PP-7002 MIN FLOW - PRESSURE TO LP DRUM	NORMAL CIRCUIT
BFW-FIT-7500-04	NONE	NONE	U7-14				HP BYPASS DESUPER HEATER FEEDWATER FLOW	NORMAL CIRCUIT
BFW-FIT-7303-04	191	IE-04	U7-15				HP DESUPERHEATER BYPASS FLOW	CRITICAL TRANSMITTER
BFW-PIT-7303-03	189	IE-03	U7-16	FPS-PN-001	15	BYPASS DECK U7	HP BYPASS DESUPER HEATER FEEDWATER PRESSURE	NORMAL CIRCUIT
BFW-PDIT-7303-02	189	IE-03	U7-16	FPS-PN-001	15	BYPASS DECK U7	HP BYPASS DESUPERHEATER STRAINER D/P	CRITICAL TRANSMITTER
BFW-FIT-7200-02	169	NONE	U7-17	FPS-PN-002	2	MEZZANINE DECK U7	BOILER FEEDWATER DISCHARGE FLOW	CRITICAL TRANSMITTER
BFW-PDIT-7102-04	166	IE-10	U7-18	FPS-PN-001	20	MEZZANINE DECK U7	BFW-PP-7002 PUMP SUCTION D/P	CRITICAL TRANSMITTER
BFW-PDIT-7101-04	166	IE-10	U7-18	FPS-PN-001	20	MEZZANINE DECK U7	BFW-PP-7001 PUMP SUCTION D/P	CRITICAL TRANSMITTER
CNS-FIT-7100-04	174	NONE	U7-19	FPS-PN-002	3	MEZZANINE DECK U7	CONDENSATE/FEED WATER TO LP DRUM FLOW	CRITICAL TRANSMITTER
BFW-FIT-7201-06	172	IE-07	U7-20	FPS-PN-002	3	MEZZANINE DECK U7	BFW-PP-7001 DISCHARGE FLOW TRANSMITTER CHANNEL B	CRITICAL TRANSMITTER
BFW-FIT-7201-05	172	IE-07	U7-20	FPS-PN-002	3	MEZZANINE DECK U7	BFW-PP-7001 DISCHARGE FLOW TRANSMITTER CHANNEL A	CRITICAL TRANSMITTER
CNS-PIT-7100-03	150	IE-12	U7-21	FPS-PN-001	18	MEZZANINE DECK U7	LP FEEDWATER MAKE UP PRESSURE	CRITICAL TRANSMITTER
SLP-PIT-7101-02	150	IE-12	U7-21	FPS-PN-001	18	MEZZANINE DECK U7	LP STEAM HEADER PRESSURE	CRITICAL TRANSMITTER
SRC-PIT-7110-04	163	NONE	U7-22	FPS-PN-001	14	MEZZANINE DECK U7	COLD REHEAT HEADER PRESSURE TRANSMITTER "A"	CRITICAL TRANSMITTER
SRC-FIT-7110-02	161	IE-15	U7-23	FPS-PN-001	16	MEZZANINE DECK U7	COLD REHEAT HEADER FLOW TRANSMITTER "A"	NORMAL CIRCUIT
SRC-FIT-7110-03	161	IE-15	U7-23	FPS-PN-001	16	MEZZANINE DECK U7	COLD REHEAT HEADER FLOW TRANSMITTER "B"	NORMAL CIRCUIT
SRC-PIT-7110-06	156	IE-13	U7-24	FPS-PN-001	16	MEZZANINE DECK U7	COLD REHEAT PRESSURE TRANSMITTER "B"	CRITICAL TRANSMITTER
SRC-PIT-7110-05	156	IE-13	U7-24	FPS-PN-001	16	MEZZANINE DECK U7	COLD REHEAT PRESSURE TRANSMITTER "C"	CRITICAL TRANSMITTER
BFW-FIT-7202-05	153	IE-07	U7-25	FPS-PN-001	18	MEZZANINE DECK U7	BFW-PP-7002 DISCHARGE FLOW TRANSMITTER "A"	CRITICAL TRANSMITTER

LIST CAN BE FILTERED BY SEVERAL VARIBLES

- IDENTIFY CIRCUITS FROM PANELS AND CIRCUIT BREAKERS
- LOCATE PANEL AND OBRIEN BOX PHYSICAL LOCATIONS

ENTER TRANSMITTER DEVICE ID NUMBER (IN YELLOW FIELD)

PT-245A

REHEAT BOWL PRESSURE TRANSMITTER "A"

CBEC 2 O'BRIEN BOX NUMBER	O'BRIEN BOX LOCATION
U9-49	GROUND LEVEL UNDER STG9

O'BRIEN BOX HEATER FREEZE PROTECTION PANEL NUMBER	HEATER CIRCUIT BREAKER NUMBER
FPS-PN-006	7
NORMAL CIRCUIT	
FREEZE PROTECTION PANEL LOCATION	
NORTH OF CCW HEAD TANK	

HEAT TRACE CIRCUITS POWERED FROM COMMON CIRCUIT BREAKER

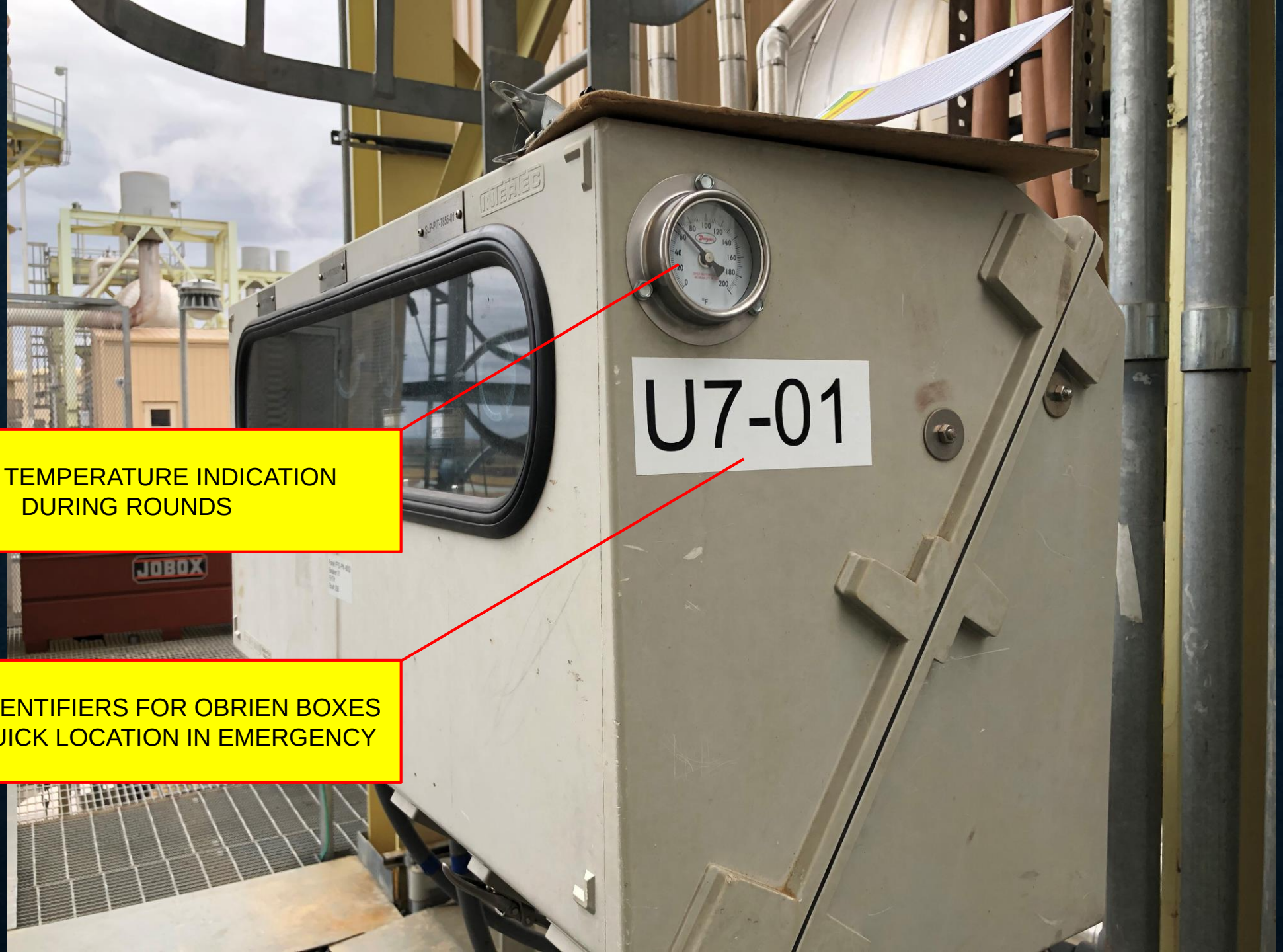
DESCRIPTION	PANEL	BREAKER	CRITICAL CIRCUIT
LP STEAM INLET PRESSURE	FPS-PN-006	7	CRITICAL TRANSMITTER
COLD REHEAT, HP EXHAUST PRESSURE TRANSMITTER "A"	FPS-PN-006	7	NORMAL CIRCUIT
COLD REHEAT, HP EXHAUST PRESSURE TRANSMITTER "B"	FPS-PN-006	7	NORMAL CIRCUIT
COLD REHEAT, HP EXHAUST PRESSURE TRANSMITTER "C"	FPS-PN-006	7	NORMAL CIRCUIT
REHEAT BOWL PRESSURE TRANSMITTER "A"	FPS-PN-006	7	NORMAL CIRCUIT
REHEAT BOWL PRESSURE TRANSMITTER "B"	FPS-PN-006	7	NORMAL CIRCUIT
REHEAT BOWL PRESSURE TRANSMITTER "C"	FPS-PN-006	7	NORMAL CIRCUIT
COLD REHEAT, HP EXHAUST PRESSURE TRANSMITTER "1"	FPS-PN-006	7	CRITICAL TRANSMITTER
COLD REHEAT, HP EXHAUST PRESSURE TRANSMITTER "2"	FPS-PN-006	7	CRITICAL TRANSMITTER
COLD REHEAT, HP EXHAUST PRESSURE TRANSMITTER "3"	FPS-PN-006	7	CRITICAL TRANSMITTER

CONTROL ROOM CAN MANUALLY SEARCH FOR PROBLIMATIC TRANSMITTERS

- FILTERS OBRIEN BOX NUMBERS AND LOCATIONS
- FREEZE PROTECTION PANEL LOCATIONS AND CIRCUIT BREAKER NUMBERS

LISTS HEAT TRACE CIRCUITS WITH COMMON POWER SOURCE

- HEAT TRACE DESCRIPTIONS
- FREEZE PROTECTION PANELS
- IDENTIFY CRITICAL CIRCIUTS



LOCAL TEMPERATURE INDICATION
DURING ROUNDS

UNIQUE IDENTIFIERS FOR OBRIEN BOXES
ALLOW QUICK LOCATION IN EMERGENCY

FREEZE PROTECTION PANEL CIRCUITS IDENTIFIED AS CRITICAL

- ALERTS OPERATORS TO CRITICAL CIRCUIT FAULTS, WHILE IN THE FIELD

Laminated Panel Schedule with Critical Circuits Identified

- Cold Weather Box with Inventory Label Inside
- One For Each HRSG

LESSONS LEARNED

- Developed site procedure for establishing vacuum without Aux Boiler
- Created a more efficient way to help identify heat trace components in the field
- PM for annual calibrations on Air Dryer Dew Point censors
- Conduct annual Heat Trace Audit with vendor (expensive but effective)
- Issued a SUN for Heat Trace breaker reset procedure

LESSONS LEARNED CONT.

Date	Alarm Type	Name	Description	Value
6/24/2020 9:07:36 AM	ALARM	CND-TE-9001-01-FPPR	FREEZE PROTECTION PLAN RE...	TRUE 1

THANK YOU

Break

Temple Power Station

IMONNIT PRESENTATION

Panda Temple Power II, LLC
TEMPLE GENERATION I, LLC

Outline

1. Temple Power Station Overview
2. Cold Weather Protection System
3. Winter Weather Procedure
4. Benefits of Remote Temperature Monitoring
5. iMonnit system overview
6. iMonnit system demonstration

Facility Overview

Temple Power Station consists of two 2 on 1 combined cycle power blocks located in Temple, Texas.

Temple Power Station Highlights

- Temple I Power Block is owned by Temple Generation I, LLC
- Temple II Power Block is owned by Panda Temple Power, LLC.
- Each Block uses reclaim water for cooling tower makeup.
- The facility is a “zero liquid discharge” facility.
- Heat Trace system designed to º15F with a wind speed of 15mph.

Facility Location Within ERCOT

Facility Overview

Location	▪ Bell County, TX
Market Area	▪ ERCOT North
Design Capacity (MW)	▪ Approximately 758 MW
COD	▪ July 2014 and May 2015
Key Equipment	▪ 4 Siemens Model SGT6-5000F CTs. ▪ 4 Benson Heat Recovery Steam Generators ▪ 2 Siemens SST6-5000 Steam Turbines
Fuel	▪ Natural Gas
Electronic Interconnection	▪ Oncor 345 kV Knob Creek Substation
Water Supply	▪ City of Temple, TX

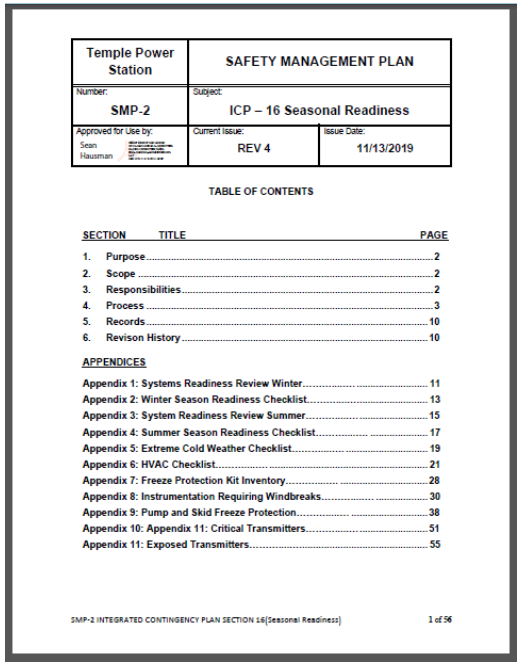
Cold Weather Protection Systems

- Methods of Protection
  - Heat Trace Systems
    - Power Distribution/Alarm Panel
    - “O’Brien” boxes with heating elements
    - Heat Trace cabling
      - Self Regulating heating cables
      - Mineral Insulated cables (MIQ)
  - Insulation
  - Windwalls
  - Use of iMonnit system for online monitoring

Winter Weather Procedural Improvements

- Key Components
  - Personnel Training
  - Cold Weather Emergency Kit Inventory
  - System Walkdowns (insulation/windwall verification)
  - HVAC Inspections
    - Conducted by a third party
  - Extreme Cold Weather Checklists
  - Heat Trace and Insulation Verification
    - Conducted by a third party in September.

- Procedural Improvements since initial draft
  - Identification of Critical Transmitters
    - Includes method of protection (Heat Trace, Insulation, Windwalls, etc.)
  - Inclusion of the iMonnit system as a method of monitoring the transmitter boxes.



Temple Power Station	SAFETY MANAGEMENT PLAN	
Number: SMP-2	Subject: ICP – 16 Seasonal Readiness	
Approved for Use by: Sean Hausman	Current Issue: REV 4	Issue Date: 11/13/2019

TABLE OF CONTENTS

SECTION TITLE PAGE

1. Purpose 2
2. Scope 2
3. Responsibilities 2
4. Process 3
5. Records 10
6. Revison History 10

APPENDICES

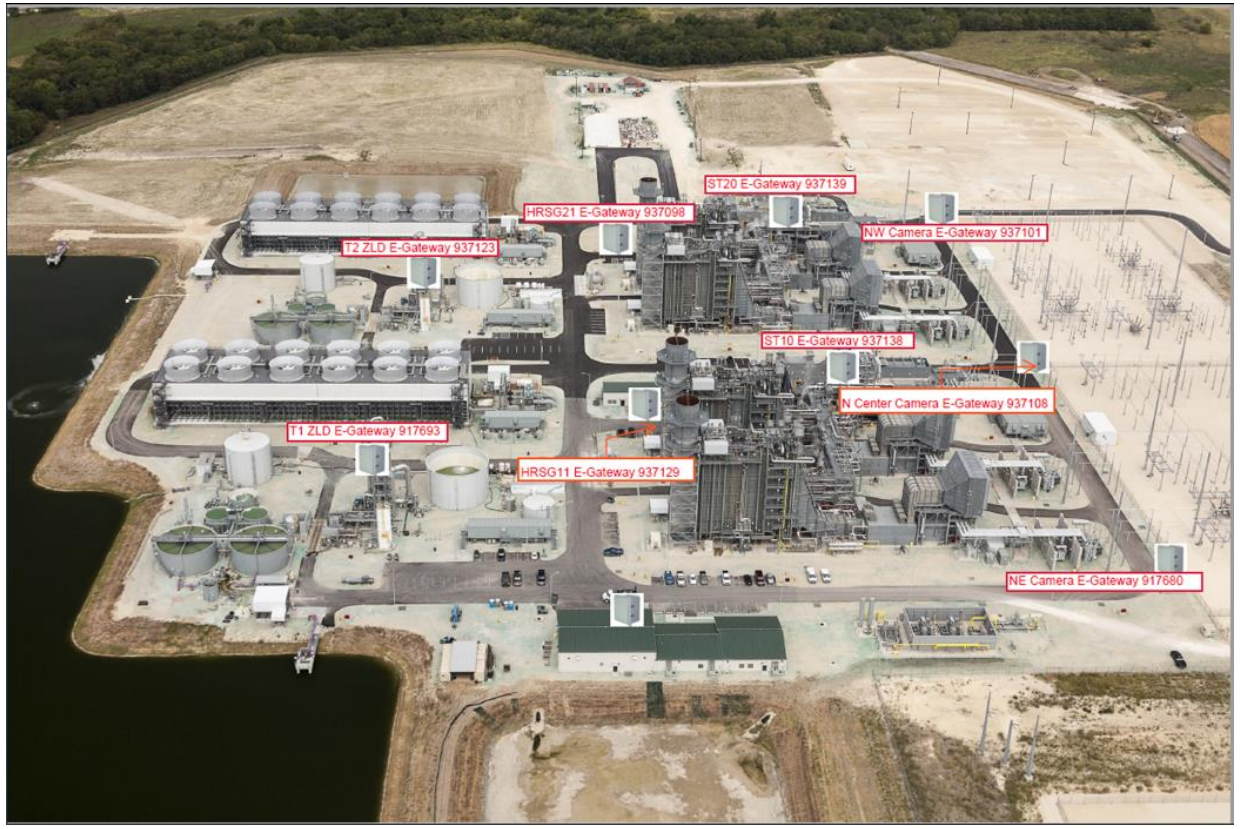
Appendix 1: Systems Readiness Review Winter 11
Appendix 2: Winter Season Readiness Checklist 13
Appendix 3: System Readiness Review Summer 15
Appendix 4: Summer Season Readiness Checklist 17
Appendix 5: Extreme Cold Weather Checklist 19
Appendix 6: HVAC Checklist 21
Appendix 7: Freeze Protection Kit Inventory 28
Appendix 8: Instrumentation Requiring Windbreaks 30
Appendix 9: Pump and Skid Freeze Protection 38
Appendix 10: Appendix 11: Critical Transmitters 51
Appendix 11: Exposed Transmitters 55

Benefits of Remote Temperature Monitoring

- Global vs. Individual Alarming
  - DCS will alarm a Heat Trace Panel; however, this includes several circuits with several transmitter boxes
  - iMonnit allows individual box alarms
    - Allows O&M staff to troubleshoot quickly
    - Temperature sensor alarms allow for prompt maintenance before it becomes a bigger issue
- Ability to trend temperature data
- Quick dashboard view of the heat trace health
- Additional personnel not needed for physical box rounds during cold weather
  - Physical rounds of transmitter boxes every 2-4 hours (ambient temperature dependent) no longer needed
  - Operators print sensor status page every 2 hours when ambient is below º40 F.
    - Status page includes current box temperature, connectivity, and battery capacity.
  - Safety

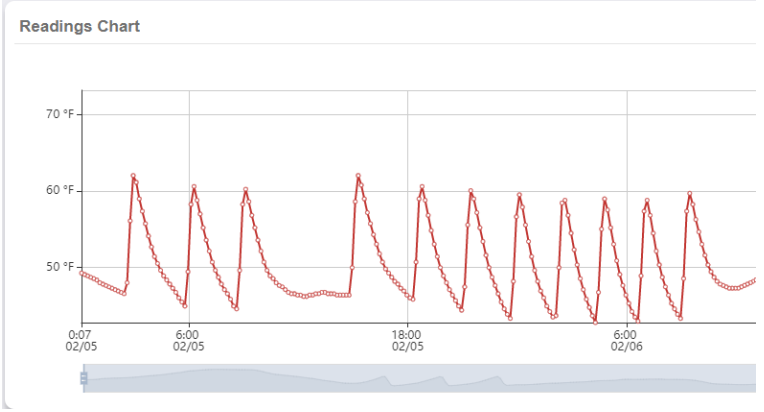
iMonnit System Overview (Equipment)

- Top/Down Equipment description
  - Network Requirements
    - Cellular
    - Wifi (Mesh system)
  - Ethernet Gateways
  - Temperature Sensors
    - AA 3.6v lithium battery
    - Frequency Hopping Spread Spectrum (FHSS) 900MHz.
  - Estimated equipment cost for 320 sensors and 11 gateways was approximately $62K.



iMonnit System Platform

- Internet
  - Mesh System
    - Independent of business network
    - Setup behind its own firewall
- iMonnit Portal
  - Web-based Interface
  - Annual subscription is approx. $600 for up to 500 sensors
  - Subscription allows facility to poll each sensor every 10 minutes
    - One-minute polling option for extra cost.
  - Interface allows:
    - User to import maps
    - Make global or individual changes to sensor settings
    - Trend sensor data
    - View battery life and connectivity
    - Creation of event email notifications



Other iMonnit applications – Summer Operations

- Additional Temperature Sensors have been placed in:
  - Combustion Turbine Compartments
  - NH3 Dilution Fan Variable Speed Drive Control Cabinets
  - Duct Burner Control Cabinets
  - Auxiliary Boiler Cabinets
  - Al 480vac & 4,160vac Motor Control Center Buildings

iMonnit System for Temple Power Station

Generator Winter Weatherization Workshop

September 3, 2020

Alan H. Allgower
Operations Analyst, Senior
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PUCT Regulatory Requirements for Generator Preparedness

- §25.53. Electric Service Emergency Operations Plans.
  - (c)(1)(H) A plan for the inventory of pre-arranged supplies for emergencies.
  - (c)(1)(I) A plan that addresses staffing during severe weather events.
  - (c)(2)(A) A plan that addresses severely cold and severely hot weather.
  - (c)(2)(B) A plan that addresses any known critical failure points, including any effects of weather design limits.
  - (c)(2)(G) Checklists for generating facility personnel to address emergency events.
  - (c)(2)(H) A summary of alternate fuel and storage capacity.
  - (c)(2)(I) A plan for alternative fuel testing if the facility has the ability to utilize alternative fuels.
  - (c)(2)(d) A Market entity shall conduct or participate in one or more drills annually to test its emergency procedures if its emergency procedures have not been implemented in response to an actual event within the last 12 months.

Plant spot checks winter season 2019/2020 results

- 80 units spot checked
  - ✓The purpose of spot checks is to verify plant personnel are following their weatherization plan.
  - ✓As necessary, plant personnel are left with a recommendation(s) based on PUCT requirements, lessons learned or best practices observed.
  - ✓Company senior management is emailed results.
- Fuel types spot checked
    - 71 gas fired units (conventional and combined cycle).
    - 3 coal fired units.
    - 6 gas fired black start contracted units.
  - ➢23 units agreed to improve preparations and/or records management and will be scheduled early in 2020 to verify improvements.
  - ➢57 units had no observed deficiencies in their plan or records management.

Four coldest days in the past nine years

	EEA3 – 4000MW firm load shed	EEA2	Normal Operations	Normal Operations
	2/2/2011	**1/6/2014**	**1/7/2017**	**1/17/2018**
Dallas	13°/20MPH	15°/9MPH	14°/6MPH	13°/5MPH
Houston	21°/16MPH	27°/16 MPH	21°/11 MPH	19°/13 MPH
San Antonio	19°/25MPH	27°/15 MPH	20°/6 MPH	23°/10 MPH
Austin	18°/26 MPH	20°/13 MPH	19°/10 MPH	18°/10 MPH
Brownsville	32°/26 MPH	37°/17 MPH	30°/27 MPH	30°/14 MPH
Abilene	7°/16 MPH	11°/5 MPH	9°/3 MPH	8°/5 MPH
Midland	6°/16 MPH	14°/12 MPH	10°/4 MPH	28°/7 MPH

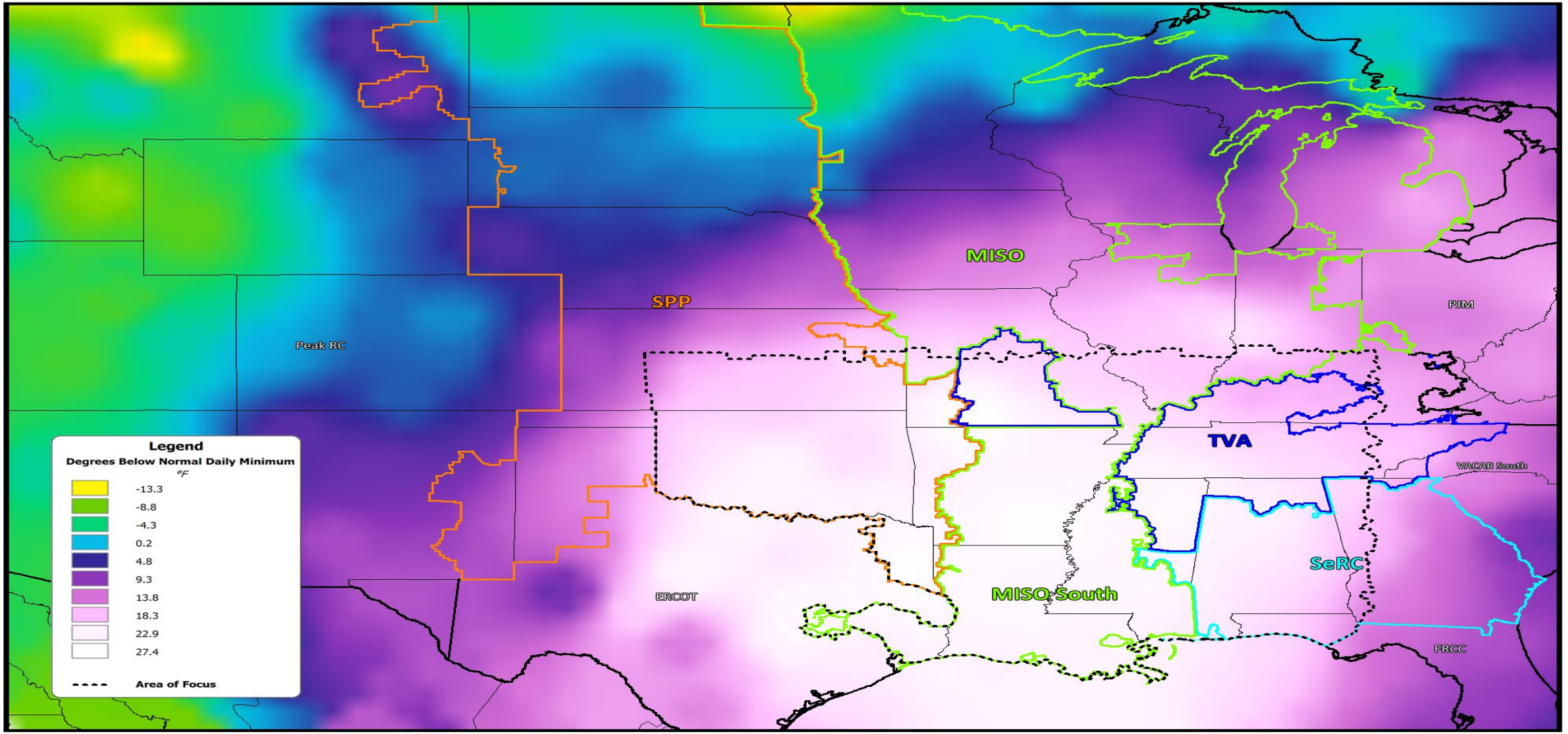
Source: Chris Coleman, ERCOT

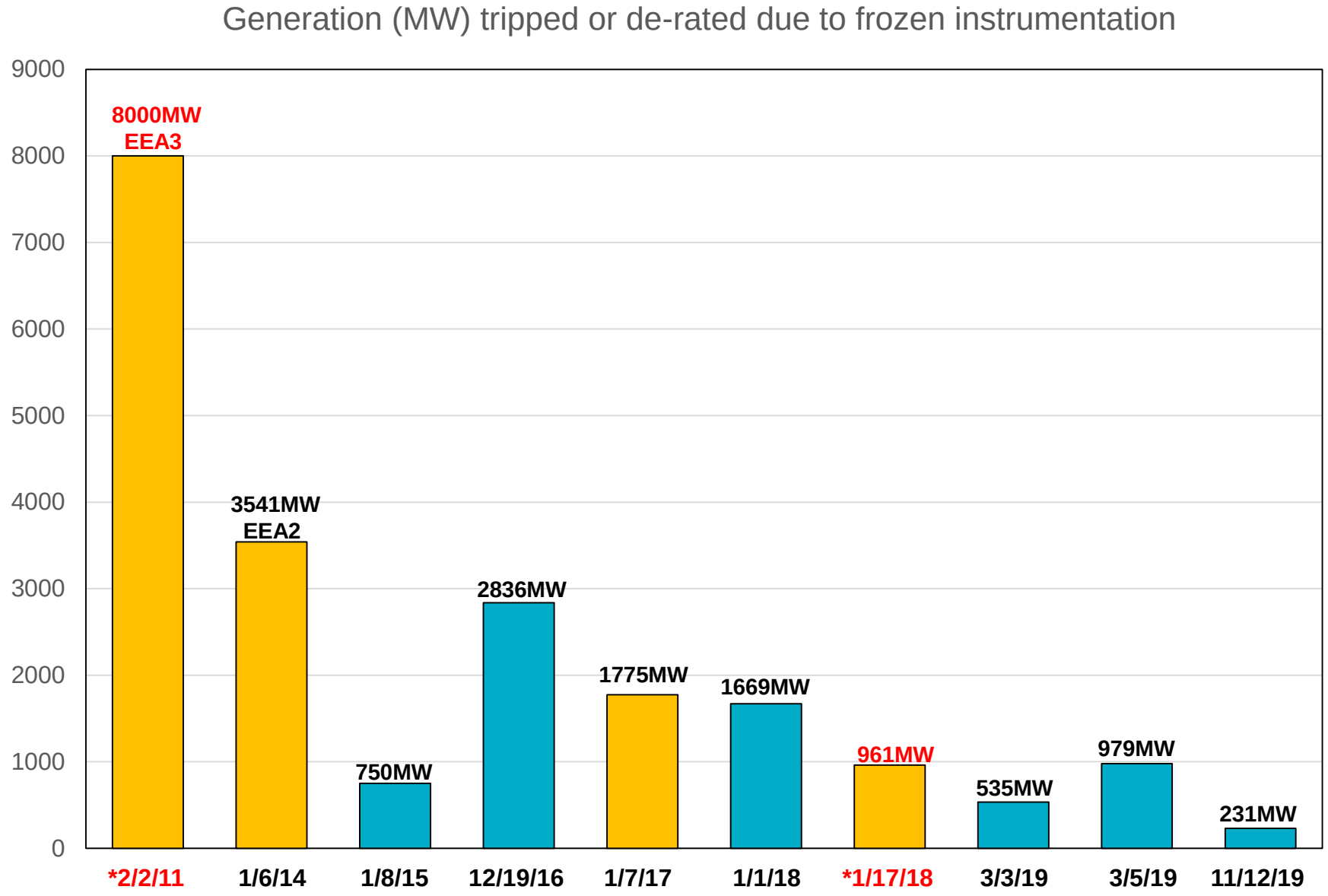
Hours at and below freezing (32 DegF or less) during four coldest days in ERCOT in the past nine years.

	EEA3 – 4000MW firm load shed	EEA2	Normal operations	Normal operations
	2/2/2011	**1/6/2014**	**1/7/2017**	**1/17/2018**
Dallas	24	22	19	19
Houston	14	18	13	18
San Antonio	24	14	14	12
Austin	24	20	16	20
Brownsville	0	0	5	10
Abilene	24	24	16	19
Midland	24	24	15	10

Source: Chris Coleman, ERCOT

The South Central United States Cold Weather Event – January 17, 2018





***2/2/11 and *1/17/18 were the two coldest days this decade.**

Salmon colored are the four coldest days in last nine years.

Resistance temperature detector (RTD) failure – lesson learned

- During the cold front on November 12, 2019 a CT experienced a trip due to transition steam flow showing a high reading.
- Inspection of the transmitter box showed that the heater and heat trace was not energized.
  - I&C technician found that the RTD that senses the ambient temperature for the heat trace panel had failed.
  - RTD measures ambient temperature to energize heat trace circuits.
  - Manufacturer default for a RTD failure is to de-energize heat trace circuits.
- It was also discovered that the thermometer that measures inside transmitter box temperature was reading 15DegF higher than enclosure temperature. This temperature is recorded by operators on rounds and gave the operator a false reading.
- Corrective action:
  - RTD replaced on all heat trace panels of this type.
  - All heat trace panels of this type were re-programmed to energize heat trace circuits for an RTD failure.
  - All transmitter box thermometers that measure the inside temperature have been replaced.
  - During the spring 2020 outage, GMS was upgraded to telemeter internal box temperatures for all critical transmitters into the control system for monitoring by the control room operators.
- Lessons learned shared with the remainder of company fleet.

Heat trace panel – resistance temperature detector (RTD) failure

Common causes of transmitter manifolds and/or sensing lines freezing

- Tripped heat trace circuit breaker.
- Blown fuse in heat trace panel.
- Contractor error when terminating heat trace after testing.
- Insulating contractor damage to heat trace.
- Section of heat trace not functioning.
- Incorrect heat trace for application.
- Heat trace open ended and not grounded.
- Transmitter cabinet heater not functioning.
- Poor or lack of wind break measures.
- Transmitter(s) exposed to the elements.
- Gaps in insulation.

Closing comments……

- ✓ ERCOT assists generators in preparing for winter operations with spot checks, sharing lessons learned, best practices, recommendations and the annual fall workshop.
- ✓ Recent history has shown us that for every extreme cold weather event, a small amount of generation will experience freeze related derates or trips.
- ✓ For winter 2020/2021, spot checks will begin November 16, 2020 and will conclude February 26, 2020.
- ✓ Due to COVID-19, the majority of the spot checks will be table top WebEx with some on-site visits.

Thank you generator owners, operators and plant staff for your efforts on winter weatherization!

2020-21 Preliminary Winter Weather Outlook

Chris Coleman
ERCOT Sr. Meteorologist

Generator Weatherization Workshop
Sep 3, 2020

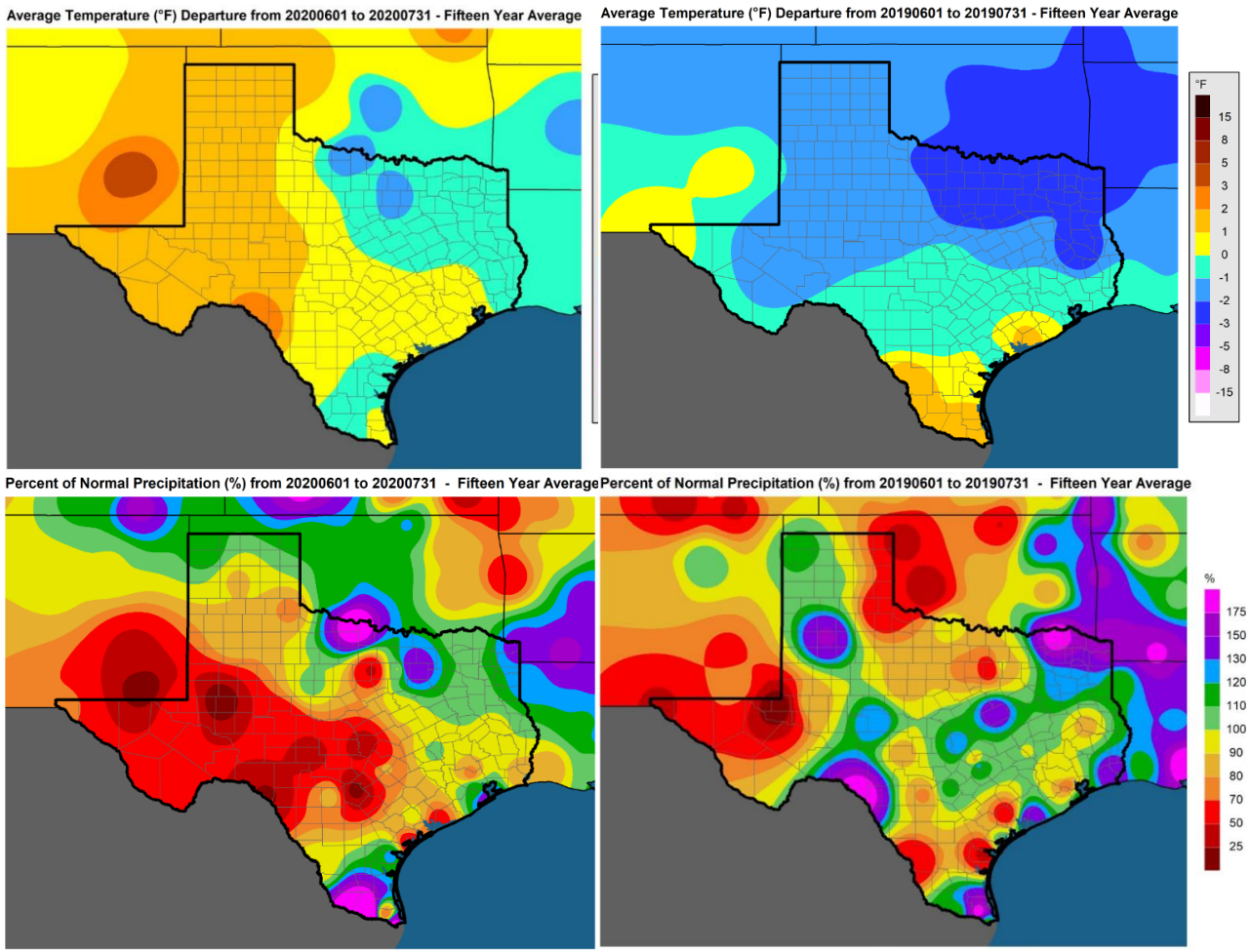
Agenda

- Updating the summer
- Quick look ahead to fall
- Review of last winter (and other recent winters)
- Expectations for the upcoming winter

Updating Summer 2020

- June-July 2020 was the 15th hottest on record – much hotter than June-July 2019 (76th)
- June-July 2020 tied with 2016 for the 4th hottest of the past 10 years (2011, 2012, and 2018 were hotter)
- The largest year-over-year change is in West Texas, which has been much hotter the first-half of this summer
- August has tracked hotter-than-normal for most of the state (similar to Jun-Jul). Summer 2020 should be mostly above-normal for Texas, though parts of North, East, and South Texas may remain closer to normal or a bit below
- Dallas is recording a below-average number of 100° days for the 6th year of the past seven. On track for the second-fewest 100-degree days of the past 15 years

2020 2019

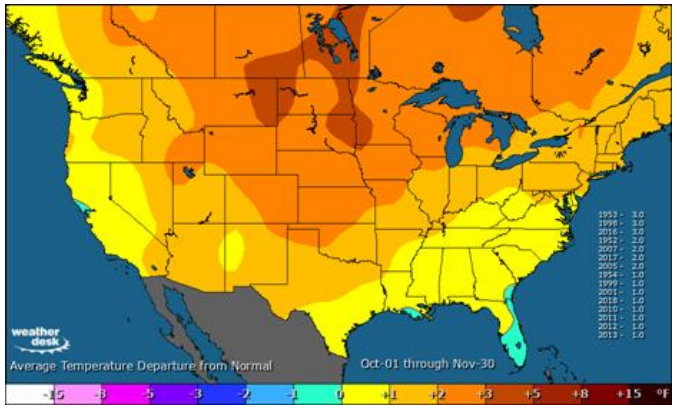


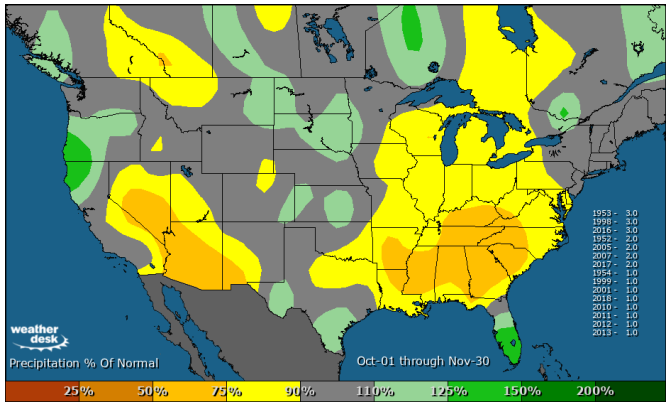
The first-half of this summer was drier for most of the state compared to the first-half of last summer

Fall 2020 Weather Outlook

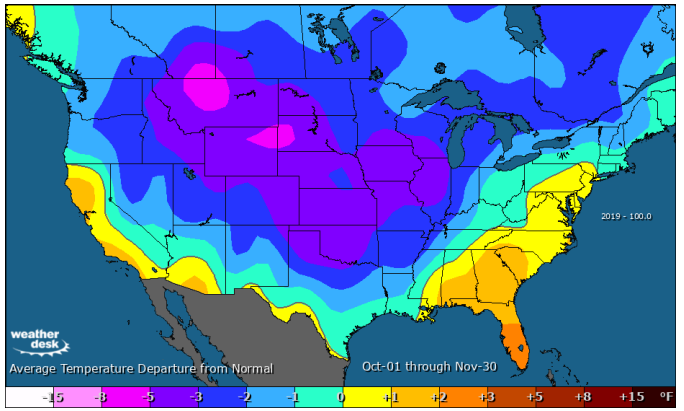
- Fall of 2019 started out very warm, but turned sharply colder mid-October and persisted below-normal through most of November
- Fall 2020 is expected to continue the warm, above-normal pattern that set up in summer. Very likely to be much warmer than last fall
- November has more above-normal potential than October
- The upcoming fall season is also likely to be mostly dry. Fall 2019 was also dry. Fall 2020 could be just as dry – the forecast is a blend of 15 historical fall seasons – but 11 have more area dry than wet. Best chance of a wetter-than-average fall will be South Texas and part of the Coast

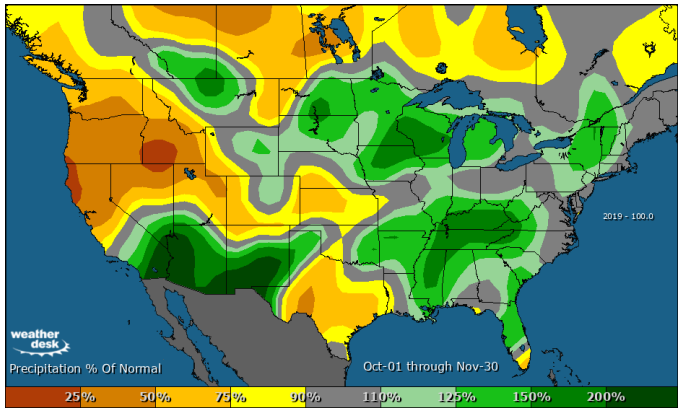
2020





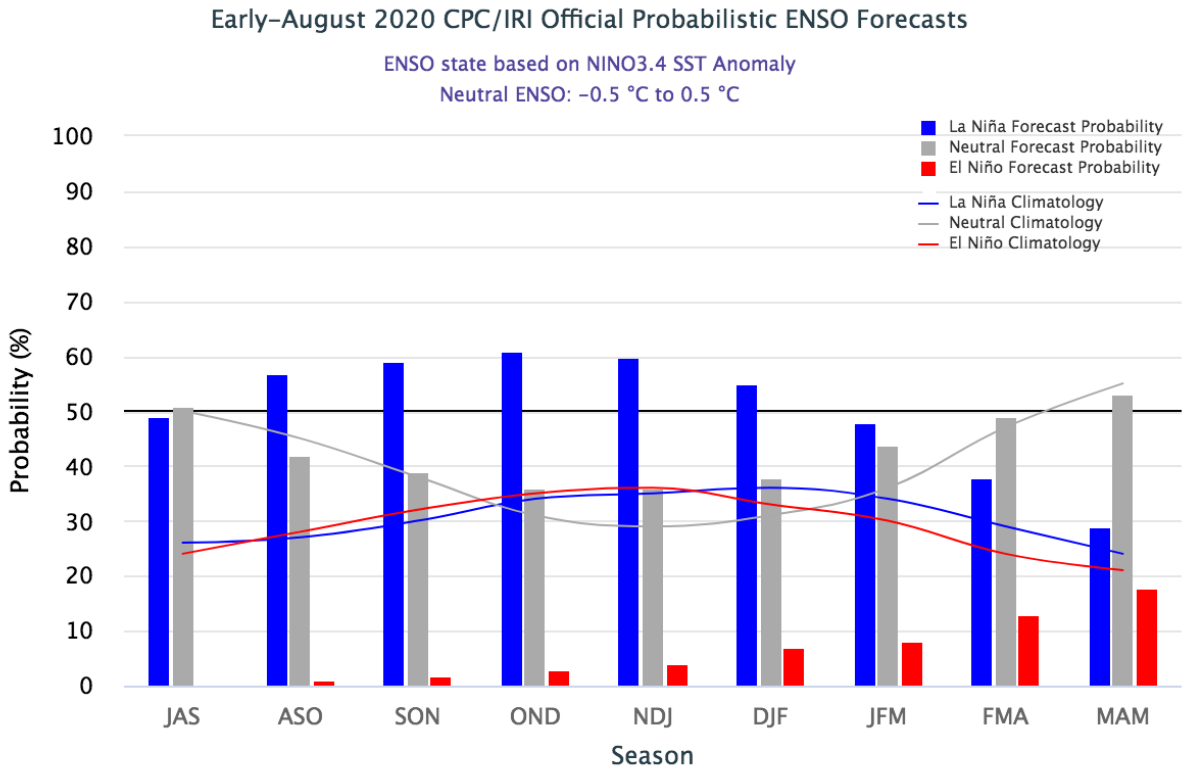
2019





La Niña

- What's responsible for this warm, dry pattern?
- Certainly many factors, but one of the main drivers is a developing La Niña.
- The last La Niña was in 2017-18 – a weak event. A more pronounced La Niño occurred in 2011-12
- As early as mid-summer, La Niña characteristics were increasing. This event is likely to become an official La Niña during the fall season – however, it will likely be a weak event
- Of the 8 La Niña winters this century, 5 have resulted in warm winters in Texas, 2 in normal winters, and 1 correlated to a cold winter

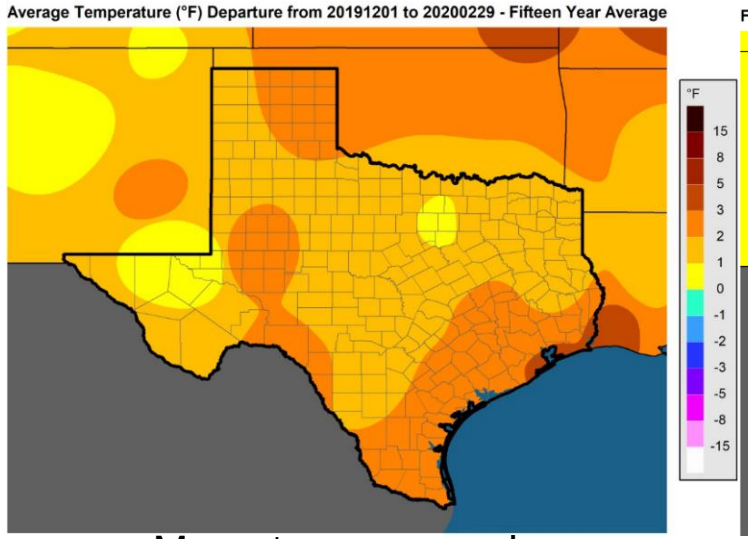


La Niña winters:

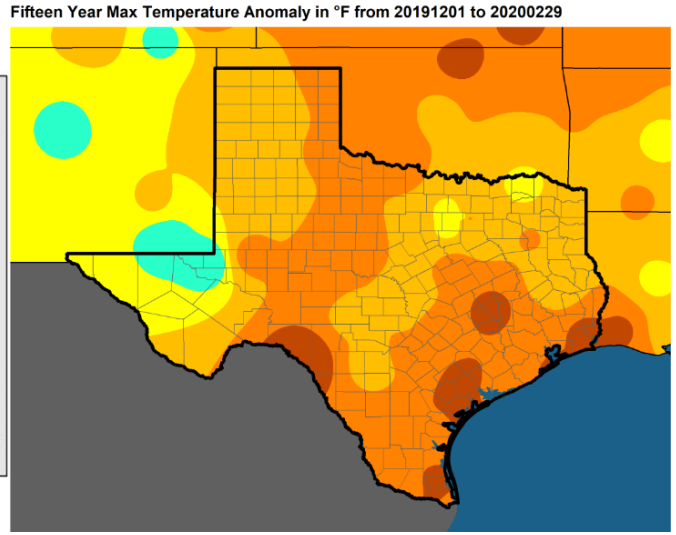
2017-18: 49th warmest
2016-17: 1st warmest
2011-12: 26th warmest
2010-12: 57th warmest
2008-09: 14th warmest
2007-08: 25th warmest
2005-06: 18th warmest
2000-01: 92nd warmest

Reviewing Last Winter

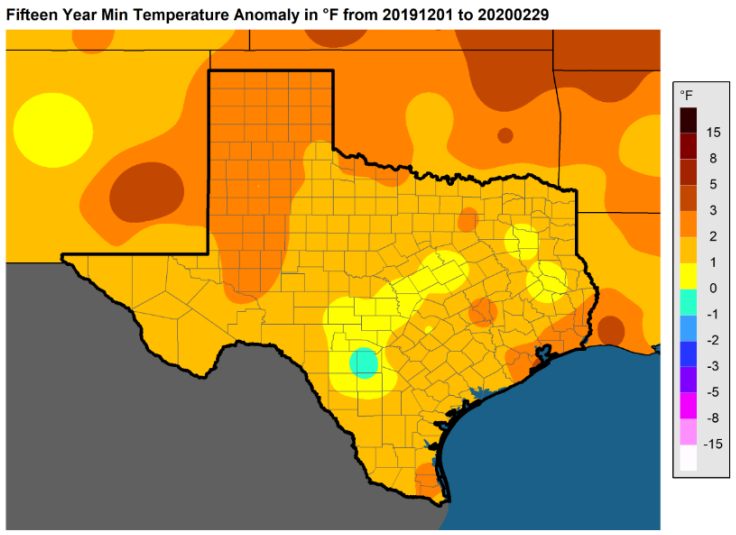
ERCOT winter (Dec 1 – Feb 28)



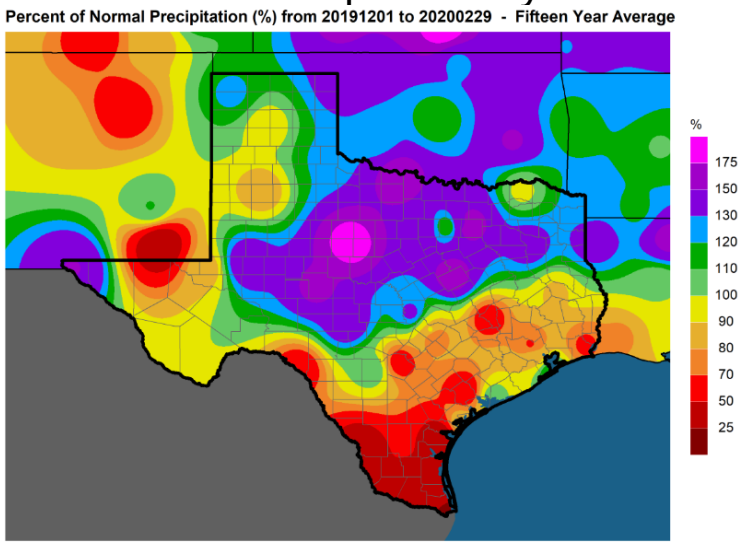
Mean temp anomaly



Max temp anomaly

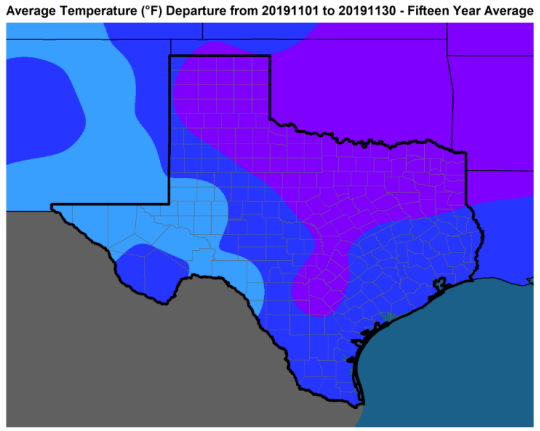


Min temp anomaly



Precip Anomaly

- Last winter was the 15th warmest on record (125 historical winters)
- Winter of 2016-17 was the warmest on record for Texas
- November was a colder anomaly than any of the winter months (which also happened the year prior)



Nov 2019

Austin Freezes

Camp Mabry Dec - Feb	total # of freezes	total # below 40	coldest temp
2019-20	3	24	30
2018-19	5	27	32
2017-18	15	36	18
2016-17	5	16	19
2015-16	4	29	31
2014-15	11	41	23
2013-14	22	48	22
2012-13	11	33	27
2011-12	7	23	27
2010-11	19	46	17
2009-10	23	51	17
2008-09	11	42	28
2007-08	14	41	25
2006-07	13	43	24
2005-06	8	35	23
2004-05	13	26	24
2003-04	6	36	28
2002-03	9	41	24
2001-02	11	44	25
2000-01	16	50	27
Averages:	11.3	36.6	24.6

Only 3 freezes were recorded last winter in Austin – the fewest number this century!

4 of the past 5 winters have had a below-average number of freezes in Austin

Notice the anomaly in the winter of 2016-17
The coldest temperature was 19, but that winter had fewer days below 40 than any winter this century (it was the warmest winter ever for Texas)

Mean Temperature Ranking of Recent Texas Winters (125 historical winters)

2019-20	**109th** coldest
2018-19	93rd
2017-18	75th
2016-17	**125th** coldest (warmest winter on record)
2015-16	**117th**
2014-15	67th
2013-14	30th
2012-13	**109th**
2011-12	98th
2010-11	67th
2009-10	**8th**

Since 2001, only two winters have ranked in the coldest third (1-42) of historical winters

January 17, 2018
All-time winter peak
65,915 MW

Like the winter prior, the coldest period fell outside of the ERCOT winter season
November **12**&13 (56,427/56,120 MW peaks)

February 6, 2020
was the highest true winter peak at 56,116 MW

Seasonal Rankings

- 125-126 years of data, 1895-2020
- Chart shows the ranking within that set of years, by season
- 1 = warmest, 126 = coldest
- Mean temperature trends:
  - Of the past 42 seasons, **26** have ranked in the **warmest** third (1-42; indicated by red-shaded cells)
  - **5** have ranked in the **coldest** third (85-126; indicated by blue-shaded cells)

- What does this tell you?
  - You should have strong supporting evidence if forecasting a colder-than-normal (coldest third) season

	mean	max	min
spring 2020	11	15	4
winter 2019-20	15	19	18
fall 2019	91	85	102
summer 2019	4	11	3
spring 2019	72	95	43
winter 2018-19	31	54	16
fall 2018	104	117	60
summer 2018	7	31	3
spring 2018	9	6	16
winter 17-18	48	49	54
fall 2017	8	9	16
summer 2017	52	72	22
spring 2017	9	10	9
winter 16-17	1	4	1
fall 2016	1	2	1
summer 2016	19	59	7
spring 2016	23	40	16
winter 15-16	8	10	19
fall 2015	9	32	5
summer 2015	19	35	10
spring 2015	60	100	19
winter 2014-15	56	82	23
fall 2014	66	61	63
summer 2014	52	80	13
spring 2014	83	61	100
winter 13-14	95	77	104
fall 2013	84	91	64
summer 2013	19	33	13
spring 2013	78	54	102
winter 2012-13	15	18	20
fall 2012	20	20	35
summer 2012	14	17	17
spring 2012	1	2	1
winter 2011-12	25	40	15
fall 2011	33	22	54
summer 2011	1	1	1
spring 2011	3	1	13
winter 2010-11	56	35	88
fall 2010	33	13	75
summer 2010	12	43	5
spring 2010	69	68	66
winter 2009-10	116	120	104

Seasonal Rankings – what is normal?

- "Normal" may no longer be the best way to express seasonal (or monthly, or possibly even daily) temperatures
- As Texas keeps having many more above normal temperature seasons, it keeps raising the bar for what is "normal"
- For an extreme example, say the past ten years were the ten warmest on record of 125 historical years. Then let's say the next year ranks 11th of 125 . Based on the past 10 years, it would rank below the 10-year normal
  - We aren't quite to that extreme – but not far from it
- This is why I'll oftentimes give all-time rankings and comparisons with recent years (in addition to or instead of "normal")

Winter vs Summer

Winter extremes happen quickly

- **A strong cold front moves through dropping temperatures sharply – sometimes 30-40 degrees in a matter of an hour or two.**
- **High wind speeds also tend to accompany strong cold fronts, resulting in even colder wind chills – and cold air that more readily penetrates buildings and other structures.**
- **A winter load peak can be 20,000 MW greater than the day prior**

Summer extremes are typical, with an uninterrupted build of heat over an extended period

- **A hot summer pattern in Texas is the result of high pressure that parks itself over the state, limiting rain chances and cloud cover, while allowing the high angle of the Texas sun in the summer to reach its full impact**
- **It's commonly the day-after-day build of heat that result in load peaks during summer**
- **A summer load peak is likely only a few hundred to a couple thousand megawatts higher than the previous day**

Because of this difference, a summer long-range weather outlook tends to do a better job at capturing extremes and peaks than a winter long-range outlook. Remember, a very strong cold front can move through in an otherwise mild winter (cold winters are defined more by the frequency of cold fronts).

Seasonal versus Extremes

*****Mild winters can have very cold periods*****

- February 2, 2011:
  - **Dallas**: 13° (20MPH wind)
  - **Houston**: 21° (16MPH wind)
  - **San Antonio**: 19° (25MPH wind)
  - **Austin**: 18° (26MPH wind)
  - **Brownsville**: 32° (26MPH wind)
  - **Abilene**: 7° (16MPH wind)
  - **Midland**: 6° (16MPH wind)

Winter of 2010-11: 67th coldest in TX weather history

Remains the winter peak record (65,915 MW)

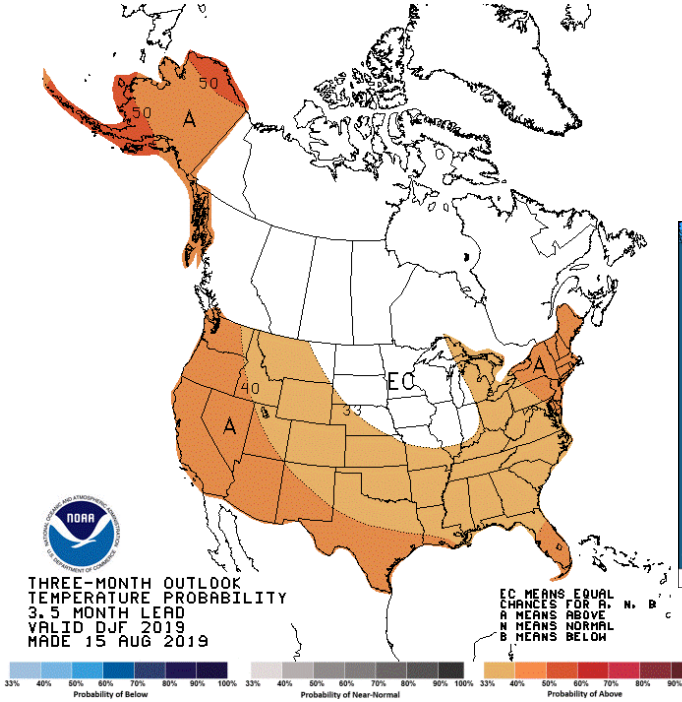
- January 17, 2018:
  - **Dallas**:13° (5MPH wind)
  - **Houston**: 19° (13MPH wind)
  - **San Antonio**: 23° (10MPH wind)
  - **Austin**: 18° (10MPH wind)
  - **Brownsville**: 30° (14MPH wind)
  - **Abilene**: 8° (5MPH wind)
  - **Midland**:28° (7MPH wind)

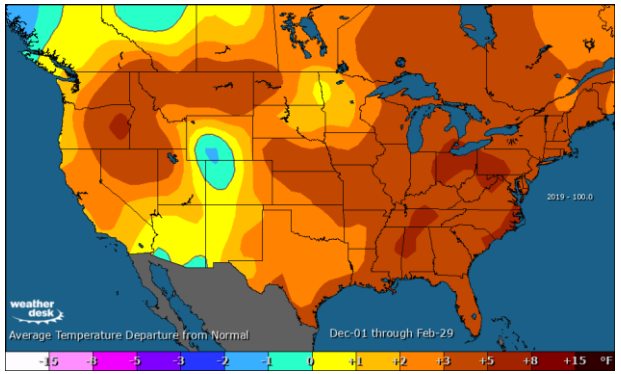
Winter of 2017-18: 75th coldest in TX weather history
*****Including the Coldest day since February 2011*****
All-time winter peak load on this date: 65,915 MW

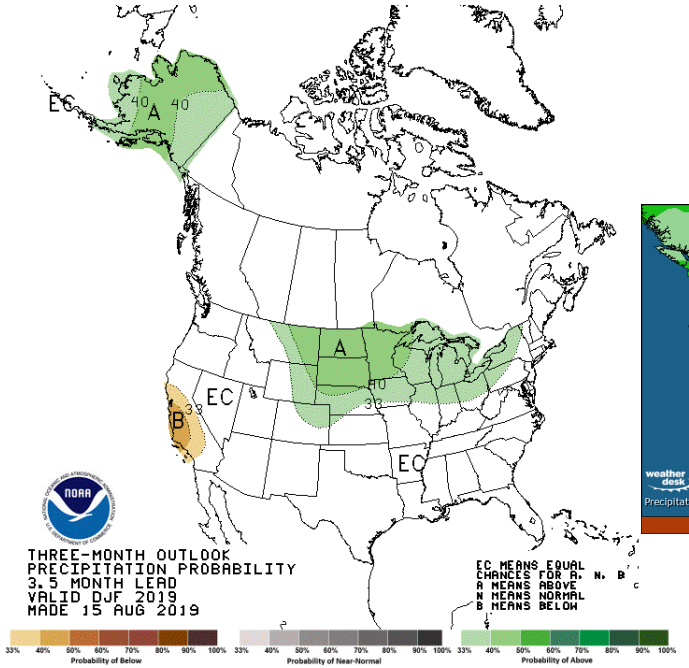
Those were the **two coldest days** this decade

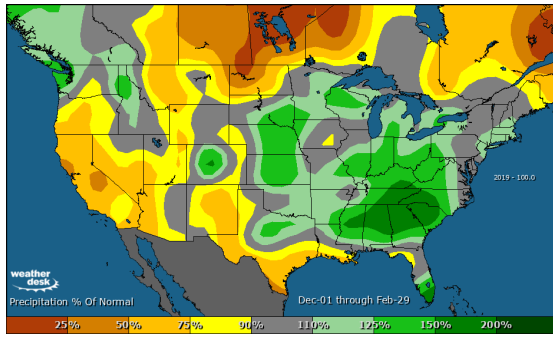
Winter 2013-14 was the coldest of the past ten years (polar vortex winter) – but no single day that winter approached the cold extremes of 2/2/11 or 1/17/18

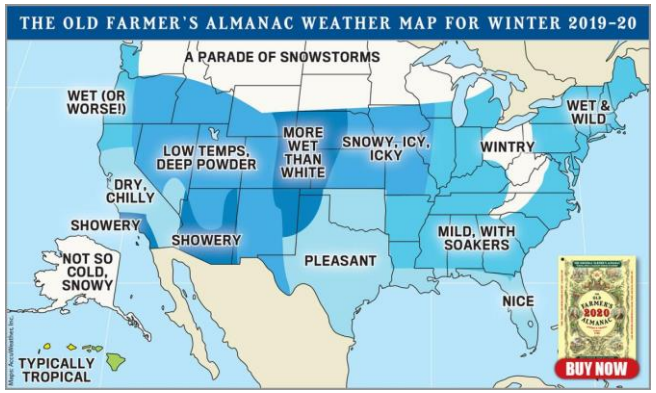
How Accurate were Last Winter's Forecasts?



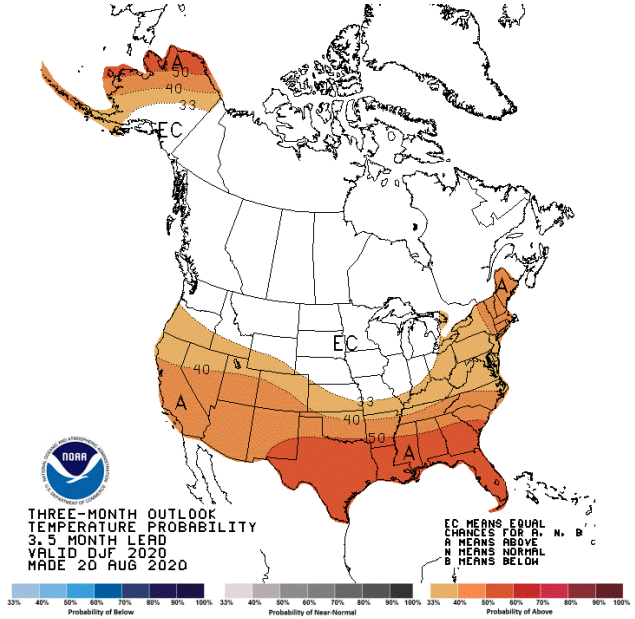


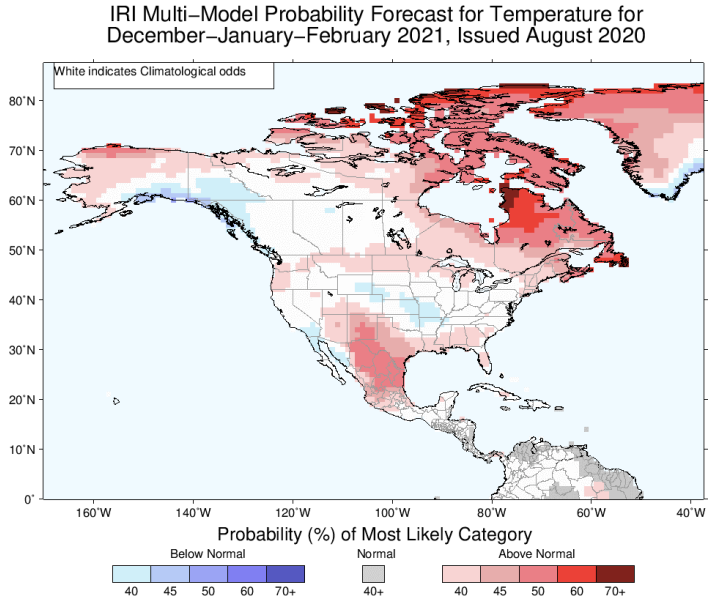




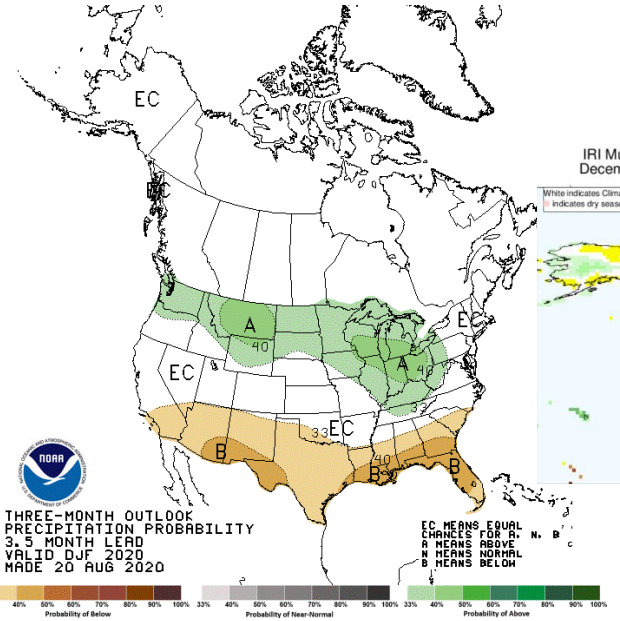


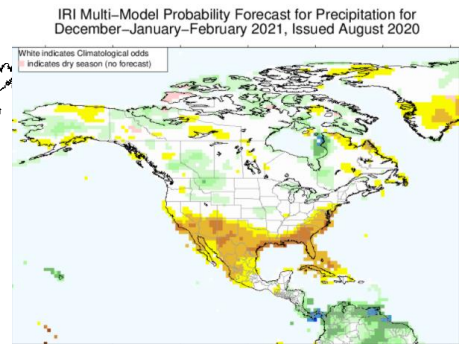
This Year's Winter Outlooks





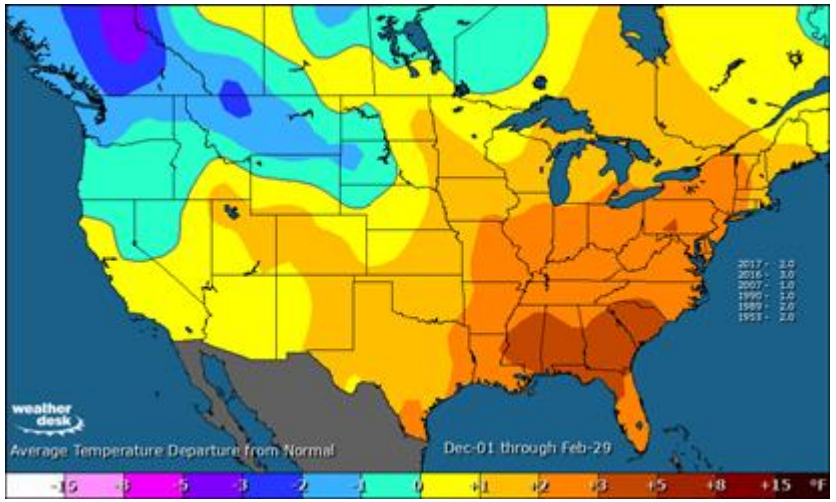
(All based on 30-year normal)



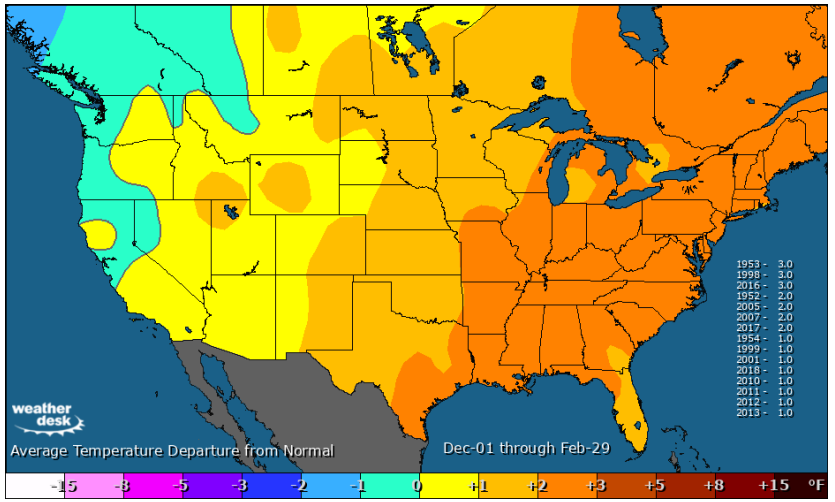


Preliminary Winter 2019-20 Temperature Outlook

Analog weighted consensus:



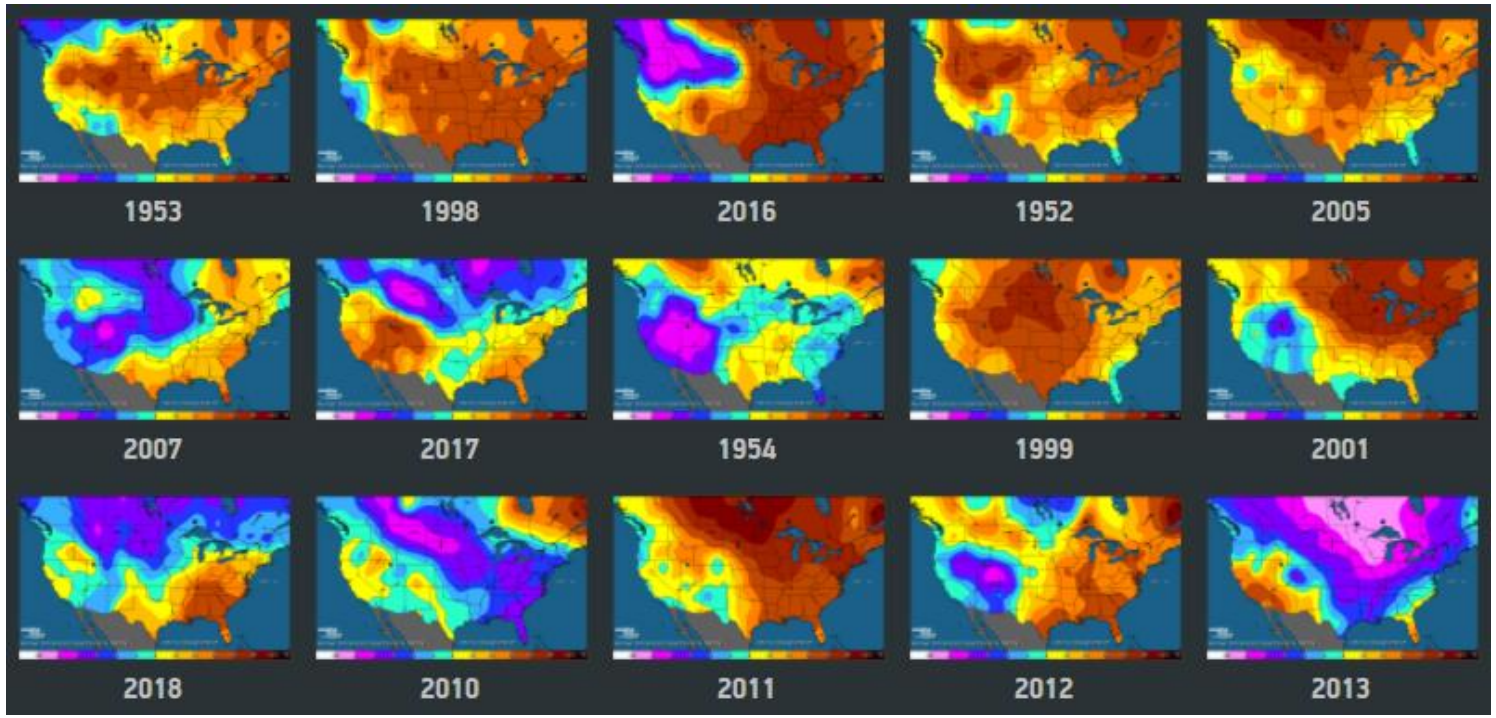
July update



August update

Historical Matches (Analogs)

The top row are those scoring/weighted highest



The bottom row are those scoring/weighted lowest

2010-11 57th warmest
2011-12 26th
2012-13 15th
2013-14 96th -- lowest scoring
2016-17 1st
2017-18 49th
2018-19 32nd

1998-99 4th
1999-00 3rd
2001-02 15th
2005-06 18th
2007-08 25th

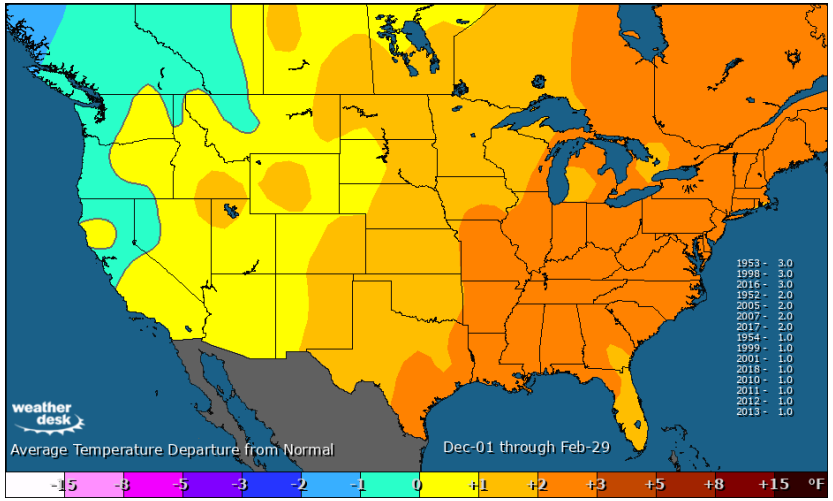
1952-53 36th
1953-54 34th
1954-55 52nd

Last winter ranked 15th warmest; this winter could be similar – although **there may be more opportunities for a strongly cold period or two than experienced the past two winters**

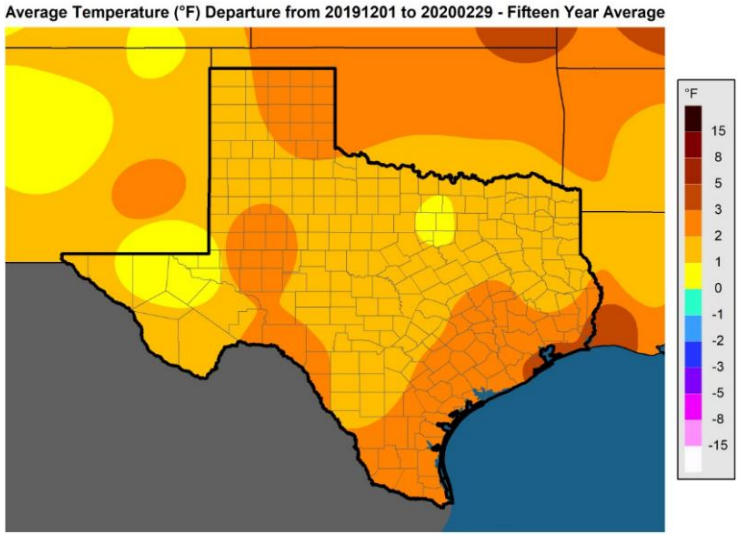
Preliminary Winter 2020-21 Temperature Outlook

- **Unlikely to see a winter that ranks among the top third coldest** of all-time (2013-14 is the most recent winter that ranked that cold – but it is an outlier historical analog)
- January and February have very warm potential (more so than December)
- February has very cold potential to parts of the North Central and Northwestern U.S. (meaning, some risk of a colder outbreak briefly impacting Texas)
- Need to analyze more if the expected dry winter could impact temperatures colder at times
- **Mild winters can – and oftentimes do – have very cold periods!**

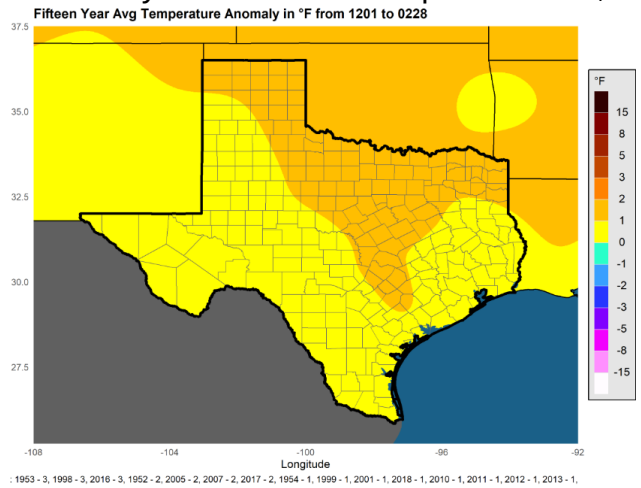
Forecast



Last winter



Slightly different forecast – the best chance of above-normal may be the northwest quarter of TX, if any chance of closer to normal or slightly below, East, Coast.



Precipitation Ranking of Recent Winters (Texas)

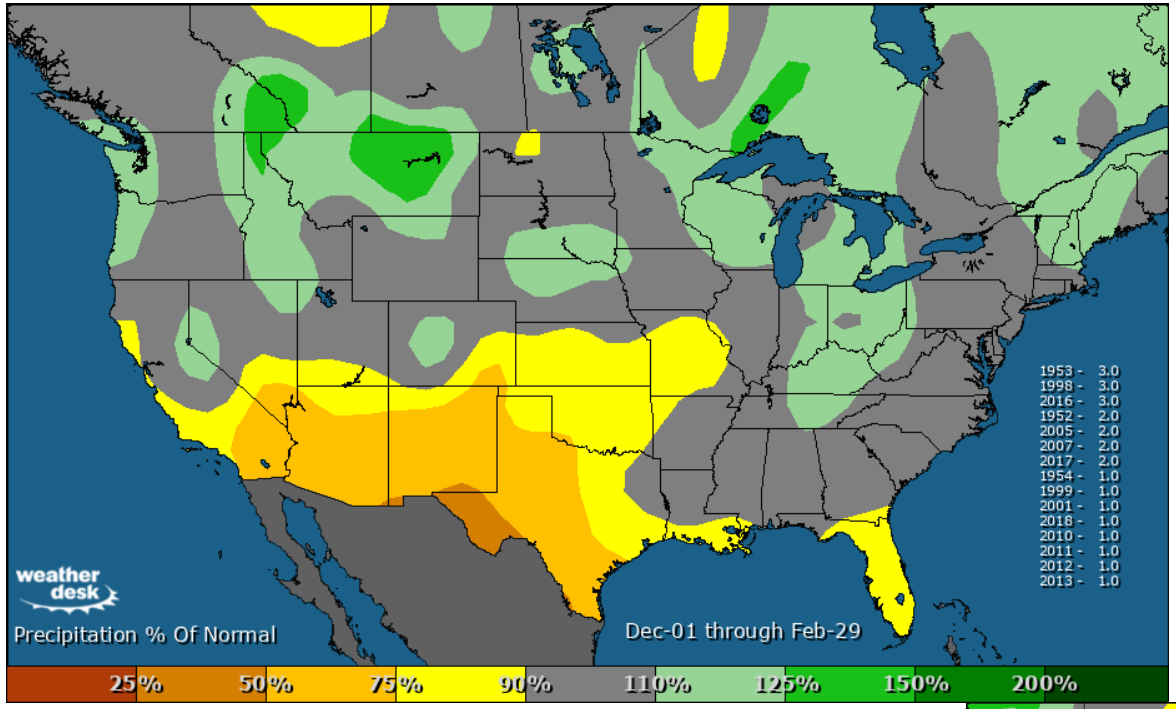
2019-20	62th driest (out of 125)
2018-19	**87th**
2017-18	71st
2016-17	**94th**
2015-16	56th
2014-15	70th
2013-14	**11th**
2012-13	60th
2011-12	**114th**
2010-11	**17th**
2009-10	**113th**

Last dry winter was 2013-14 (during long-term drought)

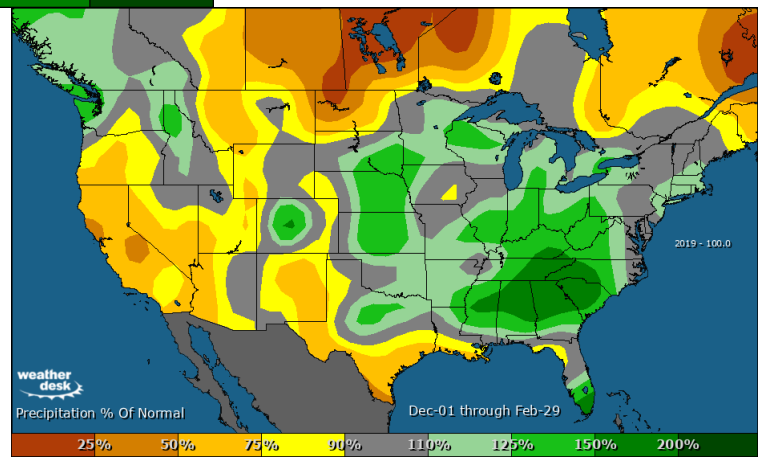
Recent winters have been quite variable in regards to precipitation

Winter 2020-21 Precipitation Outlook

- For the state on-average, last winter was a very “normal” winter for precipitation – though it varied significantly from north to south
- **The upcoming winter looks drier than last winter**
- **This winter has the potential to be the driest since the winter of 2013-14**

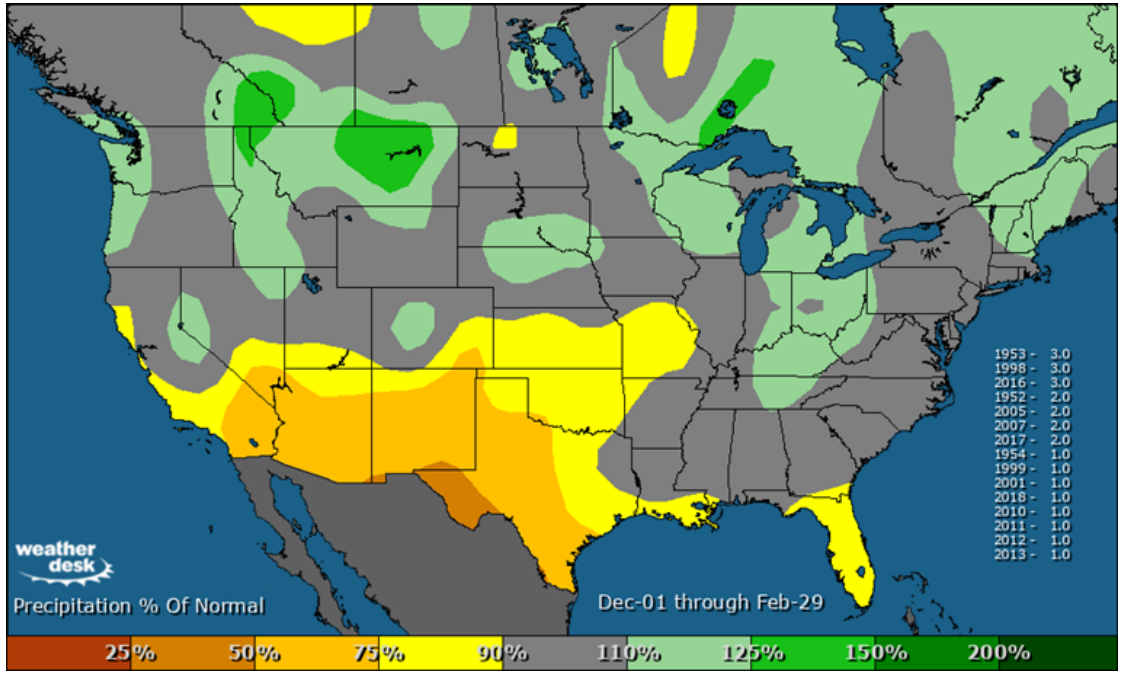


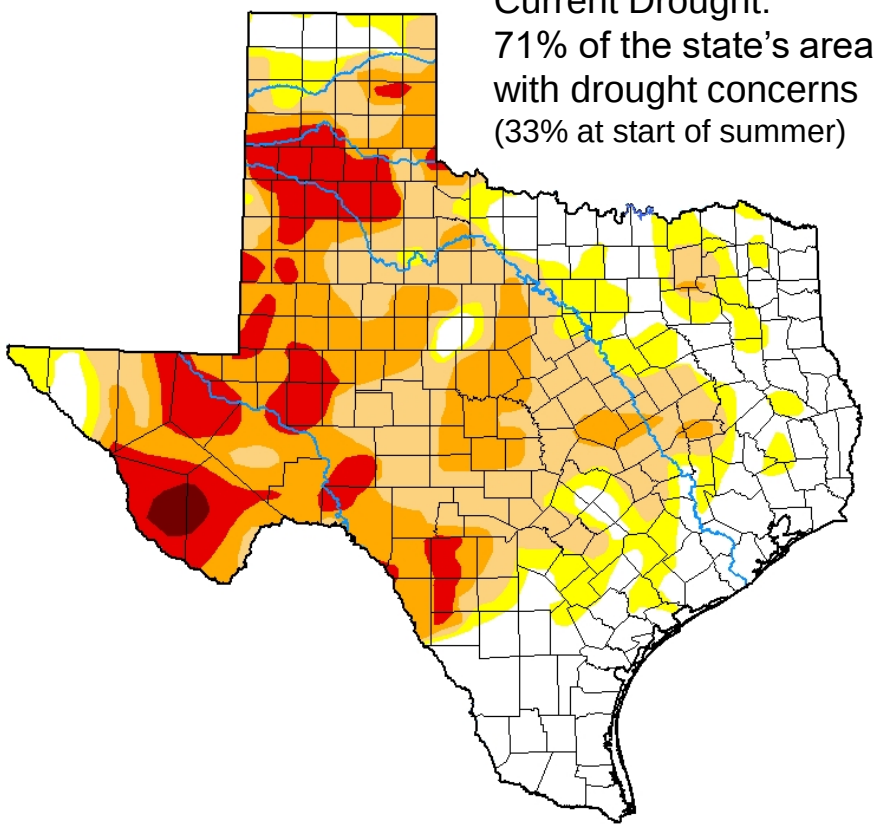
2020-21 forecast



Last winter

Winter 2020-21 Precipitation Outlook vs Drought





Current Drought:
71% of the state's area with drought concerns
(33% at start of summer)

Significant concerns that the drought that's developed in 2020 will carry forward and worsen in spots through the upcoming winter season

Winter Weather Outlook Summary

- This is preliminary. The winter forecast will be finalized by early-November and will be available on the ERCOT website
- The 2020-21 winter is most likely to either rank in the warmest third or middle third of winter rankings. Least likely is the coldest third
- A drier winter has historically allowed for colder outbreaks (polar vortex) to impact Texas a time or two. Late-winter has some signals that could encourage this to happen
- Drought may continue to expand and worsen during the winter season
- Even the mildest/warmest winters are capable of producing a period of extreme to record breaking cold. Winter is a much more volatile weather pattern than the summer season. Extreme cold can only be forecast in the shorter-term – not long-range, several months out forecasts

Closing Remarks