BP-22 Rate Proceeding

Final Proposal

Generation Inputs Study Documentation

BP-22-FS-BPA-06A

July 2021

GENERATION INPUTS STUDY DOCUMENTATION

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COMMONLY USED ACRONYMS AND SHORT FORMS

AAC	Anticipated Accumulation of Cash
ACNR	Accumulated Calibrated Net Revenue
ACS	Ancillary and Control Area Services
AF	Advance Funding
AFUDC	Allowance for Funds Used During Construction
AGC	automatic generation control
aMW	average megawatt(s)
ANR	Accumulated Net Revenues
ASC	Average System Cost
BAA	Balancing Authority Area
BiOp	Biological Opinion
BPA	Bonneville Power Administration
BPAP	Bonneville Power Administration Power
BPAT	Bonneville Power Administration Transmission
Bps	basis points
Btu	British thermal unit
CAISO	California Independent System Operator
CIP	Capital Improvement Plan
CIR	Capital Investment Review
CDQ	Contract Demand Quantity
CGS	Columbia Generating Station
CHWM	Contract High Water Mark
CNR	Calibrated Net Revenue
COB	California-Oregon border
COE	U.S. Army Corps of Engineers
COI	California-Oregon Intertie
Commission	Federal Energy Regulatory Commission
Corps	U.S. Army Corps of Engineers
COSA	Cost of Service Analysis
COU	consumer-owned utility
Council	Northwest Power and Conservation Council (see also “Council”)
COVID-19	coronavirus disease 2019
CP	Coincidental Peak
CRAC	Cost Recovery Adjustment Clause
CRFM	Columbia River Fish Mitigation
CSP	Customer System Peak
CT	combustion turbine
CWIP	Construction Work in Progress
CY	calendar year (January through December)
DD	Dividend Distribution
DDC	Dividend Distribution Clause
dec	decrease, decrement, or decremental
DERBS	Dispatchable Energy Resource Balancing Service

DFS	Diurnal Flattening Service
DNR	Designated Network Resource
DOE	Department of Energy
DOI	Department of Interior
DSI	direct-service industrial customer or direct-service industry
DSO	Dispatcher Standing Order
EE	Energy Efficiency
EESC	EIM Entity Scheduling Coordinator
EIM	Energy imbalance market
EIS	Environmental Impact Statement
ELMP	Extended Locational Marginal Pricing
EN	Energy Northwest, Inc.
ESA	Endangered Species Act
ESS	Energy Shaping Service
e-Tag	electronic interchange transaction information
FBS	Federal base system
FCRPS	Federal Columbia River Power System
FCRTS	Federal Columbia River Transmission System
FELCC	firm energy load carrying capability
FERC	Federal Energy Regulatory Commission
FMM-IIE	Fifteen Minute Market – Instructed Imbalance Energy
FOIA	Freedom of Information Act
FORS	Forced Outage Reserve Service
FPS	Firm Power and Surplus Products and Services
FPT	Formula Power Transmission
FRP	Financial Reserves Policy
F&W	Fish & Wildlife
FY	fiscal year (October through September)
G&A	general and administrative (costs)
GARD	Generation and Reserves Dispatch (computer model)
GDP	Gross Domestic Product
GI	generation imbalance or generator interconnection
GMS	Grandfathered Generation Management Service
GSP	Generation System Peak
GSR	Generation Supplied Reactive
GRSPs	General Rate Schedule Provisions
GTA	General Transfer Agreement
GWh	gigawatthour
HLH	Heavy Load Hour(s)
HOSS	Hourly Operating and Scheduling Simulator (computer model)
HYDSIM	Hydrosystem Simulator (computer model)
IE	Eastern Intertie
IIE	Instructed Imbalance Energy
IM	Montana Intertie
inc	increase, increment, or incremental

IOU	investor-owned utility
IP	Industrial Firm Power
IPR	Integrated Program Review
IR	Integration of Resources
IRD	Irrigation Rate Discount
IRM	Irrigation Rate Mitigation
IRPL	Incremental Rate Pressure Limiter
IS	Southern Intertie
kcfs	thousand cubic feet per second
KSI	key strategic initiative
kW	kilowatt
kWh	kilowatthour
LAP	Load Aggregation Point
LDD	Low Density Discount
LGIA	Large Generator Interconnection Agreement
LLH	Light Load Hour(s)
LMP	Locational Marginal Price
LPP	Large Project Program
LT	long term
LTF	Long-term Firm
Maf	million acre-feet
Mid-C	Mid-Columbia
MMBtu	million British thermal units
MNR	Modified Net Revenue
MRNR	Minimum Required Net Revenue
MW	megawatt
MWh	megawatthour
NCP	Non-Coincidental Peak
NEPA	National Environmental Policy Act
NERC	North American Electric Reliability Corporation
NFB	**N**ational Marine Fisheries Service (NMFS) **F**ederal Columbia River Power System (FCRPS) **B**iological Opinion (BiOp)
NLSL	New Large Single Load
NMFS	National Marine Fisheries Service
NOAA Fisheries	National Oceanographic and Atmospheric Administration Fisheries
NOB	Nevada-Oregon border
NORM	Non-Operating Risk Model (computer model)
NWPA	Northwest Power Act/Pacific Northwest Electric Power Planning and Conservation Act
NP-15	North of Path 15
NPCC	Northwest Power and Conservation Council
NPV	net present value
NR	New Resource Firm Power
NRFS	NR Resource Flattening Service

NRU	Northwest Requirements Utilities
NT	Network Integration
NTSA	Non-Treaty Storage Agreement
NUG	non-utility generation
NWPP	Northwest Power Pool
OATT	Open Access Transmission Tariff
O&M	operations and maintenance
OATI	Open Access Technology International, Inc.
ODE	Over Delivery Event
OS	Oversupply
OY	operating year (August through July)
PDCI	Pacific DC Intertie
PF	Priority Firm Power
PFp	Priority Firm Public
PFx	Priority Firm Exchange
PNCA	Pacific Northwest Coordination Agreement
PNRR	Planned Net Revenues for Risk
PNW	Pacific Northwest
POD	Point of Delivery
POI	Point of Integration or Point of Interconnection
POR	Point of Receipt
PPC	Public Power Council
PRSC	Participating Resource Scheduling Coordinator
PS	Power Services
PSC	power sales contract
PSW	Pacific Southwest
PTP	Point-to-Point
PUD	public or people's utility district
RAM	Rate Analysis Model (computer model)
RAS	Remedial Action Scheme
RCD	Regional Cooperation Debt
RD	Regional Dialogue
RDC	Reserves Distribution Clause
REC	Renewable Energy Certificate
Reclamation	U.S. Bureau of Reclamation
REP	Residential Exchange Program
REPSIA	REP Settlement Implementation Agreement
RevSim	Revenue Simulation Model
RFA	Revenue Forecast Application (database)
RHWM	Rate Period High Water Mark
ROD	Record of Decision
RPSA	Residential Purchase and Sale Agreement
RR	Resource Replacement
RRS	Resource Remarketing Service
RSC	Resource Shaping Charge

RSS	Resource Support Services
RT1SC	RHWM Tier 1 System Capability
RTD-IIE	Real-Time Dispatch – Instructed Imbalance Energy
RTIEO	Real-Time Imbalance Energy Offset
SCD	Scheduling, System Control, and Dispatch Service
SCADA	Supervisory Control and Data Acquisition
SCS	Secondary Crediting Service
SDD	Short Distance Discount
SILS	Southeast Idaho Load Service
Slice	Slice of the System (product)
SMCR	Settlements, Metering, and Client Relations
SP-15	South of Path 15
T1SFCO	Tier 1 System Firm Critical Output
TC	Tariff Terms and Conditions
TCMS	Transmission Curtailment Management Service
TDG	Total Dissolved Gas
TGT	Townsend-Garrison Transmission
TOCA	Tier 1 Cost Allocator
TPP	Treasury Payment Probability
TRAM	Transmission Risk Analysis Model
Transmission System Act	Federal Columbia River Transmission System Act
Treaty	Columbia River Treaty
TRL	Total Retail Load
TRM	Tiered Rate Methodology
TS	Transmission Services
TSS	Transmission Scheduling Service
UAI	Unauthorized Increase
UDE	Under Delivery Event
UFE	unaccounted for energy
UFT	Use of Facilities Transmission
UIC	Unauthorized Increase Charge
UIE	Uninstructed Imbalance Energy
ULS	Unanticipated Load Service
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish & Wildlife Service
VER	Variable Energy Resource
VERBS	Variable Energy Resource Balancing Service
VOR	Value of Reserves
VR1-2014	First Vintage Rate of the BP-14 rate period (PF Tier 2 rate)
VR1-2016	First Vintage Rate of the BP-16 rate period (PF Tier 2 rate)
WECC	Western Electricity Coordinating Council
WSPP	Western Systems Power Pool

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TABLES

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Table 1
Inter-Business Line Allocations

	A	B	C
	Generation Inputs	Annual Average FY 2022-2023 Reserve Quantity Forecast (MW)	Annual Average FY 2022-2023 Revenue Forecast ($)
1	**Reserve Forecast**		
2	Balancing for Load	291	$ 24,081,677
3	Balancing for Non-Fed Generation		$ 28,814,146
4	Balancing for Federal Generation	23	$ (2,268,039)
5	Balancing for All Generation	389	$ 31,082,185
6	Operating Reserves		$ 37,894,455
7	Operating Reserves - Spinning	237	$ 22,924,157
8	Operating Reserves - Supplemental	237	$ 14,970,298
9	Reserves Total (lines 2+3+6)		$ 90,790,277
10			
11	**Other Forecasts**		
12	Synchronous Condensing		$ 922,844
13	Generation Dropping		$ 364,955
14	Redispatch		$ 370,000
15	Segmentation of COE/BOR		$ 9,502,000
16	Station Service		$ 2,295,181
17	Other Total (lines 12-17)		$ 13,454,980
18			
19	Generation Inputs Composite (lines 9+18-17)		$ 116,104,375
20	Generation Inputs Non-Slice (line 17)		$ 8,186,897
21			
22	Total Generation Inputs Credit Forecast (lines 20+21)		$ 104,245,257

Table 2.1

Forecast of Installed Generation Capacity for the FY 2022-2023 Balancing Reserve Capacity Quantity Forecast (Values in MW)

	A	B	C	D	E
		WIND	SOLAR	NON-FEDERAL THERMAL	FCRPS
1	**Oct-21**	2,930	89	1,548	3,384
2	**Nov-21**	2,830	89	1,548	3,384
3	**Dec-21**	2,830	89	1,548	3,384
4	**Jan-22**	2,830	89	1,548	3,384
5	**Feb-22**	2,830	89	1,548	3,384
6	**Mar-22**	2,830	89	1,548	3,384
7	**Apr-22**	2,830	89	1,548	3,384
8	**May-22**	2,830	89	1,548	3,384
9	**Jun-22**	2,830	89	1,548	3,384
10	**Jul-22**	2,830	89	1,548	3,384
11	**Aug-22**	2,830	89	1,548	3,384
12	**Sep-22**	2,830	89	1,548	3,384
13	**Oct-22**	2,830	109	1,548	3,384
14	**Nov-22**	2,830	109	1,548	3,384
15	**Dec-22**	2,830	109	1,548	3,384
16	**Jan-23**	2,830	109	1,548	3,384
17	**Feb-23**	2,830	109	1,548	3,384
18	**Mar-23**	2,830	109	1,548	3,384
19	**Apr-23**	2,830	109	1,548	3,384
20	**May-23**	2,830	109	1,548	3,384
21	**Jun-23**	2,830	109	1,548	3,384
22	**Jul-23**	2,830	109	1,548	3,384
23	**Aug-23**	2,830	109	1,548	3,384
24	**Sep-23**	2,830	109	1,548	3,384
25	**BP-22 AVG**	**2,834**	**99**	**1,548**	**3,384**

Table 2.2

VER Facilities in FY 2022-2023
Balancing Reserve Capacity Quantity Forecast

	A	B	C	D	E
	Project Name	**Nameplate Capacity (MW)**	**VER Type**	**County, State**	**Start Month and Year**
1	Vansycle	25	WIND	Umatilla, OR	Oct-98
2	Stateline	90	WIND	Walla Walla, WA	Dec-01
3	Condon	50	WIND	Gilliam, OR	Jun-02
4	Blue Sky/Hopkins Ridge	157	WIND	Columbia, WA	Nov-05
5	White Creek	204	WIND	Klickitat, WA	Oct-07
6	Nine Canyon I-II	50	WIND	Benton, WA	May-08
7	Arlington Wind	103	WIND	Gilliam, OR	Dec-08
8	Willow Creek	72	WIND	Morrow, OR	Jan-09
9	Wheatfield Wind	97	WIND	Gilliam, OR	Mar-09
10	Windy Flats Dooley	262	WIND	Klickitat, WA	Nov-09
11	Harvest-White Creek III	100	WIND	Klickitat, WA	Dec-09
12	Combine Hills	63	WIND	Umatilla, OR	Jan-10
13	Linden Ranch	50	WIND	Klickitat, WA	Jun-10
14	Coastal Energy Wind	6	WIND	Grays Harbor, WA	Jun-10
15	Kittitas Valley	101	WIND	Kittitas, WA	Nov-10
16	Patu (Oregon Trail Wind)	10	WIND	Sherman, OR	Nov-10
17	North Hurlburt	266	WIND	Gilliam, OR	Aug-11
18	Lower Snake Wind	343	WIND	Garfield, WA	Jan-12
19	South Hurlburt	290	WIND	Gilliam, OR	Jun-12
20	HorseShoe Bend	291	WIND	Morrow, OR	Aug-12
21	Outback Solar	5	SOLAR	Lake, OR	Sep-12
22	Starvation Solar	10	SOLAR	Harney, OR	Dec-19
23	Fort Rock Solar	10	SOLAR	Lake, OR	Mar-20
24	West Hines Solar	10	SOLAR	Harney, OR	Jun-20
25	Alkali Solar	10	SOLAR	Lake, OR	Jun-20
26	Fort Rock IV Solar	10	SOLAR	Lake, OR	Jun-20
27	Rock Garden Solar	10	SOLAR	Lake, OR	Jun-20
28	Riley Solar	10	SOLAR	Harney, OR	Jul-20
29	Suntex Solar	10	SOLAR	Harney, OR	Jul-20
30	Wheatridge Wind 1	100	WIND	Morrow, OR	Nov-20
31	Wheatridge Wind 2	200	WIND	Morrow, OR	Nov-20
32	Horn Rapids Solar	3.2	SOLAR	Benton, WA	Nov-20
33	Tygh Valley Solar	20	SOLAR	Wasco, OR	Oct-22

Table 2.3
Solar Day-of-Year and Time-of-Day Data Calculations

1	Equation of Time	[Equation 2.27 in Reference 1]
2	$ET = 9.87\sin(2B) - 7.53\cos(B) - 1.5\sin(B)$ where $B = \frac{360(n-81)}{364^o}$ n = nth day of year	
3	Local Solar Time	[Equation 2.26 in Reference 1]
4	$ST = lst + ET + 4(lon_{std} - lon_{local})$ where lon_{std} is the standard time meridian (120°) lon_{local} is the longitude of the plant 4 is in units of minutes/degree	
5	Degree from Solar Noon	[Equation 2.25 in Reference 1]
6	$h_s = \frac{ST - 12 * 60}{4}$	
7	Declination Angle	[Equation 2.23 in Reference 1]
8	$\delta_s = \sin^{-1}\left(23.45^o \cdot \sin\left(\frac{360 \cdot (284+n)}{365^o}\right)\right)$ where n=nth day of year	
9	Solar Altitude Angle	[Equation 2.28 in Reference 1]
10	$\alpha = \sin^{-1}(\sin(lat_{local})\sin(\delta_s) + \cos(lat_{local})\cos(\delta_s)\cos(h_s))$ where lat_{local} is the latitude of the plant	
11	Solar Azimuth Angle	[Equation 2.29 in Reference 1]
12	$a_s = \sin^{-1}\left(\frac{\cos(\delta_s)\sin(h_s)}{\cos(\alpha)}\right)$	
13	Tracking Angle	[Equation 4.13 in Reference 2]
14	$\beta = \rho = \tan^{-1}\left(\frac{\sin(a_s)}{\tan(\alpha)}\right)$	
15	Angle of Incidence	[Equation 4.14 in Reference 2]
16	$\theta_i = \cos^{-1}\left(\sqrt{1 - \left((\cos(\alpha))^2 \cdot (\cos(a_s))^2\right)}\right)$	
17	*References:*	
18	1) Goswami, Dr. Y et al. (2000). Principles of Solar Engineering. New York: Taylor and Francis Group	
19	2) Stine, W and Geyer, M (2001). Power From the Sun. Retrieved from http://www.powerfromthesun.net	

Table 2.4
Total Irradiance Calculations

1	Direct Normal component of Irradiance	[Equation 2.47 in Reference 1]
2	$I_{dn} = \cos(\theta_i) \cdot (Direct\ Normal\ Sensor\ Data)$	
3	Diffuse component of Irradiance	[Equation 2.49 in Reference 1]
4	$I_{df} = \left(\cos\left(\frac{\beta}{2}\right)\right)^2 \cdot (Diffuse\ Sensor\ Data)$	
5	Total Irradiance	
6	$I_t = I_{dn} + I_{df}$	
7		
8	*Reference:*	
9	1) Goswami, Dr. Y et al. (2000). Principles of Solar Engineering. New York: Taylor and Francis Group	

Table 2.5
Irradiance to Power Conversion Calculations

1	Cell Temperature	[Equation 1 in Reference 4]
2	$cell\ temp = temp + I_t \cdot cell\ temp\ coef$	
3	Temperature Coefficient	[Equation 8 in Reference 3]
4	$temp\ coef = 1 - temp\ coef_{static}(cell\ temp - 28)$	
5	Predicted Power (DC)	[Equation 8 in Reference 3]
6	$PP = NP_{DC} \cdot Efficiency \cdot \frac{I_t}{1000} \cdot temp\ coef$	
7		
8	References:	
9	3) Dobos, A (2013). PVWatts Technical Manual. NREL: https://www.nrel.gov/docs/fy14osti/60272.pdf	
10	4) Alonso Garcia, M.C. and Balenzategui, J.L. (2004). Estimation of photovoltaic module yearly temperature and performance based on Nominal Operation Cell Temperature Calculations.	

Table 2.6
Point-Source Scaling PV Calculations

1	Rolling Average Calculation	[Reference 5]
2	$RollingAvg(t) = average\left(data\left[t - \left(\frac{T}{2} - 1\right) : t + \frac{T}{2}\right]\right)$	
3	$T = 2 * round\left(\sqrt{400 \cdot NP_{DC}}\right)$	
4		
5	Inverter Loading Ratio Adjustment	
6	$PP(PP > NP_{AC}) = NP_{AC}$	
7		
8	References:	
9	5) Adapted from "A Wavelet-Based Variability Model (WVM for Solar PV Power Plants" by Matthew Lave, Jan Kleissl, and Joshua Stein, 2013, IEEE Transactions on Sustainable Energy, Volume 4, No. 2	

Table 2.7
Incremental Standard Deviation Calculation Example

$$\text{Reg } inc_{\text{Load HE1}} = \text{Total Reg } inc * R_{\text{Load Reg HE1, Total Reg HE1}} * S_{\text{Load Reg HE1}} / S_{\text{TotalReg HE1}}$$

$$\text{Reg } inc_{\text{Wind HE1}} = \text{Total Reg } inc * R_{\text{Wind Reg HE1, Total Reg HE1}} * S_{\text{Wind Reg HE1}} / S_{\text{TotalReg HE1}}$$

$$\text{Reg } inc_{\text{Solar HE1}} = \text{Total Reg } inc * R_{\text{Solar Reg HE1, Total Reg HE1}} * S_{\text{Solar Reg HE1}} / S_{\text{TotalReg HE1}}$$

$$\text{Reg } inc_{\text{FCRPS HE1}} = \text{Total Reg } inc * R_{\text{FCRPS Reg HE1, Total Reg HE1}} * S_{\text{FCRPS Reg HE1}} / S_{\text{TotalReg HE1}}$$

$$\text{Reg } inc_{\text{Non-Fed Thermal HE1}} = \text{Total Reg } inc * R_{\text{Non-Fed Thermal Reg HE1, Total Reg HE1}} * S_{\text{Non-Fed Thermal Reg HE1}} / S_{\text{TotalReg HE1}}$$

Where: Reg is Regulating Reserves

HE1 is Hour Ending 1

$R_{\text{Load Reg HE1, Total Reg HE1}}$ = correlation between Load Reg HE1 and Total Reg HE1

$S_{\text{Load Reg HE1}}$ = standard deviation of Load Reg HE1

$S_{\text{Total Reg HE1}}$ = Standard deviation of Total Reg HE1

Table 2.8
Load Regulation Incremental Reserves Example

$$\text{Reg } inc_{\text{Load}} = \text{Total Reg } inc * \text{Reg } inc_{\text{Load Max24}} / \text{Reg } inc_{\text{Total Max24}}$$

Where Reg is Regulating Reserves

$$\text{Reg } inc_{\text{Load Max24}} = \text{MAX}(\text{Reg } inc_{\text{Load HE1}}, \text{Reg } inc_{\text{Load HE2}}, \ldots, \text{Reg } inc_{\text{Load HE24}})$$

$$\text{Reg } inc_{\text{Total Max24}} = \text{Reg } inc_{\text{Load Max24}} + \text{Reg } inc_{\text{Wind Max24}} + \text{Reg } inc_{\text{Solar Max24}} + \text{Reg } inc_{\text{FCRPS Max24}} + \text{Reg } inc_{\text{Non-Fed Thermal Max24}}$$

Table 2.9

Total Balancing Reserve Capacity Requirement (Values in MW) for FY2022-2023 Balancing Reserve Capacity Quantity Forecast

		INSTALLED CAPACITY				TOTAL					
						REG		NON-REG		TOTAL	
		WIND	SOLAR	NON-FEDERAL THERMAL	FCRPS	INC	DEC	INC	DEC	INC	DEC
	A	B	C	D	E	F	G	J	K	L	M
1	**Oct-21**	2,930	89	1,548	3,384	310	-332	397	-529	707	-861
2	**Nov-21**	2,830	89	1,548	3,384	308	-327	370	-498	678	-825
3	**Dec-21**	2,830	89	1,548	3,384	308	-327	370	-498	678	-825
4	**Jan-22**	2,830	89	1,548	3,384	308	-327	370	-498	678	-825
5	**Feb-22**	2,830	89	1,548	3,384	308	-327	370	-498	678	-825
6	**Mar-22**	2,830	89	1,548	3,384	308	-327	370	-498	678	-825
7	**Apr-22**	2,830	89	1,548	3,384	308	-327	370	-498	678	-825
8	**May-22**	2,830	89	1,548	3,384	308	-327	370	-498	678	-825
9	**Jun-22**	2,830	89	1,548	3,384	308	-327	370	-498	678	-825
10	**Jul-22**	2,830	89	1,548	3,384	308	-327	370	-498	678	-825
11	**Aug-22**	2,830	89	1,548	3,384	308	-327	370	-498	678	-825
12	**Sep-22**	2,830	89	1,548	3,384	308	-327	370	-498	678	-825
13	**Oct-22**	2,830	109	1,548	3,384	309	-327	370	-498	680	-825
14	**Nov-22**	2,830	109	1,548	3,384	309	-327	370	-498	680	-825
15	**Dec-22**	2,830	109	1,548	3,384	309	-327	370	-498	680	-825
16	**Jan-23**	2,830	109	1,548	3,384	309	-327	370	-498	680	-825
17	**Feb-23**	2,830	109	1,548	3,384	309	-327	370	-498	680	-825
18	**Mar-23**	2,830	109	1,548	3,384	309	-327	370	-498	680	-825
19	**Apr-23**	2,830	109	1,548	3,384	309	-327	370	-498	680	-825
20	**May-23**	2,830	109	1,548	3,384	309	-327	370	-498	680	-825
21	**Jun-23**	2,830	109	1,548	3,384	309	-327	370	-498	680	-825
22	**Jul-23**	2,830	109	1,548	3,384	309	-327	370	-498	680	-825
23	**Aug-23**	2,830	109	1,548	3,384	309	-327	370	-498	680	-825
24	**Sep-23**	2,830	109	1,548	3,384	309	-327	370	-498	680	-825
25	**BP-22 AVG**	**2,834**	**99**	**1,548**	**3,384**	**309**	**-327**	**371**	**-499**	**680**	**-827**

NOTES:

*** Load includes all Non-Federal Hydro**

**** Thermal includes new Thermal and Biomass as an allocated amount by nameplate capacity**

Table 2.10
Load Balancing Reserve Capacity Requirement (Values in MW)
for FY2022-2023 Balancing Reserve Capacity Quantity Forecast

		INSTALLED CAPACITY				LOAD*					
						REG		NON-REG		TOTAL	
		WIND	SOLAR	NON-FEDERAL THERMAL	FCRPS	INC	DEC	INC	DEC	INC	DEC
	A	B	C	D	E	F	G	J	K	L	M
1	Oct-21	2,930	89	1,548	3,384	144	-154	153	-203	296	-357
2	Nov-21	2,830	89	1,548	3,384	145	-154	145	-195	290	-350
3	Dec-21	2,830	89	1,548	3,384	145	-154	145	-195	290	-350
4	Jan-22	2,830	89	1,548	3,384	145	-154	145	-195	290	-350
5	Feb-22	2,830	89	1,548	3,384	145	-154	145	-195	290	-350
6	Mar-22	2,830	89	1,548	3,384	145	-154	145	-195	290	-350
7	Apr-22	2,830	89	1,548	3,384	145	-154	145	-195	290	-350
8	May-22	2,830	89	1,548	3,384	145	-154	145	-195	290	-350
9	Jun-22	2,830	89	1,548	3,384	145	-154	145	-195	290	-350
10	Jul-22	2,830	89	1,548	3,384	145	-154	145	-195	290	-350
11	Aug-22	2,830	89	1,548	3,384	145	-154	145	-195	290	-350
12	Sep-22	2,830	89	1,548	3,384	145	-154	145	-195	290	-350
13	Oct-22	2,830	109	1,548	3,384	146	-155	146	-196	292	-351
14	Nov-22	2,830	109	1,548	3,384	146	-155	146	-196	292	-351
15	Dec-22	2,830	109	1,548	3,384	146	-155	146	-196	292	-351
16	Jan-23	2,830	109	1,548	3,384	146	-155	146	-196	292	-351
17	Feb-23	2,830	109	1,548	3,384	146	-155	146	-196	292	-351
18	Mar-23	2,830	109	1,548	3,384	146	-155	146	-196	292	-351
19	Apr-23	2,830	109	1,548	3,384	146	-155	146	-196	292	-351
20	May-23	2,830	109	1,548	3,384	146	-155	146	-196	292	-351
21	Jun-23	2,830	109	1,548	3,384	146	-155	146	-196	292	-351
22	Jul-23	2,830	109	1,548	3,384	146	-155	146	-196	292	-351
23	Aug-23	2,830	109	1,548	3,384	146	-155	146	-196	292	-351
24	Sep-23	2,830	109	1,548	3,384	146	-155	146	-196	292	-351
25	BP-22 AVG	**2,834**	**99**	**1,548**	**3,384**	**146**	**-155**	**146**	**-196**	**291**	**-351**

NOTES:

*** Load includes all Non-Federal Hydro**

**** Thermal includes new Thermal and Biomass as an allocated amount by nameplate capacity**

Table 2.11
Wind Balancing Reserve Capacity Requirement (Values in MW)
for FY2022-2023 Balancing Reserve Capacity Quantity Forecast

		INSTALLED CAPACITY				WIND					
						REG		NON-REG		TOTAL	
		WIND	SOLAR	NON-FEDERAL THERMAL	FCRPS	INC	DEC	INC	DEC	INC	DEC
	A	B	C	D	E	F	G	J	K	L	M
1	Oct-21	2,930	89	1,548	3,384	129	-139	242	-323	371	-461
2	Nov-21	2,830	89	1,548	3,384	125	-133	223	-300	348	-433
3	Dec-21	2,830	89	1,548	3,384	125	-133	223	-300	348	-433
4	Jan-22	2,830	89	1,548	3,384	125	-133	223	-300	348	-433
5	Feb-22	2,830	89	1,548	3,384	125	-133	223	-300	348	-433
6	Mar-22	2,830	89	1,548	3,384	125	-133	223	-300	348	-433
7	Apr-22	2,830	89	1,548	3,384	125	-133	223	-300	348	-433
8	May-22	2,830	89	1,548	3,384	125	-133	223	-300	348	-433
9	Jun-22	2,830	89	1,548	3,384	125	-133	223	-300	348	-433
10	Jul-22	2,830	89	1,548	3,384	125	-133	223	-300	348	-433
11	Aug-22	2,830	89	1,548	3,384	125	-133	223	-300	348	-433
12	Sep-22	2,830	89	1,548	3,384	125	-133	223	-300	348	-433
13	Oct-22	2,830	109	1,548	3,384	125	-133	222	-298	347	-431
14	Nov-22	2,830	109	1,548	3,384	125	-133	222	-298	347	-431
15	Dec-22	2,830	109	1,548	3,384	125	-133	222	-298	347	-431
16	Jan-23	2,830	109	1,548	3,384	125	-133	222	-298	347	-431
17	Feb-23	2,830	109	1,548	3,384	125	-133	222	-298	347	-431
18	Mar-23	2,830	109	1,548	3,384	125	-133	222	-298	347	-431
19	Apr-23	2,830	109	1,548	3,384	125	-133	222	-298	347	-431
20	May-23	2,830	109	1,548	3,384	125	-133	222	-298	347	-431
21	Jun-23	2,830	109	1,548	3,384	125	-133	222	-298	347	-431
22	Jul-23	2,830	109	1,548	3,384	125	-133	222	-298	347	-431
23	Aug-23	2,830	109	1,548	3,384	125	-133	222	-298	347	-431
24	Sep-23	2,830	109	1,548	3,384	125	-133	222	-298	347	-431
25	BP-22 AVG	**2,834**	**99**	**1,548**	**3,384**	**125**	**-133**	**223**	**-300**	**349**	**-433**

NOTES:

*** Load includes all Non-Federal Hydro**

**** Thermal includes new Thermal and Biomass as an allocated amount by nameplate capacity**

Table 2.12
Non-Federal Thermal Balancing Reserve Capacity Requirement (Values in MW)
for FY2022-2023 Balancing Reserve Capacity Quantity Forecast

		INSTALLED CAPACITY				NON-FEDERAL THERMAL*					
						REG		NON-REG		TOTAL	
		WIND	SOLAR	NON-FEDERAL THERMAL	FCRPS	INC	DEC	INC	DEC	INC	DEC
	A	B	C	D	E	F	G	J	K	L	M
1	Oct-21	2,930	89	1,548	3,384	11	-12	0	0	11	-12
2	Nov-21	2,830	89	1,548	3,384	11	-12	0	0	11	-12
3	Dec-21	2,830	89	1,548	3,384	11	-12	0	0	11	-12
4	Jan-22	2,830	89	1,548	3,384	11	-12	0	0	11	-12
5	Feb-22	2,830	89	1,548	3,384	11	-12	0	0	11	-12
6	Mar-22	2,830	89	1,548	3,384	11	-12	0	0	11	-12
7	Apr-22	2,830	89	1,548	3,384	11	-12	0	0	11	-12
8	May-22	2,830	89	1,548	3,384	11	-12	0	0	11	-12
9	Jun-22	2,830	89	1,548	3,384	11	-12	0	0	11	-12
10	Jul-22	2,830	89	1,548	3,384	11	-12	0	0	11	-12
11	Aug-22	2,830	89	1,548	3,384	11	-12	0	0	11	-12
12	Sep-22	2,830	89	1,548	3,384	11	-12	0	0	11	-12
13	Oct-22	2,830	109	1,548	3,384	11	-11	0	0	11	-12
14	Nov-22	2,830	109	1,548	3,384	11	-11	0	0	11	-12
15	Dec-22	2,830	109	1,548	3,384	11	-11	0	0	11	-12
16	Jan-23	2,830	109	1,548	3,384	11	-11	0	0	11	-12
17	Feb-23	2,830	109	1,548	3,384	11	-11	0	0	11	-12
18	Mar-23	2,830	109	1,548	3,384	11	-11	0	0	11	-12
19	Apr-23	2,830	109	1,548	3,384	11	-11	0	0	11	-12
20	May-23	2,830	109	1,548	3,384	11	-11	0	0	11	-12
21	Jun-23	2,830	109	1,548	3,384	11	-11	0	0	11	-12
22	Jul-23	2,830	109	1,548	3,384	11	-11	0	0	11	-12
23	Aug-23	2,830	109	1,548	3,384	11	-11	0	0	11	-12
24	Sep-23	2,830	109	1,548	3,384	11	-11	0	0	11	-12
25	BP-22 AVG	**2,834**	**99**	**1,548**	**3,384**	**11**	**-12**	**0**	**0**	**11**	**-12**

NOTES:

*** Load includes all Non-Federal Hydro**

**** Thermal includes new Thermal and Biomass as an allocated amount by nameplate capacity**

Table 2.13
Solar Balancing Reserve Capacity Requirement (Values in MW)
for FY2022-2023 Balancing Reserve Capacity Quantity Forecast

		INSTALLED CAPACITY				SOLAR					
						REG		NON-REG		TOTAL	
		WIND	SOLAR	NON-FEDERAL THERMAL	FCRPS	INC	DEC	INC	DEC	INC	DEC
	A	B	C	D	E	F	G	J	K	L	M
1	Oct-21	2,930	89	1,548	3,384	3	-4	2	-3	6	-7
2	Nov-21	2,830	89	1,548	3,384	3	-4	2	-3	6	-7
3	Dec-21	2,830	89	1,548	3,384	3	-4	2	-3	6	-7
4	Jan-22	2,830	89	1,548	3,384	3	-4	2	-3	6	-7
5	Feb-22	2,830	89	1,548	3,384	3	-4	2	-3	6	-7
6	Mar-22	2,830	89	1,548	3,384	3	-4	2	-3	6	-7
7	Apr-22	2,830	89	1,548	3,384	3	-4	2	-3	6	-7
8	May-22	2,830	89	1,548	3,384	3	-4	2	-3	6	-7
9	Jun-22	2,830	89	1,548	3,384	3	-4	2	-3	6	-7
10	Jul-22	2,830	89	1,548	3,384	3	-4	2	-3	6	-7
11	Aug-22	2,830	89	1,548	3,384	3	-4	2	-3	6	-7
12	Sep-22	2,830	89	1,548	3,384	3	-4	2	-3	6	-7
13	Oct-22	2,830	109	1,548	3,384	4	-4	3	-4	6	-8
14	Nov-22	2,830	109	1,548	3,384	4	-4	3	-4	6	-8
15	Dec-22	2,830	109	1,548	3,384	4	-4	3	-4	6	-8
16	Jan-23	2,830	109	1,548	3,384	4	-4	3	-4	6	-8
17	Feb-23	2,830	109	1,548	3,384	4	-4	3	-4	6	-8
18	Mar-23	2,830	109	1,548	3,384	4	-4	3	-4	6	-8
19	Apr-23	2,830	109	1,548	3,384	4	-4	3	-4	6	-8
20	May-23	2,830	109	1,548	3,384	4	-4	3	-4	6	-8
21	Jun-23	2,830	109	1,548	3,384	4	-4	3	-4	6	-8
22	Jul-23	2,830	109	1,548	3,384	4	-4	3	-4	6	-8
23	Aug-23	2,830	109	1,548	3,384	4	-4	3	-4	6	-8
24	Sep-23	2,830	109	1,548	3,384	4	-4	3	-4	6	-8
25	BP-22 AVG	**2,834**	**99**	**1,548**	**3,384**	**4**	**-4**	**2**	**-3**	**6**	**-7**

NOTES:

*** Load includes all Non-Federal Hydro**

**** Thermal includes new Thermal and Biomass as an allocated amount by nameplate capacity**

Table 2.14
FCRPS Balancing Reserve Capacity Requirement (Values in MW)
for FY2022-2023 Balancing Reserve Capacity Quantity Forecast

		INSTALLED CAPACITY				FCRPS					
						REG		NON-REG		TOTAL	
		WIND	SOLAR	NON-FEDERAL THERMAL	FCRPS	INC	DEC	INC	DEC	INC	DEC
	A	B	C	D	E	F	G	J	K	L	M
1	Oct-21	2,930	89	1,548	3,384	22	-24	0	0	22	-24
2	Nov-21	2,830	89	1,548	3,384	23	-24	0	0	23	-24
3	Dec-21	2,830	89	1,548	3,384	23	-24	0	0	23	-24
4	Jan-22	2,830	89	1,548	3,384	23	-24	0	0	23	-24
5	Feb-22	2,830	89	1,548	3,384	23	-24	0	0	23	-24
6	Mar-22	2,830	89	1,548	3,384	23	-24	0	0	23	-24
7	Apr-22	2,830	89	1,548	3,384	23	-24	0	0	23	-24
8	May-22	2,830	89	1,548	3,384	23	-24	0	0	23	-24
9	Jun-22	2,830	89	1,548	3,384	23	-24	0	0	23	-24
10	Jul-22	2,830	89	1,548	3,384	23	-24	0	0	23	-24
11	Aug-22	2,830	89	1,548	3,384	23	-24	0	0	23	-24
12	Sep-22	2,830	89	1,548	3,384	23	-24	0	0	23	-24
13	Oct-22	2,830	109	1,548	3,384	23	-24	0	0	23	-24
14	Nov-22	2,830	109	1,548	3,384	23	-24	0	0	23	-24
15	Dec-22	2,830	109	1,548	3,384	23	-24	0	0	23	-24
16	Jan-23	2,830	109	1,548	3,384	23	-24	0	0	23	-24
17	Feb-23	2,830	109	1,548	3,384	23	-24	0	0	23	-24
18	Mar-23	2,830	109	1,548	3,384	23	-24	0	0	23	-24
19	Apr-23	2,830	109	1,548	3,384	23	-24	0	0	23	-24
20	May-23	2,830	109	1,548	3,384	23	-24	0	0	23	-24
21	Jun-23	2,830	109	1,548	3,384	23	-24	0	0	23	-24
22	Jul-23	2,830	109	1,548	3,384	23	-24	0	0	23	-24
23	Aug-23	2,830	109	1,548	3,384	23	-24	0	0	23	-24
24	Sep-23	2,830	109	1,548	3,384	23	-24	0	0	23	-24
25	BP-22 AVG	**2,834**	**99**	**1,548**	**3,384**	**23**	**-24**	**0**	**0**	**23**	**-24**

NOTES:
*** Load includes all Non-Federal Hydro**
**** Thermal includes new Thermal and Biomass as an allocated amount by nameplate capacity**

Table 3.1
Balancing Area Net Load and Generation
MegaWatts

	A	B	C	D	E	F	G
	BPA BALANCING AREA NET LOAD						
	Month	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
1	OCT	5,747	5,745	6,062	5,589	5,584	5,669
2	NOV	6,320	5,766	6,635	6,336	6,156	6,256
3	DEC	7,392	6,580	7,028	6,881	7,068	7,177
4	JAN	6,866	6,261	7,061	6,771	6,944	7,051
5	FEB	7,171	7,677	6,964	7,203	6,869	6,975
6	MAR	6,642	6,825	6,644	6,359	6,394	6,493
7	APR	6,145	6,123	6,048	5,964	5,997	6,090
8	MAY	5,883	5,824	5,852	5,793	5,825	5,915
9	JUN	6,115	6,099	5,972	6,075	6,108	6,203
10	JUL	6,389	6,112	6,276	6,204	6,238	6,335
11	AUG	6,090	6,122	6,087	6,031	6,065	6,159
12	SEP	5,675	5,749	5,381	5,593	5,624	5,710
13	**AVG**	**6,370**	**6,240**	**6,334**	**6,233**	**6,239**	**6,336**
14	**BPA BALANCING AREA NET GENERATION**						
15	**Month**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
16	OCT	10,273	7,929	7,803	8,718	9,881	9,831
17	NOV	11,574	9,929	9,590	10,476	11,715	11,518
18	DEC	13,453	10,073	9,652	10,936	11,929	11,979
19	JAN	14,735	10,753	11,313	12,432	13,405	12,604
20	FEB	15,993	10,117	12,980	12,333	13,050	14,169
21	MAR	13,899	10,376	10,076	11,305	13,561	11,913
22	APR	13,354	11,515	9,042	12,034	14,830	14,648
23	MAY	14,759	12,042	12,824	12,108	12,046	12,517
24	JUN	14,537	11,166	13,550	14,354	14,588	15,090
25	JUL	12,082	9,842	12,595	12,276	13,668	14,462
26	AUG	16,485	9,277	10,935	11,105	14,480	14,427
27	SEP	14,933	8,236	8,991	10,170	10,600	10,932
28	**AVG**	**13,840**	**10,105**	**10,779**	**11,521**	**12,813**	**12,841**

Table 3.2
Forecst Operating Reserve Obligation
MegaWatts

	A	B	C	D
1	**Total Balancing Area Obligation**			
2	**Month**	**2022**	**2023**	**AVG**
3	Oct	464.0	465.0	**464.5**
4	Nov	536.0	533.1	**534.5**
5	Dec	569.8	574.8	**572.3**
6	Jan	610.6	589.8	**600.2**
7	Feb	597.6	634.2	**615.9**
8	Mar	598.7	552.3	**575.5**
9	Apr	624.9	622.0	**623.5**
10	May	536.0	553.0	**544.5**
11	Jun	620.9	638.8	**629.8**
12	Jul	597.1	624.0	**610.5**
13	Aug	616.4	617.5	**617.0**
14	Sep	486.9	499.2	**493.0**
15	**AVG**	**571.6**	**575.3**	**573.4**
16				
17	**Self- and Third Party Supply**			
18	**Month**	**FY22**	**FY23**	**AVG**
19	Oct	88.6	88.6	**88.6**
20	Nov	112.6	112.6	**112.6**
21	Dec	119.4	119.4	**119.4**
22	Jan	125.0	125.0	**125.0**
23	Feb	124.7	124.7	**124.7**
24	Mar	110.8	110.8	**110.8**
25	Apr	86.7	86.7	**86.7**
26	May	85.4	85.4	**85.4**
27	Jun	83.8	83.8	**83.8**
28	Jul	88.9	88.9	**88.9**
29	Aug	87.6	87.6	**87.6**
30	Sep	86.6	86.6	**86.6**
31	**AVG**	**100.0**	**100.0**	**100.0**
32				
33	**BPA Obligaiton**			
34	**Month**	**2022**	**2023**	**AVG**
35	Oct	375.4	376.4	**375.9**
36	Nov	423.4	420.5	**421.9**
37	Dec	450.4	455.5	**452.9**
38	Jan	485.6	464.8	**475.2**
39	Feb	472.9	509.5	**491.2**
40	Mar	487.9	441.5	**464.7**
41	Apr	538.3	535.4	**536.8**
42	May	450.6	467.6	**459.1**
43	Jun	537.1	555.0	**546.1**
44	Jul	508.2	535.1	**521.6**
45	Aug	528.9	529.9	**529.4**
46	Sep	400.3	412.5	**406.4**
47	**AVG**	**471.6**	**475.3**	**473.4**

Table 4.1
1-Hour Capacity of Federal System Resources for FY 2022 and FY 2023 Adjusted for Transmission Losses (without reserve obligations)
1937 Water Conditions

		Annual Average	Oct	Nov	Dec	Jan	Feb	Mar	1-Apr	16-Apr	May	Jun	Jul	1-Aug	16-Aug	Sep
		B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	**FY 2022 Federal Resources**															
2	Regulated Hydro	**11,992.7**	9,823.6	12,272.2	13,258.4	11,248.1	10,803.1	12,703.5	10,760.1	8,783.3	13,725.9	14,835.0	12,476.3	12,167.3	11,866.2	10,860.4
3	Independent Hydro	**487.2**	471.9	416.9	311.0	198.0	225.1	385.4	613.0	628.7	814.5	839.7	605.3	463.2	463.2	482.8
4	Small Hydro	**4.2**	4.1	4.5	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.1	3.2	3.5	3.5	3.0
5	Large Thermal (Columbia Generation Station)	**1,168.5**	1,181.0	1,179.0	1,180.0	1,169.0	1,169.0	1,169.0	1,160.0	1,160.0	1,151.0	1,154.0	1,168.0	1,163.0	1,163.0	1,179.0
6	Renewable Resources	**-**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	Augmentation Purchases	**-**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	Augmentation Purchases (to serve Tier 2 Load)	**-**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	**FY 2023 Federal Resources**	**-**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	Regulated Hydro	**11,915.0**	9,760.0	12,507.7	13,188.3	11,369.2	10,914.2	10,856.6	10,853.4	8,934.7	14,107.2	14,933.4	12,501.5	12,151.8	11,897.9	10,846.8
11	Independent Hydro	**487.2**	471.9	416.9	311.0	198.0	225.1	385.4	613.0	628.7	814.5	839.7	605.3	463.2	463.2	482.8
12	Small Hydro	**4.2**	4.1	4.5	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.1	3.2	3.5	3.5	3.0
13	Large Thermal (Columbia Generation Station)	**975.9**	1,181.0	1,179.0	1,180.0	1,169.0	1,169.0	1,169.0	1,160.0	1,160.0	-	-	1,168.0	1,163.0	1,163.0	1,179.0
14	Renewable Resources	**-**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	Augmentation Purchases	**-**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	Augmentation Purchases (to serve Tier 2 Load)	**-**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	**Rate Period Average After Losses**	**-**														
18	Regulated Hydro	**11,581.0**														
19	Independent Hydro	**471.9**														
20	Small Hydro	**4.0**														
21	Large Thermal (Columbia Generation Station)	**1,038.9**														
22	Renewable Resources	**-**														
23	Augmentation Purchases	**-**														
24	Augmentation Purchases (to serve Tier 2 Load)	**-**														
25	1-Hour Capacity Adjusted for Transmission Losses	**13,095.9**														

	Oct	Nov	Dec	Jan	Feb	Mar	1-Apr	16-Apr	May	Jun	Jul	1-Aug	16-Aug	Sep
2022	31	30	31	31	28	31	15	15	31	30	31	15	16	30

	Oct	Nov	Dec	Jan	Feb	Mar	1-Apr	16-Apr	May	Jun	Jul	1-Aug	16-Aug	Sep
2023	31	30	31	31	28	31	15	15	31	30	31	15	16	30

Table 4.2
Capacity Costs
($ in thousands)

	A	B	C		D
		FY 2022	FY 2023	Capacity Classification (%)	Annual Average for FY 2022-FY 2023 Classified to Capacity
1	**Capital Related Costs**				
2	Depreciation	$ 140,949	$ 144,155	100%	$ 142,552
3	Amortization	$ 278,822	$ 284,344	100%	$ 281,583
4	Interest Expense	$ 252,948	$ 239,995	100%	$ 246,471
5	Minimum Required Net Revenues	$ 67,831	$ 104,443	100%	$ 86,137
6	Decomissioning Costs	$ 25,839	$ 27,023	100%	$ 26,430.95
7	**Subtotal**	**$ 766,388**	**$ 799,960**		**$ 783,174**
8					
9	**Fish & Wildlife Costs**				
10	Fish & Wildlife (Other than Planning Council)	$ 280,508	$ 276,196	100%	$ 278,352
11	Fish & Wildlife - Planning Council	$ 11,942	$ 12,431	50%	$ 6,093
12	**Subtotal**	**$ 280,508**	**$ 276,196**		**$ 284,445**
13					
14	**Power Purchase Costs**				
15	Clearwater Hatchery Generation	$ 1,368	$ 1,410	60%	$ 840
16	Non-Tier 2 Augmentation Power Purchases	$ -	$ -	50%	$ -
17	Tier 2 Augmentation Power Purchases	$ -	$ -	50%	$ -
18	**Subtotal**	**$ 1,368**	**$ 1,410**		**$ 840**
19					
20	**Cost Adjustments**				
21	4h10C	$ (94,171)	$ (94,216)	69%	$ (64,748.42)
22	Synchronous Condensing	$ (923)	$ (923)	20%	$ (185)
23	**Subtotal**	**$ (95,094)**	**$ (95,138)**		**$ (64,933)**
24	**Total Allocated Costs**				**$ 1,003,526**

Table 4.3 Embedded Cost Calculation ($ in Thousands)		
	A	**B**
		Annual Average of FY2022-FY2023
1	**Assumptions for Calculation:**	
2	1Hr Capacity adjusted for Transmission Losses (MW)	13,096
3	Regulation Reserve (MW)	309
4	Non-regulation Reserve (MW)	371
5	Operating Reserve (MW)	473
6		
7	**Forecast of Total Capacity of Federal System Resources:**	
8	1Hr Capacity adjusted for Transmission Losses (Line 2)	13,096
9	Total PS Reserve Obligation (Line 3+4+5)	1,153
10	Total Capacity of Federal System Resources (Line 8+9)	14,249
11		
12	**Revenue Requirement:**	
13	Capacity Costs	$ 1,003,526
14	Hydro Projects Capacity System Uses (Line 10)	14,249
15	Total kW/month/year Hydro Project Capacity System Uses (Line 14 * 12 months * 1000 kW/MW)	170,991,635
16	**Unit Cost Allocation of Capacity System Uses $/kW/month (Line 13 / Line 15)**	$ 5.87

Table 4.4
Super Peak Market Prices for FY 2022 by Month and Water Year
($/MWh)

	A	B	C	D	E	F	G	H	I	J	K	L	M
	Water Year	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22
1	1929	50.40	51.34	65.59	61.00	66.85	63.78	60.51	58.85	52.72	86.88	78.44	52.85
2	1930	62.40	58.75	65.67	62.33	70.19	63.39	64.38	59.26	52.91	71.60	73.52	53.13
3	1931	64.44	53.24	64.39	62.22	66.50	60.01	62.47	57.64	49.51	74.31	69.75	52.03
4	1932	58.29	54.28	66.96	63.99	110.56	69.26	57.94	47.23	39.68	87.61	70.96	54.90
5	1933	57.34	56.32	60.37	65.18	72.94	60.69	62.43	54.38	18.86	60.52	63.35	51.63
6	1934	46.39	54.32	62.00	57.88	71.17	63.20	41.76	49.82	54.60	100.92	79.93	56.97
7	1935	59.60	62.30	62.03	61.14	71.44	60.14	62.71	57.09	54.28	69.50	63.95	52.59
8	1936	55.05	56.16	62.67	64.28	75.43	67.83	61.03	40.54	49.36	76.61	73.78	56.06
9	1937	58.34	57.52	67.01	68.77	88.30	64.53	64.34	61.30	56.90	76.52	75.27	52.16
10	1938	51.16	52.09	59.95	63.52	65.36	63.36	54.48	47.18	46.27	74.19	82.80	60.22
11	1939	56.01	58.03	62.84	60.09	66.55	63.19	59.48	53.29	54.61	71.25	68.78	53.26
12	1940	56.56	51.55	60.90	58.95	69.45	66.07	62.75	59.15	53.82	87.36	83.47	55.21
13	1941	55.74	53.81	60.77	61.98	68.84	60.89	62.26	59.33	50.94	78.53	72.93	53.22
14	1942	54.16	53.36	59.75	56.71	70.90	60.61	58.73	57.23	44.88	68.47	67.75	48.97
15	1943	57.51	55.73	60.00	62.99	73.87	65.11	41.58	53.54	35.21	61.88	74.56	57.88
16	1944	57.39	55.73	62.10	63.25	66.93	62.01	69.37	59.55	50.39	77.14	76.11	54.12
17	1945	54.36	53.64	60.35	62.91	72.21	61.91	66.02	55.58	46.35	86.13	73.20	51.01
18	1946	57.70	53.70	60.47	62.28	67.65	61.91	46.75	43.48	49.64	69.19	60.15	51.19
19	1947	57.78	57.28	65.84	60.82	69.61	63.01	58.77	47.78	46.68	71.97	71.31	54.82
20	1948	39.24	54.25	58.64	69.22	77.66	62.45	60.77	24.87	17.85	80.96	59.80	50.20
21	1949	51.21	52.26	62.99	56.53	65.74	64.39	53.04	34.51	50.76	85.70	70.78	52.39
22	1950	59.06	52.83	57.92	66.23	73.61	61.79	52.51	55.58	20.89	40.29	67.05	55.42
23	1951	45.93	53.96	68.33	57.31	62.46	61.79	49.59	46.92	50.33	62.40	68.00	55.07
24	1952	49.07	54.88	57.47	67.10	72.70	62.47	46.32	34.13	46.64	68.53	66.94	54.40
25	1953	63.88	54.62	65.76	61.43	72.60	64.40	71.71	52.93	17.69	65.91	68.26	50.81
26	1954	53.33	52.81	60.06	67.45	72.75	60.46	59.41	44.41	35.51	48.59	61.22	51.01
27	1955	50.60	52.33	55.31	59.32	67.09	64.47	61.94	55.33	28.07	46.62	64.01	54.00
28	1956	50.07	56.40	63.24	57.98	73.19	66.15	41.50	35.82	18.52	68.48	62.98	49.69
29	1957	52.75	54.76	56.89	61.86	67.45	63.36	52.40	25.13	21.44	82.15	64.86	53.05
30	1958	58.29	54.41	61.08	65.52	76.36	63.17	60.18	35.51	39.81	87.03	68.77	51.19
31	1959	50.94	53.42	60.78	67.22	74.82	64.97	62.27	58.53	31.90	61.15	62.75	47.28
32	1960	36.58	55.77	62.54	62.87	72.81	61.57	52.23	61.22	44.97	71.92	68.10	57.54
33	1961	53.22	54.12	60.71	61.23	72.63	63.30	61.46	51.04	34.99	88.27	68.25	52.68
34	1962	59.21	55.13	60.20	61.33	74.07	64.40	54.05	54.35	44.61	78.27	68.14	54.24
35	1963	52.27	54.31	56.05	59.31	75.88	64.49	62.58	54.03	44.82	68.98	72.59	50.26
36	1964	55.05	53.33	59.49	60.36	70.99	62.60	64.74	52.63	16.16	54.52	64.63	49.30
37	1965	45.53	50.39	60.76	61.19	61.10	59.23	56.87	41.22	44.29	71.67	59.27	48.00
38	1966	53.24	58.08	61.69	60.99	72.00	63.79	61.08	58.57	51.93	67.89	69.44	53.16
39	1967	52.83	53.81	55.04	66.63	72.82	62.30	57.57	53.66	19.49	64.03	63.92	48.63
40	1968	51.84	52.56	59.85	65.32	67.92	64.55	92.19	55.82	41.79	70.77	65.33	47.72
41	1969	44.94	50.94	58.21	62.89	75.09	64.00	40.09	40.21	46.55	67.43	67.30	52.46
42	1970	55.84	55.11	63.91	63.83	74.02	59.89	69.76	52.05	29.96	87.98	72.60	51.55
43	1971	52.69	53.29	56.62	61.32	59.90	61.20	53.11	32.81	11.43	64.65	60.93	48.48
44	1972	49.44	54.65	57.56	59.92	69.66	31.07	48.17	39.84	13.77	63.31	59.38	50.31
45	1973	47.33	53.42	56.35	60.86	71.85	66.01	71.92	62.00	52.22	81.10	83.36	56.24
46	1974	57.12	54.90	57.19	49.61	59.41	50.70	41.14	44.74	13.73	46.38	59.72	52.25
47	1975	58.49	55.44	58.76	58.84	73.01	59.54	60.65	47.49	21.38	61.09	71.40	49.72
48	1976	43.53	55.81	63.06	61.52	70.89	63.03	51.78	37.35	41.11	60.23	51.59	49.05
49	1977	55.32	57.63	63.55	63.50	65.73	66.28	74.71	60.71	53.67	85.58	76.67	58.01
50	1978	57.26	57.69	58.61	64.64	70.25	65.50	56.32	51.97	53.58	74.88	75.49	46.93
51	1979	52.38	55.34	62.49	61.44	67.89	67.46	61.82	46.65	53.60	81.94	74.75	53.33
52	1980	55.05	55.61	66.43	59.64	67.66	65.85	61.74	37.26	42.19	80.05	73.00	53.95
53	1981	58.58	56.52	63.39	66.10	76.21	63.43	69.93	56.21	32.92	68.68	64.93	52.61
54	1982	51.26	51.56	55.72	61.99	68.43	48.98	55.56	43.41	24.57	54.61	62.67	48.86
55	1983	47.06	56.56	57.80	65.53	73.52	52.52	59.41	53.78	46.51	61.27	63.41	52.93
56	1984	52.96	59.53	57.54	63.66	72.02	65.09	61.34	55.85	30.10	72.52	69.41	53.26
57	1985	49.45	54.18	59.63	63.73	69.36	62.95	63.53	56.46	57.11	84.98	81.97	54.77
58	1986	46.93	51.47	58.34	67.02	72.54	46.92	53.76	58.40	45.65	80.91	74.26	54.90
59	1987	59.28	56.13	58.94	62.42	68.49	66.04	61.70	55.73	55.97	100.40	75.15	55.42
60	1988	57.21	55.45	63.84	67.29	74.27	65.00	62.14	62.56	53.40	70.33	75.32	54.56
61	1989	65.47	50.14	58.12	58.64	83.96	62.75	56.47	56.82	52.44	74.41	74.10	53.09
62	1990	56.26	56.70	59.91	64.57	72.88	61.85	57.54	61.01	45.80	64.00	65.47	52.75
63	1991	61.15	55.70	58.39	63.81	71.35	58.40	58.26	54.68	47.44	60.02	62.47	54.07
64	1992	60.23	53.16	67.31	62.00	69.25	67.73	63.84	57.49	53.39	90.65	79.03	56.81
65	1993	70.90	52.45	63.86	62.29	83.53	59.94	59.62	41.52	52.30	71.44	67.60	51.09
66	1994	61.86	54.27	62.81	63.40	68.65	63.58	59.43	53.29	51.31	77.89	78.22	54.10
67	1995	59.44	54.86	60.65	61.13	66.52	63.47	69.36	53.43	38.66	73.05	74.45	50.53
68	1996	47.55	50.35	53.32	50.30	58.52	44.31	47.73	46.85	37.23	68.31	69.76	54.50
69	1997	58.44	58.11	56.49	53.43	62.29	46.28	31.89	25.17	17.00	58.29	63.42	53.10
70	1998	38.55	50.61	61.23	59.66	70.09	65.09	64.17	39.67	38.57	69.12	64.09	52.17
71	1999	57.12	54.40	57.00	62.26	74.90	52.14	54.29	53.33	26.10	58.31	54.75	54.67
72	2000	63.10	59.58	57.99	60.86	70.77	62.18	50.80	57.58	55.13	69.65	72.91	56.28
73	2001	58.28	57.45	63.36	64.75	68.21	64.67	71.17	58.80	51.72	90.02	81.25	58.17
74	2002	59.26	57.48	59.51	60.37	69.03	62.40	59.06	54.30	38.59	63.88	76.52	58.78
75	2003	62.91	55.81	64.89	59.38	67.76	66.65	62.44	60.87	46.96	94.48	80.26	53.43
76	2004	57.17	53.81	56.72	57.08	66.90	61.79	59.59	56.08	51.10	73.47	66.82	49.84
77	2005	50.79	52.81	58.11	59.95	74.26	62.98	68.44	57.86	49.65	71.44	75.21	53.02
78	2006	66.12	53.60	58.09	64.94	77.40	63.97	50.97	40.30	43.08	75.06	81.56	57.80
79	2007	62.09	53.63	59.35	62.94	65.68	60.12	58.71	57.52	52.69	69.79	80.25	52.82
80	2008	71.61	56.80	64.85	57.51	65.76	61.02	67.75	47.54	25.19	70.98	70.08	52.78

Super peak is the eight highest load hours of each day.

Table 4.5
Super Peak Market Prices for FY 2023 by Month and Water Year
($/MWh)

	A	B	C	D	E	F	G	H	I	J	K	L	M
	Water Year	Oct-22	Nov-22	Dec-22	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23
1	1929	53.53	57.61	62.30	60.08	69.25	68.28	73.92	71.63	46.79	83.34	66.82	52.12
2	1930	66.90	62.42	67.12	61.36	70.59	67.87	75.36	66.65	51.63	70.49	69.00	51.29
3	1931	67.42	60.58	65.21	61.32	71.90	66.54	75.50	68.74	54.74	70.97	69.22	50.74
4	1932	66.20	61.22	63.89	59.74	80.67	67.19	53.58	56.60	45.29	77.33	60.10	48.46
5	1933	62.56	60.30	57.45	65.07	73.04	67.39	71.56	59.51	22.12	58.75	58.11	49.09
6	1934	48.22	56.66	60.12	54.53	69.09	66.54	47.42	59.37	61.13	92.43	68.59	51.12
7	1935	66.35	62.99	58.65	60.75	72.10	66.41	69.68	62.60	50.64	61.80	59.30	47.85
8	1936	62.43	62.29	68.69	64.39	79.12	69.98	71.65	52.31	55.81	81.89	67.98	53.90
9	1937	66.96	65.85	63.69	69.16	80.19	68.50	75.06	68.10	50.66	74.97	70.56	51.96
10	1938	56.31	56.98	56.36	60.82	68.08	66.66	56.30	57.05	54.10	69.96	69.18	50.53
11	1939	70.06	64.37	65.60	60.42	69.81	66.54	69.06	59.09	52.10	68.97	73.23	54.06
12	1940	61.31	60.27	62.50	60.92	70.48	65.76	67.02	64.22	57.67	76.96	74.45	52.21
13	1941	59.86	59.54	60.39	59.60	70.66	66.00	73.01	67.16	52.32	72.80	64.28	49.60
14	1942	57.19	58.30	61.82	59.34	71.43	68.47	70.23	69.35	47.05	62.71	64.73	48.98
15	1943	61.06	56.84	56.63	63.23	72.21	64.26	34.08	59.81	39.38	57.97	59.90	50.64
16	1944	67.76	66.88	63.32	62.40	67.60	65.91	78.70	70.98	53.46	75.07	67.07	53.89
17	1945	64.92	62.60	64.34	63.89	71.80	68.84	75.23	63.20	50.05	88.89	67.55	52.60
18	1946	58.93	57.83	58.75	61.17	70.36	65.91	48.82	52.22	51.95	65.02	56.65	49.64
19	1947	65.64	64.63	69.60	64.65	75.27	66.69	69.24	60.16	53.39	72.71	64.43	48.93
20	1948	46.41	57.26	57.04	59.51	72.58	67.07	58.07	29.75	21.00	72.23	52.35	47.01
21	1949	54.25	58.44	62.84	62.85	68.95	67.91	61.17	45.48	56.38	84.95	75.03	51.85
22	1950	60.53	58.36	57.89	63.30	71.69	62.59	54.96	65.96	22.67	43.93	58.96	52.96
23	1951	51.40	56.43	69.82	59.28	59.83	62.96	51.11	54.53	51.33	59.12	61.55	49.87
24	1952	49.22	59.06	60.42	63.93	77.00	65.91	47.81	36.95	52.84	68.98	60.42	51.12
25	1953	66.97	62.35	63.67	63.04	73.04	73.06	81.21	60.11	22.64	64.64	60.93	49.93
26	1954	60.29	59.47	60.43	63.75	74.54	65.92	66.76	55.26	37.51	43.86	52.80	45.06
27	1955	62.11	65.70	59.47	58.18	67.94	70.27	71.30	61.68	33.52	48.19	61.81	50.30
28	1956	50.05	59.02	68.74	55.25	70.89	62.49	38.27	44.04	23.23	64.92	55.16	47.87
29	1957	53.10	54.57	58.73	57.09	65.14	65.22	56.07	32.39	23.81	73.15	60.30	48.05
30	1958	66.62	61.68	60.04	61.48	71.51	68.05	66.29	44.07	45.61	79.38	63.65	50.31
31	1959	58.24	64.51	61.74	60.10	70.71	64.99	61.21	60.72	39.58	59.78	53.40	43.24
32	1960	43.19	60.21	63.72	63.53	70.09	71.56	51.21	68.35	47.87	75.28	61.46	51.70
33	1961	69.32	59.39	62.18	63.41	71.91	65.03	64.87	54.94	39.59	81.51	63.70	50.99
34	1962	63.87	58.54	60.10	57.52	72.21	75.34	56.62	65.47	49.40	78.73	57.60	49.84
35	1963	56.07	65.10	61.29	60.28	73.14	71.06	69.12	60.24	46.47	67.32	57.82	47.86
36	1964	58.22	57.38	60.89	59.59	70.88	64.38	66.05	55.75	18.55	52.49	56.14	48.10
37	1965	51.89	60.49	64.78	57.29	62.03	61.05	62.51	51.36	51.82	72.74	48.38	49.94
38	1966	56.74	60.23	57.55	56.73	71.27	67.98	68.32	67.59	54.30	68.56	66.01	52.94
39	1967	62.24	59.35	55.73	66.18	74.24	67.24	70.90	63.91	24.49	65.55	58.18	50.25
40	1968	52.83	60.56	58.12	59.45	73.08	65.51	131.33	62.40	45.20	67.85	56.73	46.51
41	1969	49.72	61.03	61.08	63.17	76.36	67.32	40.42	46.78	53.75	70.32	61.36	49.13
42	1970	60.99	57.04	57.17	62.75	74.15	67.82	89.24	57.08	41.28	81.98	66.53	49.15
43	1971	63.31	57.16	58.91	61.66	61.02	62.84	55.42	38.94	12.33	62.41	53.68	46.72
44	1972	53.06	58.13	55.09	55.92	72.37	32.58	50.22	49.57	17.35	57.93	55.85	48.51
45	1973	54.56	60.51	55.91	56.79	66.57	65.58	80.15	67.20	52.13	73.20	70.14	52.29
46	1974	61.91	60.58	60.21	47.75	63.58	50.78	38.89	54.19	18.75	44.32	59.93	50.54
47	1975	67.81	60.01	58.89	59.71	72.30	64.38	67.51	59.28	25.58	50.64	57.77	47.68
48	1976	49.59	61.15	64.44	59.67	72.93	66.33	51.71	44.13	48.28	57.57	47.71	44.56
49	1977	57.89	62.63	61.24	60.79	68.83	70.18	81.84	69.76	54.92	82.40	71.22	53.89
50	1978	67.12	63.87	59.51	58.35	67.81	64.98	62.43	63.13	51.36	69.55	64.95	46.48
51	1979	62.03	61.79	65.50	60.24	70.84	67.82	74.48	56.60	58.84	85.59	72.06	53.47
52	1980	61.07	63.05	64.32	58.92	69.69	67.31	60.91	39.73	47.90	75.41	65.30	47.63
53	1981	61.76	59.64	62.37	66.84	77.64	70.66	80.73	61.81	34.80	70.10	56.21	48.75
54	1982	60.74	57.96	58.85	64.64	70.18	45.94	62.62	56.34	31.85	48.01	59.80	48.43
55	1983	54.47	61.68	56.17	59.67	75.99	54.00	69.91	61.95	51.60	58.19	58.20	48.97
56	1984	62.36	65.77	56.91	61.51	75.57	65.87	61.77	64.32	31.57	68.80	60.21	47.89
57	1985	54.04	60.83	60.55	58.52	67.60	68.36	64.58	60.99	55.90	84.47	78.90	53.09
58	1986	53.97	63.11	57.52	62.39	71.89	46.17	54.98	66.28	49.30	82.99	66.14	50.00
59	1987	63.74	56.90	60.30	57.35	69.25	64.62	68.06	57.91	58.28	82.66	74.63	52.59
60	1988	68.45	63.09	63.51	65.88	74.32	68.06	71.92	71.32	53.19	68.81	67.65	52.56
61	1989	66.46	60.31	62.16	63.25	84.15	69.29	58.95	66.74	59.44	75.11	70.94	52.57
62	1990	65.73	62.19	58.07	62.26	72.27	67.86	63.65	66.33	46.25	65.27	59.37	52.07
63	1991	63.65	60.75	56.05	64.55	73.61	64.63	63.67	62.77	50.80	56.58	58.12	52.16
64	1992	65.44	60.11	62.27	58.64	69.90	68.51	74.26	65.99	61.30	87.52	68.06	53.70
65	1993	72.30	60.80	62.24	61.24	81.68	65.91	70.27	57.53	52.09	72.21	63.44	50.29
66	1994	68.41	58.82	60.80	62.02	69.86	68.51	69.88	64.74	58.76	74.63	73.51	49.93
67	1995	66.43	59.04	60.03	60.91	74.22	66.36	84.30	59.49	41.66	79.18	65.59	50.57
68	1996	50.07	57.33	56.95	47.79	53.10	35.56	45.07	57.28	42.80	65.70	60.87	49.04
69	1997	63.35	61.50	59.05	48.45	55.84	45.99	35.92	28.46	20.63	53.71	55.47	46.10
70	1998	46.77	56.67	62.01	59.11	74.48	67.42	69.39	49.21	44.71	66.41	56.54	50.49
71	1999	63.07	59.03	57.54	62.07	71.81	50.82	60.27	59.93	35.42	50.57	53.35	52.45
72	2000	63.50	64.73	61.16	62.20	70.73	67.35	52.41	62.76	58.59	66.21	65.39	49.34
73	2001	69.10	63.31	62.70	61.11	71.20	70.56	86.26	72.84	57.26	75.49	70.15	54.18
74	2002	72.68	65.38	60.39	58.83	69.78	64.40	60.81	62.65	41.44	62.56	61.34	52.66
75	2003	65.63	61.88	63.32	57.83	69.67	66.18	67.05	62.94	45.18	80.48	76.94	52.75
76	2004	63.72	59.93	59.23	56.93	68.61	67.74	67.90	69.02	54.30	77.56	69.23	49.68
77	2005	52.53	56.67	54.75	57.42	73.37	64.36	78.69	64.22	53.20	67.96	66.17	51.93
78	2006	71.77	57.73	57.98	62.25	73.15	69.42	48.78	48.44	48.84	74.91	71.61	53.20
79	2007	69.44	61.20	57.80	66.02	69.48	64.29	65.88	64.24	54.60	65.73	75.64	52.82
80	2008	79.38	61.71	65.11	60.81	69.69	67.63	76.85	55.35	32.00	70.41	62.69	48.59

Super peak is the eight highest load hours of each day.

Table 4.6
Graveyard Market Prices for FY 2022 by Month and Water Year
($/MWh)

	A	B	C	D	E	F	G	H	I	J	K	L	M
	Water Year	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22
1	1929	25.81	28.76	31.51	28.67	28.43	27.73	26.33	21.54	16.10	25.48	28.28	30.69
2	1930	25.46	30.09	31.97	29.41	29.44	27.17	28.96	21.70	18.53	23.58	27.55	30.33
3	1931	26.22	29.58	30.42	28.64	27.07	26.74	26.81	21.49	18.41	24.33	27.84	29.11
4	1932	26.33	29.86	33.03	30.59	31.42	28.93	24.56	10.15	-5.67	23.26	26.86	31.98
5	1933	30.22	29.91	31.72	25.60	25.43	26.96	28.32	17.95	-19.25	-2.41	22.46	28.11
6	1934	26.23	22.33	13.13	2.38	13.26	20.32	9.34	10.74	13.20	21.14	29.29	31.63
7	1935	29.12	35.38	32.92	24.89	25.56	27.00	27.75	20.76	15.65	19.30	24.60	27.19
8	1936	24.84	29.48	31.10	30.08	30.37	29.70	28.08	-0.64	6.91	23.51	30.24	31.85
9	1937	26.35	30.47	32.82	30.26	29.36	28.73	27.56	22.74	17.05	24.84	28.67	30.52
10	1938	24.49	28.44	29.75	24.68	27.79	25.14	21.31	11.12	5.24	18.52	30.09	34.49
11	1939	27.87	32.26	32.83	28.96	28.11	28.35	27.67	16.75	18.35	21.90	28.01	29.77
12	1940	26.71	28.31	31.63	27.14	29.16	28.35	26.86	21.44	19.30	24.22	28.32	32.07
13	1941	25.93	28.90	31.36	28.85	28.39	27.61	26.97	21.65	16.88	24.11	27.63	30.38
14	1942	24.76	28.79	26.87	26.44	26.92	26.11	27.03	19.90	5.13	19.82	27.26	27.00
15	1943	25.21	30.03	31.41	22.92	25.44	28.98	0.29	14.55	-10.90	-0.11	29.57	35.29
16	1944	29.64	32.78	32.09	28.87	27.66	27.67	27.77	23.46	18.89	23.86	27.65	29.80
17	1945	24.60	27.93	30.16	28.83	28.99	28.53	29.35	19.59	2.54	27.19	31.62	29.58
18	1946	27.13	28.98	30.44	26.26	27.20	26.74	14.08	3.07	1.60	15.63	27.00	27.97
19	1947	27.45	30.40	24.55	17.93	17.19	25.00	23.95	11.72	4.53	16.43	25.65	29.35
20	1948	19.01	26.72	29.30	21.53	25.27	27.91	27.70	-14.15	-19.41	19.79	20.00	28.47
21	1949	23.87	28.21	31.13	24.49	27.38	25.18	21.53	-5.72	10.36	21.84	28.36	30.97
22	1950	27.17	28.86	29.55	18.21	24.52	17.28	18.66	17.64	-18.98	-17.79	22.39	29.94
23	1951	24.03	25.03	23.67	5.06	-1.43	16.39	15.69	6.54	5.38	3.57	27.83	31.23
24	1952	22.68	31.00	29.63	20.59	23.86	27.15	14.76	-9.08	4.70	18.44	27.66	30.41
25	1953	29.12	31.07	32.79	28.00	17.22	28.98	28.92	18.62	-18.78	7.68	25.54	26.74
26	1954	26.94	29.81	30.16	21.05	20.77	25.30	25.22	8.49	-9.17	-13.80	16.17	26.72
27	1955	26.11	25.51	29.57	26.97	28.26	28.05	28.35	21.32	-14.77	-10.83	24.67	29.97
28	1956	28.23	25.70	24.07	4.02	17.22	22.05	2.34	-7.84	-19.94	5.52	23.79	28.69
29	1957	27.76	30.32	29.37	26.32	27.71	27.44	22.73	-13.87	-18.22	23.38	24.78	28.49
30	1958	27.12	30.75	31.64	25.26	25.98	28.56	28.58	-3.56	-5.86	25.37	30.01	29.99
31	1959	26.60	26.81	25.27	14.11	17.74	26.55	26.14	19.16	-12.26	0.90	25.72	22.82
32	1960	9.31	22.00	27.62	25.30	25.67	26.92	19.43	19.26	0.61	20.66	29.43	32.29
33	1961	26.95	29.90	31.59	21.55	27.00	24.82	26.98	15.02	-10.61	23.82	25.24	29.40
34	1962	28.19	30.25	32.50	27.90	24.69	25.67	23.69	16.67	1.68	22.88	27.93	31.05
35	1963	26.52	27.29	25.59	24.54	21.79	28.47	28.30	20.18	3.22	22.16	26.03	29.23
36	1964	24.92	29.41	31.56	28.06	27.77	27.57	27.53	15.53	-19.64	-7.11	25.65	28.29
37	1965	25.19	27.67	22.17	5.34	-1.84	16.26	24.28	1.29	-0.99	15.59	21.99	28.24
38	1966	28.94	33.72	32.74	26.59	26.77	29.12	26.34	21.59	10.92	19.49	27.29	28.78
39	1967	24.71	28.94	28.64	18.07	14.79	27.36	26.32	17.23	-17.62	6.65	22.21	27.03
40	1968	26.40	28.22	30.48	22.03	25.19	24.15	27.18	19.10	-0.58	18.94	24.99	26.27
41	1969	24.07	24.18	28.34	11.28	19.18	27.66	3.15	-3.11	0.72	18.07	28.05	31.46
42	1970	29.28	31.06	33.42	25.73	21.46	26.58	27.94	17.07	-12.95	26.92	26.89	28.24
43	1971	24.49	28.72	30.14	8.11	-2.23	17.85	18.71	-8.84	-20.98	-4.59	21.73	28.06
44	1972	27.30	29.37	29.37	4.75	15.45	-18.16	11.43	-4.41	-20.60	-5.29	19.58	28.08
45	1973	25.96	30.88	30.28	26.58	27.89	28.84	29.00	23.24	20.22	25.19	28.62	33.13
46	1974	26.79	27.98	27.03	-11.09	-1.18	-0.90	3.37	1.45	-20.40	-17.99	17.82	27.49
47	1975	26.77	31.39	32.84	24.81	24.75	25.68	26.62	14.39	-17.68	-5.41	26.12	32.01
48	1976	23.28	23.01	14.79	10.76	15.63	24.91	17.40	-5.42	-4.46	-2.18	7.45	24.99
49	1977	31.87	32.80	34.61	30.42	27.89	28.21	29.71	22.24	20.32	27.92	30.07	32.25
50	1978	25.42	29.34	30.04	27.55	29.22	29.26	23.95	16.25	8.51	16.89	28.63	26.91
51	1979	26.96	31.25	32.57	28.36	28.55	28.26	27.44	14.39	17.18	21.68	27.33	29.64
52	1980	26.83	30.57	31.75	27.72	29.04	28.46	27.40	-4.64	-4.68	23.63	30.92	32.16
53	1981	27.26	30.73	25.37	20.15	22.23	29.18	28.82	19.64	-11.76	16.84	25.32	29.43
54	1982	24.45	27.57	28.14	19.06	7.45	-4.79	26.08	6.61	-15.18	-11.83	21.62	26.83
55	1983	25.94	31.72	29.75	12.87	22.88	-1.28	27.90	15.68	3.57	-2.14	22.71	30.07
56	1984	27.13	23.10	29.89	16.17	22.63	25.26	25.71	17.97	-14.30	10.75	26.22	30.86
57	1985	25.15	29.01	30.84	27.07	27.87	28.93	28.44	18.53	17.44	23.32	26.45	32.68
58	1986	23.40	26.50	30.19	27.47	23.70	-8.75	21.05	18.09	0.71	23.42	29.28	31.94
59	1987	29.41	30.77	30.72	28.10	29.85	29.75	27.83	19.51	18.38	21.66	27.48	32.12
60	1988	25.16	29.67	31.78	31.71	30.56	28.99	28.24	22.76	18.77	24.07	28.04	31.09
61	1989	25.93	28.08	29.78	27.38	27.27	26.20	24.38	18.82	16.47	20.22	26.64	30.87
62	1990	26.91	29.24	28.25	22.71	22.91	26.44	25.29	21.88	1.45	13.75	25.91	28.40
63	1991	27.96	23.56	29.18	21.49	16.12	24.97	25.54	16.82	7.01	0.99	22.63	27.82
64	1992	28.29	29.27	33.08	30.72	29.94	27.74	28.56	23.26	19.45	26.17	29.90	31.83
65	1993	27.66	28.73	32.91	29.17	29.61	26.18	26.98	9.04	15.75	21.13	28.02	30.61
66	1994	26.62	30.13	31.41	29.17	29.10	27.55	27.23	19.06	18.05	23.80	28.56	30.48
67	1995	26.75	29.79	30.97	28.27	27.82	25.90	26.19	17.64	-7.58	24.59	28.23	27.92
68	1996	23.34	16.36	-0.01	-5.53	-4.80	-8.98	14.57	7.09	-10.91	3.26	24.67	31.16
69	1997	31.04	30.64	28.39	-7.63	-6.06	-7.58	-5.28	-14.56	-20.15	-6.36	23.30	29.55
70	1998	16.16	27.47	31.89	25.18	22.80	28.83	28.79	0.78	-7.64	21.39	26.75	30.18
71	1999	25.48	30.55	29.16	11.49	21.08	-1.59	22.85	15.14	-14.09	-7.87	15.58	31.04
72	2000	34.88	26.29	27.74	24.00	27.61	26.24	18.79	17.07	16.98	19.84	30.76	31.44
73	2001	29.00	31.13	32.31	30.81	28.32	28.21	30.09	21.29	20.47	27.13	31.87	32.39
74	2002	26.77	28.55	30.43	29.15	29.85	28.21	26.52	17.93	-6.40	13.36	29.72	36.07
75	2003	26.95	32.20	32.96	29.49	27.95	29.61	27.41	22.88	7.78	25.13	28.04	30.50
76	2004	27.09	29.03	29.37	27.34	27.32	27.02	27.35	20.39	15.08	23.76	26.02	29.33
77	2005	25.38	27.26	29.30	26.92	27.40	28.85	28.29	21.82	17.47	22.58	26.67	29.63
78	2006	26.56	29.00	29.59	22.42	20.11	27.86	17.93	-0.59	-3.28	23.55	31.31	33.66
79	2007	28.48	28.61	31.49	23.99	27.45	18.39	24.89	18.96	14.63	19.11	24.66	28.48
80	2008	28.17	31.81	32.16	27.00	27.45	26.99	28.46	13.49	-16.32	18.59	25.78	28.33

Graveyard is the period of clock hours 01:00-04:00 each day.

Table 4.7
Graveyard Market Prices for FY 2023 by Month and Water Year
($/MWh)

	A	B	C	D	E	F	G	H	I	J	K	L	M
	Water Year	Oct-22	Nov-22	Dec-22	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23
1	1929	25.77	30.29	31.22	28.23	28.19	31.67	33.37	27.70	18.22	24.62	24.88	29.06
2	1930	28.09	32.41	31.62	28.25	29.02	32.75	32.41	26.41	20.58	23.28	24.44	29.61
3	1931	27.98	31.69	33.16	28.72	29.68	31.41	31.40	27.64	20.73	22.32	26.10	29.05
4	1932	26.47	32.77	31.18	27.47	29.13	32.52	21.92	12.89	-5.68	21.85	22.30	27.39
5	1933	32.56	31.39	29.62	23.32	25.54	33.64	32.44	20.45	-17.71	-4.28	19.85	26.68
6	1934	24.96	19.13	10.89	-0.35	13.33	24.14	11.49	12.20	20.75	22.20	24.40	29.27
7	1935	32.74	34.89	31.21	23.47	24.82	31.55	29.32	22.29	17.51	14.18	21.87	24.32
8	1936	27.48	33.76	35.19	30.73	32.80	33.79	33.92	6.37	9.38	22.90	24.97	32.27
9	1937	28.58	32.81	31.93	29.67	29.31	32.46	33.05	26.18	19.97	23.13	24.77	29.25
10	1938	24.14	29.23	27.95	21.75	28.70	32.34	20.45	11.85	9.69	18.78	23.09	30.08
11	1939	34.82	35.15	35.51	28.03	28.83	32.25	32.17	21.88	20.41	21.93	25.93	30.89
12	1940	28.68	32.38	31.71	27.32	29.28	31.55	30.73	24.79	23.05	21.10	25.34	28.26
13	1941	28.58	32.43	31.89	27.38	29.18	32.27	31.75	25.89	21.17	22.47	23.75	27.51
14	1942	25.26	29.11	26.26	23.81	29.46	32.33	31.85	27.79	5.54	17.95	24.33	28.52
15	1943	25.36	31.16	29.87	22.24	23.57	30.52	-5.06	18.28	-8.22	-1.48	23.14	30.39
16	1944	36.20	36.09	32.49	28.99	28.48	30.62	32.67	25.90	20.79	22.28	26.64	30.09
17	1945	26.39	33.05	32.48	29.48	29.05	32.71	31.54	26.21	6.44	27.11	24.80	30.52
18	1946	25.17	29.78	28.86	23.40	27.86	32.32	17.15	7.61	3.80	14.26	21.55	28.44
19	1947	31.85	28.82	23.97	17.33	18.37	28.96	30.33	15.93	8.39	15.95	20.79	25.97
20	1948	19.42	24.23	26.45	15.65	23.48	31.56	28.12	-12.52	-18.78	18.26	18.15	24.90
21	1949	25.09	29.55	31.58	26.42	28.95	29.69	25.64	-2.97	16.06	23.40	26.64	30.88
22	1950	27.11	28.69	29.24	14.90	26.25	18.96	20.45	22.29	-18.71	-17.21	18.00	26.00
23	1951	24.82	19.90	19.44	6.90	0.08	15.63	17.18	10.16	7.66	2.15	22.99	26.76
24	1952	22.50	29.26	26.93	19.74	24.37	31.25	13.14	-8.86	8.37	18.51	25.49	29.61
25	1953	29.09	32.38	31.43	25.74	16.25	35.42	32.44	20.18	-17.55	6.15	20.58	26.17
26	1954	27.64	29.12	28.55	16.45	22.04	31.34	28.60	10.52	-10.31	-15.45	9.98	21.41
27	1955	30.53	30.78	28.90	27.09	28.78	30.95	31.74	23.75	-12.45	-11.04	20.95	28.48
28	1956	25.41	22.99	20.46	0.84	16.80	21.24	0.56	-3.14	-18.92	4.67	19.71	26.54
29	1957	25.99	27.01	25.29	24.29	26.92	31.68	25.38	-11.81	-17.01	21.71	20.94	26.42
30	1958	27.43	32.71	30.06	23.00	25.14	32.53	31.92	-1.19	-4.71	24.31	24.48	29.10
31	1959	27.43	27.87	23.34	8.48	15.48	32.46	28.54	20.94	-10.40	0.29	19.49	19.59
32	1960	10.40	22.81	28.14	24.93	25.14	33.13	18.64	22.65	1.91	19.15	21.44	29.37
33	1961	34.43	31.18	33.08	21.77	27.02	28.13	29.41	15.22	-10.59	27.51	23.22	27.82
34	1962	29.34	33.03	30.95	23.72	25.30	33.22	25.62	21.82	4.96	22.49	21.16	28.11
35	1963	28.70	29.95	24.70	25.08	21.04	33.55	30.16	23.49	4.04	19.06	20.30	26.52
36	1964	25.97	31.68	31.59	27.09	27.35	29.83	31.21	19.12	-19.18	-8.38	19.42	25.96
37	1965	24.77	29.14	16.43	2.44	-1.03	16.89	26.50	3.97	0.20	15.20	17.40	26.32
38	1966	30.57	32.58	30.61	25.36	26.66	31.70	33.93	26.49	14.06	18.67	23.84	28.86
39	1967	28.19	31.90	29.58	17.78	18.76	32.95	31.48	24.04	-17.86	6.43	20.79	26.14
40	1968	24.90	29.60	29.26	19.42	24.64	28.69	33.77	22.11	0.15	17.91	19.85	24.58
41	1969	24.15	25.78	27.84	10.61	19.99	30.23	2.07	-0.89	2.73	20.36	25.67	30.01
42	1970	29.62	28.03	29.77	23.34	24.78	33.33	30.92	20.22	-10.45	26.00	21.34	26.46
43	1971	28.02	29.58	29.90	5.92	-2.74	18.00	21.69	-7.68	-20.32	-3.94	16.58	24.97
44	1972	25.17	27.88	27.02	3.50	16.49	-16.39	12.13	-0.48	-19.85	-6.04	17.13	26.84
45	1973	26.58	30.39	27.74	23.74	27.91	30.49	31.67	25.79	21.27	22.16	26.76	29.64
46	1974	27.19	29.91	25.12	-10.05	1.63	-2.69	1.42	6.42	-20.08	-17.63	16.08	26.37
47	1975	32.36	31.15	29.51	22.66	25.88	31.07	30.35	18.17	-16.67	-8.65	20.28	25.78
48	1976	24.94	24.06	14.78	7.57	16.33	27.55	17.12	-1.62	-1.57	-1.53	6.61	25.30
49	1977	30.50	34.27	32.54	29.99	28.42	32.27	33.08	26.68	20.58	21.97	27.99	29.94
50	1978	26.17	31.50	29.81	24.19	28.88	32.41	28.31	17.96	12.05	14.35	21.41	26.21
51	1979	30.65	32.77	34.86	28.74	29.68	32.47	32.76	16.95	22.57	22.13	26.15	30.70
52	1980	28.80	34.45	32.68	25.07	29.45	32.38	29.74	-3.20	-2.38	22.62	24.89	29.19
53	1981	30.10	28.96	20.20	20.98	21.41	33.66	30.65	20.59	-12.55	15.58	18.24	24.38
54	1982	27.14	30.13	28.89	19.58	9.19	-7.86	28.52	9.35	-14.97	-14.06	18.21	23.92
55	1983	28.97	32.28	27.01	12.05	25.39	-1.16	32.88	19.84	6.99	-3.03	18.33	26.03
56	1984	32.33	23.85	27.56	14.43	24.06	24.54	28.06	21.15	-14.42	7.65	19.24	26.64
57	1985	25.93	29.50	30.37	26.24	25.78	32.99	31.53	21.22	22.27	22.50	25.96	32.41
58	1986	27.01	27.84	29.26	22.19	23.93	-6.84	21.53	23.34	1.86	24.34	22.28	27.90
59	1987	30.86	29.46	29.81	26.77	28.41	32.36	32.24	20.09	25.02	21.66	25.45	28.83
60	1988	28.71	32.50	34.05	31.06	29.71	32.72	34.49	28.55	20.79	21.29	26.53	29.49
61	1989	26.87	31.83	31.75	30.04	30.07	34.17	26.31	23.69	23.00	21.37	25.49	31.23
62	1990	31.43	31.82	26.92	21.48	23.81	31.23	30.27	25.12	1.96	12.75	20.73	27.55
63	1991	29.67	21.77	25.90	21.88	17.41	30.64	29.01	20.84	11.64	-1.55	18.89	25.18
64	1992	30.34	33.26	32.70	29.19	29.06	32.77	32.63	26.67	23.29	23.36	26.75	30.53
65	1993	28.74	32.31	30.98	28.66	28.82	32.21	32.44	13.99	17.79	21.41	24.84	31.08
66	1994	27.88	30.94	31.51	27.60	28.94	31.94	31.57	25.60	22.14	20.74	26.77	30.25
67	1995	27.79	31.06	32.17	28.55	28.18	30.63	34.95	20.05	-8.35	25.48	23.85	28.45
68	1996	24.23	16.77	0.44	-8.20	-7.51	-12.53	11.50	9.41	-7.68	3.92	21.29	27.34
69	1997	33.29	31.09	26.86	-7.66	-6.26	-5.31	-2.19	-13.77	-19.49	-8.82	19.74	24.37
70	1998	16.08	25.56	30.33	25.47	24.41	32.78	29.94	4.83	-5.24	19.56	20.94	28.56
71	1999	30.39	32.48	28.35	9.55	19.39	-2.68	26.92	17.88	-12.91	-9.54	13.24	27.39
72	2000	31.21	22.74	25.01	22.04	28.06	31.24	19.15	20.73	22.49	18.55	24.03	28.40
73	2001	31.98	34.80	32.62	28.41	29.84	32.60	33.90	27.52	21.78	24.96	28.80	28.79
74	2002	26.09	32.76	31.25	27.34	28.75	31.61	30.99	22.26	-4.17	9.78	21.86	30.04
75	2003	29.92	33.74	31.40	26.99	30.03	33.13	30.28	24.76	8.37	24.42	25.80	29.30
76	2004	29.69	31.71	30.49	27.07	29.31	32.32	31.89	26.77	19.29	22.09	24.37	29.54
77	2005	24.64	27.64	27.49	24.65	26.42	31.19	31.34	25.40	19.15	19.98	22.97	29.36
78	2006	27.73	28.29	29.18	18.42	20.75	33.52	16.80	2.78	-2.11	23.89	24.32	30.38
79	2007	32.30	30.15	28.42	23.98	27.80	23.16	31.84	22.78	18.34	17.95	23.11	29.49
80	2008	32.52	33.70	35.43	28.07	29.64	31.69	31.74	15.42	-15.01	16.48	20.73	25.30

Graveyard is the period of clock hours 01:00-04:00 each day.

Table 4.8
Variable Costs Sub-Categories of
Stand Ready Costs from the GARD Model

	A	B	C
		Annual Average MWh	**Annual Average $**
1	Energy Shift *dec*	354,691	6,599,765
2	Energy Shift Non-Spinning *inc*	245,629	4,570,430
3	Energy Shift Spinning *inc*	147,016	2,735,532
4	*Energy Shift Subtotal:*	*747,336*	*13,905,727*
5	Efficiency Loss *dec*	24,882	(2,935,824)
6	Efficiency Loss Non-Spinning	20,498	(2,418,589)
7	Efficiency Loss Spinning	2,796	(329,899)
8	*Efficiency Subtotal:*	*48,175*	*(5,684,312)*
9	Spill Losses Non-Spinning	47,923	1,174,391
10	Spill Losses Spinning	97,795	2,396,526
11	*Spill Subtotal:*	*145,718*	*3,570,917*
12	**Total**	**941,229**	**11,792,332**

Table 4.9
Variable Costs Components for Reserves Under 99.7% Level of Service with Self Supply of Generation Imbalance

	A	B	C
	Component	**Annual Average (MW)**	**Annual Average ($)**
1	Regulation Reserve *inc*	309	1,617,960
2	Regulation Reserve *dec*	327	1,450,595
3	Non-Regulation Reserve *inc*	371	1,948,018
4	Non-Regulation Reserve *dec*	499	2,213,346
5	Operating Reserves - Spinning	237	4,562,413
8	Total Variable Cost	917	11,792,332

Table 4.10
GARD Stand-ready Costs and EIM Cost Offsets

	A	B	C	D	E	F	G
		Regulation *inc*	**Regulation *dec***	**Non-regulation *inc***	**Non-regulation *dec***	**Operating Reserves Spinning**	**All Reserves**
1	**Energy shift**	$ 1,907,927	$ 1,710,567	$ 2,297,137	$ 2,610,016	$ 5,380,078	$ 13,905,727
2	**Efficiency**	$ (779,913)	$ (699,237)	$ (939,012)	$ (1,066,909)	$ (2,199,241)	$ (5,684,312)
3	**Spill**	$ 489,946	$ 439,265	$ 589,893	$ 670,238	$ 1,381,576	$ 3,570,917
4	**Total**	$ 1,617,960	$ 1,450,595	$ 1,948,018	$ 2,213,346	$ 4,562,413	$ 11,792,332
5	**50% Energy Shift Cost Offset**	$ -	$ -	$ 1,148,569	$ 1,305,008	$ -	$ 2,453,577
6	**50% Spill Cost Offset**	$ -	$ -	$ 294,946	$ 335,119	$ -	$ 630,065

Table 4.11
7HA.02 SCCT Frame Annual Costs

	A	B	C
2	Start Year of Operation (FY)	2022	
3	Cost of Debt	2.42%	/1
4			
5	Inflation Rate	1.66%	
6	Insurance Rate	0.25%	/2
7			
8	Debt Finance Period (years)	30	/2
9	Plant Lifecycle (years)	30	/2
10			
11	Plant in service 2022 Vintaged Heat Rate Btu/kWh	8,890	/3
12			
13	Eastside Fixed Fuel $/kW/yr with 10000 Heat Rate 2012$	$ 41.42	/4
14	Westside Fixed Fuel $/kW/yr with 10000 Heat Rate 2012$	$ 46.03	/4
15	Eastside Fixed Fuel $/kW/yr with 10000 Heat Rate 2022$	$ 48.85	
16	Westside Fixed Fuel $/kW/yr with 10000 Heat Rate 2022$	$ 54.29	
17	Average of Existing Eastside and Westside with 10000 Heat Rate 2022$	$ 51.57	
18	Average of Existing Eastside and Westside with 8890 Heat Rate 2022$	$ 45.85	
19			
20	All-in Nominal Capital Cost 7HA.02 SCCT Frame $/kW	$ 607.26	/5
21	Fixed O&M $/kW/yr 2022$	6.07	/5
22	Fixed Fuel $/kW/yr	$ 45.85	
23			
24			
25	/1 Source BPA FY 2020 Third-Party Tax-Exempt Borrowing Rate Forecast 30-year		
26	/2 Source NWPCC 7th Power Plan Appendix H.		
27	/3 Source NWPCC Microfin Model, Version 0.17 2021 Power Plan draft inputs		
28	/4 Source NWPCC Microfin Model, Version 15.0.5		
29	/5 Source NWPCC Microfin Model, Version 0.17 2021 Power Plan draft inputs in 2016 dollars		
30	/6 Source BP-22-FS-BPA-01A Power Rates Study Documentation Table 4.1.		

	D	E	F	G	H	I	J
1	**Calendar Year**	**Chained GDP IPD**		**Month**	**Load Shaping Rate HLH $/MWh**	**Demand Shaping Factor**	**Monthly Demand Rate $/kW/mo**
2	2015	104.62		Oct	29.92	8.50%	$ 7.01
3	2016	105.72		Nov	31.71	9.01%	$ 7.44
4	2017	107.71		Dec	38.76	11.01%	$ 9.09
5	2018	110.30		Jan	34.29	9.74%	$ 8.04
6	2019	112.27		Feb	34.79	9.88%	$ 8.15
7	2020	113.63		Mar	27.57	7.83%	$ 6.46
8				Apr	20.71	5.88%	$ 4.85
9		101.66%	5-year Ave.	May	16.28	4.62%	$ 3.81
10				Jun	17.15	4.87%	$ 4.02
11	Chained GDP IPD from BEA --			Jul	36.83	10.46%	$ 8.63
12	Table 1.1.9. Implicit Price			Aug	35.87	10.19%	$ 8.41
13	Deflators for Gross Domestic			Sep	28.15	8.00%	$ 6.60
14	Product (2012 Base year) - Last				**Average $/kW/mo**		**$ 6.88**
15	Revised August 27, 2020						

	D	E	F	G	H	I	J
20	**End of Fiscal Year**	**Midyear Assessed Value**	**Debt Payment**	**Fixed O&M**	**Insurance**	**Fixed Fuel**	**Cash Expense Each Year**
21	2022	$ 597.14	$28.70	$ 6.07	$ 1.49	$ 45.85	$ 82.12
22	2023	$ 576.90	$28.70	$ 6.17	$ 1.44	$ 46.61	$ 82.93
23			**Rate Period Average Expense $/kW/year**				**$ 82.52**

LMS100 Average Expense $/kW/mo /6	$9.67
7HA.02 SCCT Frame Average Expense $/kW/mo	$6.88
Expense Delta	$2.80

Table 4.12
Cost of Capacity Calculation

	A	B	C
	Annual Average of FY2022-FY2022	**No EIM Discount**	**With EIM Discount**
1	**Assumptions for Calculation:**		
2	Embedded Unit Cost of Capacity	$ 5.87	$ 5.87
3			
4	**Variable Costs:**		
5	Regulation inc	$ 0.44	$ 0.26
6	Regulation dec	$ 0.37	$ 0.37
7	Non-regulation inc	$ 0.44	$ 0.26
8	Non-regulation dec	$ 0.37	$ 0.10
9	Operating Reserves	$ 0.80	$ 0.80
10			
11	**Base Cost of Capacity by Reserve Type**		
12	Regulation inc (Line 2 + 5)	$ 6.31	$ 6.13
13	Regulation dec (Line 6)	$ 0.37	$ 0.37
14	Non-regulation inc (Line 2 + 7)	$ 6.31	$ 6.13
15	Non-regulation dec (Line 8)	$ 0.37	$ 0.10
16	Operating Reserves - Spinning and Supplemental (Line 2 + 9)	$ 6.67	$ 6.67
18			
19	**Rate Design Delta:**		
20	Inc value delta	$ 2.80	$ 2.80
21	Regulation inc weighted value delta	$ 1.53	$ 1.53
22	Non-regulation inc weighted value delta	$ (1.27)	$ (1.27)
23	Operating Reserves - Spinning value delta	$ 1.40	$ 1.40
24	Operating Reserves - Non Spinning value delta	$ (1.40)	$ (1.40)
25			
26	**Total Cost of Capacity by Reserve Type:**		
27	Regulation inc (Line 12 + 21)	$ 7.84	$ 7.66
28	Regulation dec (Line 13)	$ 0.37	$ 0.37
29	Non-regulation inc (Line 14 + 22)	$ 5.04	$ 4.86
30	Non-regulation dec (Line 15)	$ 0.37	$ 0.10
31	Operating Reserves - Spining (Line 16 + 23)	$ 8.07	$ 8.07
32	Operating Reserves - Supplemental (Line 16 + 24)	$ 5.27	$ 5.27

Table 4.13
Revenue Forecast

	A	B	C	D
1	**Cost of Capacity by Reserve Type (See Table 4.4)**	$ / kW-mo		
2	Regulation inc	$ 7.84		
3	Regulation dec	$ 0.37		
4	Non-regulation inc	$ 5.04		
5	Non-regulation dec	$ 0.37		
6	Operating Reserves - Spinning	$ 8.07		
7	Operating Reserves - Supplemental	$ 5.27		
8				
9	**Operating Reserve Quantity**	MW		
10	Operating Reserves Spinning	237		
11	Operating Reserves Supplemental	237		
12				
13	**Balancing Reserve Quantity**	**Non-Federal Generation (MW)**	**Load (MW)**	**Federal Generation (MW)**
14	Regulation Reserves inc	140	146	22.96
15	Regulation Reserves dec	148	155	24.35
16	Non-regulation Reserves inc	226	146	0.00
17	Non-regulation Reserves dec	303	196	0.01
18				
19	**Revenue Forecast ($ in Thousands)**	**Non-Federal Generation**	**Load**	**Federal Generation***
20	(Cost from A1 * Quantity from A9 or A13 * 12)			
21	Balancing Reserves - Regulation inc	$13,158	$13,709	$2,160
22	Balancing Reserves - Regulation dec	$659	$686	$108
23	Balancing Reserves - Non-regulation inc	$13,650	$8,816	$0
24	Balancing Reserves - Non-regulation dec	$1,347	$870	$0
25	**Balancing Reserves - Total**	$28,814	$24,082	$2,268
26				
27	Operating Reserves Spinning	$22,924		
28	Operating Reserves Supplemental	$14,970		
29	**Operating Reserves - Total**	$37,894		
30				
31	**Total Revenue Forecast (B25 + C25 + B29)**	$90,790		
32				
33		$/kW-mo		
34	**Average Cost of Balancing Reserves ((B25+C25)/((B14+C14+B16+C16)*12)**	$6.71		
35	**Average Cost of Operating Reserves (B29/((B10+B11)*12)**	$6.67		

*Federal Generation Balancing Costs are not included in the Total Revenue Forecast because these costs are paid for by Power Customers

Table 5.1
Synchronous Condenser Projected Motoring Hours, Hourly Energy Consumption and Energy Costs

	A	B	C	D	E	F	G	H	I	J
	Generating Project	**Nameplate rating (MW/unit)**	**Motoring power consumption (MW/unit)**	**Projected Units to be used**	**Condensing Hours FY 2018**	**Condensing Hours FY 2019**	**Condensing Hours FY 2020**	**Average Annual Condensing hours/year [(E+F+G)/3]**	**Energy Consumption MWhrs/year [H * C]**	**Total Cost of Energy [I * Market Price Forecast of energy]**
1	**John Day, units 11-14**	155	3.0	units 11-14	1,582	4,472	4,735	3,596	10,789	$ 293,461
2	**The Dalles, units 15-20**	99	1.5	units 15-20	870	430	1,177	826	1,239	$ 33,687
3								**SUBTOTAL - SOUTHERN INTERTIE***	**12,028**	**$ 327,148**
4	**Grand Coulee, units 19-24**	690 (units 19-21) 805 (units 22-24)	11.0	units 19-21	1,160	1,224	1,168	1,184	13,024	$ 354,253
5	**Dworshak (small units)**	103	4.0	units 1-2	1	55	0	19	75	$ 2,031
6	**Dworshak (big unit)**	259	8.0	unit 3	0	10	45	18	147	$ 3,989
7	**Palisades, units 1-4**	44	0.6	units 1-4	9	4,264	4,996	3,090	1,854	$ 50,423
8	**Detroit, units 1-2**	58	2.0	units 1-2	NA	NA	NA	0	0	$ -
9	**Green Peter, units 1-2**	46	1.2	units 1-2	NA	NA	NA	0	0	$ -
10	**Lookout Point, units 1-3**	46	1.1	units 1-3	NA	NA	NA	0	0	$ -
11	**Hungry Horse, units 1-4**	107	2.5	units 1-4	0	0	0	0	0	$ -
12								**SUBTOTAL - NETWORK***	**15,099**	**$ 410,696**
13								**TOTAL ENERGY COST**	**27,127**	**$ 737,844**
14	**Market Price Forecast of energy ($/MWh)**	**$ 27.20**								

***Synchronous condensing costs for the John Day and The Dalles projects are allocated to the Southern Intertie segment. Costs of all other projects are allocated to the Network segment.**

Table 5.2
Determination of Synchronous Condenser Plant Modification Costs*
($ thousands)

	A	B	C	D
		FY 2022	**FY 2023**	**Annual Average of FY 2022 - FY2023**
1	**Synchronous Condensers Net Plant**	$ 5,598	$ 5,495	$ 5,547
2	Total Corps/Reclamation Average Net Plant	$ 6,289,890	$ 6,421,851	$ 6,355,871
3	**percent**	0.09%	0.09%	0.09%
4	Corps/Reclamation Net Interest	$ 25,574	$ 21,327	$ 23,451
5	**Sync Cond Net Interest**	$ 23	$ 18	$ 21
6	Corps/Reclamation MRNR	$ 54,846	$ 86,446	$ 70,646
7	**Sync Cond MRNR**	$ 49	$ 74	$ 62
8	**Sync Cond Depreciation**	$ 103	$ 103	$ 103
9	**Total Sync Cond Plant Modification Costs**	$ 175	$ 195	$ 185

* These are costs for plant modifications at John Day and The Dalles to enable synchronous condenser operation. These costs are allocated to the Southern Intertie segment.

Table 5.3
Summary of Synchronous Condenser Costs
($)

	A	B	C	D
		FY 2022	**FY 2023**	**Annual Average of FY2022 - FY2023**
1	Modifications at John Day and The Dalles*	$ 175,000	$ 195,000	$ 185,000
2	**Energy Consumption - John Day and The Dalles**	$ 327,148	$ 327,148	$ 327,148
3	**Subtotal - Southern Intertie**	**$ 502,148**	**$ 522,148**	**$ 512,148**
4	**Energy Consumption - Network**	$ 410,696	$ 410,696	$ 410,696
5	**Total Synchronous Condenser Costs**	**$ 912,844**	**$ 932,844**	**922,844**

* These are costs for plant modifications at John Day and The Dalles to enable synchronous condenser operation. These costs are allocated to the Southern Intertie segment.

Table 6.1
ESTIMATED COSTS OF "GENERATION DROP" OF UNIT 22, 23, OR 24 AT THE GRAND COULEE THIRD POWERHOUSE

	Equipment	Incremental Equipment Deterioration, Replacement or Overhaul Costs			Incremental Routine Operation and Maintenance Costs			Incremental Lost Revenue In The Event of Replacement or Overhaul				Total Cost Per Drop
		% Life Reduction Per Drop	Cost of Major Overhaul (1)	Cost/Drop	% Increase O&M Per Drop	Annual O&M Cost	Cost/Drop	Probability of Failure	Months of Downtime	Downtime Cost (2)	Cost/Drop	
	A	B	C	D	E	F	G	H	I	J	K	L
1	550kV Circuit Breaker (50% of replacement)	0.04%	$ 865,000	$ 346	0.04%	$ 5,375	$ 2	0.04%	1	$ 1,178,667	$ 471	**$ 820**
2	Main Power Transformer (equal to replacement)	0.015%	$ 9,872,937	$ 1,481	0.015%	$ 62,087	$ 9	0.018%	1	$ 1,178,667	$ 212	**$ 1,702**
3	Generator (rewinding)	0.71%	$ 21,971,000	$ 155,994	0.71%	$ 489,483	$ 3,475	0.71%	18	$ 21,216,000	$ 150,634	**$ 310,103**
4	Turbine (refurbished)	0.24%	$ 1,730,000	$ 4,152	0.24%	$ 489,483	$ 1,175	0.05%	16	$ 18,858,667	$ 9,429	**$ 14,756**
5	500 kV Cable (replacement)	0.055%	$ 6,508,260	$ 3,580	0.055%	$ 306,502	$ 169	0.055%	1	$ 1,178,667	$ 648	**$ 4,396**
6	**Total Cost Per Drop**			**$ 165,553**			**$ 4,830**				**$ 161,395**	**$ 331,778**
7	**Total Generation Dropping Cost per year** (3)			**$ 364,955**								

(1) Updated to FY 2022-FY 2023 from original Harza Engineering Company study using the Handy-Whitman Index to calculate cost multiplier

1.73

(2) The downtime cost from last unit out at Coulee analysis, assumes normal unit availability at Coulee and then the loss of an additional big unit. The current Value of Availability is adjusted to forecasted average market price for energy ($27.20) during the FY 2022-2023 rate period. This analysis assumes that the overhauls in the Nathaniel Washington Third Powerplant are completed prior to FY2022-2023.

(3) Drops per year 1.1

Table 7.1 Redispatch Costs FY 2016 to August 2020						
	Fiscal Year	**Discretionary**	**NT Redispatch: Transmission Purchases**	**NT Redispatch: FCRPS Redispatch (INC/DEC)**	**Emergency**	**Total**
	A	B	C	D	E	F
1	**2011**	$11,355	$470,500	$0	$0	$481,855
2	**2012**	$35,858	$528,192	$0	$74,690	$638,740
3	**2013**	$93,574	$259,862	$254	$788	$354,478
4	**2014**	$62,646	$84,886	$0	$24,458	$171,990
5	**2015**	$12,309	$40,605	$4,932	$0	$57,846
6	**2016**	$15,551	$128,615	$9,100	$22,117	$175,383
7	**2017**	$8,136	$152,392	$1,381	$0	$161,909
8	**2018**	$15,133	$887,672	$0	$0	$902,804
9	**2019**	$16,033	$286,534	$0	$0	$302,568
10	**2020 (through Aug)**	$0	$243,385	$9,100	$0	$252,485
11	**Total FY2016-2020 (Aug):**	$54,853	$1,698,598	$19,581	$22,117	$1,795,149
12	**FY Average:**	$11,157	$345,478	$3,983	$4,498	$377,926
13	**FY22-23 Forecast:**	$11,000	$355,000	$4,000	$0	$370,000

Table 8.1
Load Factor Calculation for Station Service Energy Use Analysis

	Substation Name	Installed Transformation (kVA)	Historical Average Monthly Use (kWh)	Calculated Load Factor
	A	B	C	D
1	**Large**			
2	Alvey	2,267	96,923	
3	Bell	2,250	149,000	
4	Snohomish	1,250	78,000	
5	Olympia	1,100	132,738	
6	Covington	946	108,333	
7	Pearl	875	28,067	
8	Longview	825	38,317	
9	McNary	800	108,717	
10	Chemawa	725	18,140	
11	Anaconda	600	42,910	
12	Columbia	600	18,292	
13	John Day	500	65,896	
14	Santiam	400	25,740	
15	St. Johns	310	15,858	
16	Port Angeles	300	49,920	
17	Valhalla	300	17,592	
18	Fairview	300	12,560	
19	**Subtotal**	14,348	1,007,003	
20	**Medium**			
21	Oregon City	225	13,663	
22	Walla Walla	150	6,919	
23	LaGrande	150	5,663	
24	Ellensburg	100	3,897	
25	Roundup	75	5,708	
26	Boardman	75	1,595	
27	Drain	65	1,654	
28	Reedsport	55	3,922	
29	**Subtotal**	895	43,021	
30	**Small**			
31	Sappho	45	2,363	
32	Lookout Point	40	3,387	
33	The Dalles	38	2,657	
34	Bandon	25	1,746	
35	Gardiner	25	1,402	
36	Creston	15	1,122	
37	Hauser	10	1,525	
38	Duckabush	10	1,192	
39	Ione	5	1,028	
40	**Subtotal**	213	16,422	
41	**TOTAL**	**15,456**	**1,066,446**	**9.452%**

Calculated Load Factor is the Historical Average Monthly Use divided by Installed Transformation divided by 730 average hours in the month.
D = C / B / 730.

Table 8.2
Calculation of Station Service Use and Cost

	Facility Type	Installed Transformation (kVA)	Average Monthly Use[1] (kWh)	Annual Station Service Use[2] (MWh)	Transmission Losses[3] (MWh)	Annual Average Market Price Forecast ($/MWh)	Real Power Losses Capacity Charge ($/MWh)	Cost Allocation for Station Service per Year[4] ($)
	A	B	C	D	E	F	G	H
1	Large	40,253	2,777,376					
2	Medium	5,998	413,855					
3	Small	1,448	99,910					
4	Big Eddy/Celilo Complex		1,822,937					
5	Ross Complex		1,749,300					
6	**Total**	**47,699**	**6,863,378**	**82,361**	**1,680**	**$27.20**	**$5.52**	**$ 2,295,181**

1/ For Large, Medium and Small substations, the calculated average monthly use is installed transformation times 9.452% average calculated load factor times 730 average hours in month (B * 0.09452% * 730). Historical usage is metered for Big Eddy/Celilo and Ross Complexes.

2/ Annual Station Service Use is the Average Monthly Use times 12 months divided by 1000 to convert from kWh to MWh.

3/ Transmission Losses associated with Annual Station Service is based on the BPA Transmission Network Loss Factor of 2.04% (D * 0.0204)

4/ Cost Allocation for Station Service per Year is the sum of (i) the amount of Annual Station Service Use plus Transmission Losses multiplied by the Annual Average Market Price Forecast ((D+E)*F); and (ii) Transmission Losses multiplied by the Real Power Losses Capacity Rate (E*G).

BONNEVILLE POWER ADMINISTRATION
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