

Appendix H

Avoided Cost

2025 WA IRP

Appendix H – Introduction

The purpose of this document is to present the inputs into Cascade’s avoided cost calculation, as well as the sources for these inputs. The data itself is sourced from a number of processes integral to the 2025 IRP, specifically the resource integration and distribution system planning sections. Once calculated, these figures are sent to Cascade’s energy efficiency team, where they are used to generate Cascade’s Conservation Potential Assessment (CPA). Beginning on Page 13, Cascade has provided an explanation regarding the upstream emissions calculation, which is used in the avoided cost calculation. Resource Planning appreciates its partnership with the energy efficiency team, as the CPA is a vital element to forecasting energy efficiency savings over the 26-year planning horizon.

Avoided Cost Workbook

Summary of tabs

Name	Description
FINAL CALCULATION	Aggregator of data from all other tabs. Currently costs past 20 years = 20th year cost
INCRM FIXED TRANSPORT	Fixed cost of contracts that will be used to solve pre-DSM identified shortfalls
VARIABLE TRANSPORT	Variable cost of Contracts. Once a shortfall is identified this should only use new contract costs
FUEL	Average fuel loss across all of Cascade's Contracts
INCRM FIXED STORAGE	Fixed cost of storage contracts that are selected as cost effective pre-DSM
VARIABLE STORAGE	Variable cost of storage contracts. Once a shortfall is identified this should only use new contract costs
COMMODITY COST	Price of gas based on CNGC price forecast. Can be modified for either Peak AC or annual. Need to input weights for each zone, which should be calculated by SENDOUT supply take by zone
CARBON TAX	Adder to the commodity cost based on the desired carbon scenario
ENVIRONMENTAL ADDER	Should stay 10% as per NWPCC recommendation unless scenario analysis
DISTRIBUTION SYSTEM	Weighted average authorized margin, currently for Washington core cust.
RISK PREMIUM	Theoretical Cost to fully hedge natural gas portfolio
INFLATION	Estimated rate of inflation, modeled off the CPI.

Avoided Cost Workbook

Color Code

You should change this box

You probably don't need to change this box

Don't change this box

Result that will go into the final calculation

Current Avoided Cost Formula

$$AC_{nominal} = TC_f + TC_v + SC + (CC * C_{tax} * E_{adder}) + DSC + RP$$

Real 2021\$ Avoided Cost (By Zone)							
	Zone 1	Zone 2	Zone 3	Zone 4	Oregon	Washington	System
2025	\$ 1.379	\$ 1.379	\$ 1.379	\$ 1.379	\$ 1.379	\$ 1.379	\$ 1.379
2026	\$ 1.384	\$ 1.384	\$ 1.384	\$ 1.384	\$ 1.384	\$ 1.384	\$ 1.384
2027	\$ 1.410	\$ 1.410	\$ 1.410	\$ 1.410	\$ 1.410	\$ 1.410	\$ 1.410
2028	\$ 1.398	\$ 1.398	\$ 1.398	\$ 1.398	\$ 1.398	\$ 1.398	\$ 1.398
2029	\$ 1.359	\$ 1.359	\$ 1.359	\$ 1.359	\$ 1.359	\$ 1.359	\$ 1.359
2030	\$ 1.242	\$ 1.242	\$ 1.242	\$ 1.242	\$ 1.242	\$ 1.242	\$ 1.242
2031	\$ 1.300	\$ 1.300	\$ 1.300	\$ 1.300	\$ 1.300	\$ 1.300	\$ 1.300
2032	\$ 1.288	\$ 1.288	\$ 1.288	\$ 1.288	\$ 1.288	\$ 1.288	\$ 1.288
2033	\$ 1.265	\$ 1.265	\$ 1.265	\$ 1.265	\$ 1.265	\$ 1.265	\$ 1.265
2034	\$ 1.238	\$ 1.238	\$ 1.238	\$ 1.238	\$ 1.238	\$ 1.238	\$ 1.238
2035	\$ 1.209	\$ 1.209	\$ 1.209	\$ 1.209	\$ 1.209	\$ 1.209	\$ 1.209
2036	\$ 1.018	\$ 1.018	\$ 1.018	\$ 1.018	\$ 1.018	\$ 1.018	\$ 1.018
2037	\$ 0.919	\$ 0.919	\$ 0.919	\$ 0.919	\$ 0.919	\$ 0.919	\$ 0.919
2038	\$ 0.897	\$ 0.897	\$ 0.897	\$ 0.897	\$ 0.897	\$ 0.897	\$ 0.897
2039	\$ 0.883	\$ 0.883	\$ 0.883	\$ 0.883	\$ 0.883	\$ 0.883	\$ 0.883
2040	\$ 0.852	\$ 0.852	\$ 0.852	\$ 0.852	\$ 0.852	\$ 0.852	\$ 0.852
2041	\$ 0.801	\$ 0.801	\$ 0.801	\$ 0.801	\$ 0.801	\$ 0.801	\$ 0.801
2042	\$ 0.723	\$ 0.723	\$ 0.723	\$ 0.723	\$ 0.723	\$ 0.723	\$ 0.723
2043	\$ 0.701	\$ 0.701	\$ 0.701	\$ 0.701	\$ 0.701	\$ 0.701	\$ 0.701
2044	\$ 0.690	\$ 0.690	\$ 0.690	\$ 0.690	\$ 0.690	\$ 0.690	\$ 0.690
2045	\$ 0.669	\$ 0.669	\$ 0.669	\$ 0.669	\$ 0.669	\$ 0.669	\$ 0.669
2046	\$ 0.650	\$ 0.650	\$ 0.650	\$ 0.650	\$ 0.650	\$ 0.650	\$ 0.650
2047	\$ 0.631	\$ 0.631	\$ 0.631	\$ 0.631	\$ 0.631	\$ 0.631	\$ 0.631
2048	\$ 0.613	\$ 0.613	\$ 0.613	\$ 0.613	\$ 0.613	\$ 0.613	\$ 0.613
2049	\$ 0.596	\$ 0.596	\$ 0.596	\$ 0.596	\$ 0.596	\$ 0.596	\$ 0.596
2050	\$ 0.579	\$ 0.579	\$ 0.579	\$ 0.579	\$ 0.579	\$ 0.579	\$ 0.579
2051	\$ 0.563	\$ 0.563	\$ 0.563	\$ 0.563	\$ 0.563	\$ 0.563	\$ 0.563
2052	\$ 0.548	\$ 0.548	\$ 0.548	\$ 0.548	\$ 0.548	\$ 0.548	\$ 0.548
2053	\$ 0.533	\$ 0.533	\$ 0.533	\$ 0.533	\$ 0.533	\$ 0.533	\$ 0.533
2054	\$ 0.519	\$ 0.519	\$ 0.519	\$ 0.519	\$ 0.519	\$ 0.519	\$ 0.519
2055	\$ 0.505	\$ 0.505	\$ 0.505	\$ 0.505	\$ 0.505	\$ 0.505	\$ 0.505
2056	\$ 0.491	\$ 0.491	\$ 0.491	\$ 0.491	\$ 0.491	\$ 0.491	\$ 0.491
2057	\$ 0.478	\$ 0.478	\$ 0.478	\$ 0.478	\$ 0.478	\$ 0.478	\$ 0.478
2058	\$ 0.465	\$ 0.465	\$ 0.465	\$ 0.465	\$ 0.465	\$ 0.465	\$ 0.465
2059	\$ 0.452	\$ 0.452	\$ 0.452	\$ 0.452	\$ 0.452	\$ 0.452	\$ 0.452
2060	\$ 0.440	\$ 0.440	\$ 0.440	\$ 0.440	\$ 0.440	\$ 0.440	\$ 0.440
2061	\$ 0.428	\$ 0.428	\$ 0.428	\$ 0.428	\$ 0.428	\$ 0.428	\$ 0.428
2062	\$ 0.417	\$ 0.417	\$ 0.417	\$ 0.417	\$ 0.417	\$ 0.417	\$ 0.417
2063	\$ 0.406	\$ 0.406	\$ 0.406	\$ 0.406	\$ 0.406	\$ 0.406	\$ 0.406
2064	\$ 0.395	\$ 0.395	\$ 0.395	\$ 0.395	\$ 0.395	\$ 0.395	\$ 0.395
2065	\$ 0.384	\$ 0.384	\$ 0.384	\$ 0.384	\$ 0.384	\$ 0.384	\$ 0.384
2066	\$ 0.374	\$ 0.374	\$ 0.374	\$ 0.374	\$ 0.374	\$ 0.374	\$ 0.374
2067	\$ 0.364	\$ 0.364	\$ 0.364	\$ 0.364	\$ 0.364	\$ 0.364	\$ 0.364
2068	\$ 0.354	\$ 0.354	\$ 0.354	\$ 0.354	\$ 0.354	\$ 0.354	\$ 0.354
2069	\$ 0.344	\$ 0.344	\$ 0.344	\$ 0.344	\$ 0.344	\$ 0.344	\$ 0.344
2070	\$ 0.335	\$ 0.335	\$ 0.335	\$ 0.335	\$ 0.335	\$ 0.335	\$ 0.335

Discount Rate

6.09%

Source: <https://www.zillow.com/mortgage-rates/30-year-fixed/>

As of - 8/15/2024

Incremental Fixed Transportation

Total Cost - \$/dth	
2025	0
2026	0
2027	0
2028	0
2029	0
2030	0
2031	0
2032	0
2033	0
2034	0
2035	0
2036	0
2037	0
2038	0
2039	0
2040	0
2041	0
2042	0
2043	0
2044	0
2045	0
2046	0
2047	0
2048	0
2049	0
2050	0

Variable Transportation

Total Cost \$/dth	
2025	0.008868424
2026	0.008868424
2027	0.008868424
2028	0.008868424
2029	0.008868424
2030	0.008868424
2031	0.008868424
2032	0.008868424
2033	0.008868424
2034	0.008868424
2035	0.008868424
2036	0.008868424
2037	0.008868424
2038	0.008868424
2039	0.008868424
2040	0.008868424
2041	0.008868424
2042	0.008868424
2043	0.008868424
2044	0.008868424
2045	0.008868424
2046	0.008868424
2047	0.008868424
2048	0.008868424
2049	0.008868424
2050	0.008868424

Contracts	
Contract	Cost
GTN13687	0.004188618
GTN13688	0.004188618
GTN17019W	0.001364454
GTN17021	0.003422916
GTN17022	0.003562776
GTN17023	0.005168016
GTN17025	0.00537768
GTN17026	0.00552258
GTN17028	0.005726826
GTN17031	0.005911794
GTN17033	0.00609714
GTN17034	0.006312222
GTN17036	0.006544944
GTN17037	0.007716996
GTN2023	0.007716996
GTN18507	0.007716996
NWP100002N	0.00935
NWP100134N11	0.00935
NWP100149S	0.00935
NWP100150N	0.00935
NWP100302	0.00935
NWP139090Z26	0.00935
NWP139382	0.00935
NWP139383	0.00935
NWP139384	0.00935
NWP139624	0.00935
NWP139630MEO	0.00935
NWP139637Z3W	0.00935
NWP140047DC	0.00935
NWP140748Z26	0.00935
NWP143463	0.00935
RUBY6103600B	0.057
Average	0.008868424

Fuel

Total Cost - dth	
2025	0.004480688
2026	0.004480688
2027	0.004480688
2028	0.004480688
2029	0.004480688
2030	0.004480688
2031	0.004480688
2032	0.004480688
2033	0.004480688
2034	0.004480688
2035	0.004480688
2036	0.004480688
2037	0.004480688
2038	0.004480688
2039	0.004480688
2040	0.004480688
2041	0.004480688
2042	0.004480688
2043	0.004480688
2044	0.004480688
2045	0.004480688
2046	0.004480688
2047	0.004480688
2048	0.004480688
2049	0.004480688
2050	0.004480688

Existing Contracts

Contract	Cost
GTN13687	0.0038
GTN13688	0.0038
GTN17019W	0.0038
GTN17021	0.0038
GTN17022	0.0038
GTN17023	0.0038
GTN17025	0.0038
GTN17026	0.0038
GTN17028	0.0038
GTN17031	0.0038
GTN17033	0.0038
GTN17034	0.0038
GTN17036	0.0038
GTN17037	0.0038
JPWD-100302	0.84
JPWD-139624	0.84
NWP100002S	0.84
NWP100064MEO	0.84
NWP100134S3S	0.84
NWP100149N	0.84
NWP100150S	0.84
NWP132329MEO	0.84
NWP135558P3W	0.84
NWP139090Z26	0.84
NWP139382	0.84
NWP139383	0.84
NWP139384	0.84
NWP139630MEO	0.84
NWP139637Z3W	0.84
NWP140047DC	0.84
NWP140748Z26	0.84
GTN18057	0.005
Average	0.44806875

Fixed Storage

Total Cost \$/dth	
2025	0
2026	0
2027	0
2028	0
2029	0
2030	0
2031	0
2032	0
2033	0
2034	0
2035	0
2036	0
2037	0
2038	0
2039	0
2040	0
2041	0
2042	0
2043	0
2044	0
2045	0
2046	0
2047	0
2048	0
2049	0
2050	0

Variable Storage

Total Cost \$/dth		
2025		0
2026		0
2027		0
2028		0
2029		0
2030		0
2031		0
2032		0
2033		0
2034		0
2035		0
2036		0
2037		0
2038		0
2039		0
2040		0
2041		0
2042		0
2043		0
2044		0
2045		0
2046		0
2047		0
2048		0
2049		0
2050		0

Commodity Cost - Calculated From Price Forecast												
\$/dth	Zone 1	Zone 2	Zone 3	Zone 4	Oregon	Washington	System	Basin Weights (From SENDOUT)				
	2025	3.125356	3.125356	3.125356	3.125356	3.125356	3.12535602	3.125356	Aeco	Rockies	Sumas	
	2026	3.373633	3.373633	3.373633	3.373633	3.373633	3.37363283	3.373633	Zone 1	0.2	0.3	0.5
	2027	3.373981	3.373981	3.373981	3.373981	3.373981	3.3739808	3.373981	Zone 2	0.2	0.3	0.5
	2028	3.296597	3.296597	3.296597	3.296597	3.296597	3.29659691	3.296597	Zone 3	0.2	0.3	0.5
	2029	3.27065	3.27065	3.27065	3.27065	3.27065	3.27064953	3.27065	Zone 4	0.2	0.3	0.5
	2030	3.330322	3.330322	3.330322	3.330322	3.330322	3.33032179	3.330322	Oregon	0.2	0.3	0.5
	2031	3.401006	3.401006	3.401006	3.401006	3.401006	3.40100628	3.401006	Washington	0.2	0.3	0.5
	2032	3.549504	3.549504	3.549504	3.549504	3.549504	3.54950351	3.549504	System	0.2	0.3	0.5
	2033	3.683862	3.683862	3.683862	3.683862	3.683862	3.68386181	3.683862				
2034	3.703494	3.703494	3.703494	3.703494	3.703494	3.70349428	3.703494					
2035	3.792365	3.792365	3.792365	3.792365	3.792365	3.79236514	3.792365					
2036	3.8209	3.8209	3.8209	3.8209	3.8209	3.82089955	3.8209					
2037	3.773809	3.773809	3.773809	3.773809	3.773809	3.77380894	3.773809					
2038	3.882548	3.882548	3.882548	3.882548	3.882548	3.88254752	3.882548					
2039	4.014382	4.014382	4.014382	4.014382	4.014382	4.01438161	4.014382					
2040	4.282065	4.282065	4.282065	4.282065	4.282065	4.28206493	4.282065					
2041	4.3492	4.3492	4.3492	4.3492	4.3492	4.3492	4.3492					
2042	4.475112	4.475112	4.475112	4.475112	4.475112	4.47511171	4.475112					
2043	4.409227	4.409227	4.409227	4.409227	4.409227	4.4092271	4.409227					
2044	4.60372	4.60372	4.60372	4.60372	4.60372	4.60371951	4.60372					
2045	4.714961	4.714961	4.714961	4.714961	4.714961	4.71496129	4.714961					
2046	4.659459	4.659459	4.659459	4.659459	4.659459	4.65945857	4.659459					
2047	4.752236	4.752236	4.752236	4.752236	4.752236	4.75223563	4.752236					
2048	4.883262	4.883262	4.883262	4.883262	4.883262	4.88326222	4.883262					
2049	4.870033	4.870033	4.870033	4.870033	4.870033	4.8700328	4.870033					
2050	4.893976	4.893976	4.893976	4.893976	4.893976	4.8939759	4.893976					
									Forecast Type? Annual			

Commodity Cost			
Price Forecast (Annual)			
	Aeco	Rockies	Sumas
2025	3.236616	1.961084	3.779415
2026	3.67185	2.313423	3.890472
2027	3.821366	2.491224	3.724681
2028	3.938886	2.49571	3.520213
2029	4.160888	2.511761	3.369887
2030	4.31701	2.559306	3.398256
2031	4.48352	2.602514	3.447096
2032	4.588075	2.823837	3.569475
2033	4.719699	2.926712	3.723817
2034	4.834972	2.935581	3.711652
2035	4.945763	3.005496	3.803127
2036	4.97731	3.006097	3.847217
2037	5.01125	2.897673	3.804514
2038	5.124375	2.917413	3.964897
2039	5.241679	3.039751	4.108241
2040	5.511091	3.471771	4.276631
2041	5.556115	3.561939	4.33879
2042	5.674714	3.67686	4.474222
2043	5.734562	3.579375	4.377005
2044	5.946787	3.744818	4.581834
2045	6.064224	3.84475	4.697383
2046	6.090773	3.81859	4.591454
2047	6.164339	3.924318	4.684145
2048	6.282572	4.051436	4.822634
2049	6.333703	4.067315	4.766195
2050	6.36133	4.081522	4.794506

Carbon Compliance Cost			
	Combined	Combined	
\$/dth	Washington	Oregon	System
2025			
2026			
2027			
2028			
2029			
2030			
2031			
2032			
2033			
2034			
2035			
2036			
2037			
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2040			
2041			
2042			
2043			
2044			
2045			
2046			
2047			
2048			
2049			
2050			

Carbon Forecast		
	SCC 2.5%	
Year	\$/ton	\$/dth
2025		
2026		
2027		
2028		
2029		
2030		
2031		
2032		
2033		
2034		
2035		
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2043		
2044		
2045		
2046		
2047		
2048		
2049		
2050		

CCA Forecast		
	CCA	
Year	\$/ton	\$/dth
2025		
2026		
2027		
2028		
2029		
2030		
2031		
2032		
2033		
2034		
2035		
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2040		
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2042		
2043		
2044		
2045		
2046		
2047		
2048		
2049		
2050		

Combined		
	Combined	
Year	\$/ton	\$/dth
2025		
2026		
2027		
2028		
2029		
2030		
2031		
2032		
2033		
2034		
2035		
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2049		
2050		

Upstream Emissions Calculation

CNGC Emission Factor for Upstream Natural Gas System (assumed % of GHG emitted upstream of natural gas delivered)	0.97%	0.00852248	Upstream Emission Rate, CH4 g/mmbtu	Upstream Emission Rate, CO2e g/mmbtu	End Use Emission Rate, CO2e g/mmbtu (based on Table NN-2 of 40 CFR Part 98 Subpart NN and company heating value)	Total Emission Rate CO2e Metric Tons/therm
				160	4,309	48,786
						0.005310
						53,095

Upstream Natural Gas System GHG Emission Rates (assumed % of GHG lost upstream of natural gas delivered)	
GHGenius - from Puget Sound Clean Air Agency LCA Worksheet for PSE Tacoma LNG Facility (Canada supply)	0.77%
2020 EPA Annual GHG Inventory of US GHG Emissions and Sinks (1990-2018) (US Rockies supply)	1.43%
	Source: IPCC Sixth Assessment 27 Report
GWP of Methane - 100 yr therms per mmbtu - conversion	10

CNGC Gas Supply	%
Sumas (BC Canada)	50.0%
AECO (AB Canada)	20.0%
US Rockies	30.0%

1)	unit of delivered natural gas - 1 mmbtu & mcf equivalent	mmbtu	mcf		
		1	0.919		
2)	Assumption on the % of the delivered gas that is methane	% CH ₄	mcf of CH ₄		
		93.4	0.859		
3)	Calculation of the amount of methane in a delivered unit of natural gas	lb/mmbtu	g/mmbtu	lb/mcf	g/mcf
		36.350	16,488	39.535	17,933

EIA	Mcf NatGas	mmbtu NatGas - 2021 EPA eGGRT Cascade WA Subpart NN Report Value	Metric Ton CH4 in 1 Mcf of CH4
https://www.eia.gov/tools/faqs/faq.php?id=45&t=8	1	1.08761	0.0192

From 40 CFR Part 98 Subpart W Equation W-36

pi = Density of GHGi. Use 0.0526 kg/ft3 for CO2 and N2O, and 0.0192 kg/ft3 for CH4 at 60 °F and 14.7 psia.

Metric Ton MT	Grams g	Ton	lbs
1	1,000,000	1.10231	2204.62

Environmental Adder		
System	Adder	10%
2025	110%	
2026	110%	
2027	110%	
2028	110%	
2029	110%	
2030	110%	
2031	110%	
2032	110%	
2033	110%	
2034	110%	
2035	110%	
2036	110%	
2037	110%	
2038	110%	
2039	110%	
2040	110%	
2041	110%	
2042	110%	
2043	110%	
2044	110%	
2045	110%	
2046	110%	
2047	110%	
2048	110%	
2049	110%	
2050	110%	

Risk Premium

Year	System Risk Premium
2025	-0.029341722
2026	-0.025652789
2027	0.014388907
2028	0.012476627
2029	0.011886618
2030	0.012421978
2031	-0.01109248
2032	-0.010756051
2033	-0.014448533
2034	-0.043470952
2035	-0.052403689
2036	-0.052896475
2037	0.029504743
2038	0.035963717
2039	0.106875595
2040	0.142497402
2041	0.208387731
2042	0.172879096
2043	0.205475869
2044	0.297357673
2045	0.331500414
2046	0.397276475
2047	0.219838451
2048	0.152519058
2049	0.092258005
2050	0.033367183

Inflation

Year	System Inflation Factor
2025	3.00%
2026	2.99%
2027	3.02%
2028	3.07%
2029	3.11%
2030	3.15%
2031	3.18%
2032	3.19%
2033	3.20%
2034	3.21%
2035	3.21%
2036	3.22%
2037	3.22%
2038	3.23%
2039	3.23%
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2041	3.24%
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2043	3.24%
2044	3.24%
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2062	3.24%
2063	3.24%
2064	3.24%
2065	3.24%
2066	3.24%
2067	3.24%
2068	3.24%
2069	3.24%
2070	3.24%