

US COAL MARKETS AND THE CURRENT COAL SUPPLY SHORTAGE

PJM Stakeholder Process

Prepared for: America's Power

July 2022



ENERGY VENTURES ANALYSIS

1901 N. Moore St., Suite 1200
www.evainc.com

(703) 276 8900 Arlington, VA 22209

DRIVERS OF US THERMAL COAL MARKET SUPPLY SHORTAGES

- **The seeds of 2021-22 coal supply shortages were planted in the COVID market slump in 2020**
 - Domestic coal burn dropped sharply due to reduced electricity demand and low natural gas prices
 - US mines closed or reduced output and employment
- **Every factor reversed in mid-2021 and a coal supply shortage was born**
 - World thermal coal demand soared, and prices touched record highs, as LNG supply could not meet demand
 - Domestic power burn recovered all its losses on the back of increased electricity demand and high gas prices
 - Domestic power coal stockpiles melted away in the summer of 2021
- **In 2022, world market demand was boosted further by prospective bans on Russian coal**
 - Eastern US coal exports respond to world coal demand and prices
- **Coal demand can increase faster than supply – it is much easier to cut production than increase**
 - Coal is much different from gas and power – it is highly labor-intensive for both production and transportation
- **Coal generation can swing to support gas-to-coal switching – using inventories, not production**
 - Coal production must be stable – in the past, most coal plants ran baseload and signed long-term contracts for steady coal deliveries, ensuring coal supply capacity was in place

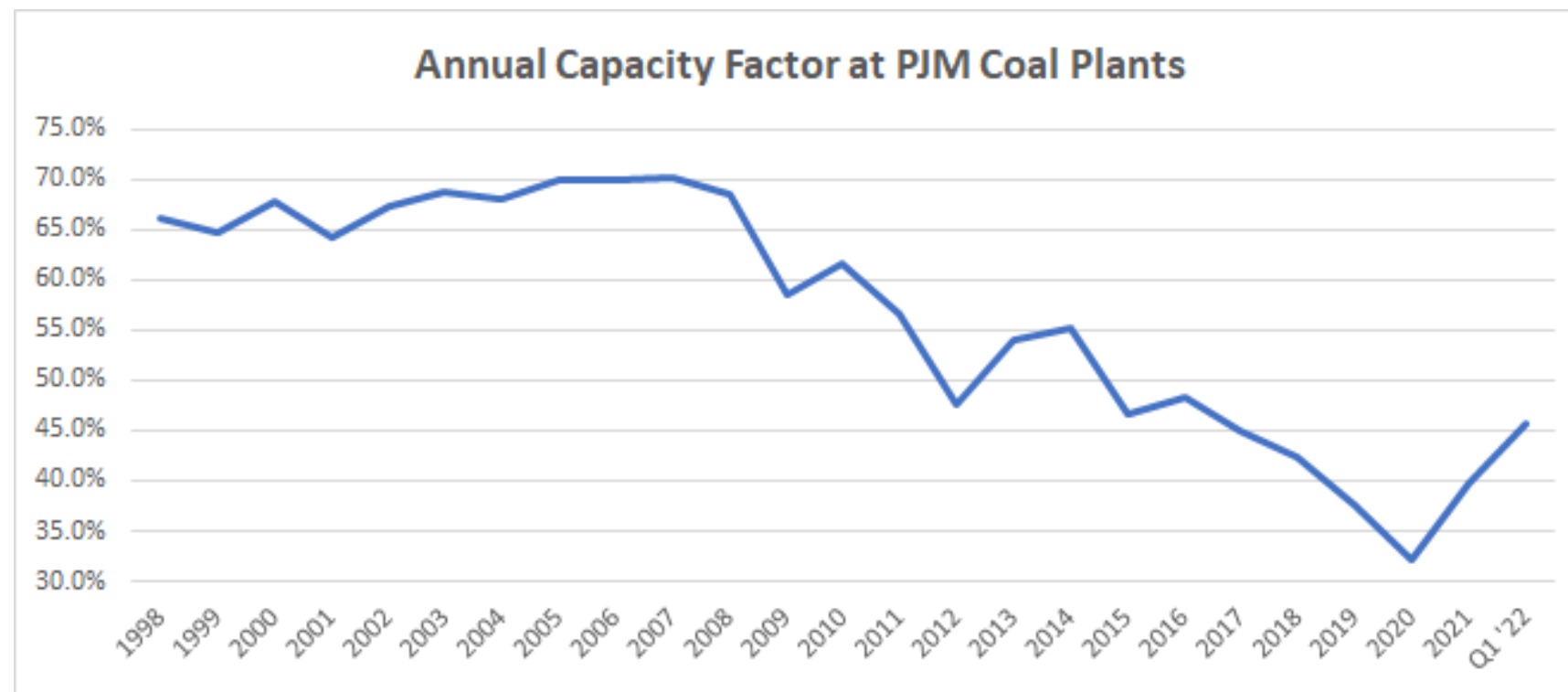
US COAL MARKETS HAVE BEEN WHIPSAWED BY SWINGS IN DEMAND

- **Domestic power burn rebound**
 - Power burn fell 195 mm tons from 2018 to 2020 but rebounded 65 mm in 2021
 - Buffered by customer coal stockpiles
- **Thermal coal exports followed a similar swing**
 - Dropped 50% from 2018 to 2020
- **US coal production was slashed by 170 mm tons from 2019 to 2020**
 - Increased demand brought 43 mm tons back into production in 2021
- **2021 power burn was met by draw of 45 mm tons of inventory**
 - Low stocks cannot support this again

US Coal Balance (mmt)	2017	2018	2019	2020	2021
Production	771.0	753.2	701.9	531.2	574.0
Imports	6.6	3.9	4.2	3.3	3.3
Total Supply	777.5	757.1	706.1	534.5	577.3
Electric Power Burn	652.2	623.0	528.1	428.3	493.9
<i>Consumer stock change</i>	<i>(26.6)</i>	<i>(38.3)</i>	<i>18.1</i>	<i>(0.2)</i>	<i>(45.1)</i>
Electric Power Receipts	625.6	584.7	546.1	428.1	448.8
Coke Ovens	17.6	18.5	18.5	13.8	17.7
Industrial/Commercial	34.5	32.5	30.0	26.1	26.6
Domestic Demand	677.7	635.7	594.7	468.0	493.0
Export metallurgical	50.7	58.9	52.3	42.8	45.9
Export thermal	52.1	64.3	48.3	32.2	45.7
Total Exports	102.8	123.2	100.5	75.0	91.6
Total Demand	780.5	758.9	695.2	543.0	584.6

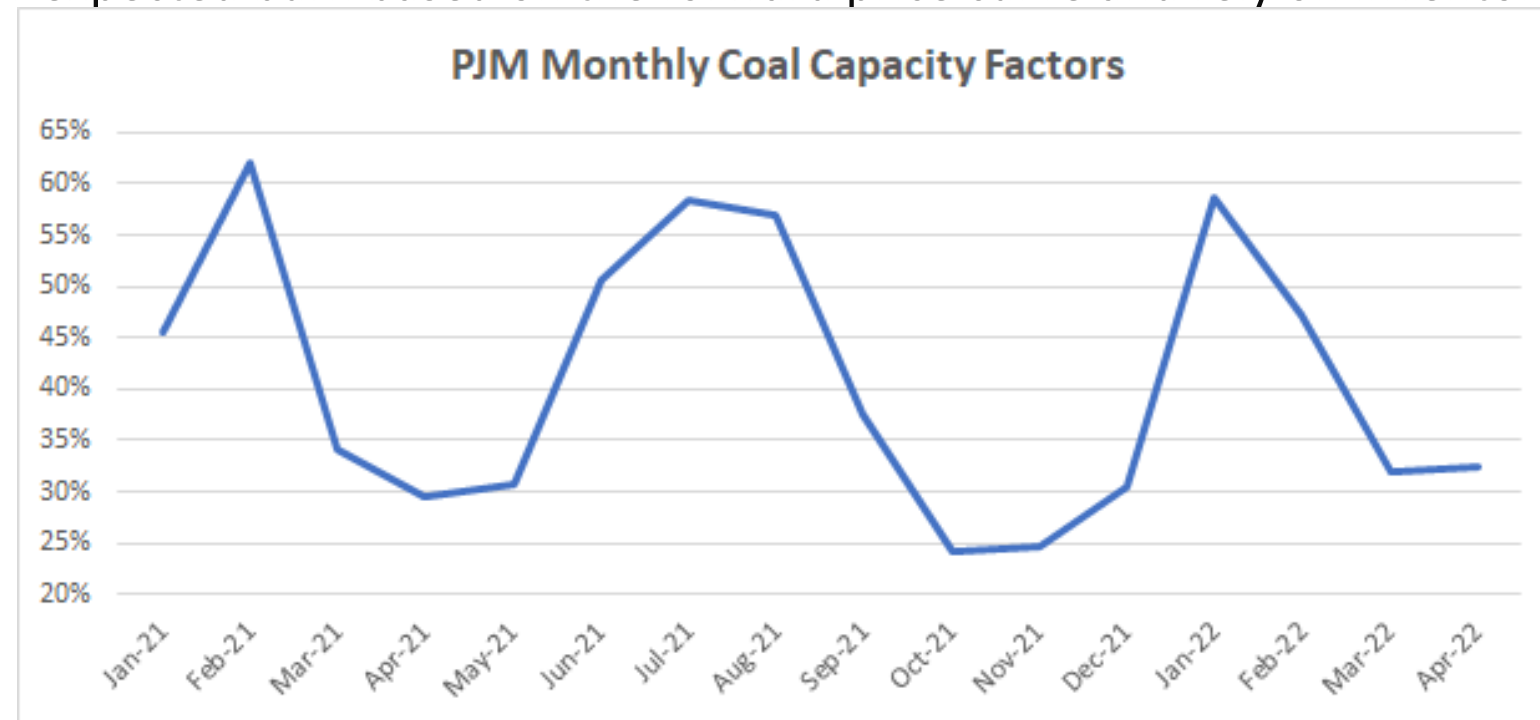
PJM COAL GENERATORS HAVE CHANGED FROM BASELOAD TO VARIABLE OPERATION

- **Prior to the fracking revolution, PJM coal plants ran at 60% - 70% capacity factors**
 - Power companies signed long-term coal contracts at high levels with confidence they would burn the coal
- **Since 2015, coal plants have run at 30% - 50% capacity factors on average**
 - Many coal plants are dispatched after gas CCGT plants and are run for reliability
- **Coal burn fell from 77 mm tons in 2019 to 61 mm in 2020, then jumped to 74 mm tons in 2021**



PJM COAL PLANTS CAN RAMP UP TO PROVIDE RELIABILITY

- **Even at lower annual capacity factors, coal plants can ramp to high rates when load is high or when natural gas is in short supply**
 - Coal plants ran hard in February 2021 and January 2022 when gas was expensive and limited
 - Coal plants run hard to meet high demand in the summer months
- **However, some generators have not contracted enough coal to run hard for months at a time**
 - Plants contract for expected burn based on the forward price curve and rely on inventory for periods of high burn



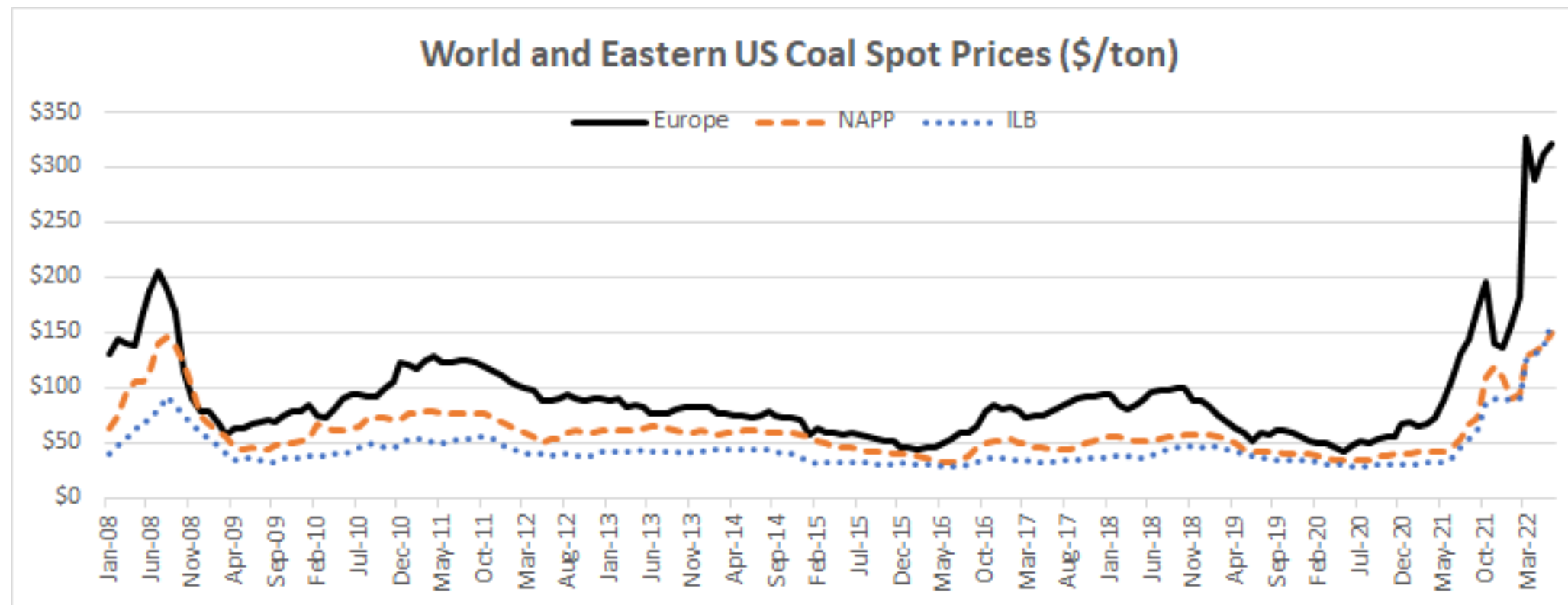
PJM COAL SUPPLY IS UNIQUELY DEPENDENT ON NORTHERN APPALACHIA COAL

- **Because of location, most of the PJM coal fleet depends on Northern Appalachia (NAPP) coal**
 - The coal plants in the ComEd zone plus AEP's Rockport plant use western coal (Powder River Basin)
 - Other power markets primarily burn lower-cost western and ILB coals
- **Appalachian coal is closely connected to world coal markets because of location and coal quality, with exports through the East Coast ports of Baltimore and Hampton Roads**
 - PRB coal is not well connected to world markets, with few exports
 - ILB coal is also exported in large volumes through New Orleans

2021 Coal Purchases	Total 1000 tons	Northern App	Central App	Illinois Basin	PRB	Other West	Import
PJM	65,426	47,152	3,709	6,434	7,934	198	-
Southeast	69,225	9,215	5,904	26,193	22,861	3,208	1,845
MISO	138,314	2,307	52	27,167	86,916	21,871	-
SPP	63,774	-	-	-	61,582	2,192	-
ERCOT	49,204	-	-	-	33,295	15,908	-
WECC	61,802	-	-	-	28,730	33,073	-
Lower 48	447,764	58,692	9,665	59,794	241,318	76,451	1,845

WORLD COAL SUPPLY SHORTAGE HAS PULLED EASTERN COAL INTO THE EXPORT MARKET

- World thermal coal prices have hit record highs after the war in Ukraine as European buyers scramble to replace Russian coal with Eastern US coal exports
- Uncommitted Eastern coals (NAPP, CAPP, ILB) have been sold to export customers, limiting available supply for domestic markets



NORTHERN APPALACHIA COAL SUPPLY RESPONSE TO INCREASED DEMAND IS LIMITED

- **Large Pittsburgh seam longwall mines provide almost all the thermal coal**
 - Thermal coal production from other small mines in OH, PA, and MD has fallen to very low levels due to high costs and depleting reserves
- **Remaining 9 Pittsburgh seam mines are running at full capacity**
 - Since 2017, 3 large Pittsburgh seam mines have been closed permanently
 - Remaining mines rebounded in 2021, adding 12 mm tons of production to reach 70 mm tons
 - Maximum potential output is 72 mm tpy
- **With exports of 13 – 15 mm tons, NAPP supply for domestic thermal markets is not enough to support 2021 burn, let alone increased burn**

Northern Appalachia Coal Demand (mm tons)					
	2017	2018	2019	2020	2021
Thermal Coal					
Electric Power Burn	80.0	75.7	66.0	56.7	65.7
Consumer stock change	(4.5)	(3.5)	6.2	(4.2)	(7.1)
Electric Power Receipts	75.5	72.1	72.3	52.5	58.7
Industrial/Commercial	2.1	1.9	1.8	1.6	1.8
Domestic Demand	77.6	74.1	74.1	54.1	60.5
Export thermal	11.8	11.1	11.5	10.0	13.3
Total Thermal	89.4	85.2	85.5	64.1	73.8
Metallurgical Coal					
Domestic	3.0	3.4	4.3	3.6	4.5
Export	10.2	13.0	12.4	8.8	9.0
Total Metallurgical	13.3	16.5	16.7	12.4	13.5
Total Demand	102.7	101.7	102.2	76.5	87.2
Coal Production					
Pittsburgh seam	81.5	81.3	81.5	57.7	69.6
Other Thermal	11.7	10.5	8.5	5.8	5.8
Total Thermal	93.2	91.8	90.0	63.5	75.4
Met Coal	11.8	12.4	13.5	12.1	13.2
Total Production	105.1	104.2	103.5	75.6	88.6

IMPROVING THE RELIABILITY OF COAL SUPPLY

- **Due to logistics, coal supply must be contracted in advance**
 - Entering any calendar year, most coal generators have contracted for 80% - 90% of expected burn
 - **There is no real “spot” coal market** – Even short-term coal purchases are contracted in advance –
 - Coal producers and transportation companies need customers to deliver coal ratably (roughly even deliveries every month) to support steady performance – they cannot lay off employees and bring them back quickly
- **It is difficult for utility and merchant plants to contract for uncertain levels of burn**
 - Coal generators manage the swing in burn using coal inventories at the plant while maintaining steady deliveries
 - If natural gas prices fall to low levels, coal generators have the risk of being over-contracted, as happened in 2020
 - Coal suppliers need higher levels of longer-term contracts to support investments to increase production
- **In the short term, coal supply is not adequate to support increased burn in 2022 or 2023**
 - Existing large mines in the Pittsburgh seam are already running hard
 - There will be an increase at one existing mine as Consol restores a 5th longwall face at Enlow Fork mine
 - Increased output at small mines in PA, OH and MD will require capital, labor & equipment, all in short supply
 - “ESG” restrictions are limiting capital available for coal supply from banks and equity investors
 - Increased coal production will take time and certainty of long-term demand