

# AN INDEX OF PRICES PAID BY GROWERS IN THE GREEN INDUSTRY

2007–2021  
INCLUDING 2022 FORECASTING

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Dr. Hall's expertise in the production and marketing of Green Industry crops is **nationally recognized** in academia and among the horticultural clientele he serves. His major research, teaching, & extension areas of specialization include strategic management, market situation/outlook, cost accounting, and financial analysis for Green Industry firms.

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He is an **Honorary Lifetime Member** of the Texas Nursery and Landscape Association and has received TNLA's **Award for Outstanding Service to the Nursery Industry**. He is also a member of the **Hall of Fame** and **Honorary Lifetime Member** of the Tennessee Nursery and Landscape Association. Dr. Hall has received Texas A&M University's **Association of Former Students' Distinguished Achievement Award in Teaching** and the **Vice Chancellor's Award in Excellence for Student Counseling and Relations**. He is a member of Alpha Gamma Rho agricultural fraternity and has received their **Grand Presidents Award** and **Brother of the Century** designation.

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# Executive Summary

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Prior to the COVID pandemic, the green industry was in the mature stage of its industry life cycle. As such, there was margin compression occurring in the industry, where prices were slow to increase due to *real and perceived* competitive forces while, at the same time, the costs of the inputs used to produce these products are increasing. Even in situations where industry firms were able to increase prices for their plants, the costs of their production inputs rose more quickly and margins across the entire industry were being “squeezed.”

Then enter COVID, resulting in significant supply chain challenges, while at the same time the industry experienced unprecedented increases in final demand. This has resulted in extraordinarily high inflationary pressures, making it is essential for growers to have full and accurate information about their cost structure to aid in managerial decision-making such as SKU rationalization, customer profitability analyses, and determining the appropriate level of price increases. Armed with such information, growers will be in a much better position to understand the inflationary pressures on their relative costs of production and use these data in making more informed pricing decisions (since total costs represent the price floor and willingness-to-pay on the part of the customer represents the price ceiling).

The *Index of Prices Paid by Growers*, first developed in 2017 as part of the **Your MarketMetrics** industry benchmarking program, has documented these inflationary pressures annually on the most important inputs used by green industry growers and each cost-related line item is weighted by its relative share of the total of the typical assortment of goods and services purchased by growers for producing, marketing, and shipping plants. Using this methodology, a weighted average rate of inflation in the prices of these grower inputs is estimated.

Results from this indexing analysis indicate that the summary weighted Index of Prices Paid by Growers ranges from 100 in 2007 to a high of 145.8 in 2021. **This means that the overall cost of producing nursery and greenhouse crops is almost 46% higher in 2021 than it was in 2007, with labor experiencing the largest increase (53.1% higher in 2021) among these inputs.** The year-over-year (YOY) increases, reflecting the inflationary pressures of costs over time, are also calculated. The tracked expenses in 2021 increased about 9.6% over what they were in 2020. **Based on market research across the industries and conversations with allied trade pundits associated with producing these inputs, a 5.3% increase in input costs is forecast for 2022.**



# An Index of Prices Paid by Growers in the Green Industry

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## Introduction

This white paper focuses on the grower sector of the green industry and the costs incurred in the propagation, production, and shipping of plants to retail and landscape customers. While there are already-existing indices that are available that reflect general inflationary pressures in the economy, the use of standard measures such as the *Producers Price Index* (PPI) and *Consumer Price Index* (CPI) for this purpose is insufficient because wholesale growers purchase different goods and services from those used for calculating these indexes. The USDA National Agricultural Statistics Service also calculates an *Index of Prices Received by Farmers* for their crops and livestock and an *Index of Prices Paid by Farmers* for the inputs they use during production. However, these indices also fall short in that they contain many items that are not applicable to nursery and greenhouse growers or exclude items that are applicable.

This *Index of Prices Paid by Growers* overcomes these challenges and includes major production inputs (e.g., containers, soil mixes, propagation stock, plant protection products, fertilizers, and fuel), along with the costs of labor, maintenance supplies, packaging materials, labels and other signage, freight, and other shipping-related expenses.



## Indexing Methodology

In calculating the index, the relative importance of each of the aforementioned input costs were determined by collecting income statement data from leading growers in the industry for multiple years and using the averages of these data to calculate a weight for each line item relative to the collective total. The weighting scheme for each of the line items is found in the following table.

**Relative weighting of items included in the Index of Prices Paid by Growers.**

COST CATEGORY	% OF SALES	% OF TRACKED EXPENSES
Containers & other plastics	6.50%	10.24%
Media (peat-based)	2.50%	3.94%
Propagative materials	15.00%	23.62%
Plant protection products	1.00%	1.57%
Fertilizers	1.00%	1.57%
Labor (wages)	22.00%	34.65%
Fuel/Energy	2.50%	3.94%
Maintenance (supplies & repairs)	2.00%	3.15%
Freight and trucking	11.00%	17.32%
<b>TOTAL</b>	<b>63.50%</b>	<b>100.00%</b>
Other expenses	36.50%	---
	100.0%	100.00%

Altogether, the production-related line items included in the calculation of the index represented 63.5% of sales. The remaining 36.5% were either G&A expenses or non-allocable expenses that could not be attributed to specific production-related categories. Thus, these were not included in the calculation of the index.

Once the weights were established, then an index for each cost line item was estimated that reflected the relative changes in price for these expense line items through time. The base year for calculation of the index was 2007, so that year is set to 100 since it reflects the most recent pre-Great Recession time frame. The costs of each line item in each subsequent year can then be compared to the same line item costs in 2007 to determine how much the cost has increased. Multiplying the weight of each line item times the index for that line item each year and then summing all of the line items yields the summary weighted index.



## The 2021 Index of Prices Paid by Growers

The 2021 index is 145.8, which means the **overall cost of inputs used in producing nursery and greenhouse crops is about 45.8% higher in 2021 than it was in 2007**. The year-over-year (YOY) increases are also presented, reflecting the annual inflationary pressures of costs over time. For example, the tracked costs in 2021 increased about 9.6% over what they were in 2020. Unlike previous years, there were no line items that were less expensive in 2021 than they were during the index year of 2007 (or even below the prior year).

Index of Prices Paid by Growers in the Green Industry, 2007-2021 (2007=100).

Cost category	Weight	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022f
Containers & other plastics	10.24%	100.0	107.0	106.3	109.3	115.3	117.6	120.8	122.8	121.5	119.9	122.5	126.9	127.3	132.7	165.1	171.7
Media (peat-based)	3.94%	100.0	93.4	94.7	100.3	104.1	96.9	97.0	105.8	121.4	119.5	121.9	128.9	126.5	137.6	141.7	144.5
Propagative materials	23.62%	100.0	102.8	106.7	108.4	111.9	114.2	115.9	117.8	117.9	119.5	122.0	125.0	128.1	131.0	142.6	146.9
Plant protection products	1.57%	100.0	107.3	114.9	111.5	112.1	118.2	121.6	122.8	119.4	120.7	116.6	112.9	113.1	109.8	113.7	116.0
Fertilizers	1.57%	100.0	181.7	127.7	117.1	152.4	154.6	147.4	144.1	132.9	109.5	100.9	101.7	106.9	103.5	126.1	145.0
Labor	34.65%	100.0	104.5	106.0	107.0	108.2	111.4	115.0	116.9	121.1	125.4	128.9	136.7	144.2	146.3	153.1	163.8
Fuel/Energy	3.94%	100.0	130.2	86.6	107.4	137.2	136.2	135.0	134.3	87.1	76.3	86.7	97.5	101.0	85.2	94.3	100.9
Supplies & repairs	3.15%	100.0	102.9	104.9	106.9	111.2	114.5	115.5	117.6	117.7	117.9	120.0	124.1	127.6	129.6	138.8	143.0
Freight and trucking	17.32%	100.0	102.2	97.3	98.8	103.2	106.8	108.4	113.8	118.3	117.6	119.8	130.0	130.5	124.9	143.1	151.7
Weighted index (2007=100)		100.0	105.7	103.9	106.1	110.8	113.2	115.4	118.0	118.6	119.4	122.2	128.6	132.3	133.1	145.8	153.6
YOY increase/decrease		---	5.7%	-1.7%	2.1%	4.4%	2.2%	1.9%	2.2%	0.6%	0.6%	2.4%	5.3%	2.9%	0.6%	9.6%	5.3%

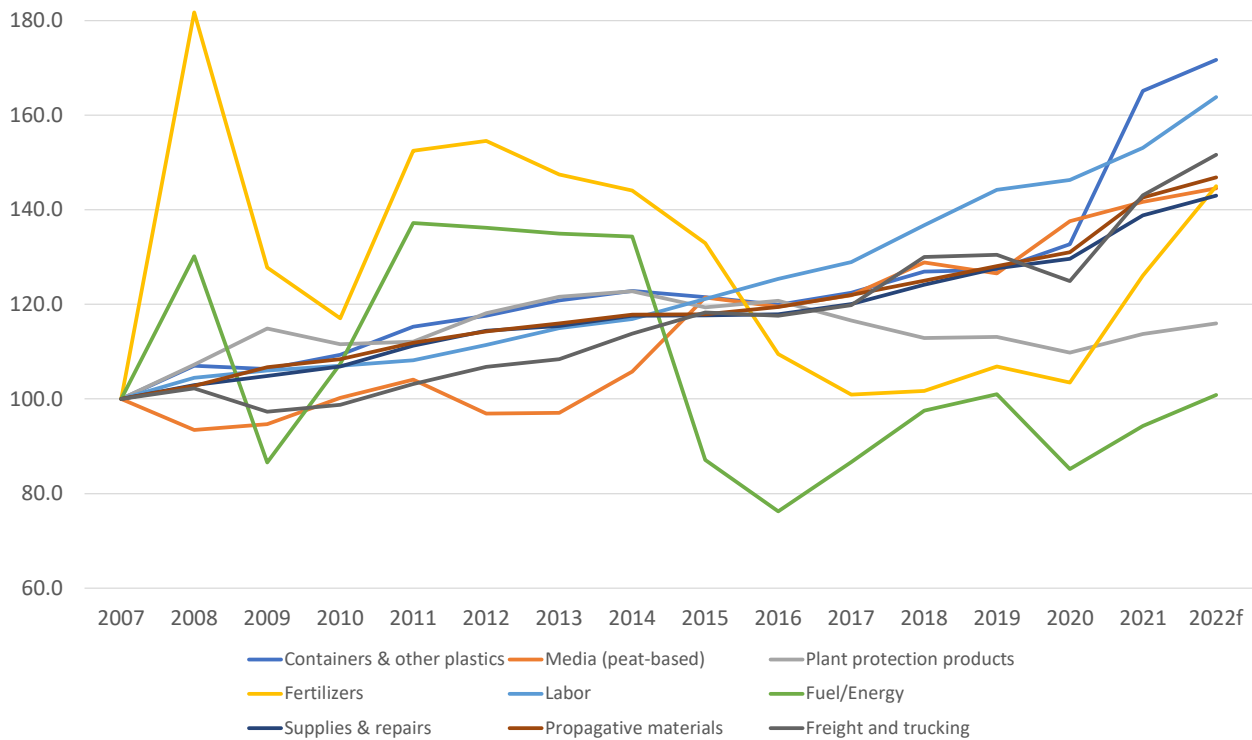
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The YOY increases in the immediate post-recession time frame (2009-2011) created considerable margin compression for growers given their input costs were rising significantly but selling prices were stagnant due to the recession's impact on demand. While selling prices have increased since then, the question remains as to whether they have outpaced the increase in input prices. Anecdotally the answer would be *not entirely*, however, given there are currently no historic indices of selling prices across the industry, it is not possible to answer this definitively.

Recent data for growers and retailers that participate in the Your MarketMetrics benchmarking program indicate margins improved in 2020 and 2021 because plant prices increased at a much faster rate than historically. **However, it is anticipated that input costs in 2022 will rise by an additional 5.3% because of the continuing supply chain disruptions and strong demand manufacturers and distributors face from growers in the industry who are looking to increase their tradeable assets (inventory) in the wake of the strong staycation-affected plant and landscape service demand of 2020-21 resulting from more time spent at home and the increased gardening and landscaping activity that resulted.**



Index of Prices Paid by Growers, 2007-2022  
(2007=100)



The three individual components of the index that experienced the largest cost increases since 2007 included containers, labor, and the cost of freight and trucking, which are 65.1%, 53.1%, and 43.1% more expensive, respectively, than they were in 2007. Labor has been a two-fold dilemma for growers with both the cost and availability of labor being a severe limitation for nursery and greenhouse growers alike. Search and acquisition costs for labor have also increased, on top of the increased wages and associated burden of labor. All other categories of costs have also experienced increases since 2007.





## Forecast for 2022

As mentioned earlier, a forecast is being included in this report for the second time. Based on market research across the industries and conversations with allied trade pundits associated with producing these inputs, a 5.3% weighted average increase in input costs is forecast for 2022. The leading input cost increases are for containers and other plastics, freight and trucking, propagative materials, fertilizers, fuel and energy, and, of course, labor.

**Note:** At the time this report was published (early March 2022), there may be further adjustments that manufacturers, distributors, and other allied trade firms will make in their respective 2022 price schedules. Three potential adjustments worthy of note:

- (1) plastics-related inputs where container and plastic sheeting prices continue to be in a state of flux, which are correlated to petroleum, resin, and energy prices that are currently erratic due to winter storms across the country and other geopolitical forces (e.g. Russia invading Ukraine).
- (2) the trucking industry where tonnage increases from e-commerce pressures continues to put demand pressure on limited trailer supplies and driver shortages continue to influence short-term freight pricing.
- (3) the methodology underlying the adverse effect wage rate is still in flux politically. Any of these factors (or other unforeseen events) may translate into higher/lower levels of input cost increases that are currently forecasted for 2022.



# Implications

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The purpose of this white paper was to update the Index of Prices Paid by Growers that documents the historical costs incurred by growers for the major inputs used during the production of nursery and greenhouse crops. It is important to note that **this is a national index** and certain factors of production (e.g., labor) may vary depending on the region of the country. Thus, growers could develop their own index by either adjusting the weights of each of the line items contained in the overall index and/or adjusting the line item indices according to the higher or lower expenses incurred in their respective region.

This index also serves to document the **cost-price squeeze** for the green industry, specifically the rising costs of inputs. Armed with such information, growers will be in a much better position to understand the inflationary pressures on their relative costs of production and use these data in making more informed pricing decisions (since total costs represent the price floor and willingness to pay on the part of the customer represents the price ceiling).

Given the findings of the Index of Prices Paid by Growers, it is clear that inflationary pressures have the potential to erode margins for green industry growers and that there will continue to be increases in the costs of major inputs they utilize during production, particularly labor. Though outside the scope of this analysis, the industry will need to adjust prices levels over time to not only keep up with these inflationary pressures, but to ensure the financial sustainability of growers over the long run.



## APPENDIX A Labor Situation & Outlook

The economy began 2020 in a strong position, as a years-long recovery continued into the first months of the year. But the coronavirus (COVID-19) pandemic shut down trade and travel, closed restaurants and schools, and forced hundreds of millions of workers to quarantine. The labor market fallout included 20 million extra layoffs, 200,000 extra business closures, and widespread hiring freezes.

Thankfully, the U.S. contraction was the shortest in history, lasting only two months from March to April 2020. But despite a rapid recovery, fear and uncertainty lingered, driven by the coronavirus pandemic, even after the emergence of vaccines. The economy recovered about 70% of the loss over the following months. But by the end of 2020, job growth had turned negative again amid surging COVID cases.

The following year looked more hopeful. Not only did 2021 begin amid a rollout of vaccines, but it also brought a font of new federal spending, including unspent coronavirus relief funds from 2020 and various forms of stimulus to households. Retail spending, home construction, and new business starts surged past pre-pandemic trends. Equity markets reached new highs. Employer demand for labor boomed. But very few of the workers who had been sidelined by the pandemic returned to the labor force, causing labor markets to become tighter than ever before. Even when COVID cases fell, schools reopened, and expanded unemployment benefits expired, workers were reluctant to return.

Employers' efforts to compete for talent became a veritable cage match:

*"While wage increases were most notable for entry-level positions, contacts suggested that pay was increasing across the wage scale. Moreover, firms were reportedly enhancing other benefits, such as hiring and retention bonuses and flexible work arrangements to attract and retain workers."*

*"An airline reported offering flight attendants triple pay to work during peak periods over the coming holiday season."*

(SOURCE: Federal Reserve Board's Beige Book, Dec 2021)

Running the economy hot had large benefits for job seekers and workers, especially disadvantaged groups. But supply chains could not keep up with unexpectedly high consumer demand. The result was the steepest rise in inflation in three decades, the classic sign of an overheated economy. By year end, the Federal Reserve was promising to double the speed with which it would taper asset purchases and eyeing multiple interest rate hikes in 2022. If the Fed strikes the right balance, it will take some of the steam out of the market, causing inflation to moderate without job growth stalling. Workers will return to the labor force gradually, but not so fast as to push unemployment up, increase labor market friction, or erode their



newfound leverage. Lockdowns likely won't need to be repeated on a wide scale, now that more targeted alternatives are available: N95 masks, vaccines and booster shots, rapid home tests (which began to be mailed free of charge to people who wanted them in early 2022), and two oral antivirals have been authorized. If we find the desirable middle ground, the likely result will be a year in which the U.S. controls both COVID and inflation without drastic measures that could damage growth or limit our future potential. As supply chains recover, and workers ease back into the labor market, there is every reason to believe we can find ourselves in a milder and more sustainable economic climate.

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## General Farm Labor Wage Rates

According to USDA's November 2021 Farm Labor Survey conducted twice annually by the National Agricultural Statistics Service, there were 772,000 workers hired directly by farm operators on the Nation's farms and ranches during the week of Oct. 10-16, 2021, up 2% from the October 2020 reference week. The 2021 all hired worker annual average gross wage rate was \$16.38 per hour, up 6% from the 2020 annual average gross wage rate. **The 2021 field worker annual average gross wage rate was \$15.77 per hour, up 7% from the 2020 annual average.** The 2021 livestock worker annual average gross wage rate was \$15.08 per hour. The 2021 annual average combined gross wage for field and livestock workers was \$15.56, up 6% from the 2020 annual average of \$14.62 per hour.

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## Adverse Effect Wage Rates for Foreign Labor

The **Adverse Effect Wage Rate (AEWR)** is the minimum wage that the U.S. Department of Labor (DOL) has determined that must be offered and paid to U.S. and alien workers by agricultural employers of nonimmigrant H-2A agricultural workers. When agricultural employers offer employment to nonimmigrant foreign workers, payment of at least the AEWR is required.

Published once a year by the DOL with the assistance of the USDA, the AEWR sets a separate minimum wage rate (i.e., a rate that will not adversely affect the employment opportunities of U.S. workers) for each state. The employer must pay all covered workers at least the highest of the following applicable wage rates in effect at the time work is performed: the adverse effect wage rate (AEWR), the applicable prevailing wage, the agreed-upon collective bargaining rate, or the Federal or State statutory minimum wage. Essentially, the AEWR is a minimum wage that provides a floor below which the wages of H-2A workers cannot fall. This wage rate has, anecdotally, had the effect of raising the existing wage rates for non-H2A workers.

With the release of USDA's Farm Labor Survey, farmers and growers that utilize the H-2A program essentially know the minimum wage they must pay their H-2A workers the following year. **The FLS reveals an average increase of 7%, for field workers from 2020 to 2021, though there are considerable regional differences.** By comparison, according to the Bureau of Labor Statistics [Employment Cost Index](#), nationally, compensation costs for private industry workers increased 4% for the 12-month period ending in December 2021.



DOL's H-2A regulations at 20 CFR 655.122(l) stipulate that employers must pay their H-2A workers and workers in corresponding employment at least the highest of:

- (i) The AEW
- (ii) the prevailing hourly wage rate
- (iii) the prevailing piece rate
- (iv) the agreed- upon collective bargaining wage rate
- (v) the federal or state minimum wage rate in effect at the time the work is performed.

Further, when the AEW is adjusted during a work contract and is higher than the highest of the previous AEW, the prevailing rate, the agreed- upon collective bargaining wage, the federal minimum wage rate, or the state minimum wage rate, the employer must pay that adjusted AEW upon the effective date of the new rate, as provided in the applicable Federal Register Notice. See 20 CFR 655.122(l) (requiring the applicable AEW or other wage rate to be paid based on the AEW or rate in effect "at the time work is performed").

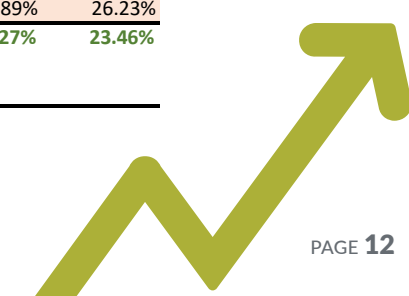
On November 5, 2020, DOL published a final rule, Adverse Effect Wage Rate Methodology for the Temporary Employment of H-2A Nonimmigrants in Non-Range Occupations in the United States, 85 FR 70445 (2020 AEW Final Rule), to establish a new methodology for setting hourly AEWs, effective December 21, 2020. However, on December 23, 2020, the U.S. District Court for the Eastern District of California issued an order enjoining DOL from implementing the 2020 AEW Final Rule and ordering DOL to set the hourly AEWs using the methodology set forth in the Temporary Agricultural Employment of H-2A Aliens in the United States, 75 FR 6884 (Feb. 12, 2010) (2010 H-2A Final Rule). See Order Granting Plaintiffs' Motion for a Preliminary Injunction, United Farm Workers, et al. v. U.S. Dep't of Labor, et al., No. 20-cv-1690 (E.D. Cal.), ECF No. 37. Pursuant to that order, DOL has used the methodology set forth in the 2010 H-2A Final Rule to determine the 2022 AEWs.

Accordingly, the 2022 AEWs for all agricultural employment (except for the herding or production of livestock on the range, which is covered by 20 CFR 655.200 through 655.235) for which temporary H-2A certification is being sought is equal to the annual weighted average hourly wage rate for field and livestock workers (combined) in the state or region as published by the U.S. Department of Agriculture (USDA) in the November 2021 Farm Labor Report. The 2010 H-2A Final Rule, 20 CFR 655.120(c), requires that the Administrator of the Office of Foreign Labor Certification publish the USDA field and livestock worker (combined) wage data as AEWs in a Federal Register Notice. Accordingly, the 2022 AEWs to be paid for agricultural work performed by H-2A and workers in corresponding employment on and after the effective date of this notice are set forth in the table on the following page.

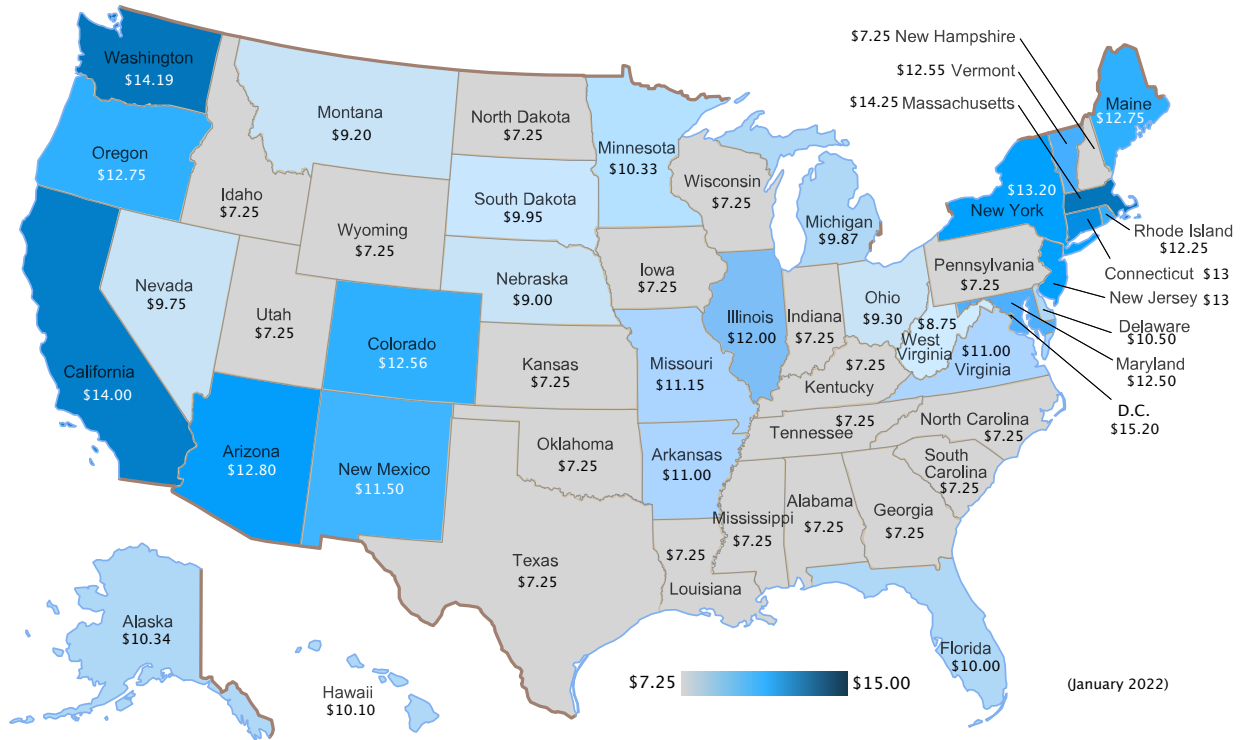


Adverse Effect Wage Rates by State 2018-2022

State	2018	2019	2020	2021	2022	YOY	Percent
	AEWR	AEWR	AEWR	AEWR	AEWR	increase	increase
(effective date)	1/4/18	1/9/19	1/1/20	2/23/21	12/29/21	2019 to	from 2018
						2022	to 2022
Alabama	10.95	11.13	11.71	11.81	11.99	1.52%	9.50%
Arizona	10.46	12.00	12.91	13.67	14.79	8.19%	41.40%
Arkansas	10.73	11.33	11.83	11.88	12.45	4.80%	16.03%
California	13.18	13.92	14.77	16.05	17.51	9.10%	32.85%
Colorado	10.69	13.13	14.26	14.82	15.58	5.13%	45.74%
Connecticut	12.83	13.25	14.29	14.99	15.66	4.47%	22.06%
Delaware	12.05	13.15	13.34	14.05	15.54	10.60%	28.96%
Florida	11.29	11.24	11.71	12.08	12.41	2.73%	9.92%
Georgia	10.95	11.13	11.71	11.81	11.99	1.52%	9.50%
Hawaii	14.37	14.73	14.90	15.56	16.54	6.30%	15.10%
Idaho	11.63	13.48	13.62	14.55	14.68	0.89%	26.23%
Illinois	12.93	13.26	14.52	15.31	15.89	3.79%	22.89%
Indiana	12.93	13.26	14.52	15.31	15.89	3.79%	22.89%
Iowa	13.42	13.34	14.58	15.37	16.19	5.34%	20.64%
Kansas	13.64	14.38	14.99	15.89	16.47	3.65%	20.75%
Kentucky	11.19	11.63	12.40	12.96	13.89	7.18%	24.13%
Louisiana	10.73	11.33	11.83	11.88	12.45	4.80%	16.03%
Maine	12.83	13.25	14.29	14.99	15.66	4.47%	22.06%
Maryland	12.05	13.15	13.34	14.05	15.54	10.60%	28.96%
Massachusetts	12.83	13.25	14.29	14.99	15.66	4.47%	22.06%
Michigan	13.06	13.54	14.40	14.72	15.37	4.42%	17.69%
Minnesota	13.06	13.54	14.40	14.72	15.37	4.42%	17.69%
Mississippi	10.73	11.33	11.83	11.88	12.45	4.80%	16.03%
Missouri	13.42	13.34	14.58	15.37	16.19	5.34%	20.64%
Montana	11.63	13.48	13.62	14.55	14.68	0.89%	26.23%
Nebraska	13.64	14.38	14.99	15.89	16.47	3.65%	20.75%
Nevada	10.69	13.13	14.26	14.82	15.58	5.13%	45.74%
New Hampshire	12.83	13.25	14.29	14.99	15.66	4.47%	22.06%
New Jersey	12.05	13.15	13.34	14.05	15.54	10.60%	28.96%
New Mexico	10.46	12.00	12.91	13.67	14.79	8.19%	41.40%
New York	12.83	13.25	14.29	14.99	15.66	4.47%	22.06%
North Carolina	11.46	12.25	12.67	13.15	14.16	7.68%	23.56%
North Dakota	13.64	14.38	14.99	15.89	16.47	3.65%	20.75%
Ohio	12.93	13.26	14.52	15.31	15.89	3.79%	22.89%
Oklahoma	11.87	12.23	12.67	13.03	13.88	6.52%	16.93%
Oregon	14.12	15.03	15.83	16.34	17.41	6.55%	23.30%
Pennsylvania	12.05	13.15	13.34	14.05	15.54	10.60%	28.96%
Rhode Island	12.83	13.25	14.29	14.99	15.66	4.47%	22.06%
South Carolina	10.95	11.13	11.71	11.81	11.99	1.52%	9.50%
South Dakota	13.64	14.38	14.99	15.89	16.47	3.65%	20.75%
Tennessee	11.19	11.63	12.40	12.96	13.89	7.18%	24.13%
Texas	11.87	12.23	12.67	13.03	13.88	6.52%	16.93%
Utah	10.69	13.13	14.26	14.82	15.58	5.13%	45.74%
Vermont	12.83	13.25	14.29	14.99	15.66	4.47%	22.06%
Virginia	11.46	12.25	12.67	13.15	14.16	7.68%	23.56%
Washington	14.12	15.03	15.83	16.34	17.41	6.55%	23.30%
West Virginia	11.19	11.63	12.40	12.96	13.89	7.18%	24.13%
Wisconsin	13.06	13.54	14.40	14.72	15.37	4.42%	17.69%
Wyoming	11.63	13.48	13.62	14.55	14.68	0.89%	26.23%
<b>Average</b>	<b>\$12.20</b>	<b>\$12.96</b>	<b>\$13.68</b>	<b>\$14.28</b>	<b>\$15.03</b>	<b>5.27%</b>	<b>23.46%</b>
<b>YOY increase</b>	-----	6.25%	5.56%	4.38%	5.27%		
	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>		



State Minimum Wage (January 2022)



## APPENDIX B Energy Situation & Outlook

### Fuels commentary

A wide range of potential macroeconomic outcomes could significantly affect energy markets during 2022. In addition, the evolving effects of consumer behavior on energy demand because of the pandemic present a wide range of potential outcomes for energy consumption. Supply uncertainty in the forecast results from the potential for disruptions, the production decisions of OPEC+, and the rate at which U.S. oil and natural gas producers increase drilling.

Brent crude oil spot prices averaged \$87 per barrel (b) in January, a \$12/b increase from December 2021. Crude oil prices have risen steadily since mid-2020 as result of consistent draws on global oil inventories, which averaged 1.8 million barrels per day (b/d) from the third quarter of 2020 (3Q20) through the end of 2021. Oil prices have also risen as result of heightened market concerns about the possibility of oil supply disruptions, notably related to tensions regarding Ukraine, paired with receding market concerns that the Omicron variant of COVID-19 will have widespread effects on oil consumption.

Brent prices are expected to average \$90/b in February as continuing draws in global oil inventories in our forecast keep crude oil prices near current levels in the coming months. However, downward price pressures will likely emerge in the middle of the year as growth in oil production from OPEC+, the United States, and other non-OPEC countries outpaces slowing growth in global oil consumption. This dynamic leads to rising global oil inventories from 2Q22 through the end of 2023, and the Brent spot price is forecast to fall to an average of \$87/b in 2Q22 and \$75/b in 4Q22 and the Brent price will average \$68/b for all of 2023. However, low inventory levels create an environment for potentially heightened crude oil price volatility and potential risk for prices to rise significantly if supply growth does not keep pace with demand growth. Global supply chain disruptions have also likely exacerbated inflationary price effects across all sectors in recent months. How central banks respond to inflation may obviously affect economic growth and oil prices.

Around 99.0 million b/d of petroleum and liquid fuels was consumed globally in January 2022, an increase of 6.6 million b/d from January 2021. Global consumption of petroleum and liquid fuels will likely average 100.6 million b/d for all of 2022, which is up 3.5 million b/d from 2021 and more than the 2019 average of 100.3 million b/d. Global consumption of petroleum and liquid fuels are expected to increase by 1.9 million b/d in 2023.

U.S. regular gasoline retail prices averaged \$3.31 per gallon (gal) in January, unchanged from December 2021 and up 98 cents/gal from January 2021. Retail diesel prices averaged \$3.72/gal in January, up 8 cents/gal from December and up \$1.04/gal from last January. Product prices have risen compared with year-ago levels because of rising crude oil prices and high refining margins. Diesel prices are expected to average \$3.49/gal from 2Q22 through 4Q22. The forecast decline in prices reflects expectations of falling





crude oil prices, particularly in the second half of 2022 (2H22), as well as lower refining margins as refineries increase throughputs in the coming months. U.S. crude oil production reached almost 11.8 million b/d in November 2021 (the most recent monthly historical data point), the most in any month since April 2020. Production is expected to rise to an average of 12.0 million b/d in 2022 and 12.6 million b/d in 2023, which would be record-high production on an annual-average basis. The previous annual average record of 12.3 million b/d was set in 2019.

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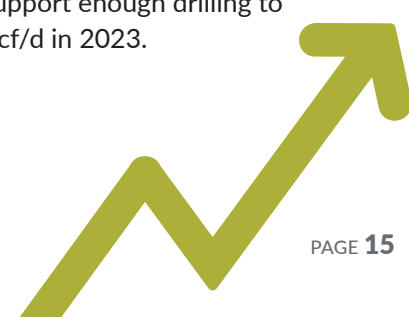
## Natural Gas

In January, the natural gas spot price at Henry Hub averaged \$4.38 per million British thermal units (MMBtu), up from the December average of \$3.76/MMBtu. Higher prices in January were a result of colder-than-normal weather in parts of the country, particularly the Northeast and the Midwest where demand increased for natural gas used for space heating and for power generation. Temperatures have continued to be cold in parts of the country in early February, which will contribute to Henry Hub prices averaging \$4.70/MMBtu for the month. The winter weather forecasts are highly variable and create a significant amount of uncertainty in price forecasts. In addition, global demand for U.S. liquefied natural gas (LNG) has remained high, limiting some of the downward pressure on natural gas prices. Natural gas prices could remain volatile over the coming months, and the way that temperatures affect natural gas demand in February and March will be a key driver of how inventories end the withdrawal season, which will be important for natural gas price formation in the coming months.

U.S. LNG exports averaged 11.2 billion cubic feet per day (Bcf/d) in January 2022, up from 10.4 Bcf/d in 4Q21, supported by large price differences between the Henry Hub price in the United States and spot prices in Europe and Asia. In particular, inventories in Europe remain much lower than their five-year averages and are contributing to strong demand for LNG imports. High levels of U.S. LNG exports are expected to continue into 2022, averaging 11.3 Bcf/d for the year, a 16% increase from 2021. The forecast reflects our assumptions that global natural gas demand remains strong and that expected additional U.S. LNG export capacity comes online.

Colder-than-normal temperatures in January resulted in U.S. natural gas inventories falling below the five-year average to end the month at 2.3 trillion cubic feet (Tcf). Natural gas inventories are expected to fall by about 730 Bcf for the rest of the withdrawal season, ending March just below 1.6 Tcf, which would be 8% less than the 2017–21 average for that time of year. U.S. consumption of natural gas will likely average 105.2 billion cubic feet per day (Bcf/d) in February, down 3% from February 2021. Consumption declines the most in the residential and commercial sectors, where consumption will average a combined 43.8 Bcf/d, down 10% from last February.

U.S. natural gas production averaged 95.5 Bcf/d in the United States in January, down 2.1 Bcf/d from December 2021. Production in January was lower due, in some part, to freezing temperatures in certain production regions. Natural gas production will likely average 95.6 Bcf/d in February and 96.1 Bcf/d for all of 2022, driven by natural gas and crude oil price levels that will be sufficient to support enough drilling to sustain production growth. Production is expected to rise to an average of 98.0 Bcf/d in 2023.



## Electricity, coal, renewables, and emissions

The share of U.S. electric power sector generation produced by natural gas is expected to average 35% in 2022 and 2023, down from 37% in 2021. The estimated cost of natural gas delivered to power generators averaged \$4.97/MMBtu in 2021 and will likely fall to \$4.16/MMBtu in 2022 and \$3.86/MMBtu in 2023. Despite the forecast decline in fuel costs, the share of electricity generation from natural gas declines in the forecast because of growth in renewable generation. The renewable generation share to increase from 20% in 2021 to 22% in 2022 and 24% in 2023. Increasing renewable generation means that the share of generation from coal will likely decline from 23% in 2021 to an average of 22% over the next two years. Forecast generation from nuclear remains relatively constant through the forecast at an average generation share of 20%.

U.S. coal production to increase by almost 28 million short tons (MMst) (5%) in 2022 to 606 MMst and then rise by 18 MMst (3%) in 2023. Producers in the Powder River Basin have increased employment at mines in recent months to boost production to meet domestic demand, but tight supply conditions will remain through the remainder of the year. U.S. coal consumption is expected to decrease by 2 MMst in 2022 as a 5 MMst (1%) decline in consumption from the electric power sector is somewhat offset by a 2 MMst (14%) increase in consumption for coke plants. Exports are expected to increase by 3 MMst (4%) in 2022 because international prices continue to be high for U.S. coal.

Planned additions to U.S. wind and solar capacity in 2022 and 2023 increase electricity generation from those sources in our forecast. The U.S. electric power sector added 16.3 gigawatts (GW) of new wind capacity in 2021. Pundits expect 7.6 GW of new wind capacity will come online in 2022 and 4.3 GW in 2023. Utility-scale solar capacity rose by an estimated 13.9 GW in 2021. The forecast for added utility-scale solar capacity is 21.8 GW for 2022 and 24.1 GW for 2023. Solar additions are expected to account for nearly half of new electric generating capacity in 2022. In addition, in 2021, small-scale solar capacity (from systems less than 1 megawatt) increased by 5.1 GW to 32.7 GW. Small-scale solar will likely grow by 4.4 GW per year in both 2022 and 2023.

U.S. energy-related carbon dioxide (CO<sub>2</sub>) emissions increased by more than 6% in 2021 as economic activity increased and contributed to rising energy use and a 2% increase in energy-related CO<sub>2</sub> emissions is expected in 2022, primarily from growing transportation-related petroleum consumption. Forecast energy-related CO<sub>2</sub> emissions remain almost unchanged in 2023. Petroleum emissions are expected to increase by 4% in 2022, and this growth rate slows to less than 1% in 2023. Natural gas emissions increase by 2% in 2022 and then decrease slightly in the forecast for 2023. Coal-related CO<sub>2</sub> emissions are expected to decline by 1% in 2022 and by 2% in 2023.



## APPENDIX C Supply Chain Situation & Outlook

The Logistics Managers' Index (LMI) reading of 75.2 in February 2022 is the second highest in the history of the index, up (+3.3) from January's reading of 71.9. **This reflects 13 consecutive months over 70.0, which would classify as significant expansion in the transportation sector, with no obvious signs of a slowdown on the horizon.** Like January, this month's growth is driven by rapid growth in inventory levels, which are up 9.1 points to 80.2 – crossing the 80.0 threshold for the first time and shattering the previous record of 72.6. This is a complete 180 from the Fall of 2021, when firms struggled to build up inventories. Now it seems that a combination of over-ordering to avoid shortages, late-arriving goods due to supply chain congestion, and a softening of consumer spending has created a logjam, with inventory levels a full 21.4 points higher than they were in November 2021. Unsurprisingly, this has spilled over to inventory costs as well, which have also reached a new peak (+2.3) of 90.3. This inventory issue seems more pronounced for downstream retailers, who reported significantly higher levels of both warehousing and transportation utilization than their upstream counterparts. There is a possibility that this surge in inventories will result in some price markdowns for durable goods. However, it seems unlikely that this will lead to a meaningful break in the inflation we have observed across supply chains, as warehousing and transportation prices remain high due to the continued mismatch in demand and available capacity.

The LMI score is a combination of eight unique components that make up the logistics industry, including: inventory levels and costs, warehousing capacity, utilization, and prices, and transportation capacity, utilization, and prices. The LMI is calculated using a diffusion index, in which any reading above 50 percent indicates that logistics is expanding; a reading below 50 percent is indicative of a shrinking logistics industry. The latest results of the LMI summarize the responses of supply chain professionals collected in February 2022. Overall, the LMI is up (+3.3) from January's reading of 71.9. The growth in this month's index is fueled by metrics from across the index. Unseasonably high rates of inventory accumulation stand out among these metrics, but capacity remains constrained, and prices continue to grow quickly. **Looking forward, respondents do not predict much relief over the next 12 months.** Given the current shortages in capacity, it is difficult to disagree with them.

### Russia / Ukraine Situation

The obvious focus of the country at the moment is the Russian invasion of Ukraine. Beyond the truly tragic loss in human life, a number of issues will have a direct effect on global supply chains. The most apparent change has been the shock to fuel prices. The price of crude oil is up to \$100 a barrel – the highest level since 2014. As sanctions rack up on Russia, prices may continue to increase, potentially driving transportation and inventory costs higher. Average diesel prices in the U.S. \$4.006 on February 28th. This is up 44 cents per gallon since the start of 2022 and up \$1.07 from this time last year. Russia's invasion has also led to no-fly zones over Moldova, Eastern Russia, and Ukraine, cutting off the most direct route between Europe and Asia. Additionally, many countries (such as the UK) have banned Russian carriers from

landing there. FedEx and UPS have also suspended shipments to Russia, with packages in route to be returned to sender. The longer routes cargo planes will have to take, along with increased fuel costs due to the war, create a “double whammy” for carriers. Finally, we are likely to observe various indirect costs here as well, as sanctions cut off access to leading producers of commodities like nickel, palladium, natural gas, wheat, grain, and sunflower oil. The ripple effects from this will be felt in products from groceries to Volkswagens.

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## US Port and Border Situations

On the other side of the globe, the number of ships waiting off the coast of LA/Long Beach was at 66 during the last week of February – the lowest level since September. Additionally, dwell time for containers at the Port of LA are down 23% from their peaks in early December. However, the number of ships queuing off of alternate US ports like Charleston or New York/New Jersey has increased steadily. Over 30 ships lingered off the Port of Charleston in late February – up from 19 in January. The Port Authority expects the backlog to clear by April. In addition to the ongoing port delays, protests at the U.S./Canada border have slowed truck traffic as well. These actions caused prices to ship goods from Canada to the US to jump up 44% from January to February. The push to avoid bottlenecks has also led some firms to move what would usually be intermodal freight by road. US intermodal transports are down by 12% year-over-year through the first six weeks of 2022. They have lost approximately 1% of their market share to long-distance trucking since the start of the pandemic, increasing the demand for truckloads of over 500 miles.

The impacts of this consistent congestion, fueled by the 10.6 million TEUs (twenty-foot equivalent units) that were processed at the Port of LA in 2021 – up 16% from 2020, a paltry 42.2% of container ships arrived on time in 2021 – down 35.8% from 2019. This has not improved much, in late February the average container was still taking 109 days to get from China to its final point of destination in the U.S., something that should take 40-60 days pre-pandemic. This has led to the forecasting headaches and a high volume of late-arriving products, partially explaining why inventory levels are up (+9.1%) so significantly to an all-time high. Unsurprisingly, the combination of too much inventory and expensive shipping has driven up inventory costs as well (+2.3%) to an all-time high reading of 90.3. Due to the high costs and slower sales, many firms are using their excess inventory as collateral to pay back the money they spent for expensive shipping on the way into the U.S. For both of the inventory metrics to be at an all-time high is especially unusual given that it's early in the year, which is often a slower time in supply chains with the wind-down from Q4 and the Chinese New Year.

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## Warehousing

The high volume of inventory in the system has led to increased warehousing utilization (+3.3%), up to 74.3 overall in February (driven particularly by downstream utilization rates of 81.1). The high levels of inventory coursing through supply chains highlights the continued contraction in available warehousing. Warehousing



capacity is once again down (-4.6) to 43.4, the lowest level since the start of the Q4 inventory buildup in August 2021. **This also marks 18 consecutive months of contraction, incentivizing many firms to aggressively explore alternatives.** Walmart is one such firm, as they are attempting to supplement their network by attaching approximately 100 new automated fulfillment centers to existing stores. This type of large capital expenditure is obviously not an option for everyone; many smaller warehouse operators are attempting to cut costs through automation – not just with expensive robotic automation, but with digital/touchscreen picking systems that allow them to go paperless as well. The impact of all of this can be seen on warehousing prices, which are up slightly (+0.5%).

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## Trucking

While truck mileage was up overall in 2021 (at an all-time high of nearly 300 billion miles), U.S. Bank, in its fourth-quarter 2021 National Shipments Index, reported a decline in freight shipments of 2.4% from the third quarter of 2021 and a year-over-year drop of 5.1% from the fourth quarter of 2020. Yet for the same period, the bank's National Spend Index, which measures freight expenditures, increased 8.4% from the third quarter and surged 20.2% from the fourth quarter a year ago. Average weekly revenue per truck was \$4,521, up 18% from last year, while the average number of trucks operating declined 5.3%. Fewer trucks are available, and those that are around are quite expensive. This is reflected in the continued contraction in available Transportation Capacity which reads in at 44.4. While the month-over-month drop is rather mild, the longevity of the contraction, now stretching 20 months back to June of 2020 is anything but.

To deal with this capacity issue, many large trucking companies are planning to use their increased operating revenue to make significant capital investments. JB Hunt planned to increase net capital expenditures by over \$600 billion from 2021, with Old Dominion planning to increase by around \$400 million. The backlog of components continues to be an issue. North American truck manufacturers produced 264,500 class 8 trucks in 2021 – nearly 65,000 less than the 330,000 they could have produced if shortages had not existed. They will be similarly short this year, projected to produce only 300,000 of the previously predicted 360,000 in 2022.

Even ocean carriers are moving to get in on the opportunity, with Maersk is attempting to use their record profits to break into the trucking and domestic 3PL business. The arrow is clearly pointing up in terms of the demand for these businesses with shippers spending 8-9 times more on domestic logistics than on ocean freight. This may mark a trend towards logistics companies putting together full-service end-to-end networks. Even with this investment, the transportation crunch cannot be solved until the semiconductor shortage ends – something experts say could begin to ease by 2023 at the earliest.

A shortage of equipment is not the only thing driving transportation issues, there is the shortage of drivers as well. Part of the labor issue can be attributed to an estimated 25% of driving schools not reopening after the pandemic. As they have for the last 21 months since May of 2020, transportation prices increased. Contract rates for dry van truckloads are up approximately 25% over the last year. The cost of freight transportation overall is up 28% since the start of 2019 – the producer price index is up 23% over that same period. Essentially, the price increases for transportation stand out even above all of the other inflationary pressures happening throughout the economy.

