THE ECONOMY AT A GLANCE
HOUSTON

GREATER HOUSTON PARTNERSHIP
Making Houston Greater.

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Table of Contents

THE PERENNIAL QUESTIONS

"How much of Houston's economy is tied to energy?"

That question gets asked every time the price of crude drops by more than a few dollars.

"Is Houston less dependent on energy than it was 10, 20 or 30 years ago?"

That gets asked by residents who lived through previous downturns and worry that Houston remains as vulnerable today as it was back then. This issue of *Glance* answers both questions.

Energy Defined

Before answering either question, one must first define the industry. Oil and gas has three sectors: upstream, midstream, and downstream. Upstream includes exploration, production, and oilfield services. Midstream focuses on the processing, transportation, and storage of crude and natural gas. Downstream involves the refining and processing of oil and natural gas into fuels, chemicals, and plastics. All three sectors are well-represented in Houston.

MAJOR PLAYERS IN HOUSTON'S ENERGY INDUSTRY

Sector	Sample Companies
Upstream	Apache, ConocoPhillips, EOG, Hess, Marathon, Noble, Southwestern
Midstream	Enbridge, Enterprise, Kinder Morgan, Plains All American, Spectra
Downstream	Dow, Citgo, Huntsman, Lyondell-Basel, Phillips66, Valero, Westlake
Integrated*	BP, Chevron, Exxon, Occidental, Shell, Total

* Operate in all three sectors

Each sector responds differently to changes in price. Exploration companies ramp up drilling as crude prices rise and ratchet it down as prices fall. Pipeline profits are tied to the volume of products moving through their systems. Prices are a secondary concern. Refiners prefer low oil prices because they translate into cheaper feedstocks and wider profit margins. Domestic chemical producers prefer low natural gas prices. Their primary feedstocks are natural gas liquids (NGLs), like ethane and propane. Overseas, the primary feedstock is naphtha, which is derived from crude. As oil prices rise and natural gas prices stay flat, U.S. chemical producers have a cost advantage over their foreign competitors. All three sectors are currently dealing with low commodity prices, excess inventories, declines in drilling, government permitting hurdles, and weak overall demand due to the pandemic.

Energy's Contribution to Houston's GDP

Every December, the Bureau of Economic Analysis (BEA) publishes its estimates of gross domestic product (GDP) for all 384 U.S. metro areas. BEA estimates that oil and gas extraction accounted for $20.5 billion (4.3 percent) of Houston's GDP in '18. That's down from $33.1 billion or 7.7 percent in '14.

Industry	$ Billions	% of Total
Manufacturing	84.800	17.7
Professional/Business Services	70.687	14.8
Finance, Insurance, Real Estate	68.963	14.4
Wholesale Trade	43.536	9.1
Government	39.328	8.2
Construction	29.082	6.1
Retail Trade	24.013	5.0
Oil and Gas Extraction	20.468	4.3
Hospitality[1]	16.707	3.5
Utilities	8.153	1.7
All Other Industries[2]	73.042	15.3
Total	**478.779**	**100.0**

1 Arts, entertainment, recreation, accommodation, and food services
2 Health care, information, transportation, warehousing, utilities
Source: U.S. Bureau of Economic Analysis

BEA no longer publishes estimates for chemicals, refining, and pipelines contribution to Houston GDP. The last year for which the data was available ('14), upstream, midstream and downstream accounted for 26.8 percent of local GDP. Once oilfield equipment and fabricated metal

product manufacturing were factored in, energy's share of Houston GDP jumped to 30 percent.

Much has happened since then, however. Oil prices have collapsed, upstream employment has tumbled, operators have added 30,000 miles of pipelines to their systems, and chemical companies have invested over $60 billion in new plants and facilities. As a result, previous estimates of energy's contribution to GDP are no longer valid.

If You Torture the Data Long Enough

There's a saying among economists: "If you torture the data long enough, eventually it will tell you anything." That applies to GDP estimates as well.

Between '14 and '18, upstream's contribution to Houston GDP fell by $12.5 billion. Over the same period, nondurables manufacturing rose by $15 billion. Chemicals and refined products are nondurables.

When BEA last published data on chemicals and refining, the two accounted for 92 percent of the nondurables total. For the sake of this analysis, the Partnership assumes the percentage hasn't changed, though in reality it's likely higher given the construction boom.

Assuming that chemicals and refined products account for over 90 percent of nondurables manufacturing, the Partnership estimates that downstream energy contributed about $52.0 billion, or 10.8 percent, to metro GDP in '18. That's two and half times upstream's share, which BEA estimates at $20.5 billion, or 4.3 percent of GDP. Add together upstream and downstream, assume that pipelines, equipment manufacturing, engineering and a handful of other sectors contributed another $15 to $20 billion, and energy likely accounted for 20 to 25 percent of GDP in '18. That's down from 30 percent in '14.

What the Model Says

IMPLAN, an econometric model the Partnership uses to estimate the impact corporate relocations and expansions on the region, offers a different approach to estimating energy's contribution to regional GDP.

The model is based on a simple assumption. For a company to produce goods or deliver services, it requires inputs from other firms. A restaurant purchases meat, vegetables and spices to prepare meals. A developer purchases concrete, lumber, wiring, and windows to build houses. An exploration firm buys seismic data, negotiates leases, and contracts with drillers to find oil and gas. The more those purchases are made locally, the greater the impact on the region. According to the IMPLAN model, energy accounted for around 20 percent of Houston's GDP in '18.

ENERGY'S CONTRIBUTION TO HOUSTON GDP IN '19

Industry	$ Millions	%
Oil & Gas Extraction	$38,597.8	7.2
Drilling Oil & Gas Wells	$5,971.5	1.1
Support Activities for Oil & Gas	$8,346.7	1.5
Oil Field Machinery Mfg.	$5,141.5	1.0
Pipe & Valve Mfg.	1,575.8	0.3
Petroleum Refineries	$19,846.0	3.7
Petrochemical Mfg.	$20,741.0	3.9
Pipeline Transportation	$7,971.5	1.5
Engineering Services	$12,209.2	2.3
Energy Sector Total	$120,401.2	22.3
HOUSTON MSA TOTAL	**$538,725.9**	**100.0%**

There are some noteworthy differences between BEA's data, IMPLAN's data, and the Partnership's estimates. For instance, IMPLAN's values for oil and gas extraction and total GDP are higher than the BEA's; additionally, IMPLAN's estimates for chemicals and refining are much lower than the Partnership's. But when comparing bottom lines, the Partership and IMPLAN are in the same neighborhood. Energy's share of regional GDP was 20 to 25 percent in '18.

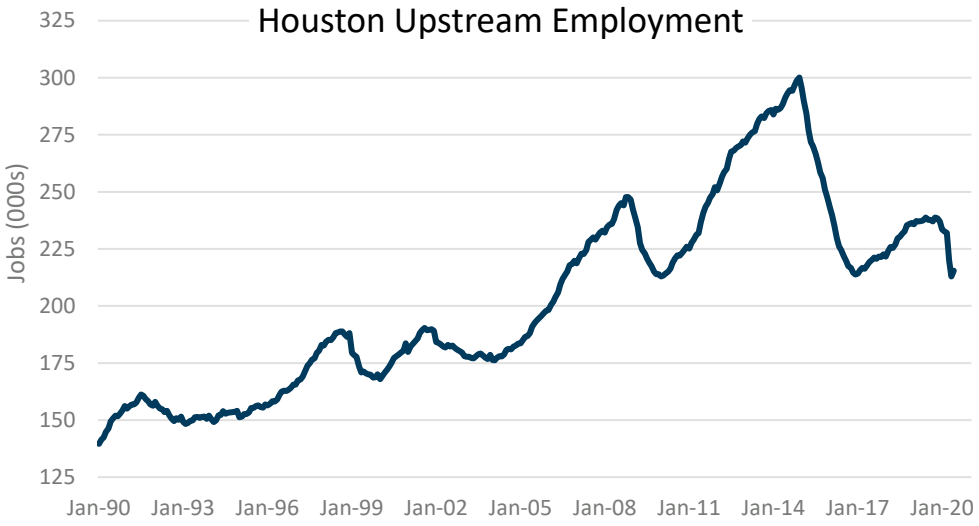
Energy's Share of Houston Employment

Each month, the Texas Workforce Commission (TWC) releases its estimates of payroll employment for all metro areas in the state. The series, referred to as the Current Employment Statistics (CES), is based on employer surveys and includes data on most industries that comprise upstream, midstream and downstream energy in Houston. The CES also provides data that allows oil field equipment manufacturing, fabricated metal products, and engineering services to be factored into the analysis.

The CES data show that upstream employment peaked at 300,000 jobs, or 10.0 percent of the metro total, in December '14.[1] The sector lost jobs through December '16, enjoyed a brief recovery starting in '17, and began trending down again this year. The trend has accelerated with the collapse in demand brought on by the pandemic.

The sector employed 215,000 as of June '20, down nearly 25,000 since December. The 215,000 mark is significant because it formed the floor of the last two downturns in Houston. If the sector falls below that threshold this time, upstream employment will be at its lowest level since '06.

[1] The Partnership is including oil field equipment manufacturing, fabricated metal products and engineering in upstream employment.



Source: Partnetrship calculations based on Texas Workforce Commission data

As a subset of upstream employment, exploration, production and oilfield services accounted for 59,600 jobs in June, or 2.1 percent of total employment. That's well below the 3.9 percent 104,000 peak of mid-'13, the height of the fracking boom.

Midstream employment peaked at 13,600 in April '02, then fell below 8,000 the middle of the decade. The steep drop reflects the collapse of Enron, which once employed more than 5,000 in Houston. Pipeline employment has inched up over the last 15 years but remains well below its previous peak. The sector employed 12,100 as of June '20, accounting for 0.4 percent of all jobs in the region.

Downstream employment peaked at 59,900 in August '91, accounting for 3.3 percent of total employment. As of June '20, the industry employed 51,400, and accounted for 1.7 percent of all jobs.

The drop in employment seems odd considering that the industry has invested billions on new plants along the Gulf Coast. Two factors likely account for this—the increased efficiencies of the plants coming online and a greater reliance on sub-contractors to maintain those plants.

The monthly CES data has its limitations, though. For one, it lacks the detail needed to understand the role that subsectors tied closely to energy, like pump and compressor manufacturing or geophysical surveying, play in Houston. The data, because it's based on a survey sample and then extrapolated, is subject to substantial revisions.

A Different Set of Jobs Data

TWC's Quarterly Census of Employment & Wages (QCEW) provides another option for measuring the degree to which local employment is tied to energy. The QCEW is based on the number of workers covered by unemployment insurance, which is mandatory in Texas. Since the data is based on administrative records, not an employer survey, revisions are minimal.

Another benefit, the QCEW covers over 800 industries in Houston compared to fewer than 80 for the CES. The QCEW also provides data on compensation by industry, something not available elsewhere. The QCEW's major limitation: there's an eight- to nine-month lag from when the data is collected to when it's released. As of early August, the most current data available was for Q4/19. Houston's economy, especially the energy industry, has contracted significantly since then.

The Partnership's analysis of QCEW data from Q1/90 to Q4/19 found that

HOUSTON'S ENERGY INDUSTRY, Q4/19

Industry	Firms	Average Employ-ment	Average Weekly Wages	Total Annual Wages
Oil & Gas Extraction	492	36,619	4,169	9,031.9
Drilling Oil & Gas Wells	137	10,772	2,658	1,615.3
Support Activities for Oil & Gas	773	27,825	2,674	3,938.1
Pipeline Construction	200	28,283	1,932	2,514.4
Petroleum Refineries	43	9,404	2,784	1,578.0
Petrochemicals	34	13,261	2,374	1,891.2
Basic Organic Chemicals	48	3,699	2,808	561.7
Synthetic Rubber	60	4,768	2,653	698.1
Industrial Valves	70	3,972	1,737	349.8
Fabricated Pipes & Fittings	93	5,360	1,335	371.4
Oil & Gas Field Equipment	251	27,780	2,182	3,308.2
Pipeline Transportation	86	12,034	3,232	2,275.0
Engineering Services	1,862	50,411	2,702	6,115.1
Geophysical Surveying	145	3,608	2,508	472.8
Totals	4,294	237,796	2,553	34,721.0

Source: Texas Workforce Commission, Quarterly Census of Employment & Wages, Q4/19

- As a share of total employment, energy peaked at 10.8 percent in Q3/91. Energy's share was 7.8 percent in Q4/19.
- As a share of total businesses, energy-related firms peaked at 4.0 percent in the early '90s. They represented only 3.2 percent of all firms in Q4/19.
- As a share of total wages, energy peaked at 21.5 percent in '12. Energy paid $34.7 billion in wages last year, or 15.7 percent of total earnings in the region. That's was near the all-time low of 15.6 percent in '18.

Returning to IMPLAN

Tallying up CES or QCEW jobs does not account for the indirect or induced impacts of the energy industry on the economy. The "indirect" impact occurs when the energy industry purchases goods and services in the community. The "induced" impact occurs when the employees at those energy companies and the firms supplying them spend their paychecks in the community. But those impacts can be estimated using IMPLAN. The table shows the impact that 1,000 jobs in various sectors of the energy industry have on Houston.

IMPACT OF 1,000 JOBS ON HOUSTON, SELECTED SECTORS

	Jobs Created			Jobs Multiplier
	Indirect	Induced	Total	
Oil & Gas Extraction	845	1,369	3,214	3.2
Drilling Oil & Gas Wells	1,085	1,290	3,376	3.4
Support Activities for Oil & Gas	909	1,053	2,962	3.0
Oil Field Machinery	684	948	2,632	2.6
Petroleum Refineries	10,853	9,400	21,253	21.3
Petrochemicals	5,590	3,607	10,197	10.2
Pipeline Transportation	617	6,302	7,919	7.9

Source: IMPLAN

Refining and chemicals have a greater impact, (or in economic parlance, "a higher multiplier"), because the plants require ongoing repair, maintenance and upgrades. A $1 billion plant may employ only a few hundred operators but it requires an army of pipefitters, welders, and electricians to repair and maintain. Most of this work is sourced from local engineering and construction firms.

Pipelines have slightly lower multiplier than the downstream sector because while engineering, design and management are concentrated in Houston, construction and maintenance occurs along the rights-of-way.

Upstream's multiplier falls below middle and downstream because most of what takes place here are management functions. Decisions about where to drill are made here, the services to do so are acquired here, and some of the equipment used to find oil is manufactured here, but the actual drilling takes place hundreds of miles away.

Although it's tempting, one can't run the model for multiple industries and then aggregate the results to determine energy's overall impact on Houston. That's because one sector's output is often another sector's input. Aggregating the results would lead to significant over-counting. The model does indicate that energy has some of the highest multipliers of any industry in Houston.

Nor can historic data be input into IMPLAN to determine how energy's importance has shifted over time. Technologies, purchasing patterns, and consumer preferences are ever-evolving. The model is updated regularly to reflect this. Regarding the energy timeline, consider: fracking first swept the industry 10 years ago; Congress only lifted the ban on crude exports five years ago; initial production per well in the Permian Basin is 50 percent higher than three years ago; and U.S. oil production has grown by 3.2 million barrels per day over the past five years. During this time, exploration and oil field service firms cut more than 125,000 jobs from their payrolls.

Additional Factors to Consider

Over the past 30 years, the nature of the energy industry has changed. To increase profitability, many companies have outsourced non-essential jobs, likely accounting for the drop in energy's share of employment. The jobs that were outsourced tend to be at the lower end of the pay scale. The jobs retained were core functions, which tend to be higher-skilled and higher-paid positions. The energy workforce was more blue-collar-oriented in the '80s and '90s. Today it's more white-collar-oriented. And over the past 30 years, Houston has shifted from a place where the industry made *things* to a place where the industry makes *decisions*.

But What Have You Done For Me Lately?

Houstonians have a love-hate relationship with oil and gas. From '10 to '14, during the height of the fracking boom, Houston lead the nation in job growth, population growth and housing starts. No one seemed to mind that the good times were driven by a drilling boom in the Eagle Ford shale. Now that energy is shedding jobs, the industry is seen as a liability, especially in light of growing concerns over climate change. But Houstonians need to consider a few points:

The energy industry helped make Houston a global city. According to *'17 Global Houston*, one-fifth of the world's

national oil companies, two-thirds of the global integrated oil companies, and half of the world's non-U.S. oil field service firms have offices in Houston.

A majority of tonnage handled at Port of Houston is energy related—crude 29 percent, refined exports 24 percent, chemicals and plastics 14 percent.

The industry is well integrated into Houston's cultural life. Scan the advertisers along the outfield fence in Minute Maid Park and over half are energy-related companies. Pick up a program for the opera, symphony or ballet and energy companies are among the major underwriters.

The Future

Houston now faces a double whammy of weak energy demand because of the COVID-19 pandemic and needs to transition away from fossil fuels to mitigate global climate change. The industry, at first slow to recognize the need for change, now embraces it.

In June '19, the Center for Houston's Future hosted the region's first low carbon energy summit. The event brought together energy executives, climate experts and thought leaders to start a dialogue on harnessing Houston's expertise to address the transition to a low carbon future. At this year's annual meeting, Partnership Chairman Bobby Tudor declared Houston having not only the opportunity, but also the responsibility, to lead the global energy transition. BP, Shell, Chevron, Exxon have all launched initiatives to reduce carbon emissions and are funding research into alternative energy sources. And Greentown Labs will soon open Houston's first climate tech and clean tech-focused startup incubator. This will be its first venture outside of its hometown of Boston.

Some have referred to this shift in focus as Energy 2.0; however, Houston would not have the opportunity for an Energy 2.0 without foundation already having been laid with Energy 1.0.

Metro Houston Employment

Metro Houston added 55,000 jobs in June. That's on top of the 78,200 jobs added in May. Despite the surge, local employment remains 217,700 jobs below its February pre-COVID level. The largest job gains occurred in restaurants and bars, retail and arts, entertainment and recreation. Government, manufacturing and transportation, warehousing and utilities and energy continued to lose jobs. Of the major sectors, only finance and insurance has returned to its pre-COVID employment level.

IMPACT OF COVID-19 ON METRO HOUSTON PAYROLL EMPLOYMENT

EMPLOYMENT SECTOR	Losses March & April	Gains or Losses May & June	Gap from Pre-COVID Level
Total Nonfarm	-350,200	+133,200	217,000
Energy (Exploration, Oil Field Services)	-8,500	-5,200	13,700
Construction	-31,300	+10,300	21,000
Manufacturing	-13,300	+700	12,600
Wholesale Trade	-17,000	+2,300	14,700
Retail Trade	-27,700	+21,400	6,300
Transportation, Warehousing, and Utilities	-3,700	-1,000	4,700
Information	-3,100	-200	3,300
Finance and Insurance	-400	+1,500	NA
Real Estate and Equipment Leasing	-5,000	+1,100	3,900
Professional, Scientific, and Technical Services	-8,800	+2,000	6,800
Management of Companies and Enterprises	-4,500	+1,600	2,900
Administrative Support and Waste Management	-13,700	+8,600	5,100
Educational Services (Private)	-5,800	-400	6,200
Health Care and Social Assistance	-41,000	+27,500	13,500
Arts, Entertainment, and Recreation	-18,000	+10,000	8,000
Hotels, Restaurants, Bars	-110,900	+64,300	46,600
Other Services	-27,400	+7,200	20,200
Government	-10,100	-18,500	28,600

Source: Partnership calculations based on Texas Workforce Commission

SNAPSHOT – KEY ECONOMIC INDICATORS

Aviation — The Houston Airport System (HAS) handled 954,066 passengers in June ’20, an 82.3 percent drop from the 5.4 million passengers handled during April ’19.

Business-Cycle Index — The Houston Business-Cycle Index increased for a second consecutive month in June but remains well below pre-COVID levels. The index declined an annualized 23.9 percent over the three months ending in June

Construction — Construction starts totaled $9.4 billion May ’20 YTD, down from $10.9 billion during the same period last year.

Crude Oil — The closing spot price for West Texas Intermediate (WTI), the U.S. benchmark for light, sweet crude, averaged $40.69 per barrel during the last week of July ’20, down 28.0 percent from $56.05 for the same period in ’19. The COVID-19 pandemic continues to reduce global economic activity. However, oil prices rose in July as OPEC and partner countries maintained production cuts and the United States continued to reduce drilling activity.

Home Sales — The Houston area housing market has fully regained its spring losses and returned to pre-COVID sales volumes though the recovery may be short-lived as listings dry up. Houston-area realtors sold 10,975 single-family homes in July ’20, up 23.0 percent from the same month last year and the most ever for a single month in Houston. Year-to-date sales totaled 51,388 single-family homes, up 2.7 percent from the first seven months of ’19.

Inflation — The cost of consumer goods and services as measured by the Consumer Price Index for All Urban Consumers (CPI-U) rose 1.0 percent nationwide from July ’19 to July ’20. Core inflation (all items less the volatile food and energy categories) increased 1.6 percent since July ’19.

Natural Gas — The cost of consumer goods and services as measured by the Consumer Price Index for All Urban Consumers (CPI-U) rose 1.0 percent nationwide from July ’19 to July ’20, according to the U.S. Bureau of Labor Statistics. Core inflation (all items less the volatile food and energy categories) increased 1.6 percent since July ’19.

Purchasing Managers Index — Overall economic activity expanded for the second straight month in Houston, though manufacturing activity continues to contract, according to the Houston Purchasing Managers Index (PMI). The PMI, which had sunk to 34.6 in April, inched up steadily in recent months, topping out at 49.5 in June. Escalation of COVID-19 cases in the Houston region caused the July reading to fall to 47.9. Readings above 45 correlate with expansion of the overall economy, below 45 a contraction.

Rig Count — Baker Hughes reports 244 drilling rigs were working in the U.S. during the second week of August ’20. That’s down 691 rigs, or 73.9 percent, from the same week in August last year.

Sales Tax Collections — Sales and use tax collections for the 12 most populous Houston-area cities1 totaled $981.7 million in the 12 months ending June ’20, up 0.1 percent from $980.8 million for the same period in ’19. Despite the slight 12-month increase of 0.1 percent, collections have trended down in the past three months. Collections for the month of June totaled $89.0 million, down 1.8 percent from $90.7 million in June ’19.

Elizabeth Balderrama, Heather Duran, Patrick Jankowski, Roel Gabe Martinez, Josh Pherigo, and Berina Suljic contributed to this issue of Glance.

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