EXH. PKW-14C
DOCKET UE-20___
2020 PSE PCORC
WITNESS: PAUL K. WETHERBEE

BEFORE THE
WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION, **Complainant,** **v.** **PUGET SOUND ENERGY,** **Respondent.**	**Docket UE-20____**

THIRTEENTH EXHIBIT (CONFIDENTIAL) TO THE PREFILED DIRECT TESTIMONY OF

PAUL K. WETHERBEE

ON BEHALF OF PUGET SOUND ENERGY

REDACTED VERSION

DECEMBER 9, 2020

Puget Sound Energy

Rate Year Resources Inputs Summary

Thermal Resources

Shaded information is designated as confidential per WAC 480-07-160

2020 PCORC

Resource	Heat rate (Btu/kWh)	Capacity (MW)[1]	Duct fire capacity (% of total)	Duct fire heat rate (Btu/kWh)	Variable O&M nominal $/MWh[2]	Variable major maintenance nominal $/MWh[2 3]	Total variable O&M 2020 $/MWh[4]	Forced outage rate (%)	Min capacity (%)	Min up time (hrs)	Min down time (hrs)	Heat rate at min (Btu/kWh)	Start-up fuel (MMBtu /MW/start)	Start-up cost ($/MW/start) nominal $[2 3]	Start-up cost ($/MW/start) $2020[3 4]	Average fuel price nominal $/MMBtu[2]	Average variable transport nominal $/MMBtu[2]	Average total fuel cost 2020 $/MMBtu[4]	Colstrip line loss %
Ferndale		271	10.0																n/a
Goldendale		300	6.7																n/a
Mint Farm		314	10.8																n/a
Sumas		123	0																n/a
Freddy1		134	7.1																n/a
Encogen		166	0																n/a
Fredonia 1		104	0																n/a
Fredonia 2		104	0																n/a
Fredonia 3		55	0																n/a
Fredonia 4		55	0																n/a
Frederickson 1		74	0																n/a
Frederickson 2		74	0																n/a
Whitehorn 2		74	0																n/a
Whitehorn 3		74	0																n/a
Colstrip 3		185	n/a																
Colstrip 4		185	n/a																

Bold text in column headings indicates values are actual inputs in the AURORA model

1. Only PSE's portion of capacity shown for shared resources Colstrip and Freddy 1
2. Fuel prices and Costrip variable O&M nominal values are expressed in 2021/2022 dollars. All other nominal values are in 2020 dollars.
3. Major Maintenance inputs for Fredonia 3&4 were expressed on a $/start basis in 2019 GRC. Change o $/MWh more closely aligns with how costs are actually incurred for these units.
4. The AURORA economic base year is 2020. Values expressed in nominal dollars are de-escalated using the AURORA escalation rate of 2.5% prior to model input.

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Puget Sound Energy

Rate Year Resources Inputs Summary

Thermal Resources

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2019 GRC

Resource	Heat rate (Btu/kWh)	Capacity (MW)[1]	Duct fire capacity (% of total)	Duct fire heat rate (Btu/kWh)	Variable O&M nominal $/MWh[2]	Variable major maintenance nominal $/MWh[2]	Total variable O&M 2012 $/MWh[3]	Forced outage rate (%)	Min capacity (%)	Min up time (hrs)	Min down time (hrs)	Heat rate at min (Btu/kWh)	Start-up fuel (MMBtu/MW/start)	Start-up cost ($/MW/start) nominal $[2]	Start-up cost ($/MW/start) $2012[3]	Average fuel price nominal $/MMBtu[2]	Average variable transport nominal $/MMBtu[2]	Average total fuel cost 2012 $/MMBtu[3]	Colstrip line loss %
Ferndale		271	10.0																n/a
Goldendale		300	6.7																n/a
Mint Farm		314	10.8																n/a
Sumas		123	n/a																n/a
Freddy1		134	7.1																n/a
Encogen		166	n/a																n/a
Fredonia 1		104	n/a																n/a
Fredonia 2		104	n/a																n/a
Fredonia 3		55	n/a																n/a
Fredonia 4		55	n/a																n/a
Frederickson 1		74	n/a																n/a
Frederickson 2		74	n/a																n/a
Whitehorn 2		74	n/a																n/a
Whitehorn 3		74	n/a																n/a
Colstrip 3		185	n/a																
Colstrip 4		185	n/a																

Bold text in column headings indicates values are actual inputs in the AURORA model

1. Only PSE's portion of capacity shown for shared resources Colstrip and Freddy 1
2. Fuel prices and Costrip variable O&M nominal values are expressed in 2020/2021 dollars. All other nominal values are in 2018 dollars.
3. The AURORA economic base year is 2012. Values expressed in nominal dollars are de-escalated using the AURORA escalation rate of 2.5% prior to model input.

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Puget Sound Energy

Rate Year Resources Inputs Summary

Thermal Resources

Shaded information is designated as confidential per WAC 480-07-160

Changes (positive values indicate an increase relative to the 2019 GRC, negative values a decrease)

Resource	Heat rate (Btu/kWh)	Capacity (MW)	Duct fire capacity (% of total)	Duct fire heat rate (Btu/kWh)	Variable O&M nominal $/MWh	Variab e major maintenance nominal $/MWh	Total variable O&M 2020 $/MWh	Forced outage rate (%)	Min capacity (%)	Min up time (hrs)	Min down time (hrs)	Heat rate at min (Btu/kWh)	Start-up fuel (MMBtu /MW/st art)	Start-up cost ($/MW/start) nominal $	Start-up cost ($/MW/start) $2020	Average fuel price nominal $/MMBtu	Average variable transport nominal $/MMBtu	Average total fuel cost 2020 $/MMBtu	Colstrip line loss %
Ferndale		0	0 0																-
Goldendale		0	0 0																-
Mint Farm		0	0 0																-
Sumas		0	-																-
Freddy1		0	0 0																-
Encogen		0	-																-
Fredonia 1		0	-																-
Fredonia 2		0	-																-
Fredonia 3		0	-																-
Fredonia 4		0	-																-
Frederickson 1		0	-																-
Frederickson 2		0	-																-
Whitehorn 2		0	-																-
Whitehorn 3		0	-																-
Colstrip 3		0	-																
Colstrip 4		0	-																

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Puget Sound Energy

Rate Year Resource Inputs Summary

Hydro and Wind

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2020 PCORC

Resource	Capacity (MW)	Capacity factor (%)	Monthly energy volume source	Hourly shape assumption	Available capacity, average (MW)[1]
Upper Baker	105.0	[redacted]	80-yr inflows, PSE model[4]	Optimized per AURORA logic	75.9
Lower Baker	111.2		80-yr inflows, PSE model	Flat[3]	n/a
Snoqualmie Falls	46.9		80-yr inflows, PSE model	Flat[3]	n/a
Mid C Wells	199.5[2]	64.3%	80-yr inflows, regional study[4]	Optimized per AURORA logic	180.1
Mid C Rocky Reach	319.9	57.2%	80-yr inflows, regional study[4]	Optimized per AURORA logic	277.0
Mid C Rock Island	155.9	48.8%	80-yr inflows, regional study[4]	Optimized per AURORA logic	110.1
Mid C Priest Rapids Project	99.1	55.0%	80-yr inflows, regional study[4]	Optimized per AURORA logic	83.8
Lower Snake River	342.7	[redacted]	2016 Vaisala study	AURORA default hourly shape	n/a
Hopkins Ridge	156.6		2016 Vaisala study	AURORA default hourly shape	n/a
Wild Horse	228.6		2016 Vaisala study	AURORA default hourly shape	n/a
Wild Horse Expansion	44.0		2016 Vaisala study	AURORA default hourly shape	n/a

1. Applicable only to hydro resources used for operating reserves
2. Rate-year average. PSE's actual share and associated capacity varies seasonally.
3. Some daily/hourly shaping is still performed by AURORA in order to smooth transitions between months/days
4. AURORA output energy volume/capacity factor will generally be lower than input when a hydro resource provides operating reserves. The optimization logic will spill hydro energy if/when it is the lower cost solution compared to adjusting thermal resource output.

2019 GRC

Resource	Capacity (MW)	Capacity factor (%)	Monthly energy volume source	Hourly shape assumption	Available capacity, average (MW)[1]
Upper Baker	105.0	[redacted]	80-yr inflows, PSE model4	Optimized per AURORA logic	90.8
Lower Baker	111.2		80-yr inflows, PSE model	Flat3	n/a
Snoqualmie Falls	46.9		80-yr inflows, PSE model	Flat3	n/a
Mid C Wells	141.62	63.6%	80-yr inflows, regional study4	Optimized per AURORA logic	135.1
Mid C Rocky Reach	319.9	57.2%	80-yr inflows, regional study4	Optimized per AURORA logic	276.9
Mid C Rock Island	155.9	48.8%	80-yr inflows, regional study4	Optimized per AURORA logic	129.3
Mid C Priest Rapids Project	12.8	55.0%	80-yr inflows, regional study4	Optimized per AURORA logic	12.2
Lower Snake River	342.7	[redacted]	2016 Vaisala study	AURORA default hourly shape	n/a
Hopkins Ridge	156.6		2016 Vaisala study	AURORA default hourly shape	n/a
Wild Horse	228.6		2016 Vaisala study	AURORA default hourly shape	n/a
Wild Horse Expansion	44.0		2016 Vaisala study	AURORA default hourly shape	n/a

1. Applicable only to hydro resources used for operating reserves
2. Rate-year average. PSE's actual share and associated capacity varies seasonally.
3. Some daily/hourly shaping is still performed by AURORA in order to smooth transitions between months/days
4. AURORA output energy volume/capacity factor will generally be lower than input when a hydro resource provides operating reserves. The optimization logic will spill hydro energy if/when it is the lower cost solution compared to adjusting thermal resource output.

Changes (positive values indicate an increase relative to the 2019 GRC, negative values a decrease)

Resource	Capacity (MW)	Capacity factor (%)	Monthly energy volume source	Hourly shape assumption	Available capacity, average (MW)
Upper Baker	0.0	[redacted]	No change	No change	(14.9)
Lower Baker	0.0		No change	Updated to reflect operational constraints	n/a
Snoqualmie Falls	0.0		No change	No change	n/a
Mid C Wells	57.9	0.7%	No change	No change	45.0
Mid C Rocky Reach	0.0	0.0%	No change	No change	0.1
Mid C Rock Island	0.0	0.0%	No change	No change	(19.2)
Mid C Priest Rapids Project	86.3	0.0%	No change	No change	71.6
Lower Snake River	0.0	[redacted]	Updated to more recent estimates	Updated to include full range of output	n/a
Hopkins Ridge	0.0		Updated to more recent estimates	Updated to include full range of output	n/a
Wild Horse	0.0		Updated to more recent estimates	Updated to include full range of output	n/a
Wild Horse Expansion	0.0		Updated to more recent estimates	Updated to include full range of output	n/a

Puget Sound Energy

Rate Year Resource Inputs Summary

Power Purchase Agreements

Shaded information is designated as confidential per WAC 480-07-160

2020 PCORC

Contract name	Resource type	Contract price, average ($/MWh)	Contract capacity (MW)	Rate year energy (aMW)	Monthly shape/volume assumption	Hourly shape assumption
Centralia coal PPA	coal	[redacted]	380	[redacted]	[redacted]	[redacted]
Klondike III wind PPA	wind	[redacted]	50	[redacted]	Owner-provided forecast	12 month X 24 hour average
Electron Hydro PPA	hydro	[redacted]	24	[redacted]	Owner-provided forecast	Flat
Baker Replacement	system	$0.00	7	0.8	1,750 MWh/mo. Nov.-Feb. per contract	All on-peak
PG&E Exchange	system	$0.00	+/-300	0.0	Historical average	Historical average on-peak/off-peak allocation
Point Roberts (BC Hydro)	system	$53.40	3	2.4	Historical average	Flat
QF Koma Kulshan	hydro	$84.47	12	4.7	Historical average	Flat
QF Twin Falls	hydro	$75.00	20	8.2	Historical average	Flat
QF Weeks Falls	hydro	$75.00	5	1.5	Historical average	Flat
Canadian Entitlement	hydro/system	$0.00	-27	-22.4	Calculated estimate per agreement	All on-peak
Schedule 91 contracts	various	$77.88	41	17.6	Owner/developer-provided estimates	Flat
Golden Hills Bridge	wind	$42.70	150	13.7	150 MW Jan-Feb	All on-peak
Energy Keepers	hydro	$47.50	40	40.0	Flat	Flat
SPI Biomass[1]	biomass	$42.93	17	15.0	Flat @ 92.5% historical availability	Flat
Morgan Stanley PPA	system	$47.45	100	13.6	100 MW Jan-Mar	All on-peak
BPA Capacity Contract[2]	system	n/a	100	0.0	$7.75/kW-month charge Jan-May	No energy assumed, priced at market + premium

1. Capacity reduced to 12 MW in May and June for outages.

2. No energy assumed in model for BPA capacity contract - priced at market price + premium. Only monthly capacity charge included in costs.

2019 GRC

Contract name	Resource type	Contract price, average ($/MWh)	Contract capacity (MW)	Rate year energy (aMW)	Monthly shape/volume assumption	Hourly shape assumption
Centralia coal PPA	coal	[redacted]	380	[redacted]	[redacted]	[redacted]
Klondike III wind PPA	wind	[redacted]	50	[redacted]	Owner-provided forecast	12 month X 24 hour average
Electron Hydro PPA	hydro	[redacted]	21	[redacted]	Owner-provided forecast	Flat
Baker Replacement	system	$0.00	7	0.8	1,750 MWh/mo. Nov.-Feb. per contract	All on-peak
PG&E Exchange	system	$0.00	+/-300	0.0	Historical average	Historical average on-peak/off-peak allocation
Point Roberts (BC Hydro)	system	$80.00	3	2.4	Historical average	Flat
QF Koma Kulshan	hydro	$82.53	12	4.6	Historical average	Flat
QF Twin Falls	hydro	$75.00	20	8.2	Historical average	Flat
QF Weeks Falls	hydro	$75.00	5	1.5	Historical average	Flat
Canadian Entitlement	hydro/system	$0.00	-27	-15.6	Calculated estimate per agreement	All on-peak
Schedule 91 contracts	various	$78.20	53	24.1	Owner/developer-provided estimates	Flat

Changes (positive values indicate an increase relative to the 2019 GRC, negative values a decrease)

Contract name	Resource type	Contract price, average ($/MWh)	Contract capacity (MW)	Rate year energy (aMW)	Monthly shape/volume assumption	Hourly shape assumption
Centralia coal PPA	coal	[redacted]	0	[redacted]	[redacted]	[redacted]
Klondike III wind PPA	wind	[redacted]	0	[redacted]	Updated to more recent estimate	No change
Electron Hydro PPA	hydro	[redacted]	3	[redacted]	No change	No change
Baker Replacement	system	$0.00	0	0.00	No change	No change
PG&E Exchange	system	$0.00	0	0.00	No change	No change
Point Roberts (BC Hydro)	system	($26.60)	0	(0.01)	No change	No change
QF Koma Kulshan	hydro	$1.94	0	0.13	No change	No change
QF Twin Falls	hydro	$0.00	0	(0.00)	No change	No change
QF Weeks Falls	hydro	$0.00	0	(0.00)	No change	No change
Canadian Entitlement	hydro/system	$0.00	0	(6.85)	No change	No change
Schedule 91 contracts	various	($0.32)	(12)	(6.49)	No change	No change
Golden Hills Bridge	wind	$42.70	150	13.70	150 MW Jan-Feb	All on-peak
Energy Keepers	hydro	$47.50	40	40.00	Flat	Flat
SPI Biomass	biomass	$42.93	17	14.95	Flat @ 92.5% historical availability	Flat
Morgan Stanley PPA	system	$47.45	100	13.59	100 MW Jan-Mar	All on-peak
BPA Capacity Contract	system	n/a	100	0.00	$7.75/kW-month charge Jan-May	No energy assumed, priced at market + premium

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REDACTED VERSION