



COLORADO

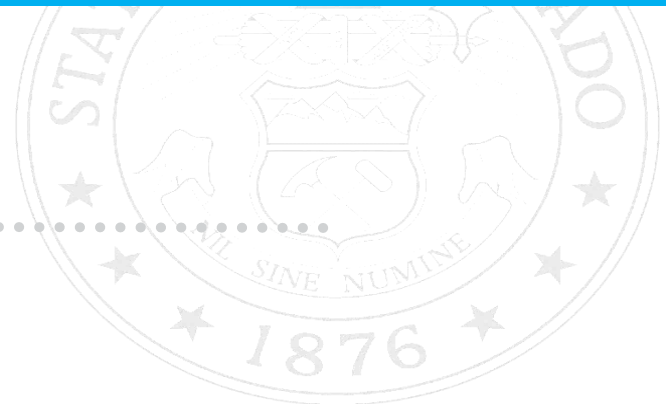
Department of
Regulatory Agencies

Public Utilities Commission

Aligning Retail Rates and Grid Needs: A Colorado Regulatory Perspective

**Market Design for Grid Services
ESIG Workshop
June 14, 2023**

**Eric Blank, Chairman
Colorado Public Utilities Commission**



Big Picture Overview

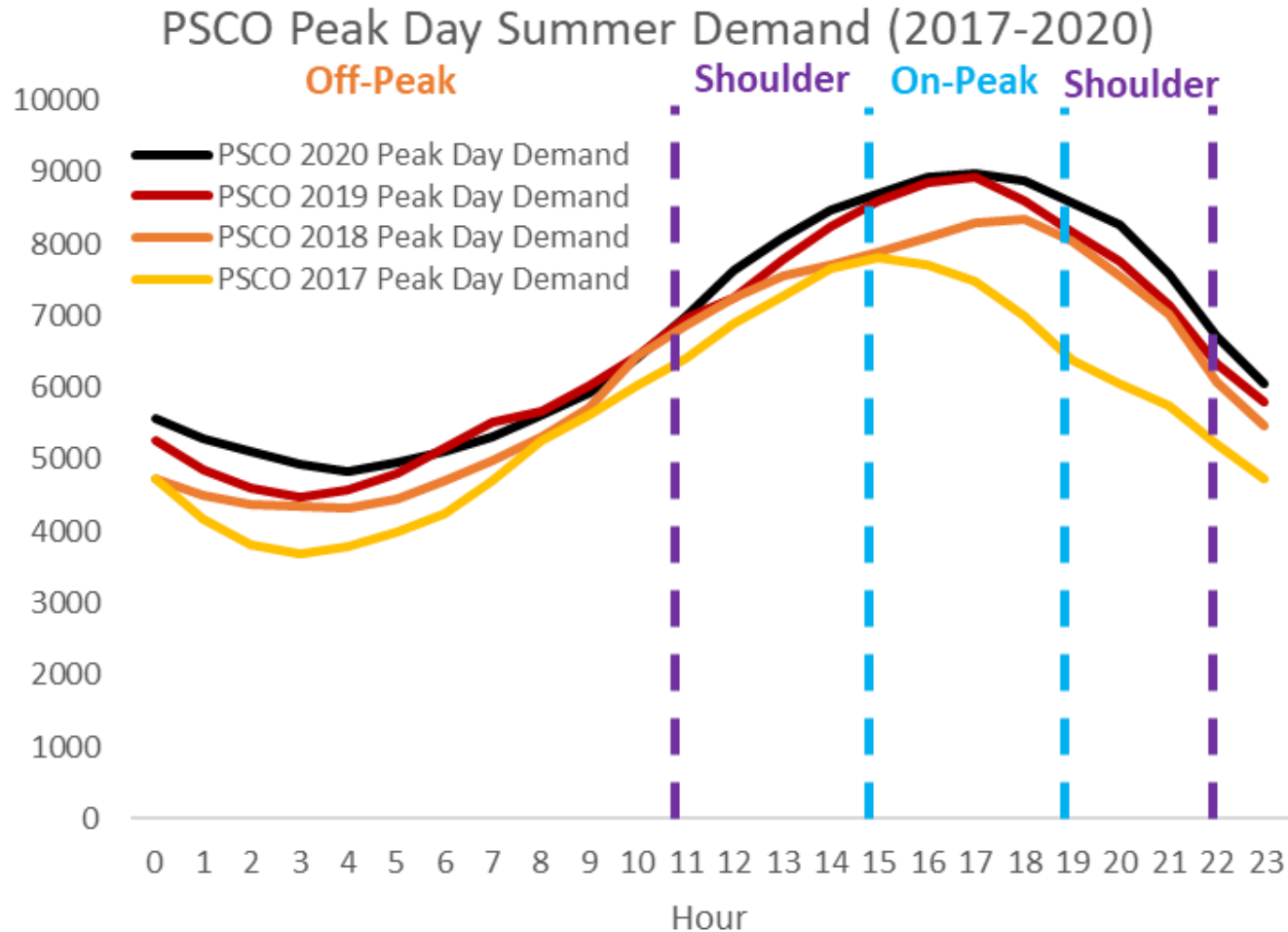
- State law requires regulated utilities in Colorado to reduce GHG emissions by 80% from 2005 levels by 2030. Colorado utilities expect to exceed this requirement through a mix of coal plant retirements and large additions of wind, solar, demand-side, storage and peaking investments.

Xcel Energy -- 2030 Nameplate Capacity*

<u>Resource Type</u>	<u>MWs</u>
Natural Gas (Combined Cycle)	1910
Natural Gas (Steam)	500
Natural Gas (Simple Cycle)	1140
Pumped Storage	410
Hydroelectric	175
Distributed Solar	1820
Utility Solar	2750
Utility Wind	5220
Battery Storage	275
Demand Response	600

* Xcel 2021 ERP: Update ELCC / Phase II Modeling (Table 2.12-1)

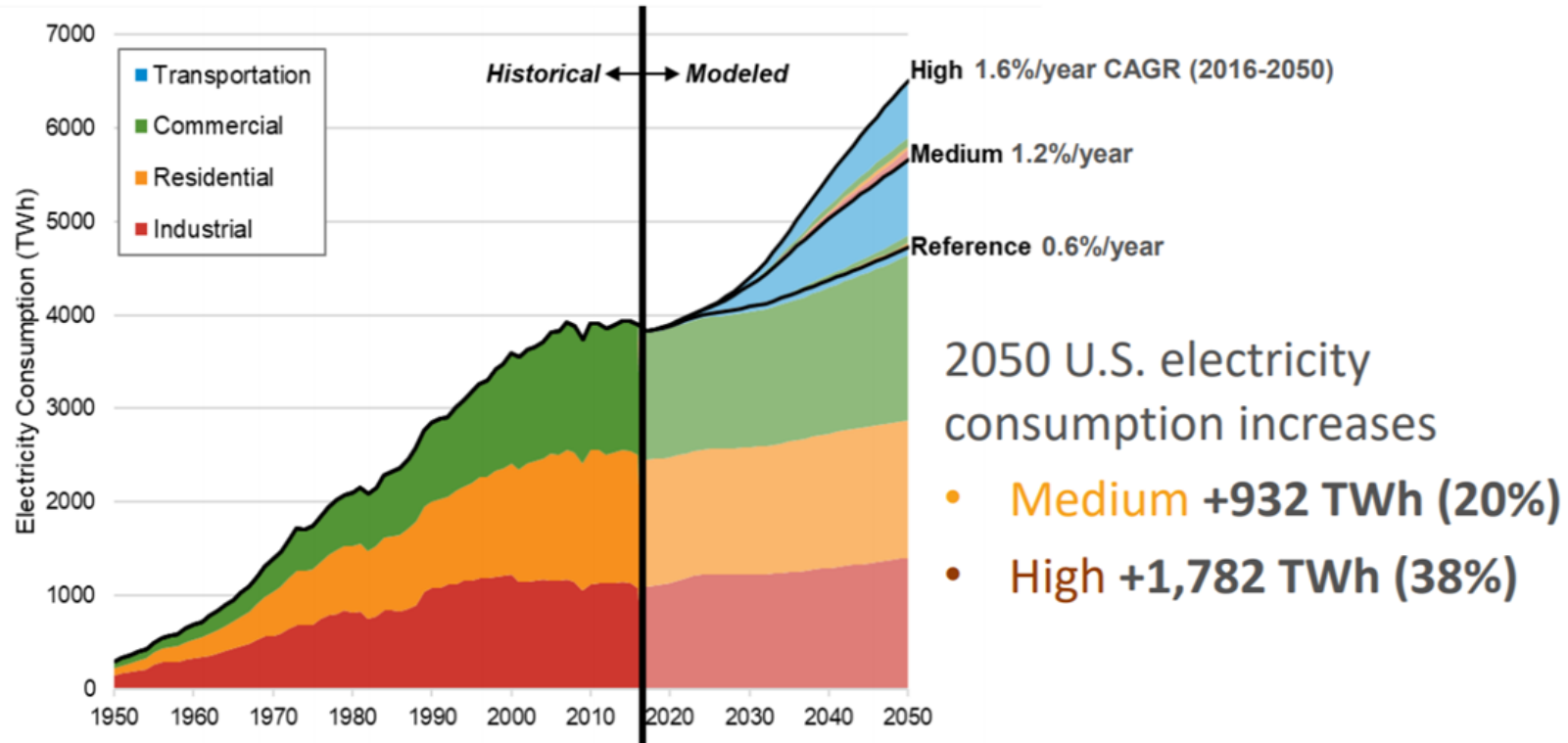
Summer Peak Demand



- Historically, summer demand in Colorado (in MWs) peaks sometime between 3-5 pm.

Projected US Electricity Consumption

Vehicle electrification dominates incremental growth in **annual** consumption



Source: NREL Electrification Futures Study, May 2021

Potential Impact of EVs in Colorado?

EVs on the Road (2030)	940,000	Vehicles
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Average Battery Size	60	Kwh
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Total Storage Capability	56,400	MWh
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4-Hour Duration Capacity	14,100	MW
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Xcel Energy BAA Peak Demand	9,000	MW
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Cost of Utility-Scale Storage	\$250	per KWh
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Value of Battery Storage?	\$14	Billion
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PSCo 2022 Electric Rate Base	\$11	Billion
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→ The potential \$ and MW impact of EVs on the CO electric system is enormous

→ Key issue: how do the costs and benefits get allocated?

Colorado Solar versus Peak Demand Profile

→ Explore the interaction on an hourly basis on a peak day between demand net of solar and what it means for retail rate structures.*

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	4555	4551	4242	3704	4021	4253	4973	4936	4569	4439	5002	5217
1	4411	4367	4150	3601	3897	4075	4694	4680	4366	4360	4895	5049
2	4358	4287	4106	3559	3820	3956	4506	4490	4231	4292	4836	4932
3	4334	4259	3986	3562	3812	3894	4372	4385	4176	4296	4807	4879
4	4350	4282	4198	3651	3883	3938	4360	4376	4195	4395	4821	4903
5	4440	4389	4356	3881	4095	4049	4485	4554	4410	4629	4950	5027
6	4667	4619	4617	4164	4374	4241	4681	4773	4697	4983	5182	5253
7	5005	4936	4815	4362	4589	4501	4861	4999	4780	5146	5472	5526
8	5237	5109	4862	4406	4678	4710	5176	5262	4868	5159	5549	5750
9	5257	5105	4816	4414	4722	4910	5558	5583	5043	5128	5522	5770
10	5171	5050	4765	4387	4730	5088	5901	5921	5259	5095	5491	5700
11	5114	4965	4687	4339	4759	5261	6211	6269	5473	5068	5453	5653
12	5014	4865	4622	4306	4809	5397	6546	6604	5706	5025	5426	5556
13	4954	4824	4575	4299	4812	5552	6832	6897	5973	5019	5392	5480
14	4895	4822	4554	4315	4827	5689	7073	7162	6245	5034	5371	5452
15	4865	4824	4553	4325	4871	5804	7292	7368	6479	5075	5331	5466
16	4889	4862	4603	4399	4918	5862	7398	7523	6599	5154	5386	5528
17	5064	4982	4693	4464	5001	5894	7373	7581	6650	5286	5614	5786
18	5530	5273	4818	4485	4980	5838	7171	7411	6515	5462	5983	6214
19	5621	5471	5036	4554	4974	5703	6901	7118	6382	5495	5966	6197
20	5489	5397	5067	4632	5043	5631	6633	6888	6164	5359	5809	6078
21	5360	5294	4911	4472	4928	5511	6353	6471	5762	5152	5688	5953
22	5132	5087	4646	4173	4580	5062	5795	5860	5261	4858	5481	5739
23	4820	4805	4402	3904	4239	4605	5379	5338	4873	4619	5204	5460

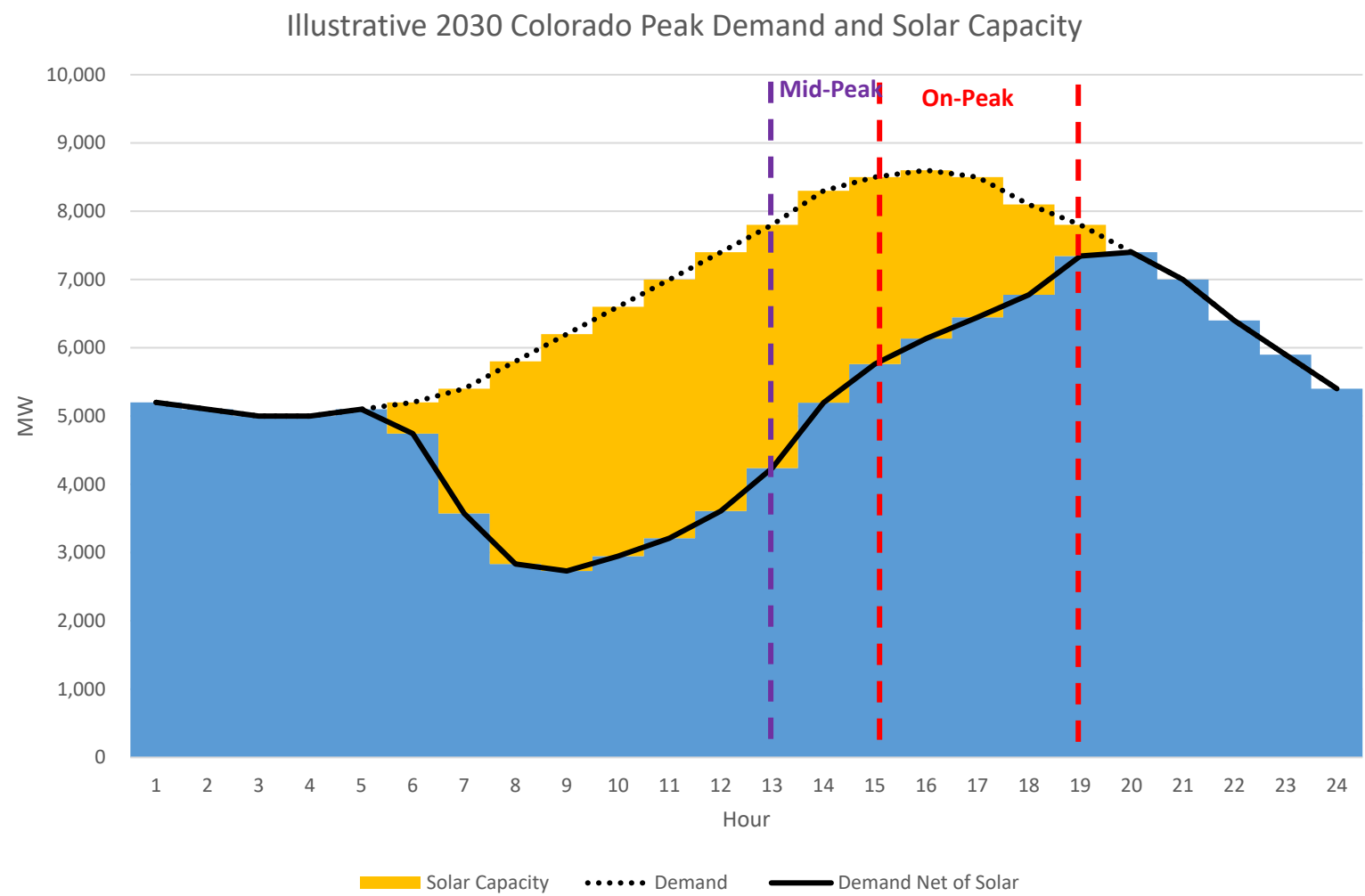
2109 Demand Profile

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	3	47	261	410	224	46	1	0	0	0
7	54	209	251	652	988	1127	991	666	383	92	277	63
8	630	819	873	1261	1217	1368	1272	1192	1041	825	869	604
9	905	1012	1105	1389	1310	1438	1385	1314	1241	1074	970	760
10	945	1102	1196	1431	1315	1491	1397	1371	1299	1085	926	796
11	926	1094	1215	1425	1298	1488	1439	1436	1367	1098	915	813
12	945	1030	1265	1373	1375	1445	1480	1432	1372	1108	979	844
13	960	1032	1325	1280	1388	1350	1461	1328	1296	1145	1018	879
14	913	955	1272	1211	1304	1271	1371	1328	1320	1181	1017	810
15	739	964	1163	1101	1141	1223	1259	1253	1280	1136	685	536
16	156	551	1010	904	1096	1269	1035	1145	1052	1035	61	26
17	0	23	680	807	999	1090	852	1002	798	432	3	0
18	0	0	161	369	653	670	535	618	190	4	0	0
19	0	0	0	17	130	219	117	48	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0

Solar Profile at 2022 Capacity

* Solar profile is based on actual forecasts from a site by Pueblo, Colorado using single axis tracking.

Illustrative 2030 Colorado Peak Demand Net of Solar



Key Takeaways

- TOU rates may need to reflect where we're headed, not where we're at?
 - Solar and wind curtailment is likely to be a growing problem in Colorado?
 - Given the sub-hourly variability of wind and solar, at higher penetrations dynamic approaches for managing load and EV charging may be needed?
 - To implement a dynamic approach in a regulated monopoly environment, innovative new programs will be likely be required.
- The dollar benefits / costs involved w/ EVs may need to be managed by the regulated system for the benefit of all customers, not privatized?