City of Bellevue

2020 Electric System Reliability Review

November 18, 2021

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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

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Introductions

Cathy Koch – Director System Planning

Jens Nedrud – Manager Electric System Planning

Ray Hisayasu – Supervisor System Planning

Sam Di Re – Regional System Planning Lead

Bill Foster – Regional System Reliability Planner

David Hoffman – Local Government Relations Manager

Andy Swayne – Senior Municipal Liaison Manager

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Workshop Purpose

2020 Electric System Performance Overview

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

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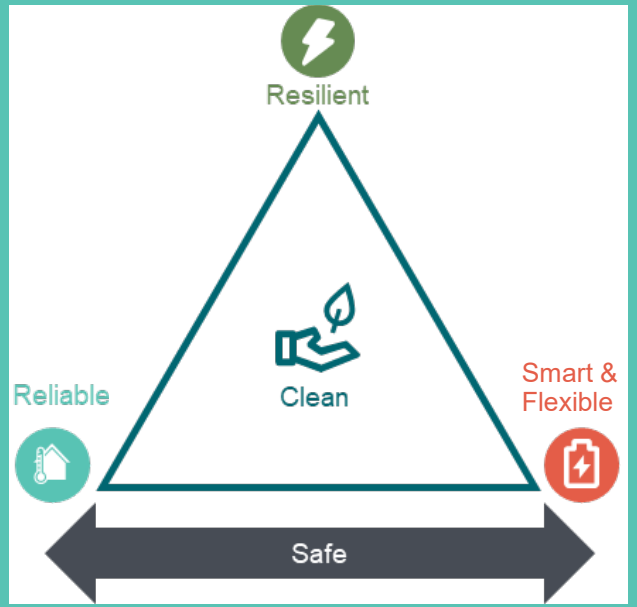
PSE's Grid Modernization Vision



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.

RESILENT:

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.

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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)

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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
2016	107.0	148.0	0.74	1.06
2017	116.4	175.0	0.91	1.2
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

SAIDI in minutes per customer, calculated using the IEEE 1366 method
SAIFI in outage events per customer

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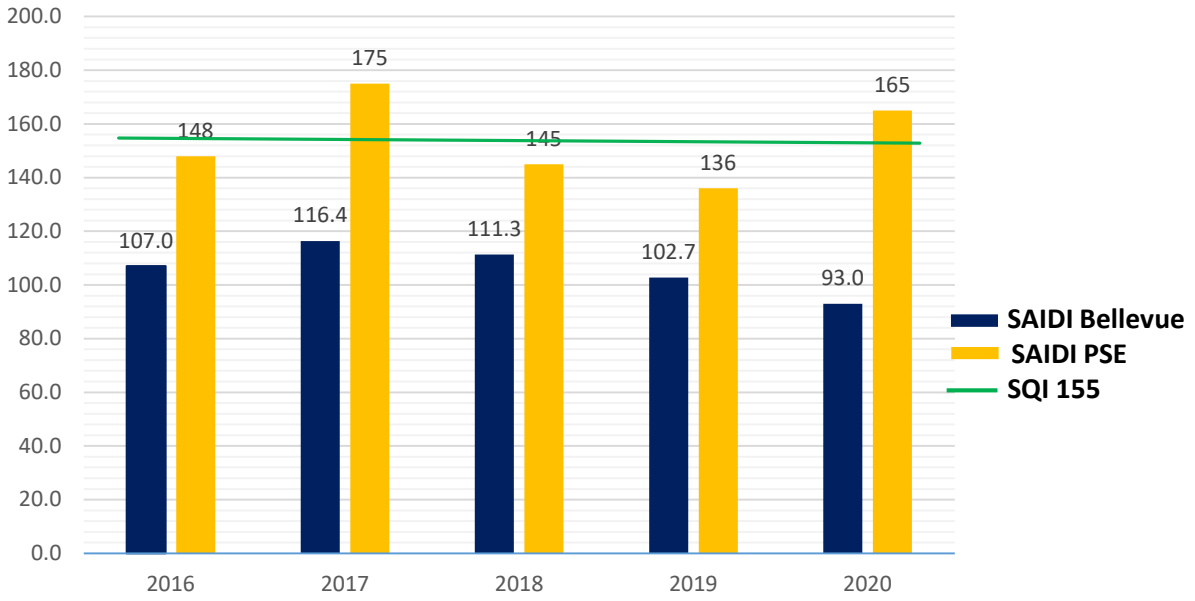
Overview

Performance Visualized

SAIDI

Bellevue **SAIDI** comparison to PSE Performance 2016-2020 (excluding storm events)



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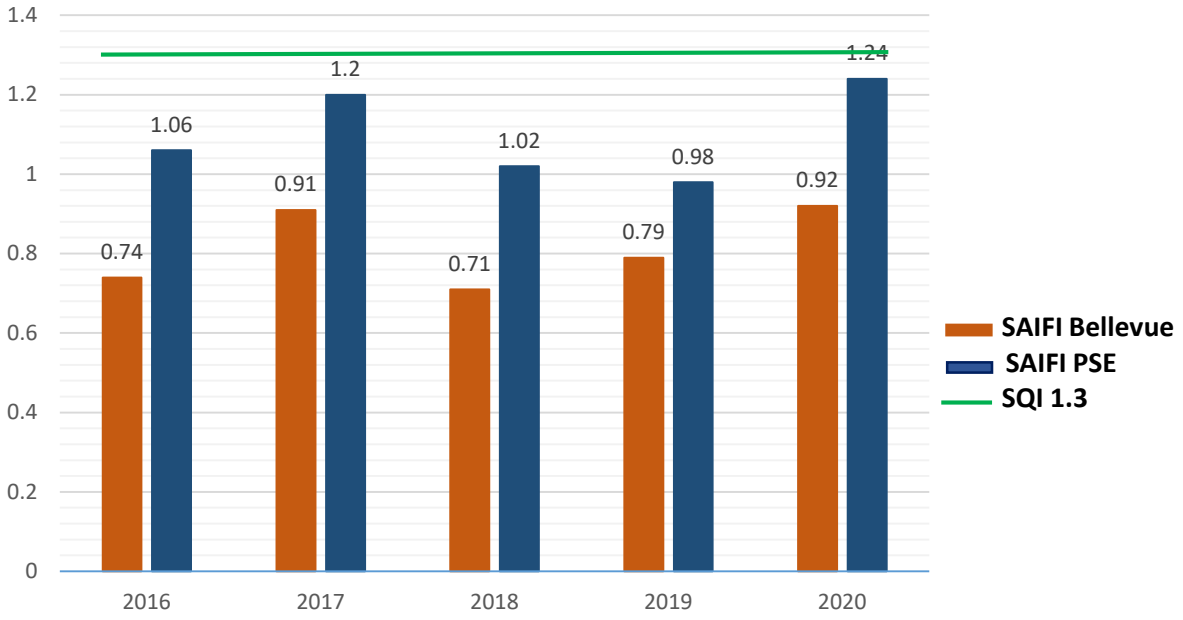
Overview

Performance Visualized

SAIFI

Bellevue **SAIFI** comparison to PSE Performance 2016-2020 (excluding storm events)



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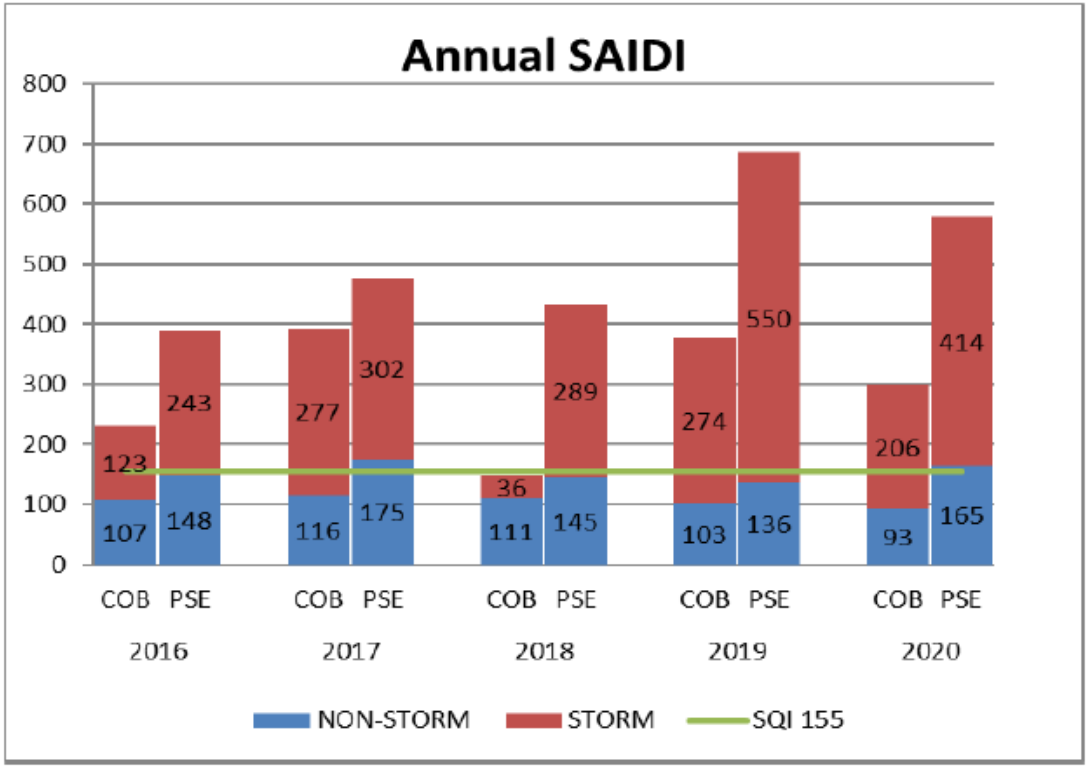
Overview

Performance 5 Year History

Bellevue & PSE System

SAIDI



Values in minutes for all years calculated using IEEE 1366 method

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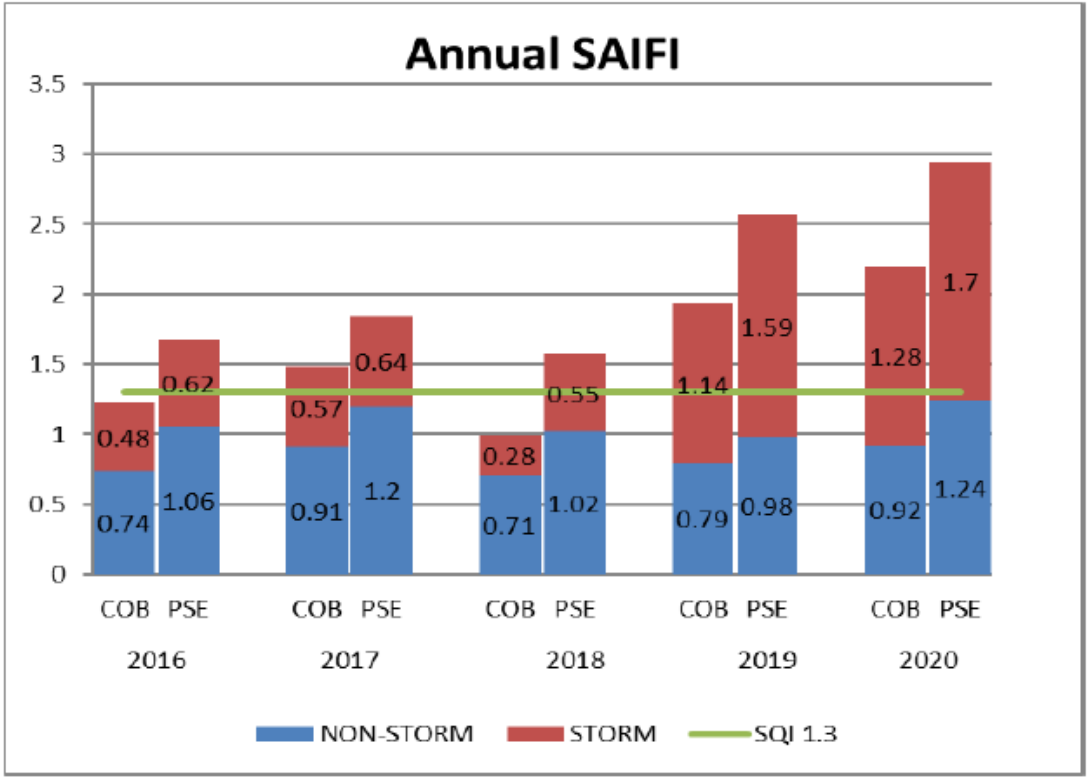
Overview

Performance 5 Year History

Bellevue & PSE System

SAIFI



Values in outage events for all years

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Overview

Performance By Circuit

Circuits Exceeding Performance Metrics

Circuits Exceeding System SAIDI and/or SAIFI 2016 - 2020

Bellevue is served by 96 distribution circuits from 23 substations.

For 2020: 76% (73) circuits performed better than system average

24% (23) circuits performed below than system average

						Repeat Counts				
CIRCUIT	2016	2017	2018	2019	2020	1	2	3	4	5
ARD-11							2			
ARD-13			1			1				
ARD-15			1					3		
BTR-21							2			
BTR-22							2			
BTR-23						1				
SOM-13			1			1				
SOM-15			1			1				
SOM-16			1						4	
SOM-17			1					3		
Totals	22	33	26	39	23	29	23	13	6	1
	2016	2017	2018	2019	2020	40%	32%	18%	8%	1%

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Overview

Bellevue Circuits Exceeding System Wide Performance in 2020

Bellevue circuits with SAIDI or SAIFI exceeding system wide figures in 2020

CIRCUITS THAT EXCEED 2020 PSE SYSTEM SAIDI AND/OR SAIFI
SQI: SAIDI = 155 SAIFI = 1.30
PSE: SAIDI = 165 SAIFI = 1.24
BELLEVUE: SAIDI = 93 SAIFI = 0.92

Notes: SAIDI figures reflect all non-med, scheduled & unscheduled
SAIFI figures reflect all non-storm outages, scheduled & unscheduled

CIRCUIT	SAIDI	SAIFI	2020 Events Comments	Actions & Projects Completed in 2020	Planned Actions & Projects
Circuits with planned actions or investigations					
BTR-21	192.5	2.54			
BTR-22	146.3	1.75			
MLK-15	227.7	1.42	One outage event involving a splice failure in underground distribution feeder contributed to both SAIDI & SAIFI.	Underground cables were repaired.	
NOB-24	130.6	2.10	One outage event involving failed switchgear and a second switchgear malfunction contributed 2.0 to SAIFI.	The failed switchgear was replaced.	
NRU-23	617.8	0.96	One outage event involving failed underground feeder cables contributed 608 to SAIDI.	Underground cables were replaced.	
NRU-27	194.9	1.46	One outage event involving an animal in overhead distribution conductor contributed to both SAIDI & SAIFI.	Equipment was repaired.	
SOM-16	208.3	4.88	One outage event involving a tree in overhead distribution feeder and three events involving underground cables and equipment contributed to both SAIDI & SAIFI.	Overhead conductors were repaired and underground cables and equipment replaced.	
Circuits for which no corrective action is needed					
ARD-15	162.8	0.83	Three scheduled outage events contributed 85 to SAIDI.		

Figure exceeded PSE system wide average figure

Figure exceeding system wide average and Service Qaulity Index

SAIFI figure results in part from circuit outages due to transmission or substation outage

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Overview

Performance By Circuit

Bellevue Circuits Performance in 2020

2020 PERFORMANCE FOR CIRCUITS SERVING BELLEVUE
EXCLUDING STORM OUTAGES

CIRCUIT	CUSTOMERS (METERS)	UNPLANNED OUTAGES[1]	OUTAGE MINUTES[1]	SAIDI[2]	SAIFI[2]
	2020 PSE Companywide performance figures			*165*	*1.24*
KWH-25	1,628	26	88,735	58.89	1.43
FAC-12	1,268	24	36,649	28.90	0.19
SBE-26	1,807	20	40,907	24.71	0.20
EGT-28	1,773	18	122,994	69.37	1.13
SOM-17	1,711	18	232,384	135.89	1.24
HAZ-13	1,227	17	120,805	113.83	0.79
EVE-23	2,971	16	193,804	66.65	0.47
GOO-21	427	15	80,579	189.60	2.20
MED-36	676	14	47,640	70.47	0.40
NRU-27	516	14	96,500	194.89	1.46
EGT-11	1,222	13	132,950	108.97	1.46
PHA-16	2,085	13	21,328	10.23	0.05
SOM-16	2,631	13	547,960	208.27	4.88
EGT-12	2,562	12	285,838	117.81	1.95
LHL-25	2,518	12	286,627	131.16	1.52

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

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Overview

2020 Performance

Bellevue Outages by Cause

We analyze and report outages by outage cause

2020 OUTAGES FOR CIRCUITS SERVING BELLEVUE
EXCLUDING STORM OUTAGES

BY CAUSE

CAUSE CODE	CAUSE DESCRIPTION	OUTAGES		OUTAGE MINUTES	
		COUNT	PERCENT	COUNT	PERCENT
AC	ACCIDENT	6	0.9%	54,862	0.7%
BA	BIRD OR ANIMAL	62	9.1%	166,637	2.1%
CE	CUSTOMER EQUIPMENT	4	0.6%	25,601	0.3%
CP	CAR EQUIPMENT	8	1.2%	139,907	1.8%
DU	DIG UP UNDERGROUND	18	2.6%	775,284	10.0%
EF	EQUIPMENT FAILURE	365	53.7%	3,597,310	46.3%
FI	FAULTY INSTALLATION	3	0.4%	22,816	0.3%
LI	LIGHTNING	1	0.1%	356	0.0%
OD	OUTSIDE DISTURBANCE	3	0.4%	7,803	0.1%
OE	OUTAGE WHILE WORKING	3	0.4%	198,966	2.6%
SO	SCHEDULED OUTAGE	127	18.7%	779,876	10.0%
TV	TREE - RIGHT OF WAY UNKNOWN	69	10.1%	1,933,479	24.9%
UN	UNKNOWN CAUSE	11	1.6%	74,368	1.0%
	Totals	680	100%	7,777,264	100%

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Overview 2020 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
USV	UNDERGROUND SERVICE	86	12.6%	35,286	0.5%
UPC	UNDERGROUND PRIMARY CABLE	83	12.2%	2,537,716	32.6%
OCO	OVERHEAD CONDUCTOR	67	9.9%	2,642,062	34.0%
UEL	UNDERGROUND ELBOW	56	8.2%	415,141	5.3%
OTF	OVERHEAD TRANSFORMER FUSE	50	7.4%	22,888	0.3%
OTR	OVERHEAD TRANSFORMER	39	5.7%	108,513	1.4%
OFU	OVERHEAD LINE FUSE / FUSE LINK	29	4.3%	138,688	1.8%
USC	UNDERGROUND SECONDARY CABLE	29	4.3%	22,792	0.3%
OPO	OVERHEAD POLE (EDOP100)	25	3.7%	252,544	3.2%
UTR	UNDERGROUND SUBMERSIBLE TRANSFORMER	24	3.5%	153,337	2.0%
OCN	OVERHEAD SECONDARY CONNECTOR	23	3.4%	13,095	0.2%
OSV	OVERHEAD SERVICE	22	3.2%	4,771	0.1%
UFJ	UNDERGROUND J-BOX	20	2.9%	270,120	3.5%
OFC	OVERHEAD CUT-OUT	20	2.9%	47,877	0.6%
UHH	UNDERGROUND HANDHOLE - SECONDARY	17	2.5%	25,617	0.3%
UPT	UNDERGROUND PADMOUNT TRANSFORMER	13	1.9%	142,994	1.8%
OMP	OVERHEAD METER POINT (EDOM100)	12	1.8%	24,577	0.3%
ACE	ALL CUSTOMER EQUIPMENT	11	1.6%	35,970	0.5%
UOT	UNDERGROUND OUTDOOR TERMINATION	9	1.3%	22,720	0.3%
UTC	UNDERGROUND TERMINAL FUSE	9	1.3%	5,589	0.1%
UPS	UNDERGROUND PADMOUNT SWITCH (EDUS100)	8	1.2%	370,215	4.8%
	Totals	680	100%	7,777,264	100%

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Bellevue System

Reliability Projects Completed 2019-2020

PSE develops and constructs system improvement projects and maintains its system to address identified reliability needs. In 2019 -2020 we completed …

- Installation of Eastgate 28 recloser
- Installation of an Eastgate 12 *Fusesaver* on a fused lateral line – new protective device pilot test
- Proactive distribution system underground cable replacement in the Crossroads area including the Pacific Village Condominiums
- 7 distribution system underground cable replacement projects on various circuits – 25,623 cable feet
- Vegetation management (tree trimming) along 28 distribution circuits - 109 miles and 5 transmission lines – 22 miles

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Bellevue System

Proposed Reliability Projects

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

- Cherry Crest Neighborhood distribution switch replacement
- South Bellevue 22 distribution recloser installation
- Bridle Trails 22 distribution undergrounding projects
  1) west of 140th AVE NE
  2) along 132nd AVE NE south of NE 60th ST
- Eastgate 12, Somerset 13, & Hazelwood 12 Distribution Automation
- Somerset 16 & 17, Factoria 13 & 14, Eastgate 15, and Hazelwood 13 Distribution Automation
- 12 underground cable replacement projects engineered for 2021 construction – 27,555 circuit feet
- 9 underground cable replacement projects scoped for engineering with projected 2022 construction – 34,033 circuit feet

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Bellevue System

Transmission System Improvements

Completed …

- Shuffleton – Lakeside 115kV SCADA Upgrade – Upgraded highline switches to provide automation on Somerset Tap to improve transmission system response to faults.

In Construction …

- Lake Hills – Phantom Lake – 115kV transmission line (in service – landscape restoration in progress).
- 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 – 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.

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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.
- Mercer Island Cable Replacement – Investigating options to address aging infrastructure needs on the submarine cables serving Mercer Island.

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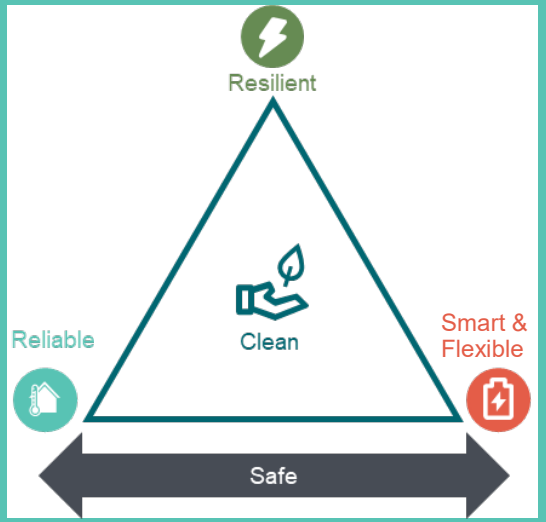
PSE System Smart & Flexible Enhancements



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 project are in engineering or construction in 2021, including the first project in Bellevue (EGT-21, HAZ-12 & SOM-13).
- 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 switches are expected to be upgraded in 2022. These upgrades will facilitate future DA implementation in the CBD.

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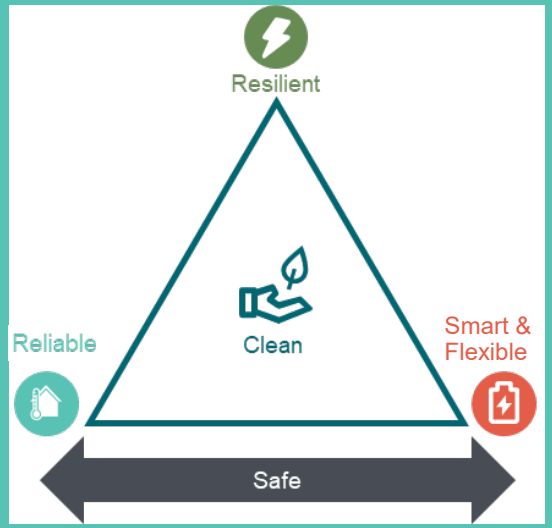
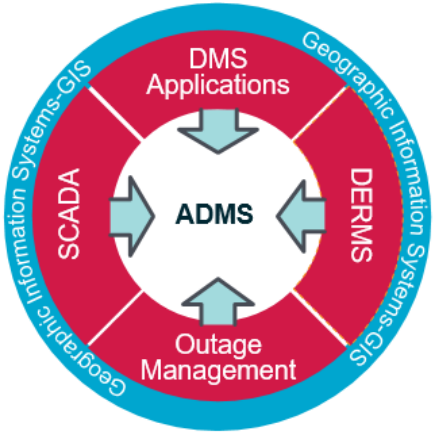
PSE System Smart & Flexible Enhancements



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 expect 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

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Wrapping Up

Thank You for attending

- Questions & Discussion

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