

Appendix H

Avoided Cost

2020 WA IRP

Appendix H – Introduction


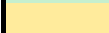


The purpose of this document is to present the inputs into Cascade’s avoided cost calculation, as well as the sources for these inputs. The data itself is sourced from a number of processes integral to the 2020 IRP, specifically the resource integration and distribution system planning sections. Once calculated, these figures are sent to Cascade’s energy efficiency team, where they are used to generate Cascade’s Conservation Potential Assessment (CPA). The Company appreciates its partnership with the energy efficiency team, as the CPA is a vital element to forecasting energy efficiency savings over the 20-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.
Cap and Trade	Results of a Carbon sensitivity using market driven pricing for carbon offset credits instead of SCC with 2.5% Discount rate. Still uses 10% Environmental Adder
Market Choice	Results of a Carbon sensitivity using the House of Representative's Market Choice Carbon Tax proposal instead of SCC with 2.5% Discount rate. Still uses 10% Environmental Adder
Raise Wages	Results of a Carbon sensitivity using the House of Representative's Raise Wages, Cut Carbon act instead of SCC with 2.5% Discount rate. Still uses 10% Environmental Adder

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

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

Nominal Avoided Cost including upstream emissions (By Zone) - \$/Therm							
	Zone 1	Zone 2	Zone 3	Zone 4	Oregon	Washington	System
2021	\$ 0.885	\$ 0.876	\$ 0.878	\$ 0.839	\$ 0.839	\$ 0.884	\$ 0.849
2022	\$ 0.842	\$ 0.837	\$ 0.838	\$ 0.809	\$ 0.809	\$ 0.841	\$ 0.816
2023	\$ 0.814	\$ 0.812	\$ 0.812	\$ 0.791	\$ 0.791	\$ 0.814	\$ 0.795
2024	\$ 0.838	\$ 0.835	\$ 0.836	\$ 0.813	\$ 0.813	\$ 0.838	\$ 0.817
2025	\$ 0.882	\$ 0.876	\$ 0.877	\$ 0.852	\$ 0.852	\$ 0.881	\$ 0.858
2026	\$ 0.903	\$ 0.898	\$ 0.899	\$ 0.873	\$ 0.873	\$ 0.903	\$ 0.879
2027	\$ 0.916	\$ 0.911	\$ 0.912	\$ 0.887	\$ 0.887	\$ 0.916	\$ 0.893
2028	\$ 0.919	\$ 0.915	\$ 0.916	\$ 0.889	\$ 0.889	\$ 0.919	\$ 0.894
2029	\$ 0.935	\$ 0.931	\$ 0.931	\$ 0.903	\$ 0.903	\$ 0.934	\$ 0.909
2030	\$ 0.951	\$ 0.947	\$ 0.948	\$ 0.920	\$ 0.920	\$ 0.951	\$ 0.925
2031	\$ 0.958	\$ 0.954	\$ 0.954	\$ 0.927	\$ 0.927	\$ 0.957	\$ 0.932
2032	\$ 0.977	\$ 0.973	\$ 0.974	\$ 0.946	\$ 0.946	\$ 0.977	\$ 0.952
2033	\$ 0.995	\$ 0.991	\$ 0.992	\$ 0.964	\$ 0.964	\$ 0.995	\$ 0.969
2034	\$ 1.002	\$ 0.999	\$ 0.999	\$ 0.971	\$ 0.971	\$ 1.002	\$ 0.977
2035	\$ 1.020	\$ 1.017	\$ 1.017	\$ 0.988	\$ 0.988	\$ 1.019	\$ 0.993
2036	\$ 1.033	\$ 1.031	\$ 1.031	\$ 1.002	\$ 1.002	\$ 1.033	\$ 1.007
2037	\$ 1.057	\$ 1.053	\$ 1.054	\$ 1.025	\$ 1.025	\$ 1.057	\$ 1.031
2038	\$ 1.079	\$ 1.075	\$ 1.076	\$ 1.047	\$ 1.047	\$ 1.079	\$ 1.053
2039	\$ 1.103	\$ 1.098	\$ 1.099	\$ 1.070	\$ 1.070	\$ 1.102	\$ 1.076
2040	\$ 1.117	\$ 1.113	\$ 1.114	\$ 1.085	\$ 1.085	\$ 1.117	\$ 1.091
2041	\$ 1.139	\$ 1.135	\$ 1.136	\$ 1.106	\$ 1.106	\$ 1.139	\$ 1.112
2042	\$ 1.162	\$ 1.158	\$ 1.159	\$ 1.129	\$ 1.129	\$ 1.162	\$ 1.135
2043	\$ 1.185	\$ 1.181	\$ 1.182	\$ 1.151	\$ 1.151	\$ 1.185	\$ 1.157
2044	\$ 1.209	\$ 1.205	\$ 1.205	\$ 1.174	\$ 1.174	\$ 1.209	\$ 1.180
2045	\$ 1.233	\$ 1.229	\$ 1.229	\$ 1.198	\$ 1.198	\$ 1.233	\$ 1.204
2046	\$ 1.258	\$ 1.253	\$ 1.254	\$ 1.222	\$ 1.222	\$ 1.257	\$ 1.228
2047	\$ 1.283	\$ 1.278	\$ 1.279	\$ 1.246	\$ 1.246	\$ 1.283	\$ 1.253
2048	\$ 1.309	\$ 1.304	\$ 1.305	\$ 1.271	\$ 1.271	\$ 1.308	\$ 1.278
2049	\$ 1.335	\$ 1.330	\$ 1.331	\$ 1.296	\$ 1.296	\$ 1.334	\$ 1.303
2050	\$ 1.362	\$ 1.357	\$ 1.357	\$ 1.322	\$ 1.322	\$ 1.361	\$ 1.329
2051	\$ 1.389	\$ 1.384	\$ 1.385	\$ 1.349	\$ 1.349	\$ 1.388	\$ 1.356
2052	\$ 1.417	\$ 1.411	\$ 1.412	\$ 1.376	\$ 1.376	\$ 1.416	\$ 1.383
2053	\$ 1.445	\$ 1.440	\$ 1.440	\$ 1.403	\$ 1.403	\$ 1.444	\$ 1.411
2054	\$ 1.474	\$ 1.468	\$ 1.469	\$ 1.431	\$ 1.431	\$ 1.473	\$ 1.439
2055	\$ 1.503	\$ 1.498	\$ 1.499	\$ 1.460	\$ 1.460	\$ 1.503	\$ 1.468
2056	\$ 1.533	\$ 1.528	\$ 1.529	\$ 1.489	\$ 1.489	\$ 1.533	\$ 1.497
2057	\$ 1.564	\$ 1.558	\$ 1.559	\$ 1.519	\$ 1.519	\$ 1.563	\$ 1.527
2058	\$ 1.595	\$ 1.589	\$ 1.590	\$ 1.549	\$ 1.549	\$ 1.595	\$ 1.558
2059	\$ 1.627	\$ 1.621	\$ 1.622	\$ 1.580	\$ 1.580	\$ 1.627	\$ 1.589
2060	\$ 1.660	\$ 1.654	\$ 1.655	\$ 1.612	\$ 1.612	\$ 1.659	\$ 1.621
2061	\$ 1.693	\$ 1.687	\$ 1.688	\$ 1.644	\$ 1.644	\$ 1.692	\$ 1.653
2062	\$ 1.727	\$ 1.720	\$ 1.722	\$ 1.677	\$ 1.677	\$ 1.726	\$ 1.686
2063	\$ 1.761	\$ 1.755	\$ 1.756	\$ 1.710	\$ 1.710	\$ 1.761	\$ 1.720
2064	\$ 1.797	\$ 1.790	\$ 1.791	\$ 1.745	\$ 1.745	\$ 1.796	\$ 1.754
2065	\$ 1.833	\$ 1.826	\$ 1.827	\$ 1.780	\$ 1.780	\$ 1.832	\$ 1.789
2066	\$ 1.869	\$ 1.862	\$ 1.863	\$ 1.815	\$ 1.815	\$ 1.868	\$ 1.825

Real 2020\$ Avoided Cost including upstream emissions (By Zone) - \$/Therm							
	Zone 1	Zone 2	Zone 3	Zone 4	Oregon	Washington	System
2021	\$ 0.885	\$ 0.876	\$ 0.878	\$ 0.839	\$ 0.839	\$ 0.884	\$ 0.849
2022	\$ 0.814	\$ 0.810	\$ 0.810	\$ 0.783	\$ 0.783	\$ 0.814	\$ 0.789
2023	\$ 0.761	\$ 0.759	\$ 0.760	\$ 0.740	\$ 0.740	\$ 0.761	\$ 0.744
2024	\$ 0.758	\$ 0.755	\$ 0.756	\$ 0.735	\$ 0.735	\$ 0.758	\$ 0.739
2025	\$ 0.771	\$ 0.767	\$ 0.768	\$ 0.746	\$ 0.746	\$ 0.771	\$ 0.751
2026	\$ 0.764	\$ 0.760	\$ 0.760	\$ 0.739	\$ 0.739	\$ 0.764	\$ 0.744
2027	\$ 0.750	\$ 0.746	\$ 0.746	\$ 0.726	\$ 0.726	\$ 0.749	\$ 0.731
2028	\$ 0.727	\$ 0.724	\$ 0.725	\$ 0.703	\$ 0.703	\$ 0.727	\$ 0.708
2029	\$ 0.715	\$ 0.712	\$ 0.713	\$ 0.691	\$ 0.691	\$ 0.715	\$ 0.696
2030	\$ 0.704	\$ 0.701	\$ 0.702	\$ 0.681	\$ 0.681	\$ 0.704	\$ 0.685
2031	\$ 0.685	\$ 0.683	\$ 0.683	\$ 0.663	\$ 0.663	\$ 0.685	\$ 0.667
2032	\$ 0.677	\$ 0.674	\$ 0.674	\$ 0.655	\$ 0.655	\$ 0.676	\$ 0.659
2033	\$ 0.666	\$ 0.663	\$ 0.664	\$ 0.645	\$ 0.645	\$ 0.666	\$ 0.649
2034	\$ 0.649	\$ 0.647	\$ 0.647	\$ 0.629	\$ 0.629	\$ 0.649	\$ 0.633
2035	\$ 0.639	\$ 0.637	\$ 0.637	\$ 0.619	\$ 0.619	\$ 0.638	\$ 0.622
2036	\$ 0.626	\$ 0.624	\$ 0.624	\$ 0.607	\$ 0.607	\$ 0.626	\$ 0.610
2037	\$ 0.619	\$ 0.617	\$ 0.617	\$ 0.600	\$ 0.600	\$ 0.619	\$ 0.604
2038	\$ 0.611	\$ 0.609	\$ 0.609	\$ 0.593	\$ 0.593	\$ 0.611	\$ 0.596
2039	\$ 0.604	\$ 0.602	\$ 0.602	\$ 0.586	\$ 0.586	\$ 0.604	\$ 0.589
2040	\$ 0.592	\$ 0.590	\$ 0.590	\$ 0.575	\$ 0.575	\$ 0.592	\$ 0.578
2041	\$ 0.584	\$ 0.582	\$ 0.582	\$ 0.567	\$ 0.567	\$ 0.584	\$ 0.570
2042	\$ 0.576	\$ 0.574	\$ 0.574	\$ 0.559	\$ 0.559	\$ 0.576	\$ 0.562
2043	\$ 0.568	\$ 0.566	\$ 0.566	\$ 0.552	\$ 0.552	\$ 0.568	\$ 0.555
2044	\$ 0.560	\$ 0.558	\$ 0.559	\$ 0.544	\$ 0.544	\$ 0.560	\$ 0.547
2045	\$ 0.553	\$ 0.551	\$ 0.551	\$ 0.537	\$ 0.537	\$ 0.553	\$ 0.540
2046	\$ 0.545	\$ 0.543	\$ 0.544	\$ 0.530	\$ 0.530	\$ 0.545	\$ 0.532
2047	\$ 0.538	\$ 0.536	\$ 0.536	\$ 0.522	\$ 0.522	\$ 0.538	\$ 0.525
2048	\$ 0.531	\$ 0.529	\$ 0.529	\$ 0.515	\$ 0.515	\$ 0.530	\$ 0.518
2049	\$ 0.523	\$ 0.521	\$ 0.522	\$ 0.508	\$ 0.508	\$ 0.523	\$ 0.511
2050	\$ 0.516	\$ 0.514	\$ 0.515	\$ 0.501	\$ 0.501	\$ 0.516	\$ 0.504
2051	\$ 0.509	\$ 0.507	\$ 0.508	\$ 0.495	\$ 0.495	\$ 0.509	\$ 0.497
2052	\$ 0.502	\$ 0.501	\$ 0.501	\$ 0.488	\$ 0.488	\$ 0.502	\$ 0.491
2053	\$ 0.496	\$ 0.494	\$ 0.494	\$ 0.481	\$ 0.481	\$ 0.495	\$ 0.484
2054	\$ 0.489	\$ 0.487	\$ 0.487	\$ 0.475	\$ 0.475	\$ 0.489	\$ 0.477
2055	\$ 0.482	\$ 0.481	\$ 0.481	\$ 0.468	\$ 0.468	\$ 0.482	\$ 0.471
2056	\$ 0.476	\$ 0.474	\$ 0.474	\$ 0.462	\$ 0.462	\$ 0.476	\$ 0.465
2057	\$ 0.469	\$ 0.468	\$ 0.468	\$ 0.456	\$ 0.456	\$ 0.469	\$ 0.458
2058	\$ 0.463	\$ 0.461	\$ 0.462	\$ 0.450	\$ 0.450	\$ 0.463	\$ 0.452
2059	\$ 0.457	\$ 0.455	\$ 0.455	\$ 0.444	\$ 0.444	\$ 0.457	\$ 0.446
2060	\$ 0.451	\$ 0.449	\$ 0.449	\$ 0.438	\$ 0.438	\$ 0.450	\$ 0.440
2061	\$ 0.444	\$ 0.443	\$ 0.443	\$ 0.432	\$ 0.432	\$ 0.444	\$ 0.434
2062	\$ 0.438	\$ 0.437	\$ 0.437	\$ 0.426	\$ 0.426	\$ 0.438	\$ 0.428
2063	\$ 0.433	\$ 0.431	\$ 0.431	\$ 0.420	\$ 0.420	\$ 0.432	\$ 0.422
2064	\$ 0.427	\$ 0.425	\$ 0.425	\$ 0.414	\$ 0.414	\$ 0.426	\$ 0.417
2065	\$ 0.421	\$ 0.419	\$ 0.420	\$ 0.409	\$ 0.409	\$ 0.421	\$ 0.411
2066	\$ 0.415	\$ 0.414	\$ 0.414	\$ 0.403	\$ 0.403	\$ 0.415	\$ 0.405

<p>Discount Rate</p> <p>3.40%</p> <p>Source: https://www.zillow.com/mortgage-rates/30-year-fixed/</p> <p>As of - 6/26/2020</p>

Incremental Fixed Transportation

Total Cost - \$/dth	
2021	0
2022	0
2023	0
2024	0
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

	Allocated Cost	
	I-5 Exp	GTN
2021	0	0
2022	0	0
2023	0	0
2024	0	0
2025	0	0
2026	0	0
2027	0	0
2028	0	0
2029	0	0
2030	0	0
2031	0	0
2032	0	0
2033	0	0
2034	0	0
2035	0	0
2036	0	0
2037	0	0
2038	0	0
2039	0	0
2040	0	0

Contracts		
Name	I-5 Exp	GTN
Cost	0.74	0.220463
Year in Service	2022	2027
Source	NWP Presentation April 8th, 2014	Blend of cost for milage based incrm. GTN capacity

Variable Transportation

Shortfalls Begin:	0
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Total Cost \$/dth	
2021	0.008012878
2022	0.008012878
2023	0.008012878
2024	0.008012878
2025	0.008012878
2026	0.008012878
2027	0.008012878
2028	0.008012878
2029	0.008012878
2030	0.008012878
2031	0.008012878
2032	0.008012878
2033	0.008012878
2034	0.008012878
2035	0.008012878
2036	0.008012878
2037	0.008012878
2038	0.008012878
2039	0.008012878
2040	0.008012878

New Allocated Cost		
	I-5 Exp	GTN
2021	0	0
2022	0	0
2023	0	0
2024	0	0
2025	0	0
2026	0	0
2027	0	0
2028	0	0
2029	0	0
2030	0	0
2031	0	0
2032	0	0
2033	0	0
2034	0	0
2035	0	0
2036	0	0
2037	0	0
2038	0	0
2039	0	0
2040	0	0

New Contracts		
	I-5 Exp	GTN
Cost	0.03	0.0069
Year in Service	2022	2027

Existing Contracts	
Contract	Cost
GTN13687	0.004001515
GTN13688	0.00531888
GTN17019W	0.00173264
GTN17021	0.00434656
GTN17022	0.00452416
GTN17023	0.00656256
GTN17025	0.0068304
GTN17026	0.0070128
GTN17028	0.00727216
GTN17031	0.00750704
GTN17033	0.0077424
GTN17034	0.00801552
GTN17036	0.00831104
GTN17037	0.00979936
NWP100002N	0.03
NWP100064Z20	0.03
NWP100134N11	0.03
NWP100149S	0.03
NWP100150N	0.03
NWP132329Z3W	0.03
NWP135558SS	0.03
NWP139090Z26	0.03
NWP139382	0.03
NWP139383	0.03
NWP139384	0.03
NWP139630MEO	0.03
NWP139637Z3W	0.03
NWP140047DC	0.03
NWP140748Z26	0.03
RUBY6103600B	0.01
GTN18507	0.00979936
Average	0.02748746

Fuel

Total Cost - dth	
2021	0.00610122
2022	0.00610122
2023	0.00610122
2024	0.00610122
2025	0.00610122
2026	0.00610122
2027	0.00610122
2028	0.00610122
2029	0.00610122
2030	0.00610122
2031	0.00610122
2032	0.00610122
2033	0.00610122
2034	0.00610122
2035	0.00610122
2036	0.00610122
2037	0.00610122
2038	0.00610122
2039	0.00610122
2040	0.00610122

Existing Contracts	
Contract	Cost
GTN13687	0.005
GTN13688	0.005
GTN17019W	0.005
GTN17021	0.005
GTN17022	0.005
GTN17023	0.005
GTN17025	0.005
GTN17026	0.005
GTN17028	0.005
GTN17031	0.005
GTN17033	0.005
GTN17034	0.005
GTN17036	0.005
GTN17037	0.005
JPWD-100302	1.61
JPWD-100401	0.17
JPWD-135365	0.17
JPWD-139622	0.17
JPWD-139624	1.61
JPWD-139626	0.17
JPWD-139627	1.61
NWP100002S	1.61
NWP100064MEO	1.61
NWP100134S3S	1.61
NWP100149N	1.61
NWP100150S	1.61
NWP132329MEO	1.61
NWP135558P3W	1.61
NWP139090Z26	1.61
NWP139382	1.61
NWP139383	1.61
NWP139384	1.61
NWP139630MEO	1.61
NWP139637Z3W	1.61
NWP140047DC	1.61
NWP140748Z26	1.61
PLWD-100304	1.61
PLWD-100601	0.53
PLWD-140857	0.53
PLWD-141193	1.61
GTN18057	0.005
Average	0.610122

Fixed Storage

Total Cost \$/dth	
2021	0
2022	0
2023	0
2024	0
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

Allocated Cost	
2021	0
2022	0
2023	0
2024	0
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

Variable Storage

Total Cost \$/dth	
2019	0
2020	0
2021	0
2022	0
2023	0
2024	0
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

New Allocated Cost	
2019	0
2020	0
2021	0
2022	0
2023	0
2024	0
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

Commodity Cost							
\$/dth	Zone 1	Zone 2	Zone 3	Zone 4	Oregon	Washington	System
2021	3.66637	3.587562	3.601672	3.238188	3.238188	3.66043695	3.336898
2022	3.196356	3.155416	3.162746	2.895741	2.895741	3.19327323	2.958477
2023	2.872565	2.854033	2.857351	2.659319	2.659319	2.87117013	2.699026
2024	3.042002	3.013771	3.018826	2.803731	2.803731	3.03987696	2.851531
2025	3.270455	3.227195	3.23494	2.997652	2.997652	3.26719771	3.05737
2026	3.419774	3.371876	3.380452	3.138333	3.138333	3.41616799	3.201434
2027	3.47104	3.426949	3.434843	3.198134	3.198134	3.46772028	3.258247
2028	3.431118	3.395179	3.401614	3.144892	3.144892	3.42841254	3.203238
2029	3.503827	3.469693	3.475804	3.212517	3.212517	3.50125695	3.270784
2030	3.58512	3.552231	3.558119	3.292365	3.292365	3.58264375	3.350275
2031	3.580557	3.547616	3.553514	3.293056	3.293056	3.57807712	3.35022
2032	3.69321	3.658444	3.664668	3.401944	3.401944	3.6905925	3.460493
2033	3.784678	3.750439	3.756569	3.490607	3.490607	3.78210007	3.549326
2034	3.784667	3.75312	3.758768	3.493551	3.493551	3.78229225	3.50609
2035	3.875157	3.849218	3.853862	3.577062	3.577062	3.8732037	3.632584
2036	3.932992	3.908774	3.91311	3.634501	3.634501	3.93116838	3.689295
2037	4.017485	3.984362	3.990293	3.717832	3.717832	4.01499129	3.77686
2038	4.147619	4.112735	4.118981	3.844611	3.844611	4.14499273	3.904934
2039	4.292668	4.255428	4.262096	3.986899	3.986899	4.28986445	4.048702
2040	4.35723	4.321483	4.327883	4.054285	4.054285	4.35453835	4.114992

Basin Weights (From SENDOUT)			
	Aeco	Rockies	Sumas
Zone 1	0	0.409083	0.590917
Zone 2	0	0.502903	0.497097
Zone 3	0	0.486105	0.513895
Zone 4	0.222371	0.394663	0.382966
Oregon	0.222371	0.394663	0.382966
Washington	0	0.416146	0.583854
System	0.189784	0.353965	0.456252
Forecast Type?	Peak		

Commodity Cost							
Price Forecast (Annual)				Price Forecast (Peak)			
	Aeco	Rockies	Sumas		Aeco	Rockies	Sumas
2021	1.81252	2.642806	3.113872	2021	2.03	3.17	4.01
2022	1.809541	2.533204	2.637385	2022	1.994713	2.938498	3.374866
2023	1.876977	2.530982	2.489636	2023	1.981599	2.755843	2.953371
2024	1.961547	2.605177	2.617228	2024	2.074082	2.864191	3.165098
2025	2.075284	2.724149	2.927154	2025	2.202391	2.997984	3.459082
2026	2.205697	2.856264	3.149313	2026	2.329881	3.118094	3.628623
2027	2.244036	2.936514	3.208745	2027	2.405562	3.193337	3.663289
2028	2.145742	2.930272	3.146836	2028	2.275832	3.204756	3.587826
2029	2.195746	3.016088	3.217855	2029	2.319057	3.288835	3.652663
2030	2.255816	3.099526	3.286449	2030	2.38928	3.377969	3.728528
2031	2.274844	3.109279	3.290142	2031	2.408534	3.373079	3.724191
2032	2.376993	3.210812	3.405177	2032	2.510956	3.474236	3.844802
2033	2.452547	3.308769	3.505658	2033	2.587874	3.569026	3.93397
2034	2.449415	3.325854	3.497453	2034	2.591273	3.585966	3.922225
2035	2.498381	3.44153	3.55464	2035	2.629806	3.711782	3.988258
2036	2.542607	3.507882	3.606951	2036	2.679546	3.780456	4.03859
2037	2.603314	3.532048	3.64951	2037	2.791485	3.808863	4.161911
2038	2.744848	3.646091	3.812539	2038	2.912992	3.927903	4.299726
2039	2.892729	3.76947	3.974227	2039	3.054269	4.058115	4.455046
2040	2.986306	3.853604	4.057331	2040	3.12605	4.132081	4.513097

Carbon Tax			
Scenario?	SCC 2.5%	SCC 2.5%	
\$/dth	Washington	Oregon	System
2021	4.02043006	4.02043	4.02043
2022	4.08424641	4.084246	4.084246
2023	4.14806276	4.148063	4.148063
2024	4.21187911	4.211879	4.211879
2025	4.33951181	4.339512	4.339512
2026	4.40332816	4.403328	4.403328
2027	4.46714451	4.467145	4.467145
2028	4.53096086	4.530961	4.530961
2029	4.59477721	4.594777	4.594777
2030	4.65859356	4.658594	4.658594
2031	4.72240991	4.72241	4.72241
2032	4.78622626	4.786226	4.786226
2033	4.85004261	4.850043	4.850043
2034	4.91385896	4.913859	4.913859
2035	4.97767531	4.977675	4.977675
2036	5.04149166	5.041492	5.041492
2037	5.16912436	5.169124	5.169124
2038	5.23294071	5.232941	5.232941
2039	5.29675706	5.296757	5.296757
2040	5.36057341	5.360573	5.360573

EPA 40 CFR Part 98 Subpart NN default higher heating value is 1.026 mmbtu/Mscf
 EPA 40 CFR Part 98 Subpart NN Methodology 2 default CO2 emissions factor - 0.0544 metric tons CO2/Mscf
 CNGC WA heating values - from EPA Subpart NN reporting

2012	1.032 mmbtu/Mscf
2013	1.035 mmbtu/Mscf
2014	1.043 mmbtu/Mscf
2015	1.062 mmbtu/Mscf
2016	1.073 mmbtu/Mscf
2017	1.075 mmbtu/Mscf
average	1.05333333 mmbtu/Mscf

Carbon Forecasts

SCC 2.5%			Cap Trade			Market Choice			Raise Wages		
Year	\$/ton	\$/dth	Year	\$/ton	\$/dth	Year	\$/ton	\$/dth	Year	\$/ton	\$/dth
2021	78.1319	4.02043	2021	21.95175	1.129571	2021	24.48	1.259666381	2021	41	2.10973536
2022	79.37209	4.084246	2022	24.69792	1.27088	2022	24.9696	1.284859708	2022	42.025	2.162478744
2023	80.61228	4.148063	2023	27.80953	1.430994	2023	25.46899	1.310556903	2023	43.075625	2.216540713
2024	81.85247	4.211879	2024	31.30967	1.611101	2024	25.97837	1.336768041	2024	44.152516	2.27195423
2025	84.33284	4.339512	2025	35.2609	1.814419	2025	26.49794	1.363503401	2025	45.256329	2.328753086
2026	85.57303	4.403328	2026	39.71672	2.043701	2026	27.0279	1.390773469	2026	46.387737	2.386971913
2027	86.81322	4.467145	2027	44.72902	2.30162	2027	27.56846	1.418588939	2027	47.54743	2.446646211
2028	88.05341	4.530961	2028	50.37485	2.592137	2028	28.11983	1.446960718	2028	48.736116	2.507812366
2029	89.2936	4.594777	2029	56.72228	2.918756	2029	28.68222	1.475899932	2029	49.954519	2.570507676
2030	90.53379	4.658594	2030	63.88136	3.287141	2030	29.25587	1.505417931	2030	51.203382	2.634770367
2031	91.77398	4.72241	2031	63.88136	3.287141	2031	29.84098	1.535526289	2031	52.483466	2.700639627
2032	93.01417	4.786226	2032	63.88136	3.287141	2032	30.4378	1.566236815	2032	53.795553	2.768155617
2033	94.25436	4.850043	2033	63.88136	3.287141	2033	31.04656	1.597561551	2033	55.140442	2.837359508
2034	95.49454	4.913859	2034	63.88136	3.287141	2034	31.66749	1.629512782	2034	56.518953	2.908293495
2035	96.73473	4.977675	2035	63.88136	3.287141	2035	32.30084	1.662103038	2035	57.931927	2.981000833
2036	97.97492	5.041492	2036	63.88136	3.287141	2036	32.94686	1.695345099	2036	59.380225	3.055525854
2037	100.4553	5.169124	2037	63.88136	3.287141	2037	33.60579	1.729252001	2037	60.86473	3.131914
2038	101.6955	5.232941	2038	63.88136	3.287141	2038	34.27791	1.763837041	2038	62.386349	3.21021185
2039	102.9357	5.296757	2039	63.88136	3.287141	2039	34.96347	1.799113782	2039	63.946007	3.290467146
2040	104.1759	5.360573	2040	63.88136	3.287141	2040	35.66274	1.835096057	2040	65.544658	3.372728825

EPA 40 CFR Part 98 Subpart NN default higher heating value is 1.026 mmbtu/Mscf
 EPA 40 CFR Part 98 Subpart NN Methodology 2 default CO2 emissions factor - 0.0544 metric tons CO2/Mscf
 CNGC WA heating values - from EPA Subpart NN reporting

2012	1.032 mmbtu/Mscf
2013	1.035 mmbtu/Mscf
2014	1.043 mmbtu/Mscf
2015	1.062 mmbtu/Mscf
2016	1.073 mmbtu/Mscf
2017	1.075 mmbtu/Mscf
average	1.053333

CO2 to Therm Conversion
0.005146

Carbon Tax including upstream emissions			
Scenario?	SCC 2.5%	SCC 2.5%	
\$/dth	Washington	Oregon	System
2021	4.2156932	4.215693	4.215693
2022	4.28260897	4.282609	4.282609
2023	4.34952473	4.349525	4.349525
2024	4.4164405	4.41644	4.41644
2025	4.55027203	4.550272	4.550272
2026	4.61718779	4.617188	4.617188
2027	4.68410356	4.684104	4.684104
2028	4.75101932	4.751019	4.751019
2029	4.81793509	4.817935	4.817935
2030	4.88485085	4.884851	4.884851
2031	4.95176662	4.951767	4.951767
2032	5.01868238	5.018682	5.018682
2033	5.08559815	5.085598	5.085598
2034	5.15251391	5.152514	5.152514
2035	5.21942968	5.21943	5.21943
2036	5.28634544	5.286345	5.286345
2037	5.42017697	5.420177	5.420177
2038	5.48709274	5.487093	5.487093
2039	5.5540085	5.554009	5.554009
2040	5.62092427	5.620924	5.620924

EPA 40 CFR Part 98 Subpart NN default higher heating value is 1.026 mmbtu/Mscf

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2014	1.043 mmbtu/Mscf
2015	1.062 mmbtu/Mscf
2016	1.073 mmbtu/Mscf
2017	1.075 mmbtu/Mscf
average	1.05333333 mmbtu/Mscf

Carbon Forecasts

SCC 2.5%			Cap Trade			Market Choice			Raise Wages		
Year	\$/ton	\$/dth	Year	\$/ton	\$/dth	Year	\$/ton	\$/dth	Year	\$/ton	\$/dth
2021	78.1319	4.215693	2021	21.95175	1.184431	2021	24.48	1.320845512	2021	41	2.10973536
2022	79.37209	4.282609	2022	24.69792	1.332603	2022	24.9696	1.347262422	2022	42.025	2.162478744
2023	80.61228	4.349525	2023	27.80953	1.500494	2023	25.46899	1.37420767	2023	43.075625	2.216540713
2024	81.85247	4.41644	2024	31.30967	1.689348	2024	25.97837	1.401691824	2024	44.152516	2.27195423
2025	84.33284	4.550272	2025	35.2609	1.902541	2025	26.49794	1.42972566	2025	45.256329	2.328753086
2026	85.57303	4.617188	2026	39.71672	2.142959	2026	27.0279	1.458320173	2026	46.387737	2.386971913
2027	86.81322	4.684104	2027	44.72902	2.413404	2027	27.56846	1.487486577	2027	47.54743	2.446646211
2028	88.05341	4.751019	2028	50.37485	2.718031	2028	28.11983	1.517236308	2028	48.736116	2.507812366
2029	89.2936	4.817935	2029	56.72228	3.060513	2029	28.68222	1.547581034	2029	49.954519	2.570507676
2030	90.53379	4.884851	2030	63.88136	3.44679	2030	29.25587	1.578532655	2030	51.203382	2.634770367
2031	91.77398	4.951767	2031	63.88136	3.44679	2031	29.84098	1.610103308	2031	52.483466	2.700639627
2032	93.01417	5.018682	2032	63.88136	3.44679	2032	30.4378	1.642305374	2032	53.795553	2.768155617
2033	94.25436	5.085598	2033	63.88136	3.44679	2033	31.04656	1.675151482	2033	55.140442	2.837359508
2034	95.49454	5.152514	2034	63.88136	3.44679	2034	31.66749	1.708654512	2034	56.518953	2.908293495
2035	96.73473	5.21943	2035	63.88136	3.44679	2035	32.30084	1.742827602	2035	57.931927	2.981000833
2036	97.97492	5.286345	2036	63.88136	3.44679	2036	32.94686	1.777684154	2036	59.380225	3.05525854
2037	100.4553	5.420177	2037	63.88136	3.44679	2037	33.60579	1.813237837	2037	60.86473	3.131914
2038	101.6955	5.487093	2038	63.88136	3.44679	2038	34.27791	1.849502594	2038	62.386349	3.21021185
2039	102.9357	5.554009	2039	63.88136	3.44679	2039	34.96347	1.886492645	2039	63.946007	3.290467146
2040	104.1759	5.620924	2040	63.88136	3.44679	2040	35.66274	1.924222498	2040	65.544658	3.372728825

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2013	1.035	mmbtu/Mscf
2014	1.043	mmbtu/Mscf
2015	1.062	mmbtu/Mscf
2016	1.073	mmbtu/Mscf
2017	1.075	mmbtu/Mscf

average 1.053333

CO2 to Therm Conversion
0.005396

CNGC Emission Factor for Upstream Natural Gas System (assumed % of GHG emitted upstream of natural gas delivered)	0.85%	End Use Emission Rate, CO2e g/mmbtu (based on on Table NN-2 of 40 CFR Part 98 Subpart W and company heating value)			Total Emission Rate CO2e Metric Tons/therm
		Upstream Emission Rate, CH4 g/mmbtu	Upstream Emission Rate, CO2e g/mmbtu	CO2e g/mmbtu	
		142	3,541	50,415	0.00540

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)	1.00%
GWP of Methane - 100 yr therms per mmbtu - conversion	25 Source: 2007 IPCC Report
	10

CNGC Gas Supply	%
Sumis (BC Canada)	52.4%
AECO (AB Canada)	11.8%
US Rockies	35.8%

	mmbtu	mcf
1) unit of delivered natural gas - 1 mmbtu & mcf equivalent	1	0.927
2) Assumption on the % of the delivered gas that is methane	93.4	0.866
3) Calculation of the amount of methane in a delivered unit of natural gas	36.639	16.619
	16,619	39,535
	17,933	

EIA	Mcf NatGas	mmbtu NatGas - 2019 EPA eGRID Cascade WA Subpart NN Report Value	Metric Ton CH4 in 1 Mcf of CH4
https://www.eia.gov/wpress.cfm?id=98405&tid=5&cid=18	1	1.07904	0.0192

From 40 CFR Part 98 Subpart W Equation W-36

ρ = Density of GHG. 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 M1	Grams g	Ton	lbs
1	1,000,000	1.10231	2204.62

Environmental Adder

	System	Adder	10%
2021	110%		
2022	110%		
2023	110%		
2024	110%		
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%		

Distribution System Costs in dth

\$/dth	Zone 1	Zone 2	Zone 3	Zone 4	Oregon	Washington	System
2021	0.17435758	0.17140622	0.17201064	0.18054241	0.18054241	0.17276028	0.17499891
2022	0.184021695	0.180921018	0.181531687	0.19079733	0.19079733	0.18232985	0.184778914
2023	0.188933316	0.185818523	0.186390201	0.19614467	0.19614467	0.187204523	0.189804404
2024	0.171094367	0.168304602	0.168936266	0.17794185	0.17794185	0.169605082	0.172060762
2025	0.20503093	0.201738289	0.202504462	0.21348958	0.21348958	0.2032673	0.206288953
2026	0.184611244	0.181679137	0.182180908	0.19234188	0.19234188	0.182957391	0.18572383
2027	0.184601138	0.18173303	0.182148696	0.19255561	0.19255561	0.182951579	0.185801045
2028	0.184269064	0.181431862	0.18181788	0.19240622	0.19240622	0.182631676	0.185539723
2029	0.184255467	0.181457928	0.181837777	0.19259725	0.19259725	0.182646487	0.185626518
2030	0.185133729	0.182381187	0.182880775	0.1938037	0.1938037	0.183591233	0.186686648
2031	0.18246011	0.179785675	0.180309637	0.19119067	0.19119067	0.180965571	0.184071226
2032	0.182086652	0.179438936	0.179699186	0.19085196	0.19085196	0.180501383	0.18364219
2033	0.184826789	0.182161249	0.182413949	0.19390931	0.19390931	0.183233204	0.186486497
2034	0.185716139	0.183100254	0.183313172	0.19501154	0.19501154	0.184136506	0.187464527
2035	0.185858798	0.183253198	0.183453781	0.1953277	0.1953277	0.184287017	0.187679667
2036	0.185496781	0.182960943	0.183378919	0.19520604	0.19520604	0.184046863	0.187506907
2037	0.182587532	0.180091432	0.180271681	0.19217151	0.19217151	0.181064002	0.18449511
2038	0.186232782	0.183747613	0.183901224	0.196162	0.196162	0.18470451	0.188262644
2039	0.186358129	0.183884086	0.184047586	0.19644579	0.19644579	0.184840619	0.188453087
2040	0.186004908	0.183568945	0.183639798	0.19620377	0.19620377	0.184482658	0.188156182

Risk Premium

System		Average Annual Portfolio Cost		Cost To Fully Hedge	
Year	Risk Premium	Year	Cost	Year	Cost
2021	0	2019	0	2019	0
2022	0	2020	0	2020	0
2023	0	2021	0	2021	0
2024	0	2022	0	2022	0
2025	0	2023	0	2023	0
2026	0	2024	0	2024	0
2027	0	2025	0	2025	0
2028	0	2026	0	2026	0
2029	0	2027	0	2027	0
2030	0	2028	0	2028	0
2031	0	2029	0	2029	0
2032	0	2030	0	2030	0
2033	0	2031	0	2031	0
2034	0	2032	0	2032	0
2035	0	2033	0	2033	0
2036	0	2034	0	2034	0
2037	0	2035	0	2035	0
2038	0	2036	0	2036	0
2039	0	2037	0	2037	0
2040	0	2038	0	2038	0

Inflation

Year	System Inflation Factor
2021	2.00%
2022	2.00%
2023	2.00%
2024	2.00%
2025	2.00%
2026	2.00%
2027	2.00%
2028	2.00%
2029	2.00%
2030	2.00%
2031	2.00%
2032	2.00%
2033	2.00%
2034	2.00%
2035	2.00%
2036	2.00%
2037	2.00%
2038	2.00%
2039	2.00%
2040	2.00%
2041	2.00%
2042	2.00%
2043	2.00%
2044	2.00%
2045	2.00%
2046	2.00%
2047	2.00%
2048	2.00%
2049	2.00%
2050	2.00%
2051	2.00%
2052	2.00%
2053	2.00%
2054	2.00%
2055	2.00%
2056	2.00%
2057	2.00%
2058	2.00%
2059	2.00%
2060	2.00%
2061	2.00%
2062	2.00%
2063	2.00%
2064	2.00%
2065	2.00%
2066	2.00%

Cap and Trade

Nominal Avoided Cost (By Zone) - \$/Therm

	Zone 1	Zone 2	Zone 3	Zone 4	Oregon	Washington	System
2021	0.545791	0.536826	0.538439	0.49931	0.499309	0.54497814	0.509613
2022	0.510599	0.505786	0.506653	0.47821	0.478209	0.51009109	0.484508
2023	0.493086	0.490736	0.491158	0.47035	0.47035	0.49275978	0.474084
2024	0.529752	0.526368	0.526987	0.50423	0.504227	0.52936933	0.508897
2025	0.58064	0.575553	0.576481	0.55148	0.551478	0.58010581	0.557327
2026	0.620245	0.614683	0.615676	0.59006	0.590059	0.61968266	0.596339
2027	0.654254	0.649117	0.650027	0.62503	0.62503	0.65372383	0.630967
2028	0.681786	0.677549	0.678296	0.65112	0.651115	0.68132489	0.656846
2029	0.725711	0.721676	0.722387	0.6945	0.694501	0.72526736	0.700213
2030	0.775263	0.771137	0.772068	0.74393	0.743927	0.7748367	0.749586
2031	0.774494	0.770603	0.771304	0.74374	0.743742	0.7740718	0.749318
2032	0.786849	0.782759	0.78347	0.75569	0.755686	0.78640208	0.761405
2033	0.797184	0.793151	0.793851	0.76574	0.765744	0.79674109	0.771461
2034	0.797272	0.79354	0.794183	0.76618	0.766178	0.79685256	0.7717
2035	0.80724	0.804126	0.804657	0.7754	0.775396	0.80686787	0.780739
2036	0.813566	0.810648	0.811167	0.7817	0.781703	0.81321997	0.78696
2037	0.822569	0.818676	0.819346	0.79057	0.790565	0.82214221	0.796291
2038	0.837248	0.833162	0.833865	0.80491	0.80491	0.83680641	0.810756
2039	0.853216	0.848872	0.849622	0.82059	0.82059	0.85275592	0.826589
2040	0.860283	0.856107	0.856818	0.82798	0.827978	0.85983425	0.833852
2041	0.877488	0.873229	0.873954	0.84454	0.844538	0.87703093	0.850529
2042	0.895038	0.890693	0.891433	0.86143	0.861429	0.89457155	0.867539
2043	0.912939	0.908507	0.909262	0.87866	0.878657	0.91246298	0.88489
2044	0.931197	0.926678	0.927447	0.89623	0.89623	0.93071224	0.902588
2045	0.949821	0.945211	0.945996	0.91416	0.914155	0.94932649	0.920639
2046	0.968818	0.964115	0.964916	0.93244	0.932438	0.96831302	0.939052
2047	0.988194	0.983398	0.984214	0.95109	0.951087	0.98767928	0.957833
2048	1.007958	1.003066	1.003899	0.97011	0.970109	1.00743286	0.97699
2049	1.028117	1.023127	1.023977	0.98951	0.989511	1.02758152	0.99653
2050	1.04868	1.043589	1.044456	1.0093	1.009301	1.04813315	1.01646
2051	1.069653	1.064461	1.065345	1.02949	1.029487	1.06909581	1.03679
2052	1.091046	1.08575	1.086652	1.05008	1.050077	1.09047773	1.057525
2053	1.112867	1.107465	1.108385	1.07108	1.071078	1.11228728	1.078676
2054	1.135125	1.129615	1.130553	1.0925	1.0925	1.13453303	1.100249
2055	1.157827	1.152207	1.153164	1.11435	1.11435	1.15722369	1.122254
2056	1.180984	1.175251	1.176227	1.13664	1.136637	1.18036816	1.144699
2057	1.204603	1.198756	1.199752	1.15937	1.15937	1.20397553	1.167593
2058	1.228695	1.222731	1.223747	1.18256	1.182557	1.22805504	1.190945
2059	1.253269	1.247186	1.248222	1.20621	1.206208	1.25261614	1.214764
2060	1.278335	1.27213	1.273186	1.23033	1.230332	1.27766846	1.239059
2061	1.303901	1.297572	1.29865	1.25494	1.254939	1.30322183	1.263841
2062	1.329979	1.323524	1.324623	1.28004	1.280038	1.32928627	1.289117
2063	1.356579	1.349994	1.351116	1.30564	1.305639	1.35587199	1.3149
2064	1.38371	1.376994	1.378138	1.33175	1.331751	1.38298943	1.341198
2065	1.411385	1.404534	1.405701	1.35839	1.358386	1.41064922	1.368022
2066	1.439612	1.432625	1.433815	1.38555	1.385554	1.43886221	1.395382

Cap and Trade

Real 2020\$ Avoided Cost (By Zone)

	Zone 1	Zone 2	Zone 3	Zone 4	Oregon	Washington	System
2021	0.545791	0.536826	0.538439	0.499309	0.499309	0.544978	0.509613
2022	0.49381	0.489155	0.489993	0.462485	0.462485	0.493318	0.468577
2023	0.461192	0.458994	0.459389	0.439927	0.439927	0.460887	0.443419
2024	0.479194	0.476132	0.476692	0.456105	0.456105	0.478847	0.460329
2025	0.507955	0.503504	0.504316	0.482443	0.482443	0.507487	0.48756
2026	0.52476	0.520054	0.520894	0.499221	0.499221	0.524284	0.504534
2027	0.535332	0.531129	0.531873	0.51142	0.51142	0.534898	0.516278
2028	0.539516	0.536163	0.536754	0.515245	0.515245	0.539151	0.519781
2029	0.555392	0.552304	0.552848	0.531507	0.531507	0.555052	0.535878
2030	0.573805	0.570924	0.57144	0.550612	0.550612	0.573489	0.5548
2031	0.554387	0.551601	0.552103	0.532374	0.532374	0.554084	0.536365
2032	0.54471	0.541879	0.542371	0.523137	0.523137	0.544401	0.527096
2033	0.533718	0.531018	0.531487	0.512669	0.512669	0.533422	0.516497
2034	0.516225	0.513809	0.514225	0.496093	0.496093	0.515954	0.499668
2035	0.505493	0.503543	0.503875	0.485553	0.485553	0.50526	0.488898
2036	0.492702	0.490935	0.491249	0.473406	0.473406	0.492493	0.47659
2037	0.481774	0.479494	0.479887	0.46303	0.46303	0.481524	0.466383
2038	0.474247	0.471933	0.472331	0.45593	0.45593	0.473997	0.459241
2039	0.467401	0.465021	0.465432	0.449528	0.449528	0.467149	0.452814
2040	0.455775	0.453563	0.45394	0.438661	0.438661	0.455538	0.441772
2041	0.449604	0.447422	0.447794	0.432721	0.432721	0.44937	0.435791
2042	0.443517	0.441364	0.441731	0.426863	0.426863	0.443286	0.42989
2043	0.437512	0.435388	0.43575	0.421083	0.421083	0.437284	0.42407
2044	0.431588	0.429493	0.42985	0.415382	0.415382	0.431363	0.418328
2045	0.425744	0.423678	0.42403	0.409758	0.409758	0.425523	0.412664
2046	0.41998	0.417942	0.418289	0.40421	0.40421	0.419761	0.407077
2047	0.414294	0.412283	0.412625	0.398737	0.398737	0.414078	0.401565
2048	0.408684	0.406701	0.407038	0.393338	0.393338	0.408471	0.396128
2049	0.403151	0.401194	0.401527	0.388012	0.388012	0.402941	0.390765
2050	0.397692	0.395762	0.396091	0.382759	0.382759	0.397485	0.385474
2051	0.392308	0.390403	0.390728	0.377576	0.377576	0.392103	0.380255
2052	0.386996	0.385118	0.385437	0.372464	0.372464	0.386794	0.375106
2053	0.381756	0.379903	0.380219	0.367421	0.367421	0.381557	0.370027
2054	0.376587	0.374759	0.375071	0.362446	0.362446	0.376391	0.365017
2055	0.371488	0.369685	0.369992	0.357539	0.357539	0.371295	0.360075
2056	0.366459	0.36468	0.364983	0.352698	0.352698	0.366268	0.3552
2057	0.361497	0.359742	0.360041	0.347923	0.347923	0.361309	0.35039
2058	0.356602	0.354871	0.355166	0.343212	0.343212	0.356417	0.345646
2059	0.351774	0.350067	0.350357	0.338565	0.338565	0.351591	0.340966
2060	0.347011	0.345327	0.345614	0.333981	0.333981	0.34683	0.33635
2061	0.342313	0.340651	0.340934	0.329459	0.329459	0.342134	0.331796
2062	0.337678	0.336039	0.336318	0.324998	0.324998	0.337502	0.327303
2063	0.333106	0.331489	0.331764	0.320598	0.320598	0.332932	0.322872
2064	0.328596	0.327001	0.327272	0.316257	0.316257	0.328425	0.3185
2065	0.324147	0.322573	0.322841	0.311975	0.311975	0.323978	0.314188
2066	0.319758	0.318206	0.31847	0.307751	0.307751	0.319591	0.309934

Discount Rate

3.40%

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

As of - 6/26/2020

House of Representatives Market Choice Bill

Nominal Avoided Cost (By Zone) - \$/Therm							
	Zone 1	Zone 2	Zone 3	Zone 4	Oregon	Washington	System
2021	0.560101	0.551137	0.55275	0.51362	0.513619	0.55928868	0.523923
2022	0.512137	0.507324	0.508191	0.47975	0.479747	0.5116289	0.486046
2023	0.479838	0.477488	0.47791	0.4571	0.457102	0.47951171	0.460836
2024	0.499575	0.496191	0.49681	0.47405	0.47405	0.49919275	0.47872
2025	0.53104	0.525952	0.526881	0.50188	0.501877	0.53050514	0.507726
2026	0.548423	0.542861	0.543854	0.51824	0.518237	0.54786059	0.524516
2027	0.557121	0.551984	0.552894	0.5279	0.527896	0.55659046	0.533833
2028	0.555817	0.55158	0.552326	0.52515	0.525146	0.55535551	0.530877
2029	0.566997	0.562962	0.563673	0.53579	0.535787	0.56655319	0.541499
2030	0.579274	0.575381	0.576078	0.54794	0.547938	0.5788472	0.553596
2031	0.581816	0.577926	0.578627	0.55106	0.551064	0.58139422	0.55664
2032	0.597549	0.59346	0.594171	0.56639	0.566386	0.59710265	0.572106
2033	0.61133	0.607297	0.607997	0.57989	0.579891	0.61088739	0.585608
2034	0.614933	0.611201	0.611844	0.58384	0.583839	0.61451349	0.589361
2035	0.628486	0.625372	0.625903	0.59664	0.596642	0.62811373	0.601985
2036	0.638468	0.63555	0.636069	0.60661	0.606605	0.63812246	0.611862
2037	0.651201	0.647308	0.647978	0.6192	0.619198	0.65077445	0.624923
2038	0.669685	0.665599	0.666301	0.63735	0.637347	0.66924301	0.643192
2039	0.689533	0.685189	0.685939	0.65691	0.656907	0.68907296	0.662906
2040	0.700558	0.696382	0.697093	0.66825	0.668254	0.70010934	0.674127
2041	0.714569	0.71031	0.711035	0.68162	0.681619	0.71411153	0.687609
2042	0.72886	0.724516	0.725256	0.69525	0.695251	0.72839376	0.701361
2043	0.743437	0.739006	0.739761	0.70916	0.709156	0.74296163	0.715389
2044	0.758306	0.753786	0.754556	0.72334	0.723339	0.75782086	0.729696
2045	0.773472	0.768862	0.769647	0.73781	0.737806	0.77297728	0.74429
2046	0.788942	0.784239	0.78504	0.75256	0.752562	0.78843683	0.759176
2047	0.80472	0.799924	0.800741	0.76761	0.767613	0.80420556	0.77436
2048	0.820815	0.815922	0.816756	0.78297	0.782966	0.82028967	0.789847
2049	0.837231	0.832241	0.833091	0.79862	0.798625	0.83669547	0.805644
2050	0.853976	0.848886	0.849752	0.8146	0.814597	0.85342938	0.821757
2051	0.871055	0.865863	0.866748	0.83089	0.830889	0.87049796	0.838192
2052	0.888476	0.883181	0.884082	0.84751	0.847507	0.88790792	0.854956
2053	0.906246	0.900844	0.901764	0.86446	0.864457	0.90566608	0.872055
2054	0.924371	0.918861	0.919799	0.88175	0.881746	0.9237794	0.889496
2055	0.942858	0.937238	0.938195	0.89938	0.899381	0.94225499	0.907286
2056	0.961715	0.955983	0.956959	0.91737	0.917369	0.96110009	0.925431
2057	0.98095	0.975103	0.976098	0.93572	0.935716	0.98032209	0.94394
2058	1.000569	0.994605	0.99562	0.95443	0.954431	0.99992854	0.962819
2059	1.02058	1.014497	1.015533	0.97352	0.973519	1.01992711	0.982075
2060	1.040992	1.034787	1.035844	0.99299	0.99299	1.04032565	1.001717
2061	1.061812	1.055483	1.05656	1.01285	1.012849	1.06113216	1.021751
2062	1.083048	1.076592	1.077692	1.03311	1.033106	1.0823548	1.042186
2063	1.104709	1.098124	1.099245	1.05377	1.053769	1.1040019	1.06303
2064	1.126803	1.120087	1.12123	1.07484	1.074844	1.12608194	1.08429
2065	1.149339	1.142488	1.143655	1.09634	1.096341	1.14860358	1.105976
2066	1.172326	1.165338	1.166528	1.11827	1.118268	1.17157565	1.128096

House of Representatives Market Choice Bill

Real 2020\$ Avoided Cost (By Zone)

	Zone 1	Zone 2	Zone 3	Zone 4	Oregon	Washington	System
2021	0.560101	0.551137	0.55275	0.513619	0.513619	0.559289	0.523923
2022	0.495297	0.490642	0.491481	0.463972	0.463972	0.494806	0.470064
2023	0.448801	0.446603	0.446998	0.427536	0.427536	0.448496	0.431028
2024	0.451897	0.448836	0.449396	0.428808	0.428808	0.451551	0.433032
2025	0.464563	0.460112	0.460925	0.439051	0.439051	0.464096	0.444168
2026	0.463994	0.459289	0.460129	0.438456	0.438456	0.463519	0.443768
2027	0.455854	0.451651	0.452396	0.431942	0.431942	0.45542	0.4368
2028	0.439833	0.43648	0.437071	0.415562	0.415562	0.439468	0.420098
2029	0.433927	0.430839	0.431383	0.410041	0.410041	0.433587	0.414413
2030	0.428745	0.425864	0.42638	0.405552	0.405552	0.428429	0.40974
2031	0.416467	0.413682	0.414184	0.394455	0.394455	0.416165	0.398446
2032	0.413664	0.410833	0.411325	0.392091	0.392091	0.413355	0.39605
2033	0.409288	0.406588	0.407057	0.38824	0.38824	0.408992	0.392067
2034	0.398163	0.395746	0.396162	0.37803	0.37803	0.397891	0.381605
2035	0.393557	0.391607	0.39194	0.373617	0.373617	0.393324	0.376962
2036	0.386662	0.384895	0.385209	0.367365	0.367365	0.386452	0.370549
2037	0.381405	0.379125	0.379518	0.362661	0.362661	0.381155	0.366014
2038	0.379334	0.377019	0.377417	0.361016	0.361016	0.379083	0.364327
2039	0.377733	0.375354	0.375765	0.359861	0.359861	0.377481	0.363147
2040	0.371154	0.368941	0.369318	0.354039	0.354039	0.370916	0.35715
2041	0.366128	0.363946	0.364318	0.349245	0.349245	0.365894	0.352315
2042	0.361171	0.359018	0.359385	0.344517	0.344517	0.36094	0.347545
2043	0.356281	0.354157	0.354519	0.339852	0.339852	0.356053	0.342839
2044	0.351457	0.349362	0.349719	0.335251	0.335251	0.351232	0.338197
2045	0.346698	0.344632	0.344984	0.330711	0.330711	0.346477	0.333618
2046	0.342004	0.339966	0.340313	0.326234	0.326234	0.341785	0.329101
2047	0.337374	0.335363	0.335705	0.321817	0.321817	0.337158	0.324645
2048	0.332806	0.330822	0.33116	0.317459	0.317459	0.332593	0.320249
2049	0.3283	0.326343	0.326676	0.313161	0.313161	0.328089	0.315913
2050	0.323855	0.321924	0.322253	0.308921	0.308921	0.323647	0.311636
2051	0.31947	0.317565	0.31789	0.304738	0.304738	0.319265	0.307417
2052	0.315144	0.313266	0.313586	0.300612	0.300612	0.314942	0.303254
2053	0.310877	0.309024	0.30934	0.296542	0.296542	0.310678	0.299148
2054	0.306668	0.30484	0.305151	0.292527	0.292527	0.306472	0.295098
2055	0.302516	0.300713	0.30102	0.288566	0.288566	0.302322	0.291102
2056	0.29842	0.296641	0.296944	0.284659	0.284659	0.298229	0.287161
2057	0.294379	0.292625	0.292924	0.280805	0.280805	0.294191	0.283273
2058	0.290394	0.288663	0.288957	0.277003	0.277003	0.290208	0.279437
2059	0.286462	0.284754	0.285045	0.273252	0.273252	0.286278	0.275654
2060	0.282583	0.280899	0.281186	0.269553	0.269553	0.282402	0.271922
2061	0.278757	0.277096	0.277378	0.265903	0.265903	0.278579	0.26824
2062	0.274983	0.273344	0.273623	0.262303	0.262303	0.274807	0.264608
2063	0.27126	0.269643	0.269918	0.258751	0.258751	0.271086	0.261025
2064	0.267587	0.265992	0.266264	0.255248	0.255248	0.267416	0.257491
2065	0.263964	0.26239	0.262658	0.251792	0.251792	0.263795	0.254005
2066	0.26039	0.258838	0.259102	0.248383	0.248383	0.260223	0.250566

Discount Rate
3.40%
Source: https://www.zillow.com/mortgage-rates/30-year-fixed/
As of - 6/26/2020

Raise Wages, Cut Carbon Act

Nominal Avoided Cost (By Zone) - \$/Therm							
	Zone 1	Zone 2	Zone 3	Zone 4	Oregon	Washington	System
2021	0.653609	0.644645	0.646257	0.60713	0.607127	0.65279627	0.617431
2022	0.608675	0.603862	0.604729	0.57629	0.576285	0.60816699	0.582584
2023	0.579496	0.577146	0.577568	0.55676	0.55676	0.57916993	0.560494
2024	0.602446	0.599062	0.599681	0.57692	0.576921	0.60206323	0.581591
2025	0.637217	0.632129	0.633058	0.60805	0.608055	0.63668261	0.613904
2026	0.658004	0.652443	0.653436	0.62782	0.627819	0.65744242	0.634098
2027	0.670207	0.66507	0.66598	0.64098	0.640983	0.66967676	0.64692
2028	0.672511	0.668274	0.66902	0.64184	0.641839	0.67204919	0.647571
2029	0.687404	0.683369	0.684079	0.65619	0.656194	0.68696005	0.661906
2030	0.703503	0.69961	0.700307	0.67217	0.672167	0.70307596	0.677825
2031	0.709979	0.706088	0.706789	0.67923	0.679227	0.70955669	0.684803
2032	0.72976	0.725671	0.726382	0.6986	0.698597	0.72931372	0.704317
2033	0.747708	0.743675	0.744375	0.71627	0.716269	0.74726516	0.721985
2034	0.755599	0.751867	0.752509	0.72451	0.724505	0.75517937	0.730027
2035	0.773564	0.770451	0.770982	0.74172	0.741721	0.77319249	0.747064
2036	0.788088	0.78517	0.785689	0.75622	0.756225	0.78774234	0.761482
2037	0.805494	0.801601	0.802271	0.77349	0.773491	0.80506727	0.779216
2038	0.828786	0.8247	0.825403	0.79645	0.796448	0.82834424	0.802294
2039	0.853582	0.849238	0.849988	0.82096	0.820956	0.85312183	0.826955
2040	0.869697	0.865521	0.866233	0.83739	0.837393	0.86924894	0.843266
2041	0.887091	0.882832	0.883557	0.85414	0.854141	0.88663392	0.860132
2042	0.904833	0.900489	0.901228	0.87122	0.871224	0.9043666	0.877334
2043	0.92293	0.918498	0.919253	0.88865	0.888648	0.92245393	0.894881
2044	0.941388	0.936868	0.937638	0.90642	0.906421	0.94090301	0.912778
2045	0.960216	0.955606	0.956391	0.92455	0.92455	0.95972107	0.931034
2046	0.97942	0.974718	0.975519	0.94304	0.943041	0.97891549	0.949655
2047	0.999009	0.994212	0.995029	0.9619	0.961901	0.9984938	0.968648
2048	1.018989	1.014096	1.01493	0.98114	0.98114	1.01846368	0.988021
2049	1.039369	1.034378	1.035228	1.00076	1.000762	1.03883295	1.007781
2050	1.060156	1.055066	1.055933	1.02078	1.020778	1.05960961	1.027937
2051	1.081359	1.076167	1.077051	1.04119	1.041193	1.0808018	1.048496
2052	1.102986	1.097691	1.098592	1.06202	1.062017	1.10241784	1.069465
2053	1.125046	1.119644	1.120564	1.08326	1.083257	1.1244662	1.090855
2054	1.147547	1.142037	1.142976	1.10492	1.104922	1.14695552	1.112672
2055	1.170498	1.164878	1.165835	1.12702	1.127021	1.16989463	1.134925
2056	1.193908	1.188176	1.189152	1.14956	1.149561	1.19329252	1.157624
2057	1.217786	1.211939	1.212935	1.17255	1.172553	1.21715837	1.180776
2058	1.242142	1.236178	1.237193	1.196	1.196004	1.24150154	1.204392
2059	1.266985	1.260901	1.261937	1.21992	1.219924	1.26633157	1.22848
2060	1.292324	1.286119	1.287176	1.24432	1.244322	1.2916582	1.253049
2061	1.318171	1.311842	1.31292	1.26921	1.269209	1.31749137	1.27811
2062	1.344534	1.338079	1.339178	1.29459	1.294593	1.34384119	1.303672
2063	1.371425	1.36484	1.365962	1.32048	1.320485	1.37071802	1.329746
2064	1.398853	1.392137	1.393281	1.34689	1.346894	1.39813238	1.356341
2065	1.42683	1.41998	1.421146	1.37383	1.373832	1.42609503	1.383468
2066	1.455367	1.448379	1.449569	1.40131	1.401309	1.45461693	1.411137

Raise Wages, Cut Carbon Act

Real 2020\$ Avoided Cost (By Zone)

	Zone 1	Zone 2	Zone 3	Zone 4	Oregon	Washington	System
2021	0.653609	0.644645	0.646257	0.607127	0.607127	0.652796	0.617431
2022	0.588661	0.584006	0.584844	0.557336	0.557336	0.588169	0.563428
2023	0.542013	0.539815	0.54021	0.520748	0.520748	0.541708	0.52424
2024	0.54495	0.541888	0.542448	0.521861	0.521861	0.544604	0.526085
2025	0.557449	0.552998	0.553811	0.531937	0.531937	0.556982	0.537054
2026	0.556706	0.552001	0.552841	0.531168	0.531168	0.556231	0.53648
2027	0.548385	0.544182	0.544927	0.524473	0.524473	0.547951	0.529331
2028	0.532176	0.528823	0.529414	0.507905	0.507905	0.531811	0.512441
2029	0.526075	0.522987	0.523531	0.50219	0.50219	0.525735	0.506561
2030	0.520692	0.517811	0.518327	0.497499	0.497499	0.520376	0.501687
2031	0.508206	0.505421	0.505923	0.486194	0.486194	0.507904	0.490185
2032	0.505189	0.502359	0.502851	0.483616	0.483616	0.50488	0.487576
2033	0.500594	0.497894	0.498362	0.479545	0.479545	0.500297	0.483372
2034	0.489242	0.486826	0.487242	0.46911	0.46911	0.488971	0.472685
2035	0.484405	0.482456	0.482788	0.464465	0.464465	0.484172	0.467811
2036	0.477273	0.475506	0.47582	0.457976	0.457976	0.477063	0.46116
2037	0.471774	0.469493	0.469886	0.453029	0.453029	0.471524	0.456383
2038	0.469454	0.46714	0.467538	0.451137	0.451137	0.469204	0.454448
2039	0.467601	0.465222	0.465632	0.449728	0.449728	0.467349	0.453015
2040	0.460763	0.458551	0.458928	0.443649	0.443649	0.460526	0.44676
2041	0.454525	0.452342	0.452714	0.437642	0.437642	0.45429	0.440711
2042	0.448371	0.446218	0.446584	0.431716	0.431716	0.448139	0.434744
2043	0.4423	0.440176	0.440538	0.425871	0.425871	0.442072	0.428858
2044	0.436311	0.434216	0.434573	0.420105	0.420105	0.436086	0.423051
2045	0.430404	0.428337	0.428689	0.414417	0.414417	0.430182	0.417323
2046	0.424576	0.422538	0.422885	0.408806	0.408806	0.424357	0.411673
2047	0.418828	0.416817	0.417159	0.403271	0.403271	0.418612	0.406099
2048	0.413157	0.411173	0.411511	0.39781	0.39781	0.412944	0.400601
2049	0.407563	0.405606	0.405939	0.392424	0.392424	0.407353	0.395177
2050	0.402045	0.400114	0.400443	0.387111	0.387111	0.401837	0.389826
2051	0.396601	0.394697	0.395021	0.38187	0.38187	0.396397	0.384548
2052	0.391231	0.389353	0.389673	0.376699	0.376699	0.39103	0.379341
2053	0.385934	0.384081	0.384397	0.371599	0.371599	0.385735	0.374205
2054	0.380709	0.378881	0.379192	0.366568	0.366568	0.380512	0.369138
2055	0.375554	0.373751	0.374058	0.361604	0.361604	0.37536	0.36414
2056	0.370469	0.36869	0.368993	0.356708	0.356708	0.370278	0.35921
2057	0.365453	0.363698	0.363997	0.351879	0.351879	0.365265	0.354347
2058	0.360505	0.358774	0.359069	0.347114	0.347114	0.360319	0.349549
2059	0.355624	0.353916	0.354207	0.342415	0.342415	0.355441	0.344816
2060	0.350809	0.349124	0.349411	0.337778	0.337778	0.350628	0.340147
2061	0.346059	0.344397	0.34468	0.333205	0.333205	0.345881	0.335542
2062	0.341373	0.339734	0.340014	0.328693	0.328693	0.341198	0.330999
2063	0.336751	0.335135	0.33541	0.324243	0.324243	0.336578	0.326517
2064	0.332192	0.330597	0.330869	0.319853	0.319853	0.332021	0.322096
2065	0.327694	0.326121	0.326389	0.315522	0.315522	0.327525	0.317735
2066	0.323257	0.321705	0.32197	0.31125	0.31125	0.323091	0.313433

Discount Rate

3.40%

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

As of - 6/26/2020