

For this weekend's report, we wanted to continue looking at the impacts of the renewable buildout on gas burns. It's no surprise that the addition of wind and solar is bearish for nat gas usage but what is surprising is the speed at which those generation types are becoming part of the power mix. Below is some data and visualization from BNEF, which give a great look at the growth of solar and wind last year and in the coming years.

We are going to focus on just 4 regions for this report – ERCOT, MISO, SPP & California. More regions are available through the BNEF platform.

To start, here is the number of new MWs that have come online and are expected to come online in the next few years.

<b>ERCOT</b>	2017	2018	2019	2020	2021	2022	2023	Total for 2021-23
Solar	657	707	499	2852	8356	8201	2984	19541
Wind	1832	1655	3472	3948	7208	1986	579	9772
NatGas	2704	786	187	444	1312	1143	743	3198

<b>MISO</b>	2017	2018	2019	2020	2021	2022	2023	Total for 2021-23
Solar	410	361	205	705	2048	3357	4140	9545
Wind	846	1798	2677	6432	5427	1213	536	7175
NatGas	1094	989	1509	2470	1711	2544	638	4894

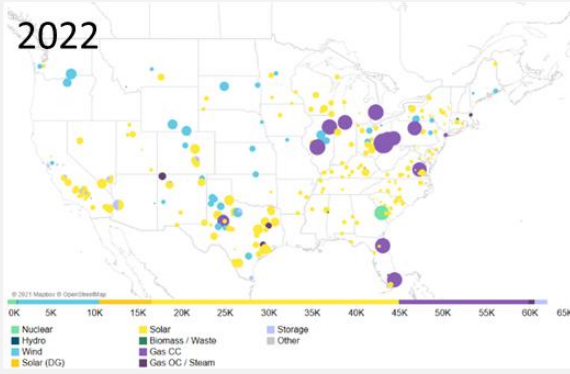
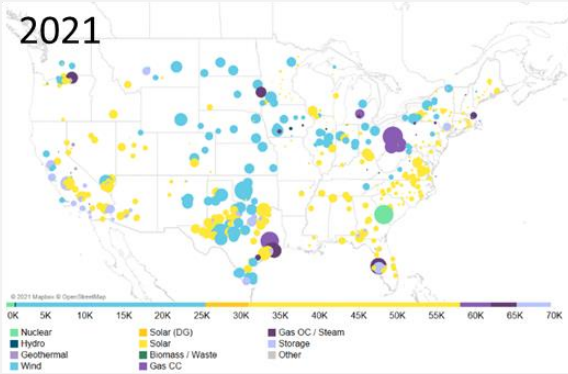
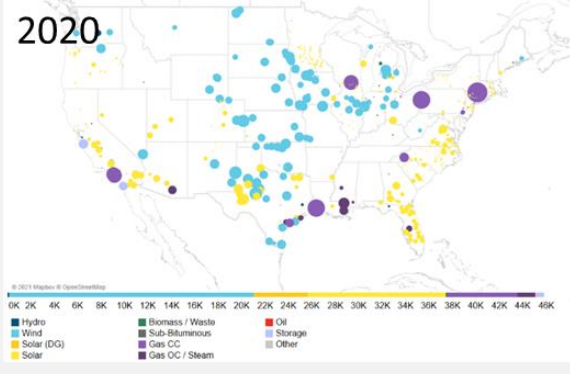
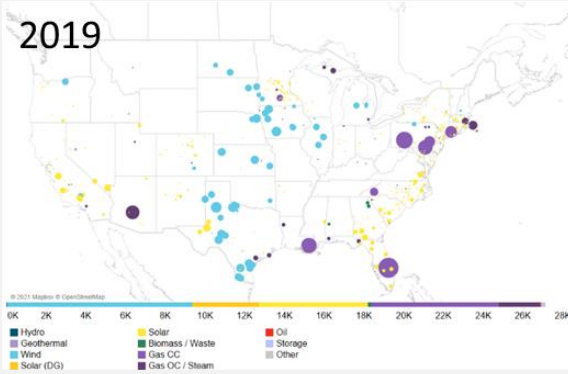
  

<b>SPP</b>	2017	2018	2019	2020	2021	2022	2023	Total for 2021-23
Solar	59	21	25	30	607	571	508	1685
Wind	2132	1976	1833	5473	4064	906	849	5819
NatGas	1351	9	0	0	0	0	0	0

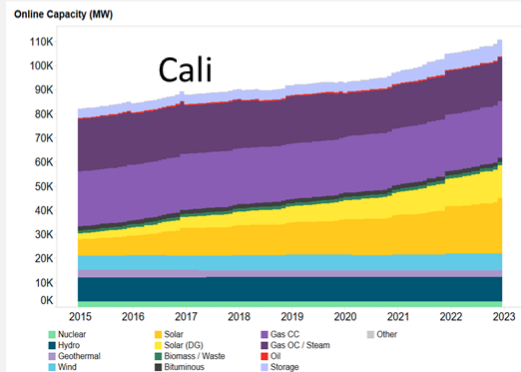
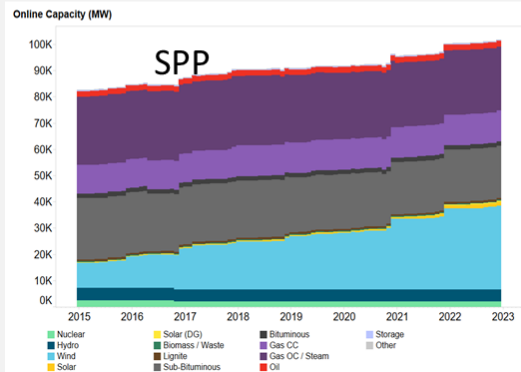
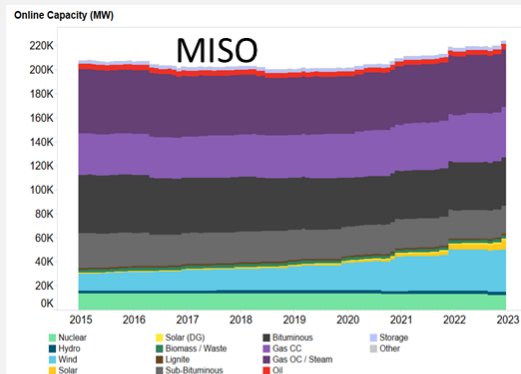
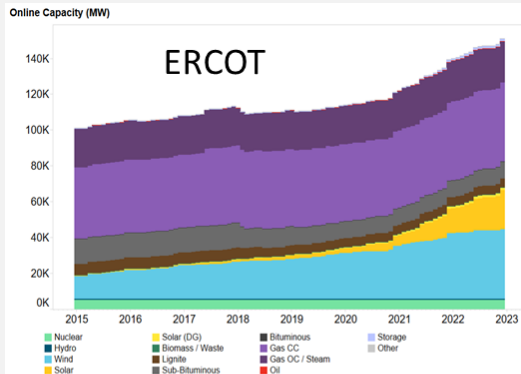
  

<b>Cali</b>	2017	2018	2019	2020	2021	2022	2023	Total for 2021-23
Solar	910	961	1142	1926	3171	3252	2824	9247
Wind	193	202	133	79	482	92	0	574
NatGas	43	666	34	1498	3	0	0	3

Here is the same data overlaid on a map to see visually where the new generation is located. The maps show all types of new generation, but it's very apparent that wind and solar dominate.



To see how the power stack has changed, this next visual shows the growth of wind and solar as it offsets coal and natural gas usage.

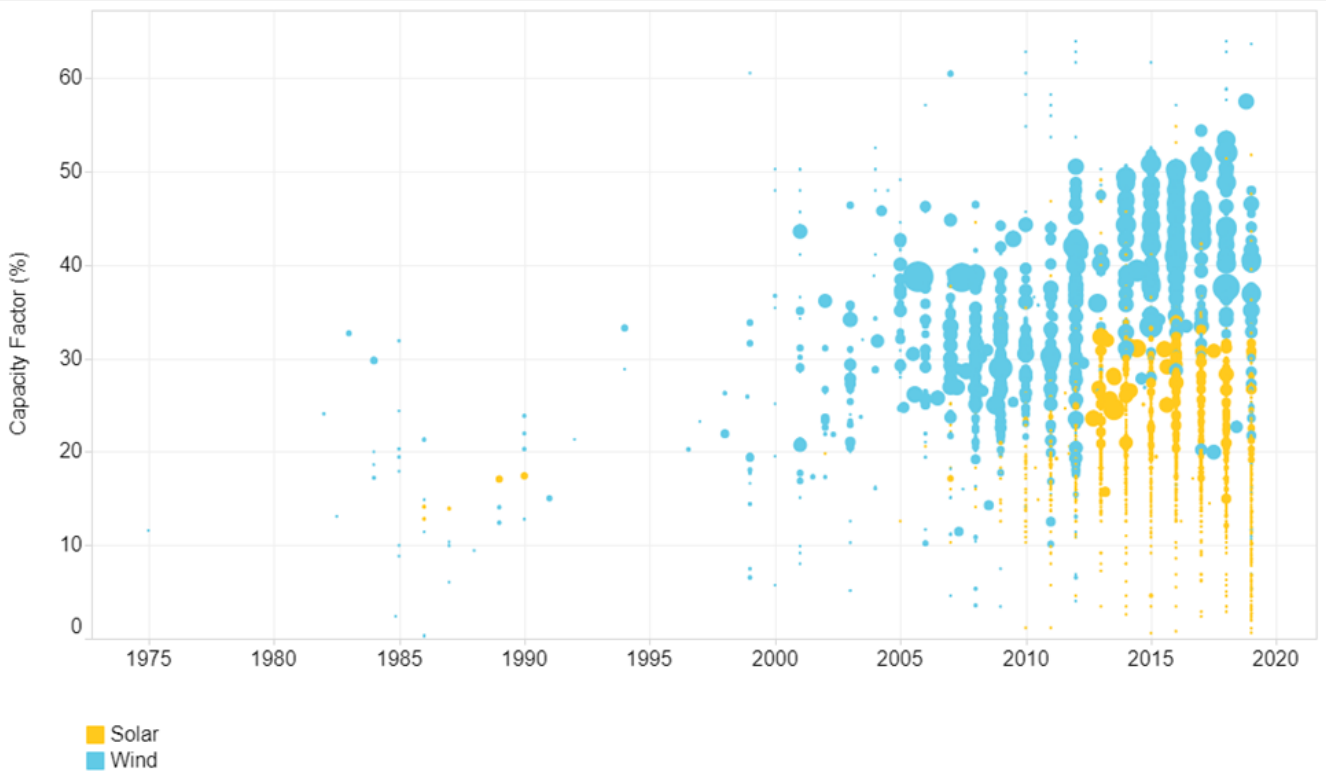


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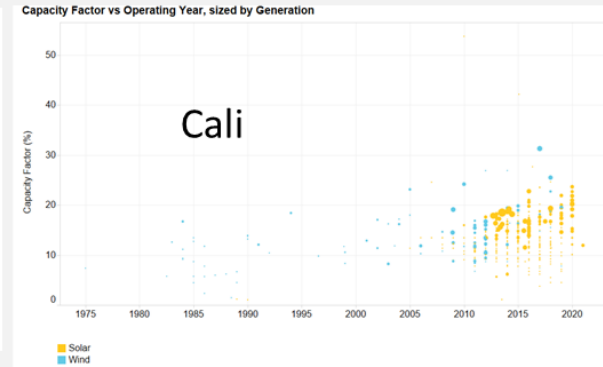
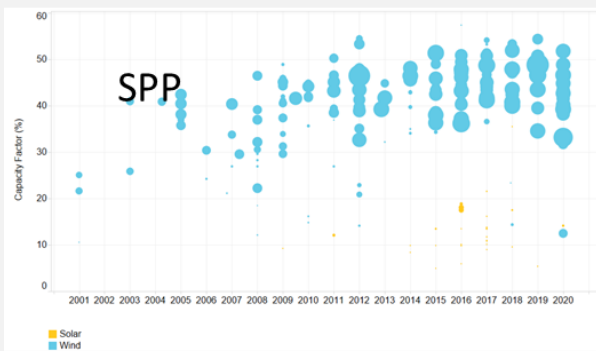
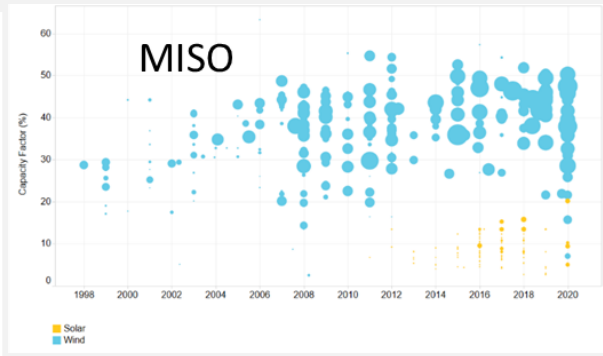
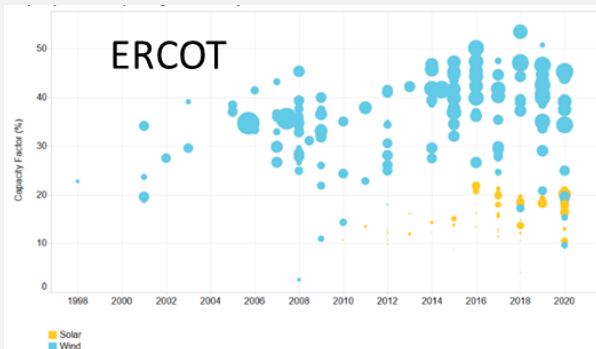
Finally, we want to get back to the analysis of how the new renewable energy could impact gas burns this summer. We estimated the impact of the YoY change in the power stack at the national level. This a very rough estimate, but should serve as a good estimate on the change to power burns purely from the change in the power generation mix.

Last time we estimated the new wind and solar capacity is utilized 30%, but the data from BNEF sheds some more light on the capacity factor of this generation type. The charts below show the capacity factor of wind and solar by age of the plant. As can be seen, the capacity factor of the new wind assets greatly exceeded our estimate.

The chart below shows the capacity factor (y-axis) of wind and solar assets against the year they commenced operations (x-axis). As can be seen, the news wind plants have become very efficient with some achieving a capacity factor above 50%.



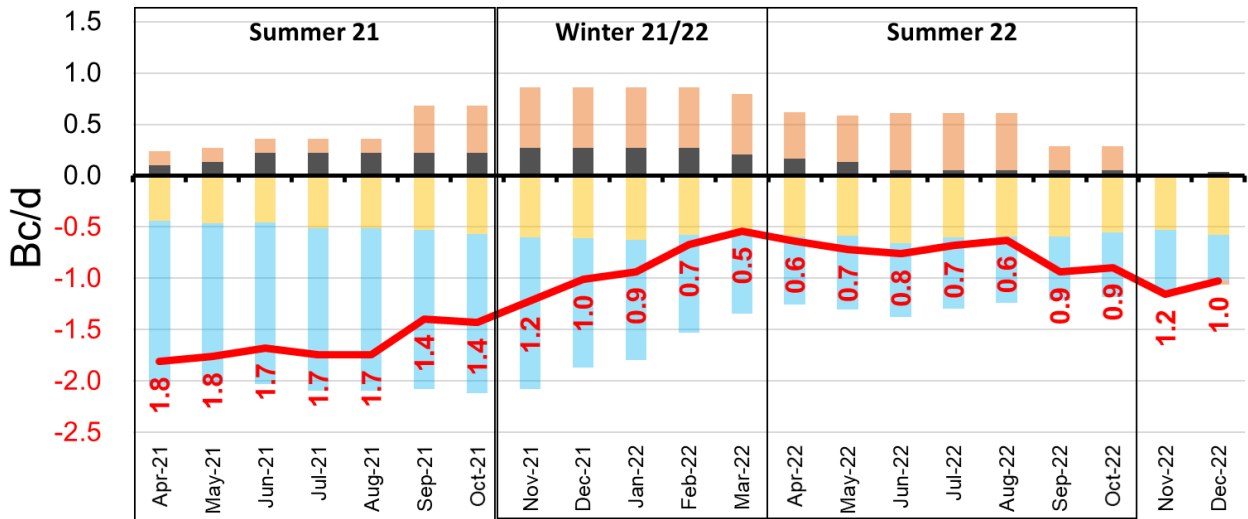
Here is the same data for the 4 regions.



In reviewing this data, we have modified the capacity factor in our calculations to 40% for new wind assets, and 20% for the news solar projects. Using these assumptions, we estimate the gas burns (pushing out 7.5 HR natgas gens) will be on average 1.5 Bcf/d lower this summer and 0.8 Bcf/d lower this winter from the net generation change.

### Impact to Gas Burns from the Incremental Buildout of Renewables and Coal/Nuke Retirements

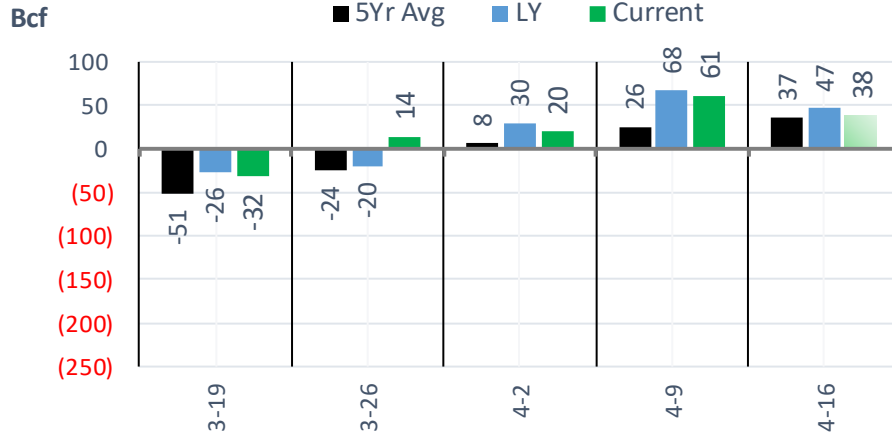
Legend: Solar (yellow), Wind (blue), Coal (grey), Nuke (orange), Impact to Gas Burn (red line)



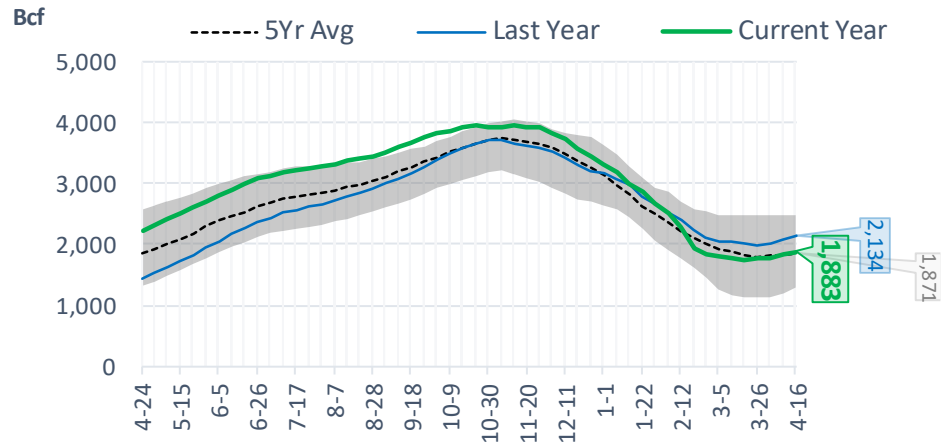
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## EIA Storage Report

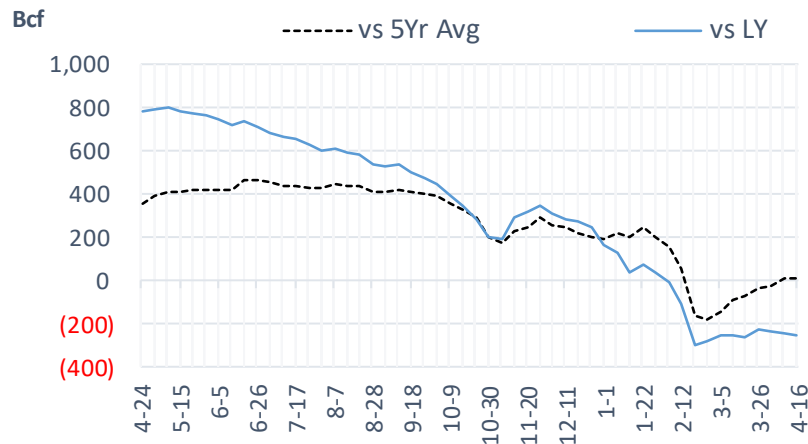
### Total Lower 48 YoY Weekly Change



### Total Lower 48 Storage Levels



### Total Lower 48 LY Surplus/Deficit

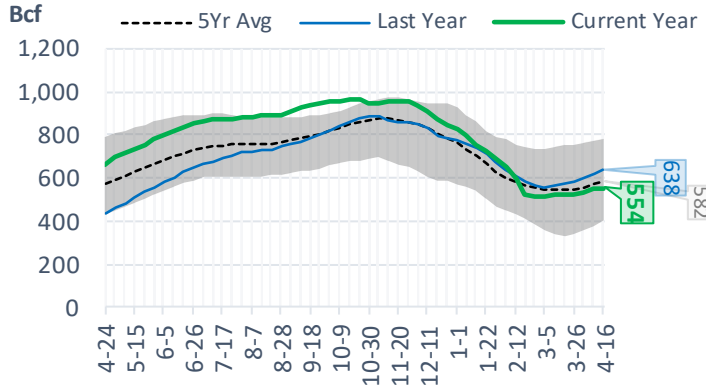


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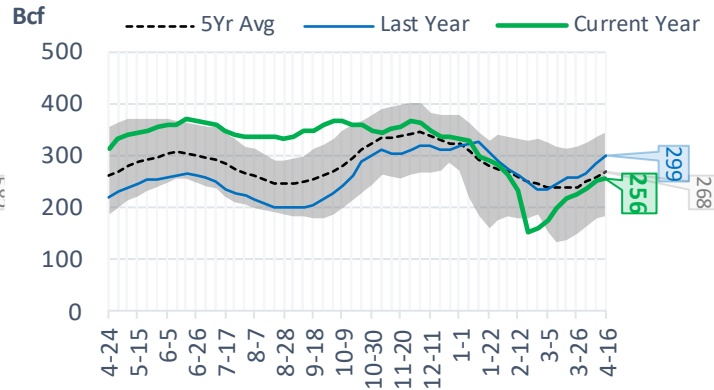
## Natural Gas Storage Stats - Last 5 Weeks

Week Ending	Current 16-Apr	Week - 1 9-Apr	Week - 2 2-Apr	Week - 3 26-Mar	Week - 4 19-Mar	Week - 5 12-Mar
<b>Total Lower 48 Storage Level</b>	<b>1883</b>	1845	1784	1764	1750	1782
Weekly Change	+38	+61	+20	+14	-32	-11
vs LY	-251	-242	-235	-225	-259	-253
vs 5Yr Avg	+12	+11	-24	-36	-74	-93
<b>S. Central Salt Storage Level</b>	<b>256</b>	251	235	226	215	197
Weekly Change	+5	+16	+9	+11	+18	+21
vs LY	-43	-32	-29	-30	-41	-48
vs 5Yr Avg	-12	-7	-13	-13	-21	-40
<b>S. Central NonSalt Storage Level</b>	<b>554</b>	547	533	523	519	519
Weekly Change	+7	+14	+10	+4	0	+10
vs LY	-84	-76	-71	-60	-52	-47
vs 5Yr Avg	-28	-22	-25	-25	-23	-24
<b>Midwest Storage Level</b>	<b>421</b>	414	398	401	405	426
Weekly Change	+7	+16	-3	-4	-21	-14
vs LY	-71	-71	-77	-77	-90	-88
vs 5Yr Avg	+20	+16	-2	-6	-19	-23
<b>East Storage Level</b>	<b>325</b>	311	305	307	307	328
Weekly Change	+14	+6	-2	0	-21	-22
vs LY	-75	-86	-77	-77	-93	-86
vs 5Yr Avg	+16	+8	+2	-3	-22	-25
<b>Mountain Storage Level</b>	<b>118</b>	118	115	112	112	114
Weekly Change	0	+3	+3	0	-2	+1
vs LY	+22	+23	+23	+20	+19	+18
vs 5Yr Avg	+9	+11	+9	+6	+6	+7
<b>Pacific Storage Level</b>	<b>210</b>	205	198	194	193	199
Weekly Change	+5	+7	+4	+1	-6	-6
vs LY	+1	+2	-4	-3	-2	0
vs 5Yr Avg	+7	+7	+4	+5	+7	+13

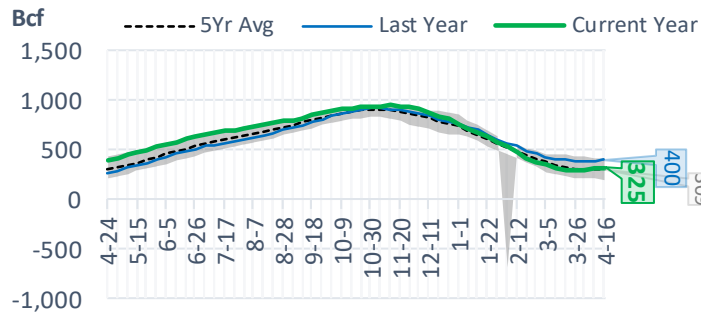
## NonSalt Storage Levels



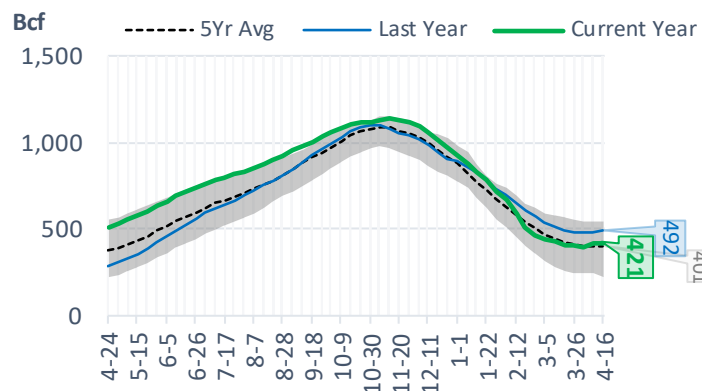
## Salt Storage Levels



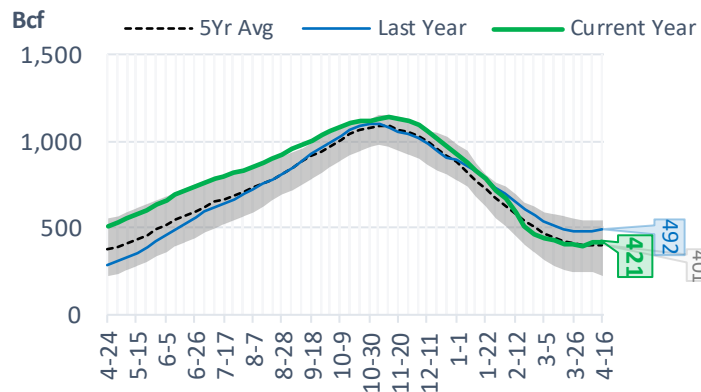
## East Storage Levels



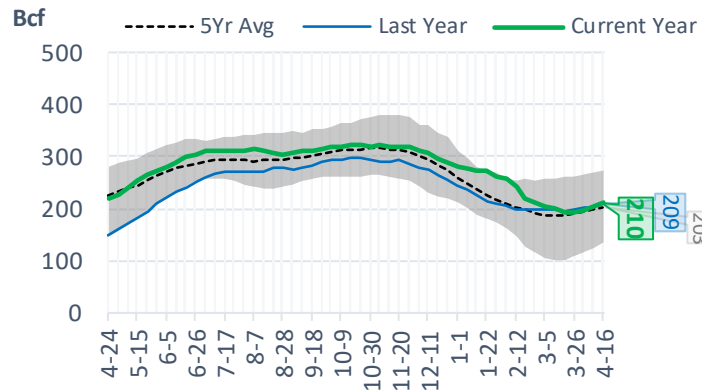
## Midwest Storage Levels



## Midwest Storage Levels



## Pacific Storage Levels



## EIA Storage Week Balances

	19-Mar	26-Mar	2-Apr	9-Apr	16-Apr	23-Apr	WoW	vs. 4W
<b>Lower 48 Dry Production</b>	<b>91.8</b>	<b>92.0</b>	<b>92.5</b>	<b>92.1</b>	<b>91.4</b>	<b>90.5</b>	▼ -0.9	▼ -1.5
<b>Canadian Imports</b>	<b>5.0</b>	<b>4.5</b>	<b>4.5</b>	<b>4.2</b>	<b>4.3</b>	<b>5.3</b>	▲ 1.1	▲ 1.0
L48 Power	24.9	24.1	24.6	23.2	24.6	25.8	▲ 1.2	▲ 1.7
L48 Residential & Commercial	30.3	24.9	23.3	18.5	18.5	23.7	▲ 5.3	▲ 2.4
L48 Industrial	21.2	20.3	21.2	21.4	22.0	19.7	▼ -2.4	▼ -1.6
L48 Lease and Plant Fuel	5.1	5.1	5.1	5.1	5.0	5.0	▼ 0.0	▼ -0.1
L48 Pipeline Distribution	2.6	2.3	2.3	2.1	2.1	2.4	▲ 0.3	▲ 0.2
<b>L48 Regional Gas Consumption</b>	<b>84.0</b>	<b>76.7</b>	<b>76.5</b>	<b>70.3</b>	<b>72.3</b>	<b>76.7</b>	▲ 4.4	▲ 2.7
<b>Net LNG Exports</b>	<b>11.2</b>	<b>11.6</b>	<b>11.7</b>	<b>11.5</b>	<b>11.4</b>	<b>11.6</b>	▲ 0.2	▲ 0.1
<b>Total Mexican Exports</b>	<b>6.3</b>	<b>6.6</b>	<b>6.4</b>	<b>6.2</b>	<b>7.3</b>	<b>6.8</b>	▼ -0.5	▲ 0.2
<b>Implied Daily Storage Activity</b>	<b>-4.7</b>	<b>1.6</b>	<b>2.4</b>	<b>8.3</b>	<b>4.7</b>	<b>0.7</b>	<b>-4.0</b>	
<b>EIA Reported Daily Storage Activity</b>	<b>-4.6</b>	<b>2.0</b>	<b>2.9</b>	<b>8.7</b>	<b>5.4</b>			
<b>Daily Model Error</b>	<b>-0.2</b>	<b>-0.4</b>	<b>-0.5</b>	<b>-0.5</b>	<b>-0.7</b>			

## Monthly Balances

	2Yr Ago Apr-19	LY Apr-20	Dec-20	Jan-21	Feb-21	Mar-21	MTD Apr-21	MoM	vs. LY
<b>Lower 48 Dry Production</b>	<b>89.1</b>	<b>91.9</b>	<b>91.0</b>	<b>90.5</b>	<b>85.1</b>	<b>92.0</b>	<b>91.3</b>	▼ -0.6	▲ 0.8
<b>Canadian Imports</b>	<b>4.6</b>	<b>4.0</b>	<b>5.8</b>	<b>6.3</b>	<b>6.4</b>	<b>4.7</b>	<b>4.6</b>	▼ -0.1	▼ -1.7
L48 Power	24.6	25.6	28.0	28.1	27.8	25.0	24.7	▼ -0.3	▼ -3.4
L48 Residential & Commercial	19.1	20.5	40.0	43.8	47.7	28.3	20.8	▼ -7.4	▼ -23.0
L48 Industrial	21.4	19.8	23.3	23.5	22.1	20.1	21.1	▲ 0.9	▼ -2.4
L48 Lease and Plant Fuel	4.9	5.1	5.0	5.1	4.7	5.1	5.0	▼ 0.0	▼ 0.0
L48 Pipeline Distribution	2.2	2.3	3.1	3.2	3.4	2.5	2.2	▼ -0.3	▼ -1.0
<b>L48 Regional Gas Consumption</b>	<b>72.3</b>	<b>73.2</b>	<b>99.4</b>	<b>103.7</b>	<b>105.7</b>	<b>81.0</b>	<b>73.9</b>	▼ -7.2	▼ -29.8
<b>Net LNG Exports</b>	<b>4.5</b>	<b>8.2</b>	<b>11.0</b>	<b>10.5</b>	<b>8.4</b>	<b>11.1</b>	<b>11.5</b>	▲ 0.4	▲ 1.0
<b>Total Mexican Exports</b>	<b>4.7</b>	<b>4.8</b>	<b>5.8</b>	<b>6.2</b>	<b>5.7</b>	<b>6.5</b>	<b>6.7</b>	▲ 0.3	▲ 0.6
<b>Implied Daily Storage Activity</b>	<b>12.3</b>	<b>9.6</b>	<b>-19.5</b>	<b>-23.5</b>	<b>-28.3</b>	<b>-1.9</b>	<b>3.9</b>		
<b>EIA Reported Daily Storage Activity</b>									
<b>Daily Model Error</b>									

Source: Bloomberg, analytix.ai



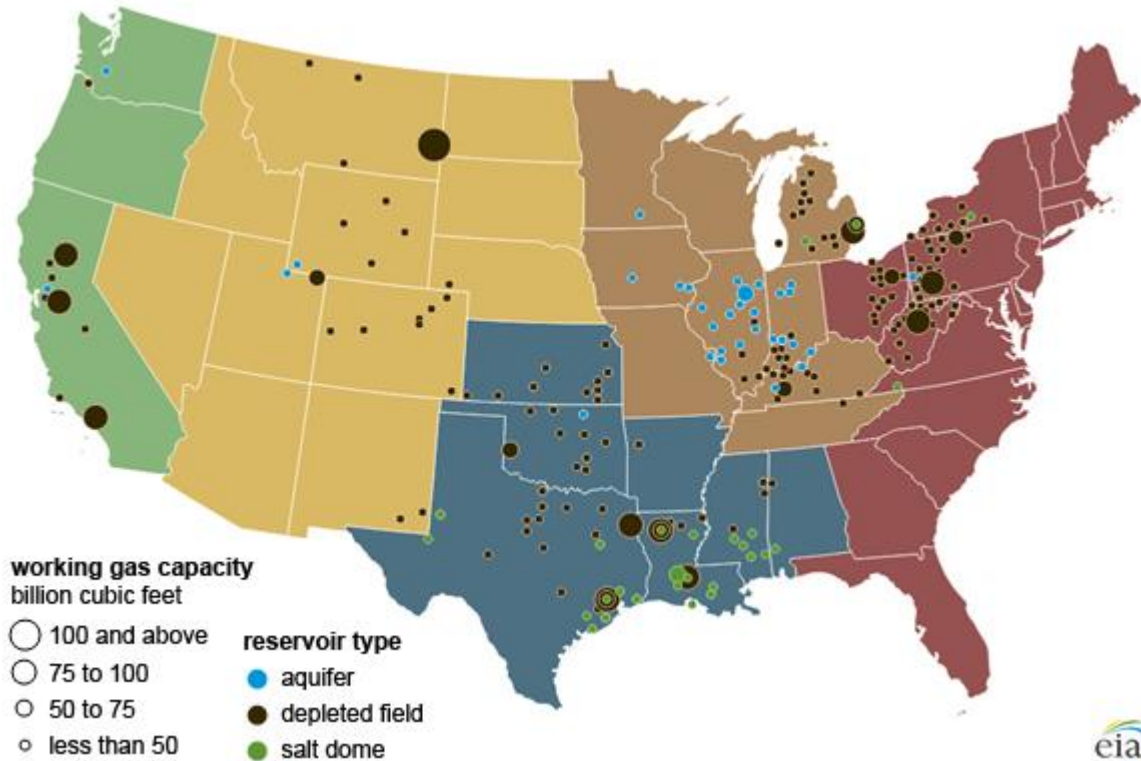
## Regional S/D Models Storage Projection

Week Ending 23-Apr

	Daily Raw Storage	Daily Adjustment Factor	Daily Average Storage Activity (Adjusted) *	Weekly Adjusted Storage Activity
L48	0.4	0.9	1.4	9
East	-2.3	1.8	-0.5	-3
Midwest	0.1	-0.3	-0.2	-1
Mountain	3.3	-2.9	0.4	3
South Central	-2.4	2.7	0.3	2
Pacific	1.7	-0.4	1.3	9

\*Adjustment Factor is calculated based on historical regional deltas

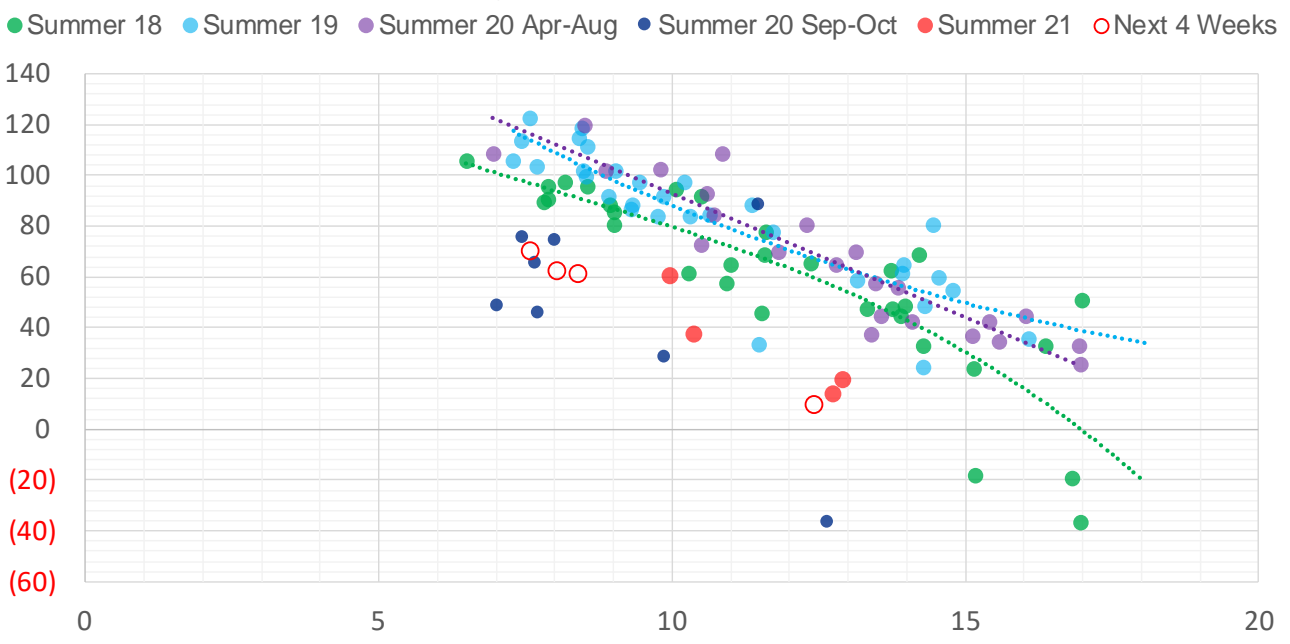
U.S. underground natural gas storage facilities by type (July 2015)



## Weather Model Storage Projection

Next report and beyond		
Week Ending	Temp	Week Storage Projection
30-Apr	8.4	61
07-May	7.6	70
14-May	8.1	62

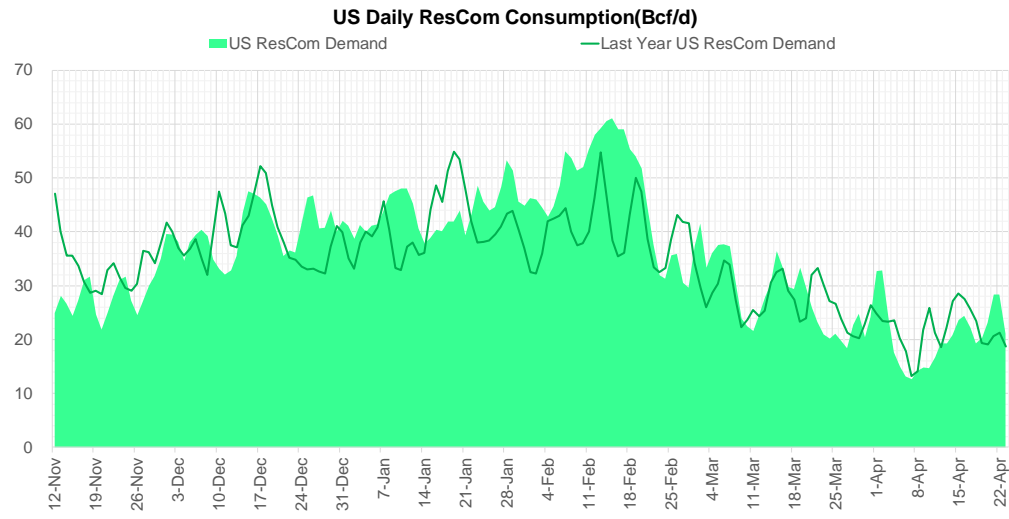
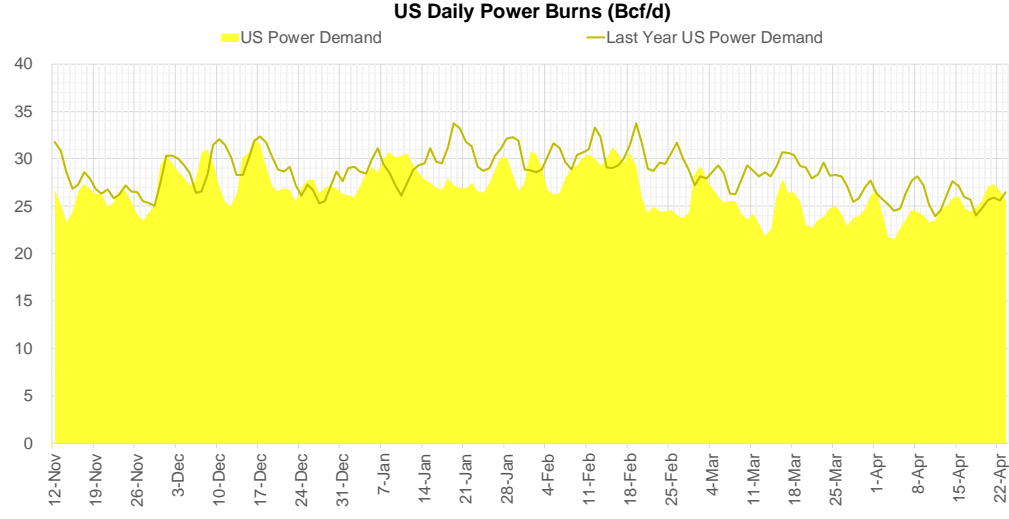
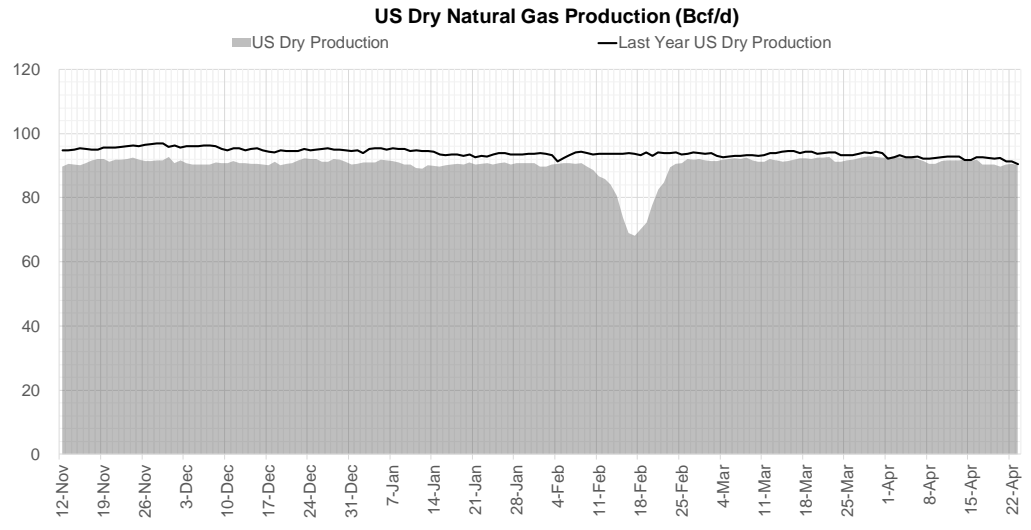
### Weather Storage Model - Next 4 Week Forecast



Note: this is not our official end of season forecast. This chart signifies where storage levels end with 10-year normal weather and current market tightness relative to last year

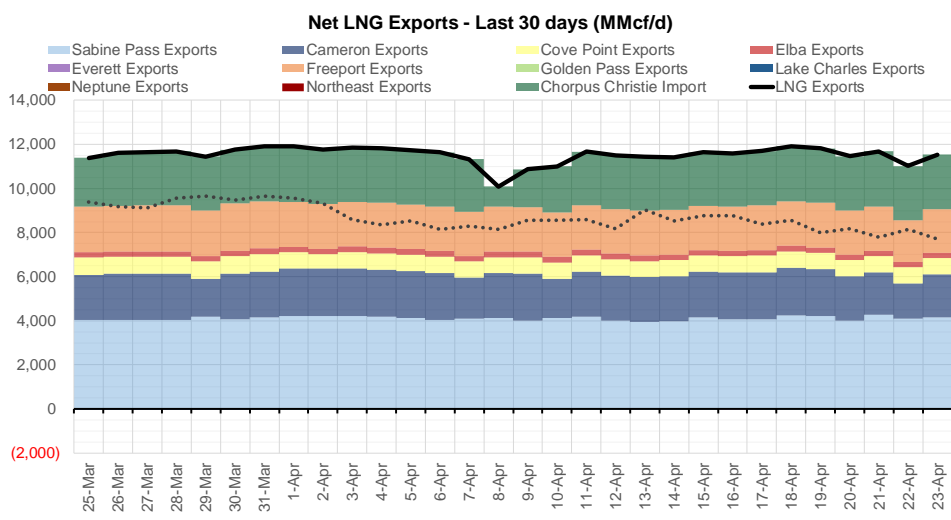
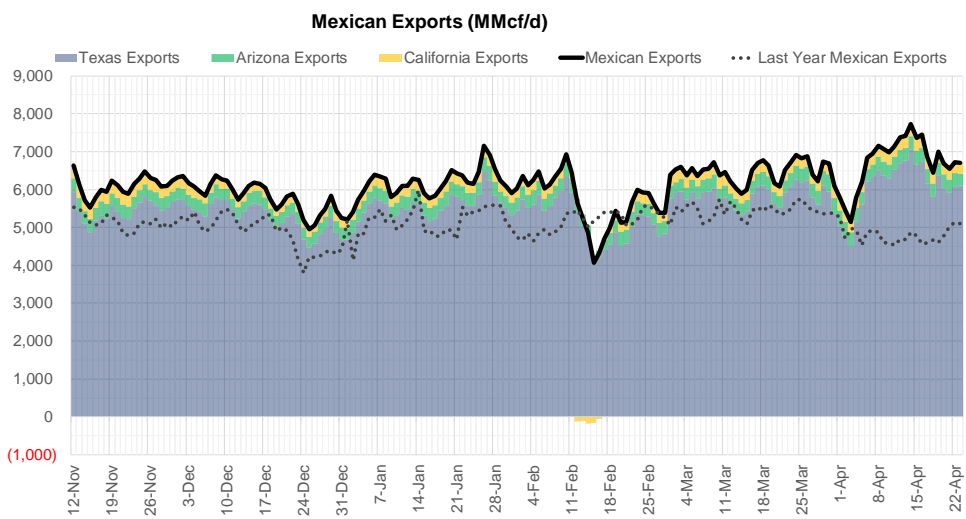
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## Supply – Demand Trends



Source: Bloomberg

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## Nat Gas Options Volume and Open Interest CME, ICE and Nasdaq Combined

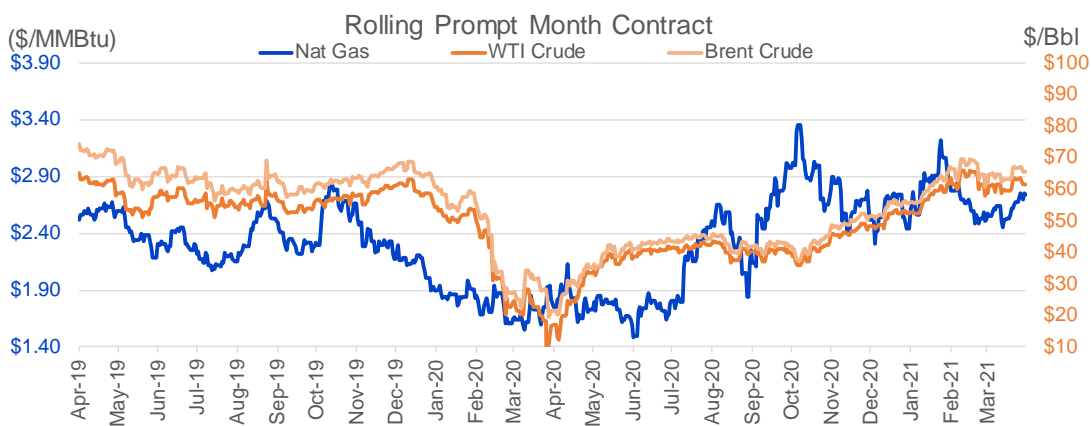
CONTRACT MONTH	CONTRACT YEAR	PUT/CALL	STRIKE	CUMULATIVE VOL	CONTRACT MONTH	CONTRACT YEAR	PUT/CALL	STRIKE	CUMULATIVE OI
6	2021	P	2.65	6320	10	2021	C	4.00	38898
6	2021	P	2.55	5619	5	2021	C	3.00	34335
8	2021	C	3.25	5180	8	2021	C	4.00	33833
7	2021	C	3.25	4531	5	2021	P	2.50	31001
6	2021	C	3.00	3638	10	2021	C	3.25	30594
8	2021	C	3.00	3574	6	2021	P	2.50	28610
5	2021	C	2.75	3500	7	2021	C	4.00	28238
8	2021	P	2.50	3051	8	2021	C	3.50	27956
5	2021	P	2.60	2985	6	2021	C	4.00	27953
10	2021	C	3.25	2901	10	2021	C	5.00	26339
5	2021	C	2.70	2896	5	2021	C	3.50	25933
6	2021	C	3.25	2750	6	2021	C	3.00	25561
10	2021	P	2.50	2608	5	2021	P	2.00	25423
5	2021	P	2.50	2476	5	2021	C	3.25	24854
8	2021	C	3.50	2255	5	2021	C	4.00	24706
6	2021	P	2.25	2210	8	2021	C	3.25	24528
5	2021	C	2.80	2120	5	2021	P	2.25	24000
5	2021	P	2.65	2003	10	2021	C	3.50	22908
6	2021	P	2.50	2001	7	2021	C	3.25	22726
2	2022	C	5.50	2000	5	2021	C	2.75	21750
10	2021	C	3.00	1882	6	2021	C	3.25	20849
10	2021	P	2.75	1873	10	2021	C	3.00	20359
6	2021	P	2.60	1709	10	2021	P	2.50	19414
9	2021	C	3.25	1601	6	2021	C	3.50	19121
7	2021	C	3.00	1579	9	2021	C	3.50	18989
8	2021	C	4.00	1540	4	2022	C	3.00	18974
10	2021	C	3.50	1526	8	2021	P	2.25	18890
10	2021	P	2.25	1500	5	2021	P	2.40	18889
7	2021	P	2.50	1489	7	2021	C	3.50	18708
7	2021	P	2.25	1401	8	2021	P	2.50	18669
10	2021	C	5.50	1400	6	2021	P	2.25	18571
11	2021	C	3.25	1400	10	2021	P	2.00	18110
5	2021	C	2.90	1267	10	2021	P	2.25	17977
7	2021	C	3.50	1264	7	2021	P	2.50	17851
5	2021	C	2.85	1254	9	2021	P	2.00	17819
6	2021	C	2.90	1171	6	2021	P	2.00	17058
1	2022	P	2.75	1100	12	2021	C	4.00	16790
6	2021	P	2.75	1088	11	2021	C	4.00	16626
8	2021	C	3.10	1031	8	2021	C	3.00	16586
9	2021	C	3.00	1023	6	2021	C	2.75	15755
5	2021	P	2.40	1005	6	2021	C	3.75	15649
9	2021	P	2.50	1003	7	2021	P	2.00	15536
10	2021	C	3.75	1000	7	2021	C	3.00	15455
6	2021	C	2.85	973	8	2021	P	2.00	15255
9	2021	C	3.50	900	9	2021	C	3.25	15205
7	2021	C	3.10	893	5	2021	P	2.60	14807
7	2021	P	2.60	872	9	2021	C	4.00	14220
5	2021	P	2.75	842	12	2021	P	2.00	13951
6	2021	C	2.95	828	9	2021	P	1.90	13733
					3	2022	C	5	13675

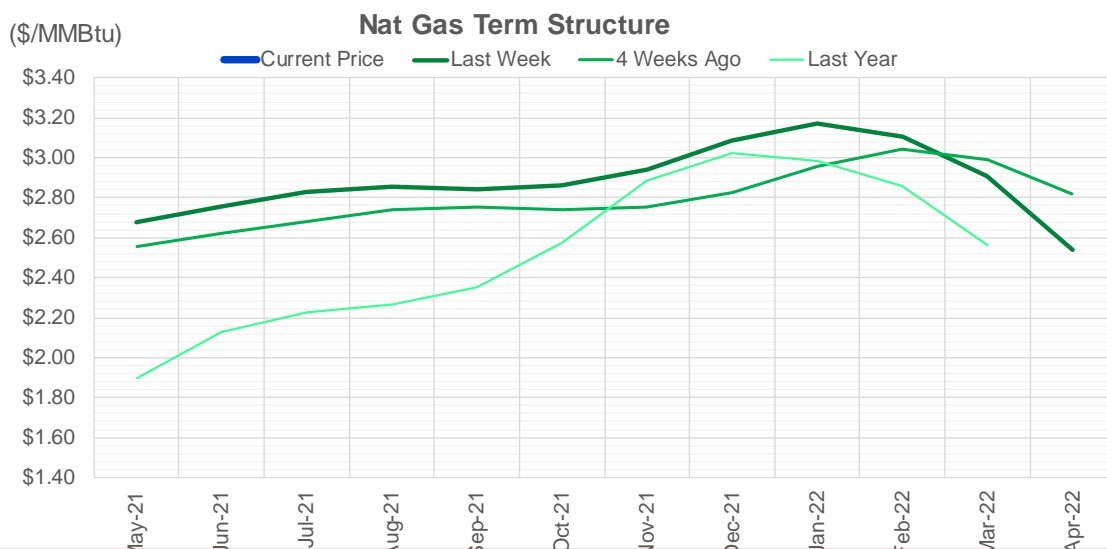
Source: CME, Nasdaq, ICE

## Nat Gas Futures Open Interest CME, ICE and Nasdaq Combined

CME Henry Hub Futures (10,000 MMBtu)				ICE Henry Hub Futures Contract Equivalent (10,000 MM			
	Current	Prior	Daily Change	FOR JUNE 26	Current	Prior	Daily Change
MAY 21	37883	61406	-23523	MAY 21	77176	79464	-2289
JUN 21	190709	178117	12592	JUN 21	79524	80418	-894
JUL 21	187522	185755	1767	JUL 21	88359	88434	-75
AUG 21	75518	73651	1867	AUG 21	78721	78260	461
SEP 21	108552	107100	1452	SEP 21	68548	68405	143
OCT 21	124717	126670	-1953	OCT 21	85038	84817	221
NOV 21	65010	64935	75	NOV 21	59961	60293	-332
DEC 21	46003	45051	952	DEC 21	59265	59049	216
JAN 22	68500	68296	204	JAN 22	63171	62798	372
FEB 22	22848	22449	399	FEB 22	46514	45918	596
MAR 22	42761	43002	-241	MAR 22	51209	50912	297
APR 22	49180	49169	11	APR 22	47390	47108	283
MAY 22	27066	26445	621	MAY 22	41066	40493	573
JUN 22	14872	14277	595	JUN 22	39640	39230	410
JUL 22	9543	9256	287	JUL 22	39452	38801	651
AUG 22	8724	8685	39	AUG 22	38300	38072	228
SEP 22	9142	9132	10	SEP 22	39135	38942	193
OCT 22	21869	21516	353	OCT 22	44626	44319	307
NOV 22	10599	10376	223	NOV 22	35005	34833	172
DEC 22	9467	9435	32	DEC 22	39260	39134	126
JAN 23	5543	5357	186	JAN 23	21816	21683	133
FEB 23	2459	2422	37	FEB 23	20499	20378	121
MAR 23	4831	4842	-11	MAR 23	21924	21873	52
APR 23	5482	5477	5	APR 23	18126	18058	68
MAY 23	4436	4436	0	MAY 23	18072	18032	40
JUN 23	957	957	0	JUN 23	16629	16560	69
JUL 23	1076	1076	0	JUL 23	16590	16489	101
AUG 23	753	753	0	AUG 23	16764	16664	101
SEP 23	621	620	1	SEP 23	16168	16085	83
OCT 23	1716	1716	0	OCT 23	16815	16761	54

Source: CME, ICE






	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22
<b>Current Price</b>	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Last Week	\$2.680	\$2.754	\$2.829	\$2.858	\$2.843	\$2.862	\$2.940	\$3.085	\$3.174	\$3.104	\$2.908	\$2.540
vs. Last Week	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
4 Weeks Ago	\$2.557	\$2.619	\$2.679	\$2.739	\$2.754	\$2.741	\$2.755	\$2.827	\$2.955	\$3.045	\$2.989	\$2.816
vs. 4 Weeks Ago	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Last Year	\$1.746	\$1.895	\$2.128	\$2.224	\$2.268	\$2.350	\$2.574	\$2.883	\$3.022	\$2.987	\$2.862	\$2.562
vs. Last Year	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

	Units	Current Price	vs. Last Week	vs. 4 Weeks Ago	vs. Last Year
NatGas Jul21/Oct21	\$/MMBtu	#N/A	#N/A	#N/A	#N/A
NatGas Oct21/Nov21	\$/MMBtu	#N/A	#N/A	#N/A	#N/A
NatGas Oct21/Jan22	\$/MMBtu	#N/A	#N/A	#N/A	#N/A
NatGas Apr22/Oct22	\$/MMBtu	#N/A	#N/A	#N/A	#N/A
WTI Crude	\$/Bbl	#N/A	#N/A	#N/A	#N/A
Brent Crude	\$/Bbl	#N/A	#N/A	#N/A	#N/A
Fuel Oil, NY Harbour 1%	\$/Bbl	#N/A	#N/A	#N/A	#N/A
Heating Oil	cents/Gallon	#N/A	#N/A	#N/A	#N/A
Propane, Mt. Bel	cents/Gallon	#N/A	#N/A	#N/A	#N/A
Ethane, Mt. Bel	cents/Gallon	#N/A	#N/A	#N/A	#N/A
Coal, PRB	\$/MTon	#N/A	#N/A	#N/A	#N/A
Coal, PRB	\$/MMBtu	#N/A	#N/A	#N/A	#N/A

Source: CME, Bloomberg

## Baker Hughes Rig Counts

Rotary Rig Count						Baker Hughes 
4/23/2021						
U.S. Breakout Information	This Week	+/-	Last Week	+/-	Year Ago	
Oil	343	-1	344	-35	378	
Gas	94	0	94	9	85	
Miscellaneous	1	0	1	-1	2	
Directional	19	-1	20	-4	23	
Horizontal	397	-1	398	-29	426	
Vertical	22	1	21	6	16	
Canada Breakout	This Week	+/-	Last Week	+/-	Year Ago	
Oil	17	0	17	9	8	
Gas	38	-1	39	20	18	
Major Basin Variances	This Week	+/-	Last Week	+/-	Year Ago	
Ardmore Woodford	0	0	0	-4	4	
Barnett	1	0	1	-1	2	
Cana Woodford	12	0	12	8	4	
DJ-Niobrara	7	0	7	-8	15	
Eagle Ford	33	0	33	-2	35	
Granite Wash	3	0	3	1	2	
Haynesville	45	0	45	11	34	
Marcellus	29	0	29	-3	32	
Permian	226	-1	227	-20	246	
Utica	10	0	10	1	9	
Williston	15	0	15	-12	27	