

City of Bellevue

2022 Electric System Reliability Review

September 28, 2023



Safety Moment - Electric System Safety

Never approach downed
utilities lines – they may be live
Stay at least 30 feet away from
lines and anything in contact
with them

Introductions

Justin McConachie – Senior Municipal Liaison Manager

Fremont Aguinaldo – Regional System
Reliability Planner

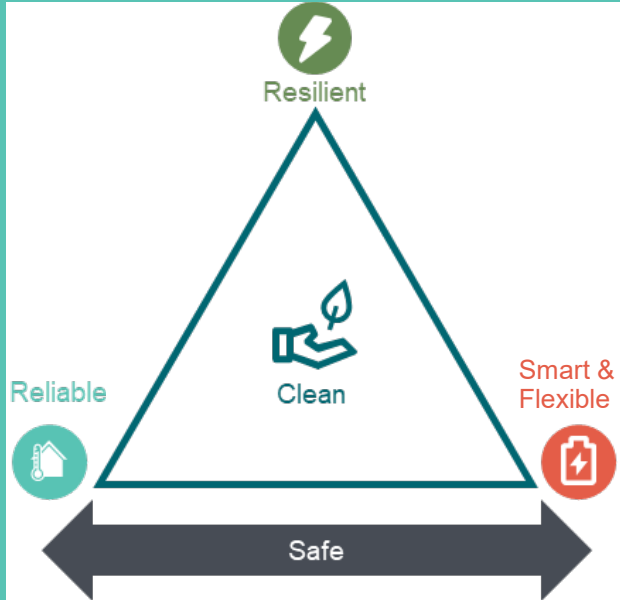
Ryan Yelle – Supervisor System Planning - Reliability

Workshop Purpose

2022 Electric System Performance Overview

- ◆ Overall performance review
- ◆ Reliability project completed and proposed
- ◆ Grid modernization / automation initiatives
- ◆ Information technology initiatives

PSE's Grid Modernization Vision



To meet PSE customer expectations, PSE needs a grid that is ...

SAFE:

Safety for the public, our workforce, and environment continues to be PSE's top priority.

RELIABLE:

To decrease the amount and impact of power outages. This involves identifying asset health, proactively anticipating and mitigating failures/outages, and performing targeted maintenance.

RESILIENT:

So our region recovers more quickly from extreme weather events and other emergencies.

SMART & FLEXIBLE:

Adding intelligence to the electric system allows for more automation and technology to save energy and improve customer experience.

CLEAN:

Enabling the rapid and equitable integration of distributed energy resources and other green technologies.

Overview

Reliability Reporting Metrics

SAIDI & SAIFI

PSE analyzes and reports on our electric system performance using two standard benchmarks of the electric utility industry, **SAIDI** and **SAIFI**.

- ◆ **SAIDI** – **S**ystem **A**verage **I**nterruption **D**uration **I**ndex
Total customer outage minutes / average total customer count
(Service Quality Index: 155 minutes)
- ◆ **SAIFI** – **S**ystem **A**verage **I**nterruption **F**requency **I**ndex
Total customers affected / average total customer count
(Service Quality Index: 1.3 outages)

Overview

Performance

5 Year History

Bellevue & PSE System

Bellevue performance compared to the PSE system performance for the past 5 years using the two standard benchmarks **SAIDI** and **SAIFI**

	SAIDI		SAIFI	
	BELLEVUE	PSE	BELLEVUE	PSE
2018	111.3	145.0	0.71	1.02
2019	102.7	136.0	0.79	0.98
2020	93.0	165.0	0.92	1.24
2021	111.0	207.0	0.65	1.35
2022	58.2	181.0	0.37	1.06

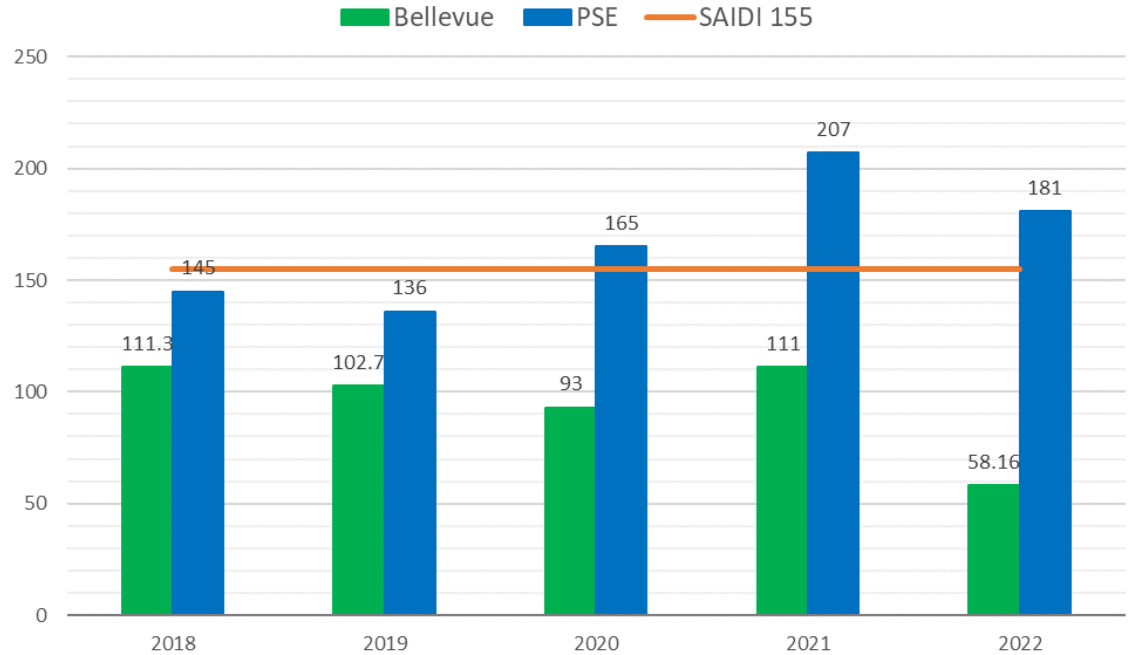
SAIDI in minutes per customer, calculated using the IEEE 1366 method
SAIFI in outage events per customer
(SAIDI and SAIFI data excludes Major Storms)

Overview

Performance Visualized

SAIDI

Bellevue **SAIDI** comparison to PSE Performance 2018-2022 (excluding storm events)

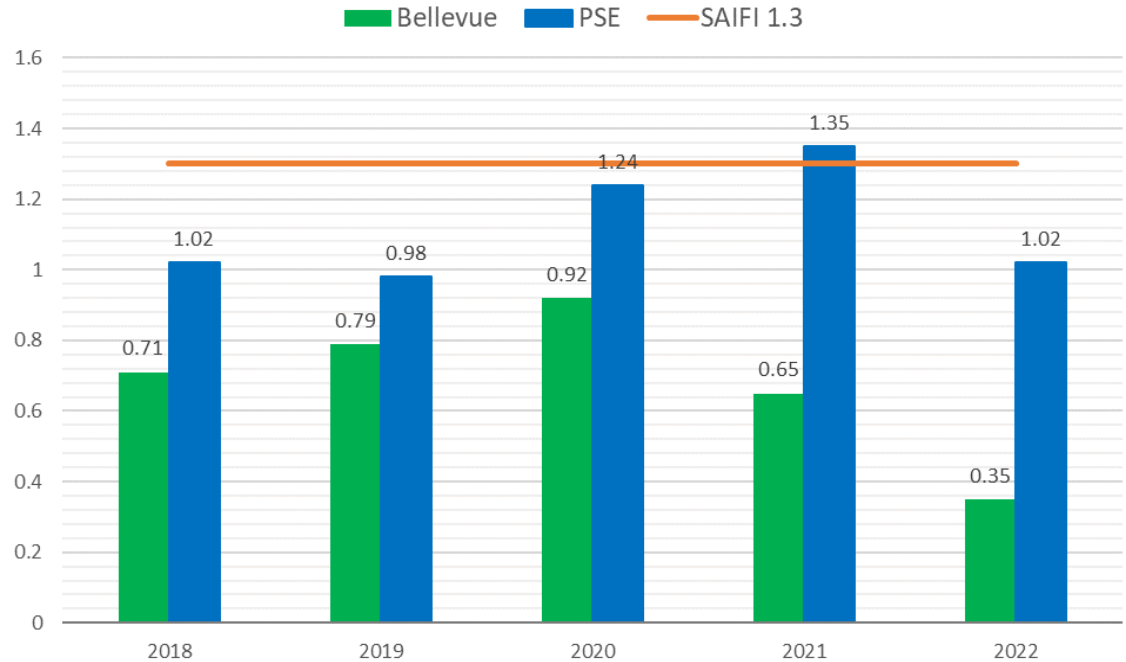


Overview

Performance Visualized

SAIFI

Bellevue **SAIFI** comparison to PSE Performance 2018-2022 (excluding storm events)



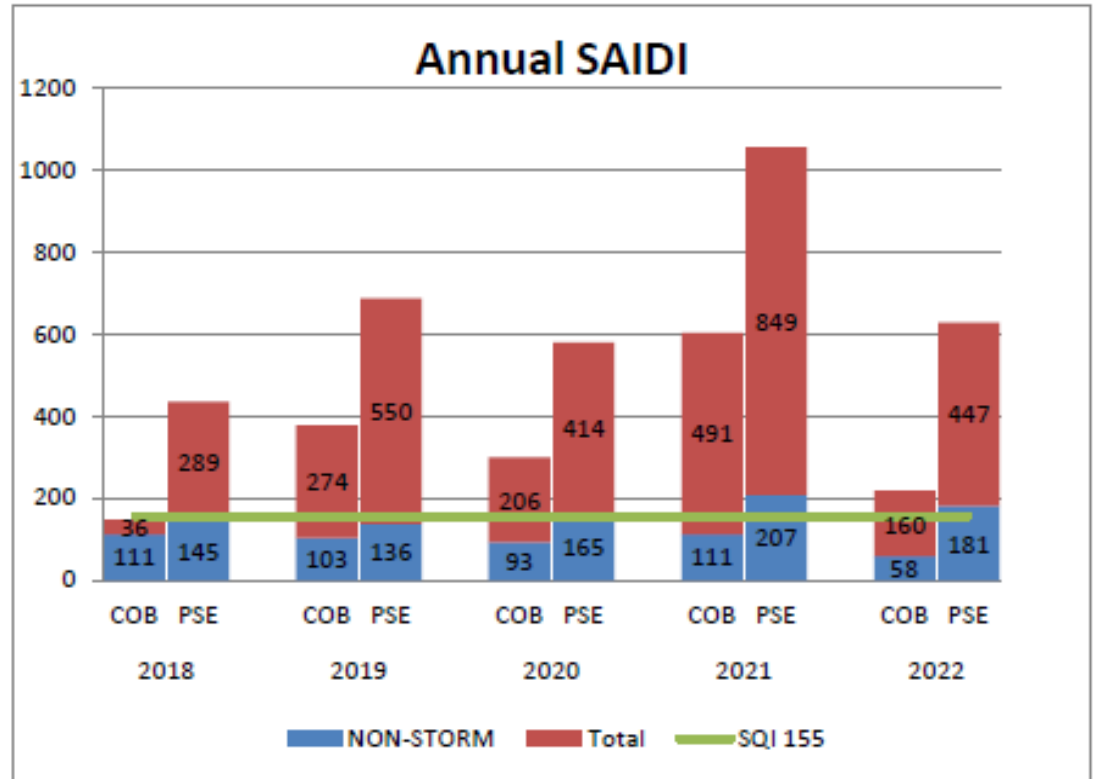
Overview

Performance

5 Year History

Bellevue & PSE System

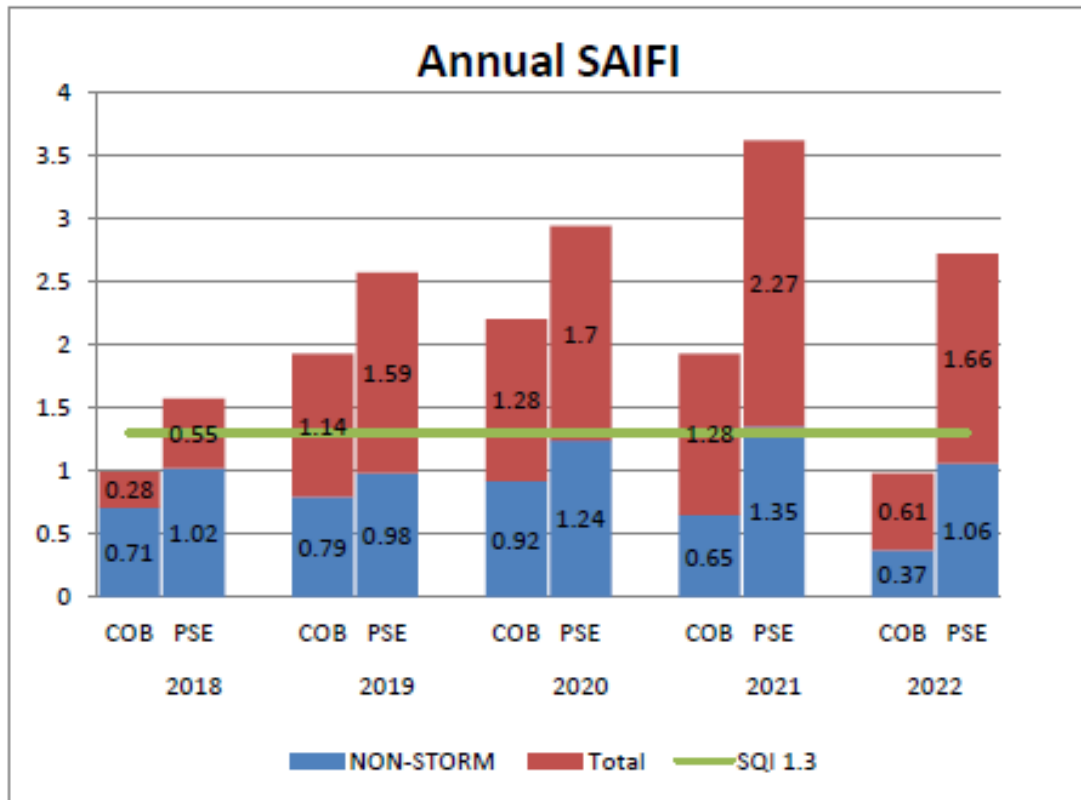
SAIDI



Values in minutes for all years calculated using IEEE 1366 method

Overview Performance 5 Year History

Bellevue & PSE System SAIFI



Values in outage events for all years

Overview Performance By Circuit

Circuits Exceeding Performance Metrics

Circuits Exceeding System SAIDI and/or SAIFI 2018 - 2022

Bellevue is served by 98 distribution circuits from 23 substations.

For 2022: 87% (85) circuits performed better than system average

13% (13) circuits performed below than system average

CIRCUIT	Repeat Counts					Repeat Counts				
	2018	2019	2020	2021	2022	1	2	3	4	5
ARD-13								3		
ARD-15								3		
BTR-21							2			
BTR-22									4	
BTR-23							2			
CEN-11						1				
CEN-25						1				
SOM-13						1				
SOM-15							2			
SOM-16								3		
SOM-17								3		
Totals	27	40	26	22	13	25	24	14	2	1
	2018	2019	2020	2021	2022	38%	36%	21%	3%	2%

Overview Bellevue Circuits Exceeding System Wide Performance in 2022

Bellevue circuits with SAIDI or SAIFI exceeding system wide figures in 2022

CIRCUITS THAT EXCEED 2022 PSE SYSTEM SAIDI AND/OR SAIFI			Notes: SAIDI figures reflect all non-med, scheduled & unscheduled SAIFI figures reflect all non-storm outages, scheduled & unscheduled		
SQI: SAIDI = 155 SAIFI = 1.30					
PSE: SAIDI = 181 SAIFI = 1.06					
BELLEVUE: SAIDI = 58 SAIFI = 0.37					
CIRCUIT	SAIDI	SAIFI	2022 Events Comments	Actions & Projects Completed in 2022	Planned Actions & Projects
CIRCUITS THAT EXCEED 2022 PSE SYSTEM SAIDI AND/OR SAIFI					
NRU-27	293.36	1.29	There were 3 separate outage events involving a failed switch and failed underground cable that	Both switch and underground cables were replaced and power restored.	A underground cable replacement project to help reduce outages from aging and failed cables, is in development and is estimated to be completed in 2024.
SBE-26	276.42	0.66		Trees and branches were removed and overhead distribution lines were repaired.	The distribution circuit has a tree trimming cycle of 4 years, the last time trees were trimmed and removed was in 2021 and the next scheduled trim will be in 2025.
BTR-22	173.83	1.42		Tree and branches were repaired.	The distribution circuit has a tree trimming cycle of 4 years, the last time trees were trimmed and removed was in 2018 and the next scheduled trim will be in 2023.
PHW-17				The tree branch was repaired.	Construction of a distribution underground use and is projected to start construction in 2024. There is a permit going through the permitting stage and is projected to start in 2024.
LHC-02				The tree branch was repaired.	at time trees were trimmed and removed was in 2022 and the next scheduled trim will be in 2023.
2022 Events Comments					
Actions & Projects Completed in 2022					
Planned Actions & Projects					
CIRCUIT	SAIDI	SAIFI			
Circuits with planned actions or investigations					
NRU-27	293.36	1.29		The underground switch was replaced and power restored.	
SBE-26	276.42	0.66		The underground overhead cut	
BTR-22	173.83	1.42		The crew investigated but found no fault.	
				The dead animal was removed and power was restored.	

 Figure exceeded Service Quality Index

 Figure exceeding system wide average and Service Quality Index

Overview Performance By Circuit

Bellevue Circuits Performance in 2022

2022 PERFORMANCE FOR CIRCUITS SERVING BELLEVUE					
EXCLUDING STORM OUTAGES					
CIRCUIT	CUSTOMERS (METERS)	UNPLANNED OUTAGES ¹	OUTAGE MINUTES ¹	SAIDI ²	SAIFI ²
<i>2022 PSE Companywide performance figures</i>				181	1.06
ARD-11	229	1	84	0	0
ARD-13	860	5	389,532	462.19	2.11
ARD-14	248	0	0	0.71	0.01 ⁵
ARD-15	1,621	7	99,853	64.34	0.21
ARD-43	1,037	1	10,481	10.11	0.01
BTR-14	1,132	2	91,703	81.01	0.15
BTR-21	1,137	7	76,642	67.41	0.32
BTR-22	687	11	117,243	173.83	1.42
BTR-23	642	0	0	0.00	0.00
SBE-23	120	0	0	20.53	0.15 ⁵
SBE-25	589	2	540	27.42	0.25
SBE-26	1,866	30	509,442	276.42	0.66
SOM-13	1,913	7	20,059	10.49	0.05 ³
SOM-15	1,745	9	291,762	169.42	1.10 ⁵
SOM-16	2,640	21	75,745	35.77	0.26 ³
SOM-17	1,711	7	18,043	10.72	0.05 ³

This resorted report excerpt shows the number of customers (meters) served by each distribution circuit, the number of outages excluding storms, corresponding outage minutes and the circuits calculated SAIDI and SAIFI values.

Includes one circuit outage resulting from transmission line outage
Includes one circuit outage resulting from substation bank outage



Overview

2022 Performance

Bellevue Outages by Cause

We analyze and report outages by outage cause

2022 OUTAGES FOR CIRCUITS SERVING BELLEVUE EXCLUDING STORM OUTAGES

BY CAUSE

CAUSE CODE	CAUSE DESCRIPTION	OUTAGES		OUTAGE MINUTES	
		COUNT	PERCENT	COUNT	PERCENT
AC	ACCIDENT	5	0.8%	121,276	2.6%
AO	ACCIDENT OTHER, WITH FIRES	1	0.2%	826	0.0%
AV	ACCIDENT/VANDALISM NOT RESULTING IN DC	2	0.3%	1,330	0.0%
BA	BIRD OR ANIMAL	50	8.1%	117,042	2.5%
CE	CUSTOMER EQUIPMENT	10	1.6%	190,622	4.1%
CP	CAR POLE	12	1.9%	107,703	2.3%
DU	DIG UP UNDERGROUND	16	2.6%	52,298	1.1%
EF	EQUIPMENT FAILURE	308	49.8%	2,738,979	58.4%
ND	NATURAL DISASTER	1	0.2%	43,934	0.9%
OD	OUTSIDE DISTURBANCE	1	0.2%	844	0.0%
OE	OPERATING ERROR	1	0.2%	150	0.0%
SO	SCHEDULED OUTAGE	128	20.7%	345,558	7.4%
TV	TREE - RIGHT OF WAY UNKNOWN	55	8.9%	788,159	16.8%
UN	UNKNOWN CAUSE	23	3.7%	146,415	3.1%
(blank)	BLANK	6	1.0%	33,963	0.7%
Totals		619	100%	4,689,099	100%

Overview

2022 Performance

Bellevue Outages by Equipment Involved

We analyze and report outages by equipment involved

BY EQUIPMENT

EQUIP CODE	EQUIPMENT DESCRIPTION	OUTAGES		OUTAGE MINUTES	
		COUNT	PERCENT	COUNT	PERCENT
ACE	ALL CUSTOMER EQUIPMENT	16	2.6%	21,321	0.5%
OAR	DID NOT OPERATE	1	0.2%	7,407	0.2%
OCE	OVERHEAD ARRESTER	1	0.2%	110	0.0%
OCN	CUSTOMER EQUIPMENT	12	1.9%	2,735	0.1%
OCO	OVERHEAD SECONDARY CONNECTOR	29	4.7%	752,581	16.0%
OCR	OVERHEAD CONDUCTOR	3	0.5%	6,497	0.1%
OFC	OVERHEAD CROSSARM	4	0.6%	15,322	0.3%
OFU	OVERHEAD CUT-OUT	45	7.3%	573,876	12.2%
OIN	OVERHEAD LINE FUSE / FUSE LINK	2	0.3%	21,385	0.5%
OJU	OVERHEAD INSULATOR	1	0.2%	17,680	0.4%
OMP	OVERHEAD POLE (EDOP100)	1	0.2%	72	0.0%
OPO	OVERHEAD SERVICE	41	6.6%	331,837	7.1%
OSV	OVERHEAD SWITCH	27	4.4%	7,848	0.2%
OSW	OVERHEAD TRANSFORMER FUSE	2	0.3%	7,319	0.2%
OTF	OVERHEAD TRANSFORMER	51	8.2%	35,255	0.8%
OTR	PADMOUNT SWITCH FUSE	33	5.3%	47,239	1.0%
PMJ	PADMOUNT METER POINT (EDUM100)	1	0.2%	27,579	0.6%
SCB	PADMOUNT TRANSFORMER FUSE	7	1.1%	469,324	10.0%
UEL	POWER CIRCUIT BREAKER	45	7.3%	433,501	9.2%
UFJ	STATION POWER TRANSFORMER	11	1.8%	113,025	2.4%
UGF	UNDERGROUND ELBOW	7	1.1%	66,658	1.4%
UGV	UNDERGROUND FUSED ELBOW	5	0.8%	25,462	0.5%
UHH	UNDERGROUND J-BOX	27	4.4%	22,154	0.5%
UMP	UNDERGROUND SUBMERSIBLE FUSE	2	0.3%	246	0.0%
UOT	UNDERGROUND VAULT	9	1.5%	147,802	3.2%
UPC	UNDERGROUND HANDHOLE - SECONDARY	65	10.5%	924,277	19.7%
UPS	UNDERGROUND SUBMERSIBLE METER POINT	5	0.8%	200,386	4.3%
UPT	UNDERGROUND UNKNOWN	16	2.6%	97,809	2.1%
USC	UNDERGROUND OUTDOOR TERMINATION	4	0.6%	4,336	0.1%
USV	UNDERGROUND PRIMARY CABLE	93	15.0%	43,312	0.9%
UTC	UNDERGROUND PADMOUNT SWITCH (EDUS100)	4	0.6%	23,304	0.5%
UTR	UNDERGROUND PADMOUNT TRANSFORMER	29	4.7%	194,733	4.2%
UVS	UNDERGROUND SECONDARY CABLE	2	0.3%	3,050	0.1%
(blank)	UNDERGROUND PRIMARY SPLICE	18	2.9%	43,657	0.9%
Totals		619	100%	4,689,099	100%

Bellevue System

Reliability Projects Completed 2021-2022

PSE develops and constructs system improvement projects and maintains its system to address identified reliability needs. In 2021-2022 we completed ...

- ◆ Installation of Bridle Trails 22 recloser
- ◆ Distribution Automation on Eastgate 12, Somerset 13, & Hazelwood 12
- ◆ FuseSavers on Eastgate 28, Evergreen 28, and Goodes Corner 21
- ◆ Substation SCADA upgrades for Eastgate circuit breakers
- ◆ Underground cable replacement projects on Northrup 25, Bridle Trails 21, and Eastgate 28 totaling 2,934 cable feet
- ◆ Vegetation management (tree trimming) along 14 distribution circuits totaling 40 miles and 9 transmission lines totaling 73 miles

Bellevue System

Proposed Reliability Projects

PSE has identified and is working on these improvement projects for construction in the near future ...

- ◆ SCADA capable circuit breakers in the Northrup substation
- ◆ Bridle Trails 22 overhead to underground conversion along 132nd Ave NE
- ◆ 5 reclosers; 1 each on Northrup 23 and Evergreen 23 and 3 on Kenilworth 23
- ◆ 8 FuseSaver projects on 7 different distribution circuits
- ◆ Somerset 16 & 17, Eastgate 15, Hazelwood 13, and Eastgate 28 Distribution Automation
- ◆ 3 underground cable replacement projects engineered for 2023 construction – 13,593 circuit feet
- ◆ 10 underground cable replacement projects engineered for 2024 construction – 38,529 circuit feet

Bellevue System

Transmission System Improvements

Completed ...

- ◆ **Sammamish – Lochleven Transmission Automation** – Replacing existing automatic switching scheme with new fault location, isolation and service restoration (FLISR) technology to improve transmission system response to faults.
- ◆ **Richards Creek Substation** - Add 2nd 230-115kV transformer at Richards Creek Substation to mitigate risk for overloads in specific system configurations.

In Construction ...

- ◆ **Energize Eastside 230kV** – Upgrading transmission lines along an existing corridor and construct a new transmission substation (permitting continues for some portions of this project).
- ◆ **Sammamish – Juanita 115kV line** - new 115 kV line from Sammamish substation to Juanita substation to relieve loading on the transmission lines feeding Moorland area.

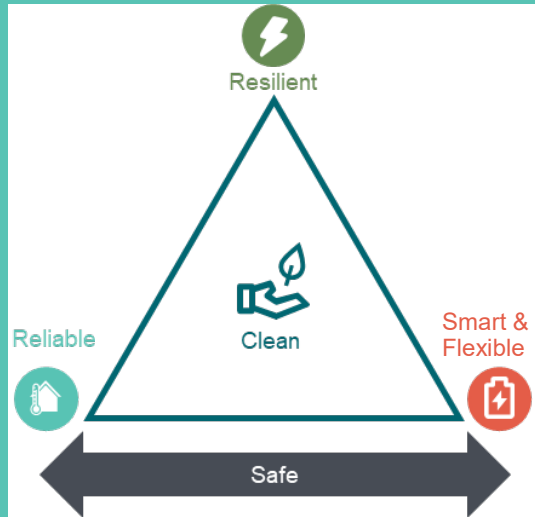
Bellevue System

Transmission System Improvements

Proposed ...

- ◆ **Vernell Substation** – New integrated 115kV transmission switching station and distribution substation to support Bellevue CBD and Spring District development.
- ◆ **Midlakes Substation** – Add 2nd 115-34.5 kV distribution bank at the Midlakes substation to relieve loading stress on substations feeding downtown Bellevue being caused by growing loads.
- ◆ **Juanita – Moorlands 115kV Line** – Upgrade 115 kV Juanita – Moorlands line to a higher conductor rating to mitigate for overloads in certain system configurations.

PSE System Smart & Flexible Enhancements



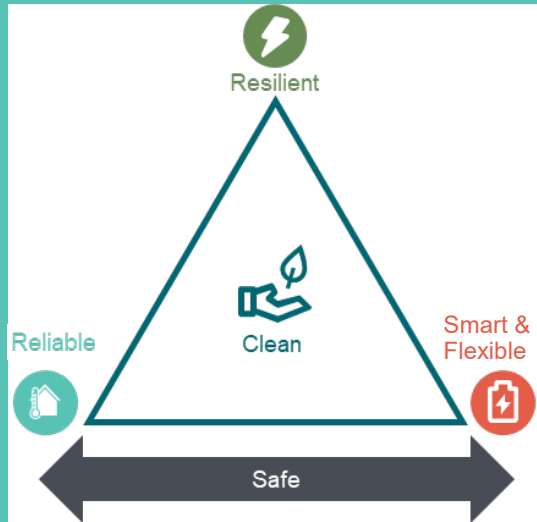
Foundational ...

- ◆ **Advanced Metering Infrastructure (AMI)** – Complete in Bellevue!

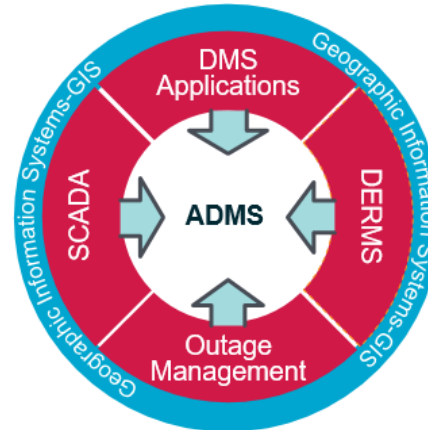
Automation ...

- ◆ **Distribution Automation (DA)** – To date we have implemented DA on 95 distribution feeders system wide. 18 DA projects are in engineering or construction in 2021 company wide, including projects in the City of Bellevue.
- ◆ **Distribution SCADA Switchgear** - 66 switches in the Bellevue CBD area get SCADA and EMS integration to allow monitoring and control of distribution system configuration to respond to system events in real time. 37 switch upgrades are complete. 5 more switches are expected to be upgraded by the end of 2022. These upgrades will facilitate future DA implementation in the CBD.

PSE System Smart & Flexible Enhancements



- ◆ Future (in progress) ...
 - Advanced Distribution Management System (ADMS)
 - ◆ Computer based decision support system used to supervise, manage and control real-time operation of the distribution system network.
 - ◆ Implementation ongoing with full deployment expected in 2024.
 - ◆ ADMS will replace our current outage management system (OMS) and Distribution Automation (DA) platforms.




DERMS: Distributed Energy Resources Management System

SCADA: Supervisory Control & Data Acquisition

Wrapping Up

Thank You for Attending

Questions & Discussion

The background of the slide features a photograph of several wind turbines silhouetted against a sunset sky. The sky transitions from a deep orange near the horizon to a darker, muted purple at the top. The turbines are scattered across the landscape, with one particularly large one in the center foreground. The overall scene is peaceful and evokes a sense of clean, renewable energy.

2022 Electric System Reliability Review

Thank You for attending!