2025 NorthWestern Energy Montana 20-Year Load Forecast Inputs and Methodology

ETAC December 9, 2024

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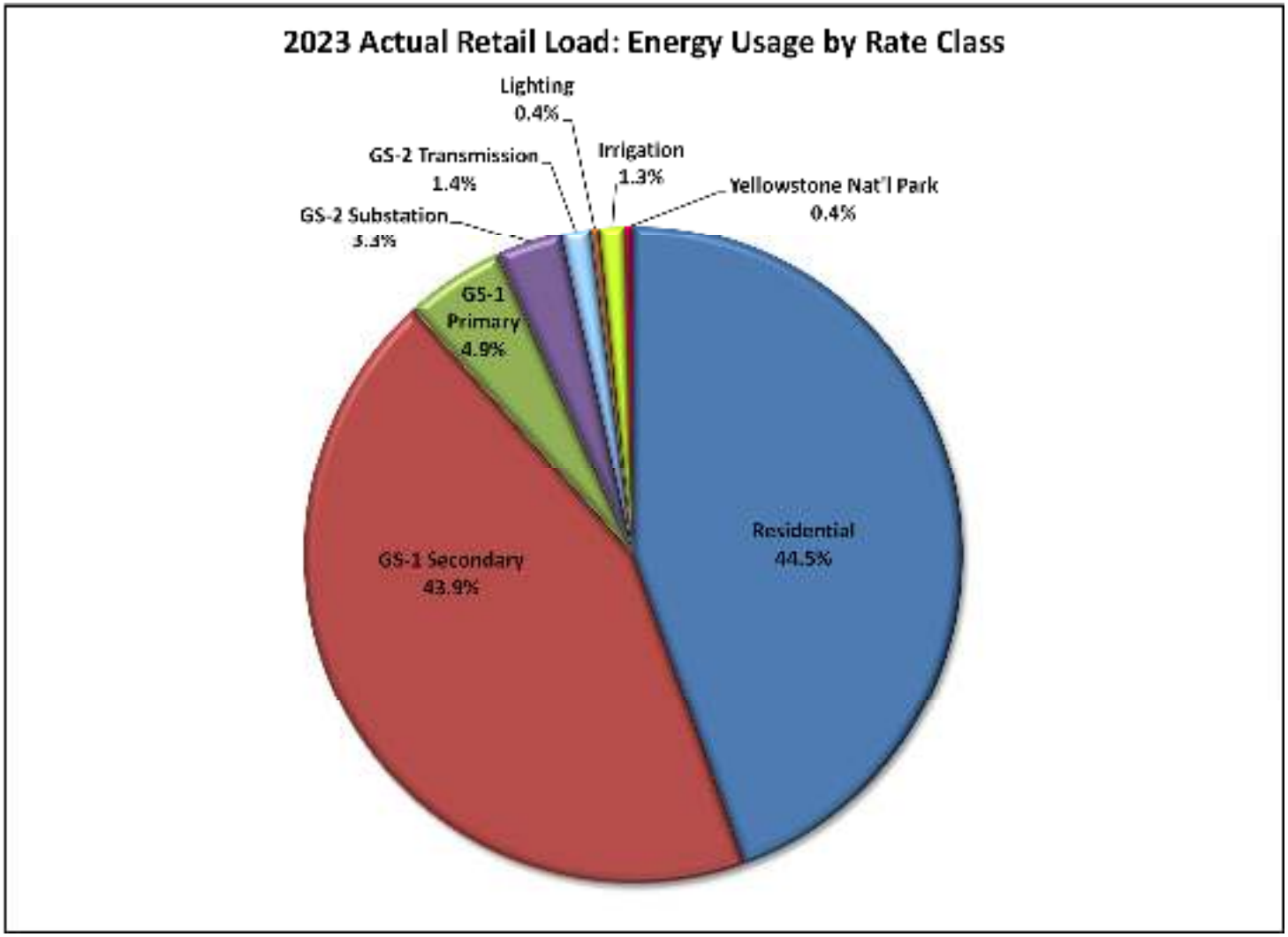
2023 Default Supply load by class

Why the emphasis on Residential and Commercial customers in developing the forecasts?



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1. Customer forecast

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Customer forecast methodology

Customer Forecast

- Customer Forecast Methodology
  - Residential & GS1 Secondary customer forecasts are based on regression models using NWE service territory population as the explanatory variable
  - All other customer classes held at recent actuals or adjusted for known changes

2. Normal weather forecast

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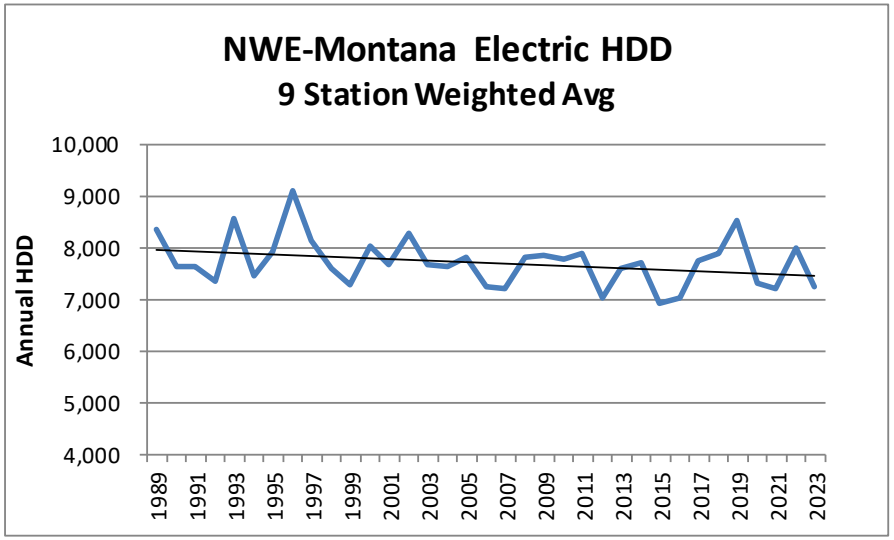
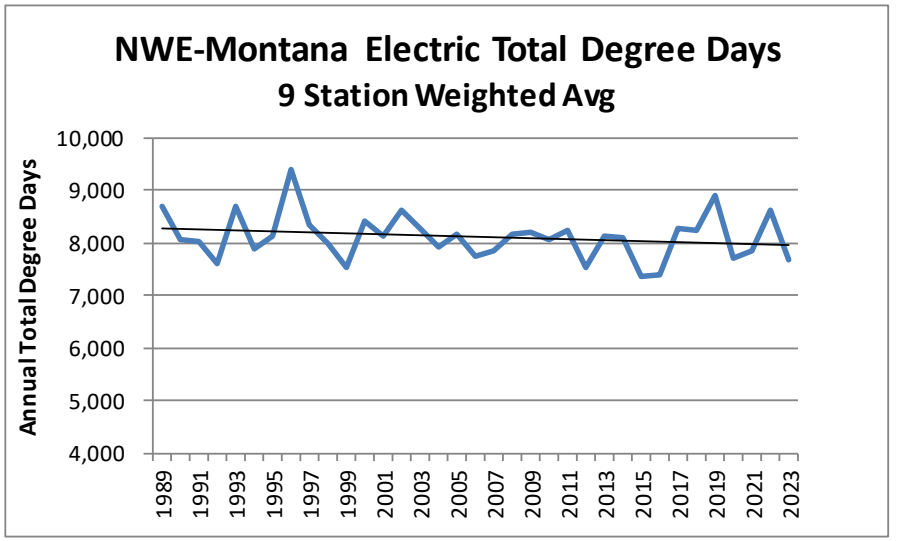
Total degree days

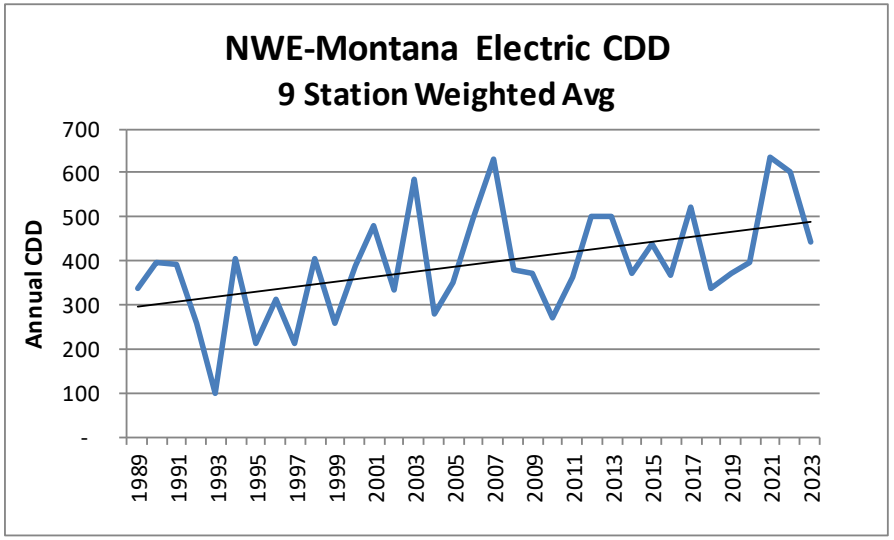
Total Degree Days (HDD + CDD)

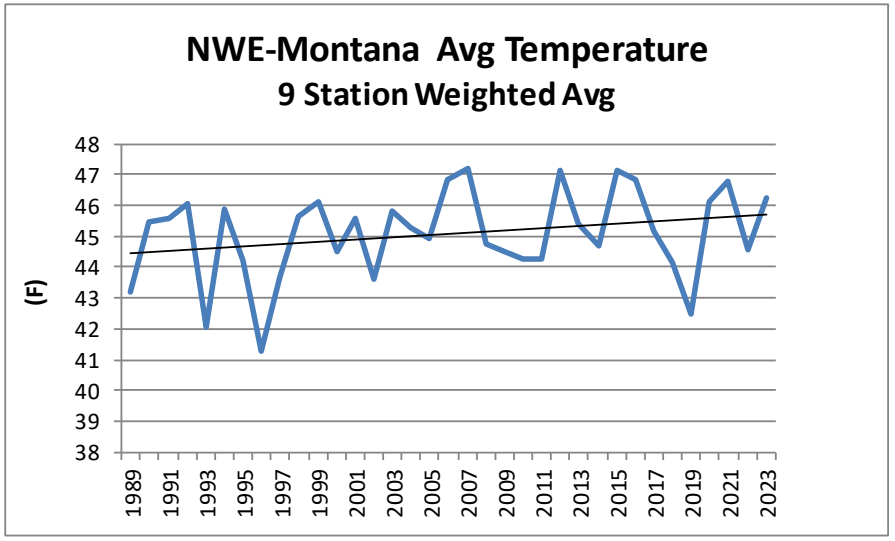
- Heating degree day (HDD) = 65° - daily average temp
- Cooling degree day (CDD) = daily average temp - 65°
- Prior years' forecasts used historical total degree days (1989 – current year)
- Beginning with 2017 forecast, normal weather equals 10-year historical average total degree days

Climate metrics pointing warmer









All signs pointing to a trend of warmer temperatures

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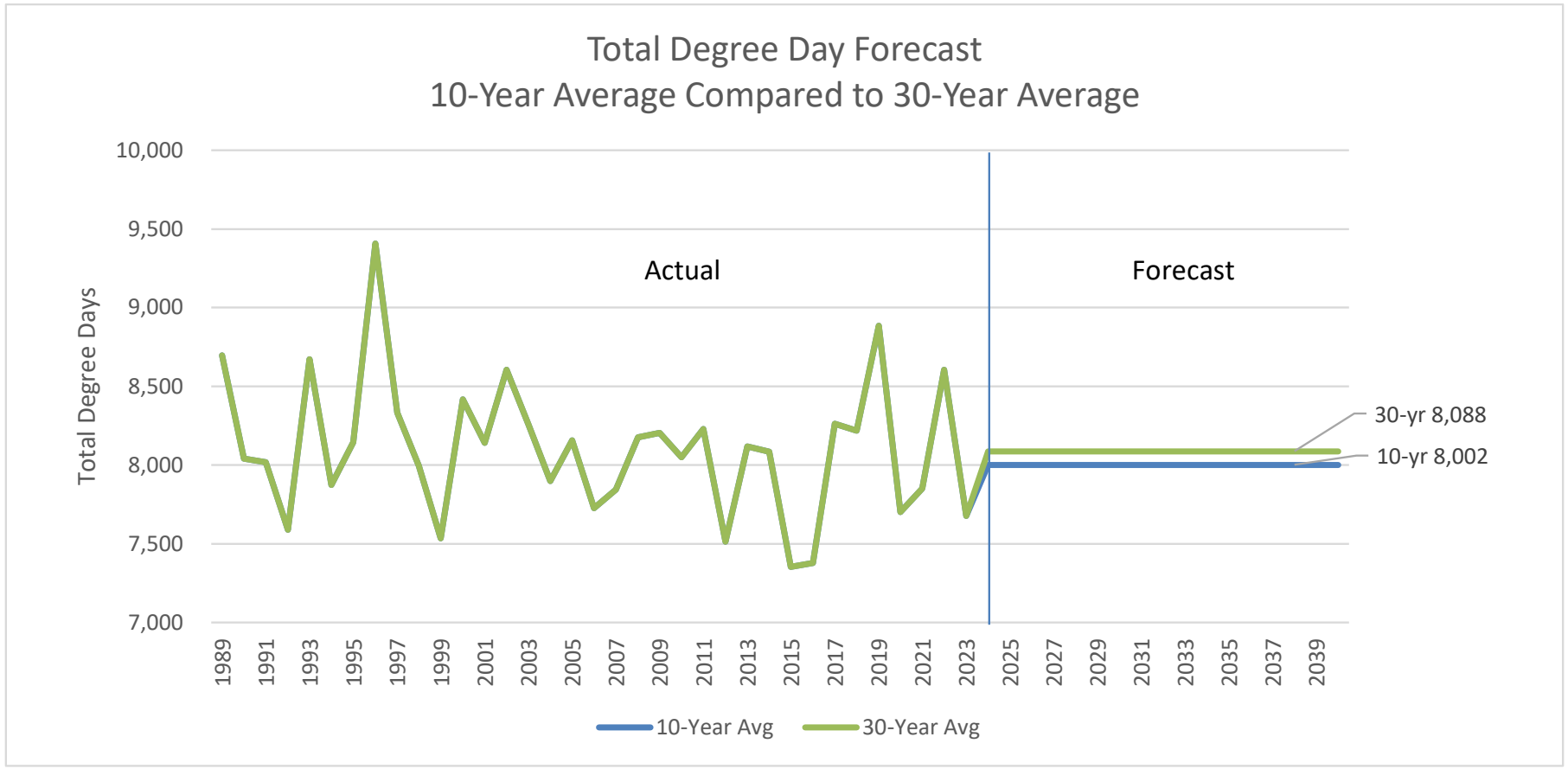
Total degree day forecast



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3. Demand Side Management (DSM) forecast

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DSM plan forecast

- NWE's Demand-Side Management group provides the details of their DSM acquisition plan to use in the long-term load forecast
- 2018 Resource Plan forward incorporates latest 20-year DSM plan of 4 aMW/year (78 aMW 2017-2036) in energy and peak forecasts
- Prior to 2018 Resource Plan, the old DSM plan was used and consisted of 6 aMW/year (84 aMW 2009-2024)

DSM plans summary

2009 DSM Plan 15 Years / 84 aMW			
	Annual aMW	Annual MWh	Cumulative MWh
2010	5.5	48,180	48,180
2011	6.0	52,560	100,740
2012	6.0	52,560	153,300
2013	6.0	52,560	205,860
2014	6.0	52,560	258,420
2015	6.0	52,560	310,980
2016	6.0	52,560	363,540
2017	6.0	52,560	416,100
2018	6.0	52,560	468,660
2019	6.0	52,560	521,220
2020	6.0	52,560	573,780
2021	6.0	52,560	626,340
2022	6.0	52,560	678,900
2023	6.0	52,560	731,460
2024	0.8	6,929	738,389
Total	84.3	738,389	

2017 DSM Plan 20 Years / 78 aMW			
	Annual aMW	Annual MWh	Cumulative MWh
2017	4.35	38,106	38,106
2018	4.35	38,106	76,212
2019	4.35	38,106	114,318
2020	4.35	38,106	152,424
2021	4.35	38,106	190,530
2022	3.77	33,025	223,555
2023	3.77	33,025	256,580
2024	3.77	33,025	289,606
2025	3.77	33,025	322,631
2026	3.77	33,025	355,656
2027	3.77	33,025	388,681
2028	3.77	33,025	421,706
2029	3.77	33,025	454,732
2030	3.77	33,025	487,757
2031	3.77	33,025	520,782
2032	3.77	33,025	553,807
2033	3.77	33,025	586,832
2034	3.77	33,025	619,858
2035	3.77	33,025	652,883
2036	3.77	33,025	685,908
Total	78.3	685,908	

Combined Plans 27 Years / 120 aMW			
	Annual aMW	Annual MWh	Cumulative MWh
2010	5.5	48,180	48,180
2011	6.0	52,560	100,740
2012	6.0	52,560	153,300
2013	6.0	52,560	205,860
2014	6.0	52,560	258,420
2015	6.0	52,560	310,980
2016	6.0	52,560	363,540
2017	4.35	38,106	401,646
2018	4.35	38,106	439,752
2019	4.35	38,106	477,858
2020	4.35	38,106	515,964
2021	4.35	38,106	554,070
2022	3.77	33,025	587,095
2023	3.77	33,025	620,120
2024	3.77	33,025	653,146
2025	3.77	33,025	686,171
2026	3.77	33,025	719,196
2027	3.77	33,025	752,221
2028	3.77	33,025	785,246
2029	3.77	33,025	818,272
2030	3.77	33,025	851,297
2031	3.77	33,025	884,322
2032	3.77	33,025	917,347
2033	3.77	33,025	950,372
2034	3.77	33,025	983,398
2035	3.77	33,025	1,016,423
2036	3.77	33,025	1,049,448
Total	119.8	1,049,448	

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DSM peak shaving contribution

2009 DSM Plan 15 Years / 84 aMW			2017 DSM Plan 20 Years / 78 aMW			Combined Plans 27 Years / 120 aMW		
	Winter MW	Summer MW		Winter MW	Summer MW		Winter MW	Summer MW
2010	8	8	2017	7	6	2010	8	8
2011	17	17	2018	14	13	2011	17	17
2012	27	26	2019	21	19	2012	27	26
2013	36	34	2020	27	25	2013	36	34
2014	45	43	2021	34	32	2014	45	43
2015	54	52	2022	40	37	2015	54	52
2016	63	61	2023	46	43	2016	63	61
2017	72	69	2024	52	48	2017	70	67
2018	81	78	2025	58	54	2018	77	74
2019	90	87	2026	64	59	2019	84	80
2020	99	96	2027	70	65	2020	90	86
2021	108	104	2028	76	70	2021	97	93
2022	117	113	2029	82	76	2022	103	98
2023	126	122	2030	88	81	2023	109	104
2024	128	123	2031	94	87	2024	115	109
			2032	99	92	2025	121	115
			2033	105	98	2026	127	120
			2034	111	103	2027	133	126
			2035	117	109	2028	139	131
			2036	123	114	2029	145	137
						2030	151	142
						2031	157	148
						2032	162	153
						2033	168	159
						2034	174	164
						2035	180	170
						2036	186	175

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4. Net Energy Metering (NEM) forecast

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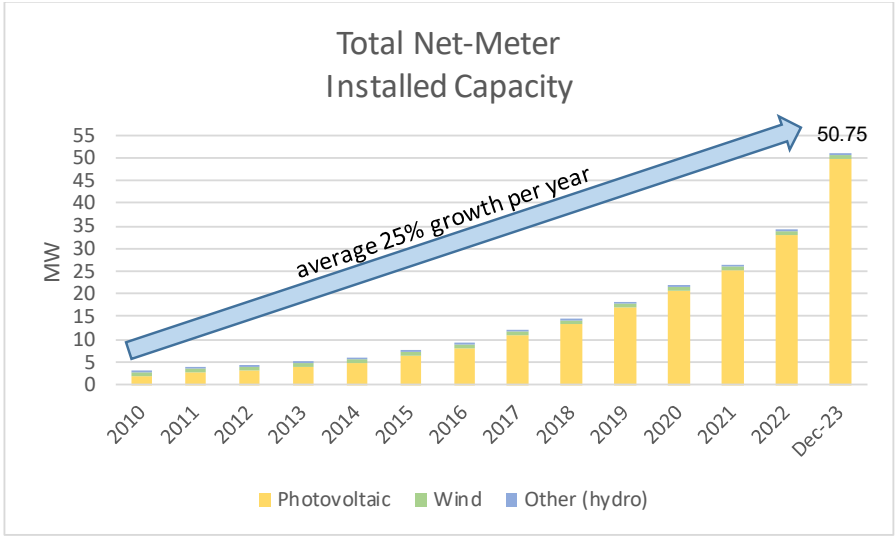
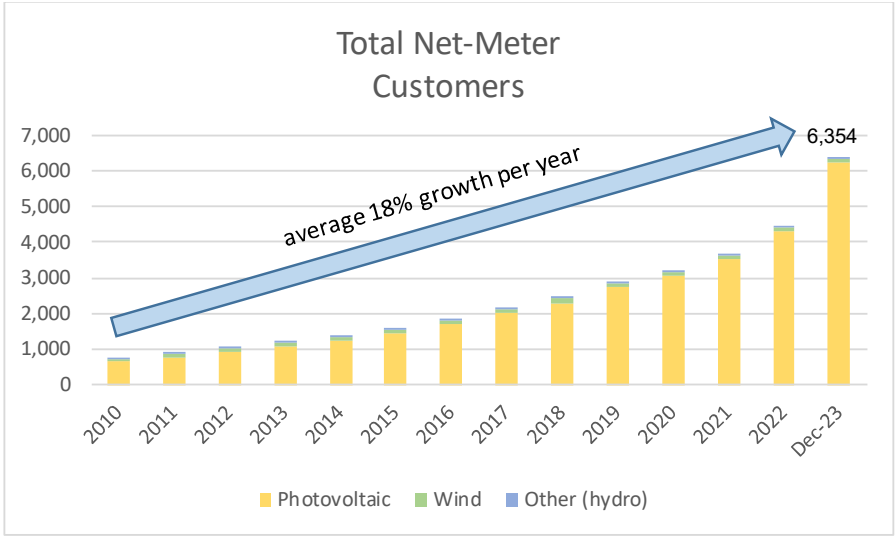
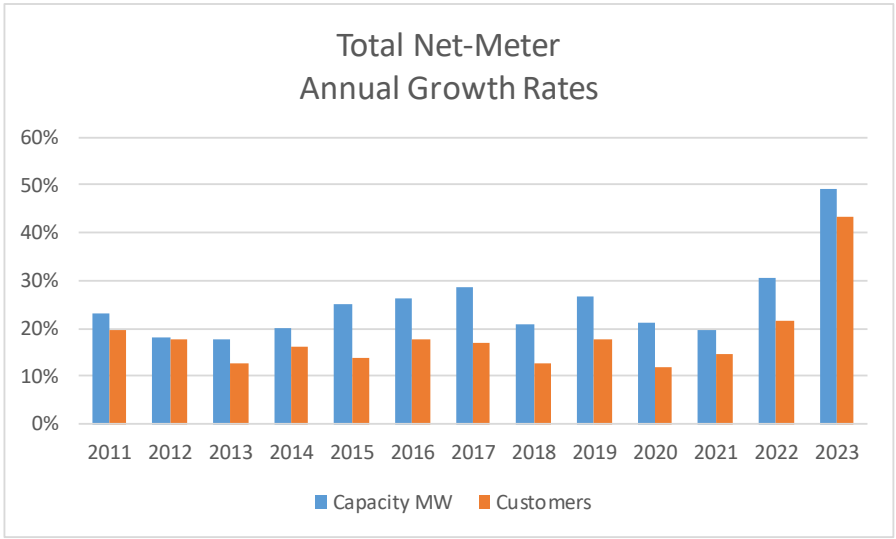
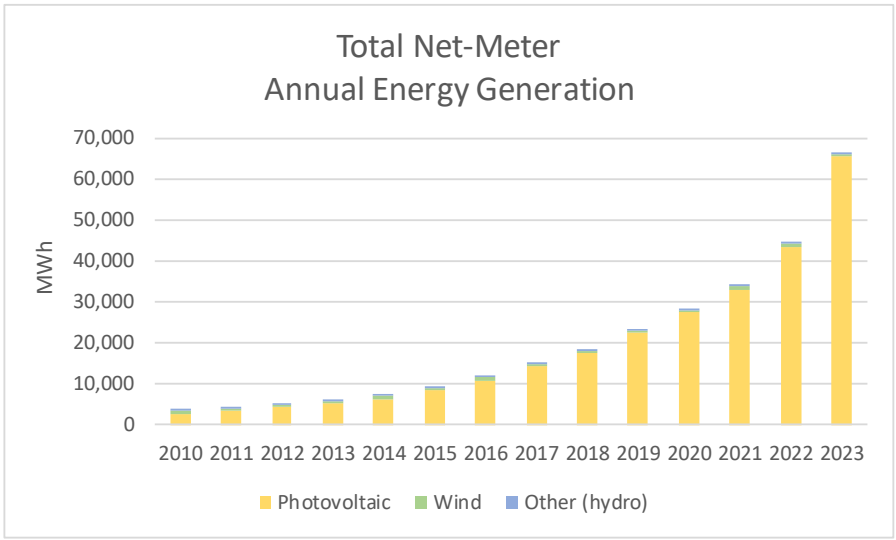
Total net metering









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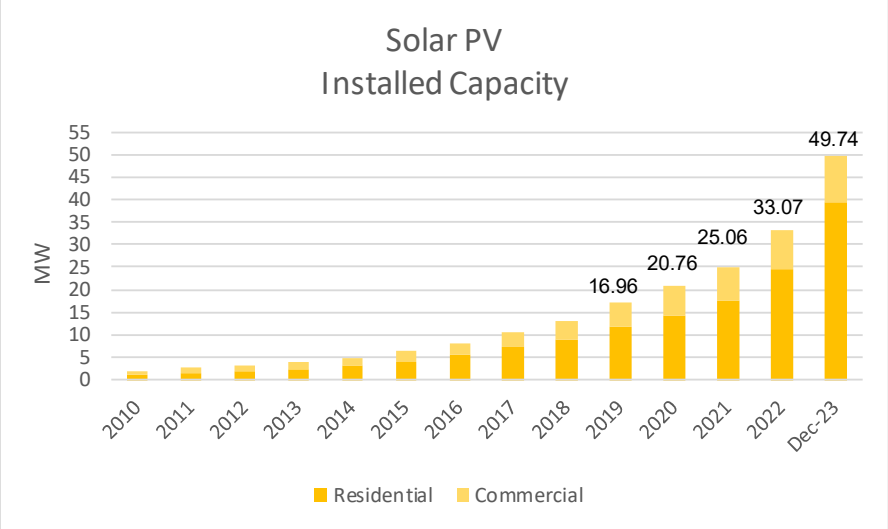
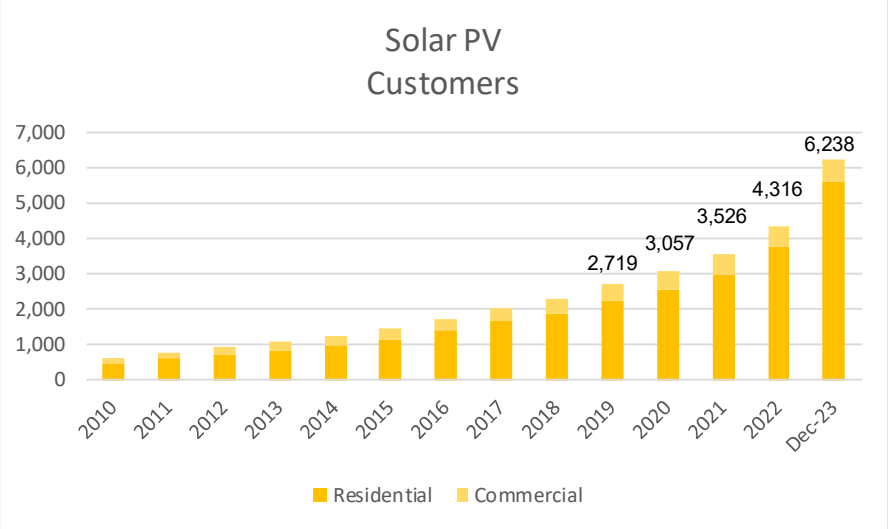
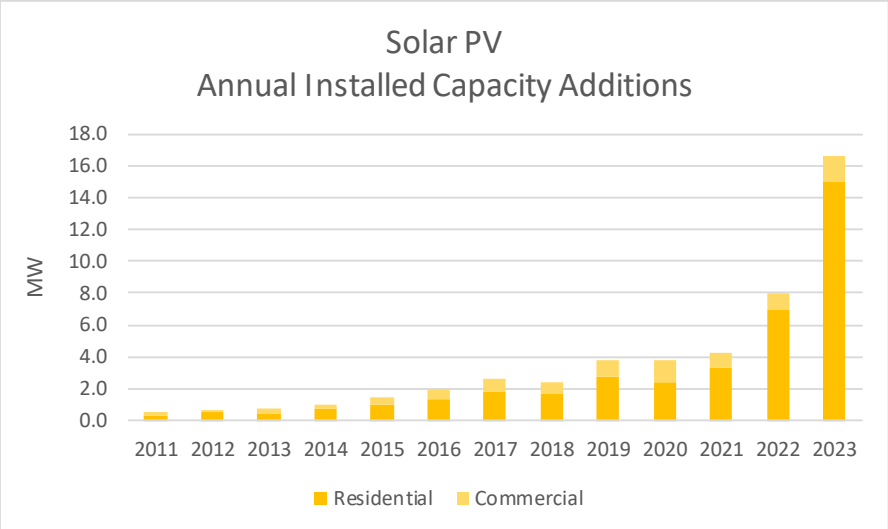
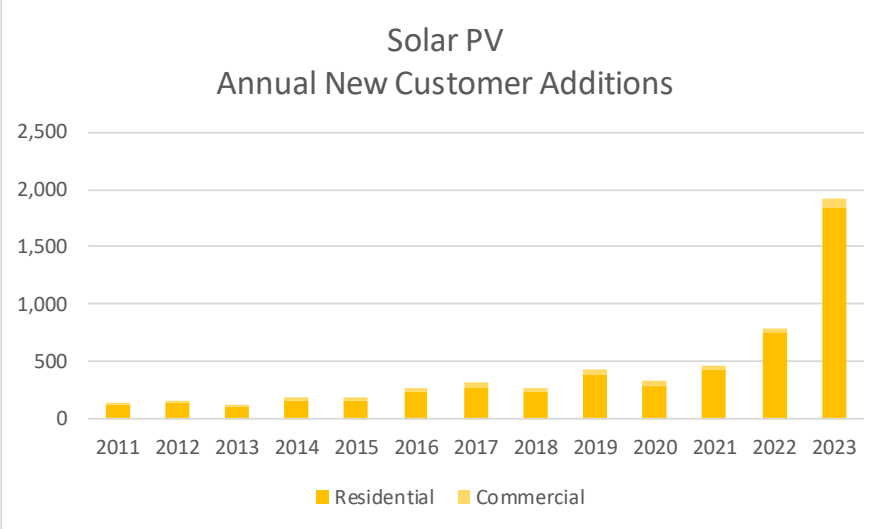
Solar-PV net metering









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Net Meter – Original solar PV forecast scenarios

Solar PV Net Meter Forecast -> Based on Navigant NEM Study (Navigant's solar net-meter penetration forecast informed by NREL's penetration study in 2017)

Installed Capacity (MW)

Growth Assumptions

	Low Growth Case				Base Growth Case				High Growth Case			
	Residential	Commercial	Total	Growth	Residential	Commercial	Total	Growth	Residential	Commercial	Total	Growth
2012	2	1	3		2	1	3		2	1	3	
2013	2	1	4	23%	2	1	4	23%	2	1	4	23%
2014	3	2	5	25%	3	2	5	25%	3	2	5	25%
2015	4	2	6	30%	4	2	6	30%	4	2	6	30%
2016	5	3	8	30%	5	3	8	30%	5	3	8	30%
2017	7	3	11	32%	7	3	11	32%	7	3	11	32%
2018	11	5	16	52%	14	5	19	76%	17	5	22	100%
2019	15	7	22	35%	22	9	31	65%	29	11	40	88%
2020	19	10	29	31%	32	15	47	51%	45	20	65	62%
2021	23	13	37	26%	41	26	67	42%	58	39	97	49%
2022	27	18	45	24%	49	39	88	32%	67	63	131	35%
2023	31	24	55	22%	56	53	108	23%	75	86	161	23%
2024	35	32	67	21%	60	68	128	18%	79	110	189	17%
2025	39	41	80	21%	65	81	146	14%	87	125	212	12%
2026	42	53	95	19%	69	94	163	12%	94	137	231	9%
2027	46	66	112	18%	74	106	180	10%	103	145	248	7%
2028	49	80	129	15%	78	117	196	8%	111	151	262	6%
2029	51	92	142	11%	82	126	208	6%	118	155	273	4%
2030	52	103	155	9%	85	133	218	5%	125	156	281	3%
2031	54	113	167	8%	88	139	227	4%	130	158	288	2%
2032	55	122	177	6%	91	145	236	4%	135	158	294	2%
2033	57	129	186	5%	94	149	243	3%	140	159	299	2%
2034	58	135	193	4%	97	152	249	3%	145	159	305	2%
2035	60	139	199	3%	100	154	254	2%	151	160	310	2%
2036	61	142	203	2%	103	156	259	2%	156	160	316	2%
2037	63	144	206	2%	107	158	265	2%	162	160	323	2%
2038	64	145	209	1%	110	159	270	2%	169	161	330	2%
2039	66	146	212	1%	115	160	275	2%	177	162	338	3%
2040	67	146	214	1%	119	161	280	2%	184	162	346	2%

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Net Meter – 2024 solar PV forecast scenarios

Solar PV Net Meter Forecast -> Based on Navigant NEM Study (Navigant's solar net-meter penetration forecast informed by NREL's penetration study in 2017)

Installed Capacity (MW)

Growth Assumptions

	Low Growth Case				Base Growth Case				High Growth Case			
	Residential	Commercial	Total	Growth	Residential	Commercial	Total	Growth	Residential	Commercial	Total	Growth
2012	2	1	3		2	1	3		2	1	3	
2013	2	1	4	23%	2	1	4	23%	2	1	4	23%
2014	3	2	5	25%	3	2	5	25%	3	2	5	25%
2015	4	2	6	30%	4	2	6	30%	4	2	6	30%
2016	5	3	8	30%	5	3	8	30%	5	3	8	30%
2017	7	3	11	32%	7	3	11	32%	7	3	11	32%
2018	9	4	13	23%	9	4	13	23%	9	4	13	23%
2019	12	5	17	29%	12	5	17	29%	12	5	17	29%
2020	14	7	21	22%	14	7	21	22%	14	7	21	22%
2021	17	8	25	21%	17	8	25	21%	17	8	25	21%
2022	24	9	33	32%	24	9	33	32%	24	9	33	32%
2023	39	10	50	50%	39	10	50	50%	39	10	50	50%
2024	51	11	62	25%	44	26	69	39%	43	34	77	56%
2025	61	12	73	18%	49	38	88	26%	51	49	100	30%
2026	66	13	80	9%	53	52	105	20%	58	61	120	19%
2027	70	14	84	6%	58	64	122	16%	67	69	137	14%
2028	73	15	88	4%	62	75	137	13%	75	76	151	10%
2029	75	16	91	3%	66	83	149	9%	83	79	161	7%
2030	76	17	93	2%	69	91	159	7%	89	81	169	5%
2031	78	18	96	3%	72	97	169	6%	94	82	176	4%
2032	79	19	98	2%	75	103	177	5%	100	83	182	3%
2033	81	20	101	3%	78	107	184	4%	105	83	188	3%
2034	82	21	103	2%	81	110	191	3%	110	84	193	3%
2035	84	22	106	2%	84	112	196	3%	115	84	199	3%
2036	85	23	108	2%	87	114	201	3%	120	84	205	3%
2037	87	24	111	2%	90	116	206	3%	127	85	211	3%
2038	88	25	113	2%	94	117	211	3%	133	85	219	3%
2039	90	26	116	2%	98	118	217	3%	141	86	227	4%
2040	91	26	118	2%	102	119	222	2%	149	86	235	4%

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Solar PV contribution to summer peak forecast

Solar PV Net Meter Forecast				
Contribution to NWE Peak Load (MW) - Including Losses				
Peak Capacity Factor for MT (SPP Model)				52%
	Low	Base	High	
2012	3	2	2	
2013	3	2	2	
2014	4	3	3	
2015	4	3	3	
2016	5	4	4	
2017	7	6	6	
2018	8	7	7	
2019	10	9	9	
2020	12	11	11	
2021	14	14	14	
2022	18	18	18	
2023	27	27	27	
2024	33	38	43	
2025	39	48	55	
2026	42	58	66	
2027	45	67	75	
2028	47	76	83	
2029	48	82	89	
2030	49	88	93	
2031	51	93	97	
2032	52	98	100	
2033	54	102	103	
2034	55	105	106	
2035	56	108	109	
2036	57	111	113	
2037	59	114	116	
2038	60	116	120	
2039	61	119	125	
2040	62	122	129	

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Net Meter – solar PV contribution to annual energy

Solar PV Net Meter Forecast -> Based on Navigant NEM Study (Navigant's solar net-meter penetration forecast informed by NREL's penetration study in 2017)

Energy Production (MWh) - Excludes Losses

Capacity Factor	**15%**

	Low Growth Case				**Base Growth Case**				**High Growth Case**			
	Residential	Commercial	Total	Growth	Residential	Commercial	Total	Growth	Residential	Commercial	Total	Growth
2012	2,611	1,539	4,150		2,611	1,539	4,150		2,611	1,539	4,150	
2013	3,198	1,887	5,085	23%	3,198	1,887	5,085	23%	3,198	1,887	5,085	23%
2014	4,293	2,237	6,530	28%	4,293	2,237	6,530	28%	4,293	2,237	6,530	28%
2015	5,625	2,868	8,761	34%	5,625	2,868	8,761	34%	5,625	2,868	8,761	34%
2016	7,408	3,650	10,982	25%	7,408	3,650	10,982	25%	7,408	3,650	10,982	25%
2017	9,908	4,668	15,795	44%	9,908	4,668	15,795	44%	9,908	4,668	15,795	44%
2018	12,155	5,718	17,873	13%	12,155	5,718	17,873	13%	12,155	5,718	17,873	13%
2019	15,897	7,089	22,987	29%	15,897	7,089	22,987	29%	15,897	7,089	22,987	29%
2020	19,093	9,037	28,130	22%	19,093	9,037	28,130	22%	19,093	9,037	28,130	22%
2021	23,589	10,362	33,951	21%	23,589	10,362	33,951	21%	23,589	10,362	33,951	21%
2022	33,039	11,764	44,803	32%	33,039	11,764	44,803	32%	33,039	11,764	44,803	32%
2023	53,387	14,003	67,390	50%	53,387	14,003	67,390	50%	53,387	14,003	67,390	50%
2024	68,890	15,358	84,247	25%	59,236	34,624	93,860	39%	58,266	46,602	104,868	56%
2025	82,389	16,713	99,102	18%	66,470	52,125	118,595	26%	69,713	66,143	135,856	30%
2026	89,677	18,068	107,745	9%	72,074	69,990	142,064	20%	78,984	83,280	162,263	19%
2027	94,887	19,423	114,310	6%	78,922	86,119	165,042	16%	91,229	94,155	185,384	14%
2028	98,447	20,778	119,225	4%	84,321	101,448	185,769	13%	102,156	102,307	204,463	10%
2029	101,233	22,133	123,366	3%	89,177	112,947	202,125	9%	111,819	106,729	218,549	7%
2030	102,583	23,488	126,071	2%	92,879	123,140	216,019	7%	120,394	109,147	229,541	5%
2031	105,234	24,843	130,077	3%	97,305	131,460	228,765	6%	127,938	110,947	238,886	4%
2032	106,954	26,198	133,152	2%	101,106	138,899	240,005	5%	135,057	111,895	246,952	3%
2033	109,470	27,553	137,023	3%	105,415	144,316	249,731	4%	141,807	112,685	254,492	3%
2034	111,201	28,908	140,109	2%	109,273	148,939	258,212	3%	148,558	113,222	261,780	3%
2035	113,329	30,263	143,592	2%	113,536	151,948	265,484	3%	155,621	113,593	269,214	3%
2036	114,984	31,618	146,602	2%	117,650	154,579	272,230	3%	163,064	114,103	277,166	3%
2037	117,241	32,973	150,214	2%	122,562	156,657	279,219	3%	171,531	114,693	286,224	3%
2038	119,265	34,328	153,593	2%	127,557	158,650	286,206	3%	180,598	115,532	296,129	3%
2039	121,532	35,248	156,780	2%	133,253	160,179	293,432	3%	191,044	116,350	307,395	4%
2040	123,658	35,771	159,429	2%	138,865	161,342	300,206	2%	201,526	116,767	318,293	4%

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5. Peak demand forecast

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Peak Demand Forecast Methodology

- Regression
  - For the summer peak forecast, peak-day max temperature, monthly energy, and customers used as explanatory variables
    - » 10-year average peak-day max temperatures assumed in forecast
  - For the winter peak forecast, peak-day heating degree days, monthly energy, and customers used as explanatory variables
    - » 10-year average peak-day heating degree days assumed in forecast
- DSM and NEM incremental forecasts are subtracted from regression results

6. Energy forecast

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Energy Forecast Methodology

- Residential & GS1 Secondary load forecasts based on regression model using customer counts and 10-year average degree days (normal weather) as explanatory variables
  - Adjustments to the forecast can be made to capture short-term drivers of electric load growth, such as Bozeman area growth, and to transition from recent actual loads more reasonably
  - DSM and NEM incremental forecasts are subtracted from regression results
- All other customer classes based on recent actuals or averages, with known changes applied

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