Supplemental Information

“Emissions in the Stream: Estimating the Greenhouse Gas Impacts of an Oil and Gas Boom”

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Section A. Uncertainty Analysis

A.1. Uncertainty Regarding Upstream Production. Production volumes, which depend upon future economic conditions, are one important source of uncertainty. Panel B of Figure 2 in the paper shows that emissions from the upstream sector could vary from 138 million tons CO$_2$e per year by 2030 in the low oil and gas resource and technology scenario to 200 million tons CO$_2$e per year in the high oil and gas resource technology scenario. The impact of this uncertainty would cause our total emissions estimate to range from 510–572 million tons CO$_2$e per year.

A.2. Uncertainty Regarding Planned Facilities. Most (73.8%) of the emissions documented in Table 4 in the paper are those from planned facilities (not yet under construction). A very conservative lower bound on our emissions estimates would assume that none of this planned capacity is built. Total incremental emissions from the buildout would amount to 142 million tons CO$_2$e, about one-quarter of our central estimate. This is still very large; industrial investments in the Gulf region are already on track to increase emissions meaningfully, even absent further buildout.

A.3. Uncertainty Regarding Emission Factors. Another source of uncertainty is the extent to which emissions from planned facilities can be predicted using an averaged, output-based emission factor from already-permitted facilities. To the extent that variation in production technology, fuel use, and scale of production yield variation in emissions that does not scale linearly with output, these estimates may err. One way to gauge the accuracy of the emissions factors we use is to consider variation between permitted emissions in our data and what the averaged emission factor would predict them to be based upon facility production capacity. In Figure S5, we plot the averaged emission factor as a dotted line predicting emissions in millions of tons of CO$_2$e per year relative to production magnitude by facility type. For some facilities (e.g., LNG terminals and fractionators), the averaged factor does a fairly good job predicting emissions. For other types (e.g., gas processing and refineries), the prediction error is noticeably larger. For some facilities (e.g., oil terminals, fertilizers), there are too few facilities in the data to assess whether the averaged factor fits the data well or not. This merits a degree of caution in interpreting our results in certain subsectors where we are less confident that averaged emission factors are accurate predictors of future emissions.
In Table S5, we compare our estimates from Table 4 in the paper to aggregate emissions and facilities that come exclusively from permit documents from the US EPA, the Federal Energy Regulatory Commission, the TCEQ, and the LA Department of Environmental Quality (EIP 2019). This comparison suggests that we estimate nearly double the emissions, but we capture nearly twice the number of facilities, with average emissions per facility within a relatively close range of 1.67 million tons of CO$_2$e per facility from the database versus 1.78 from our analysis. The fact that the additional emissions documented in our analysis are proportionally larger than the increase in facilities over these filings reflects the scales of some of the larger proposed LNG terminals and petrochemical facilities.

We also consider the sensitivity of our upstream emissions estimates to the choice of emission factors. We construct an alternative set of factors based on data provided by Alvarez, et al. (2018). These data provide figures for oil and gas production and CO$_2$ and CH$_4$ emissions for the Bakken, Barnett, Fayetteville, West Arkoma, Haynesville, Uinta, Weld County, San Juan, and Marcellus basins. We construct CO$_2$e emissions from flaring, venting and fugitive sources for these data assuming a global warming potential of 32 and estimate the following regression model:

$$e_i = \alpha_0 + \alpha_1 oil_i + \alpha_2 gas_i + \gamma_i + \varepsilon_i,$$

where $e_i$ are CO$_2$e emissions from basin $i$, $oil_i$ is oil production, $gas_i$ is natural gas production, $\gamma_i$ is a basin-specific fixed effect, and $\varepsilon_i$ is an idiosyncratic error term. From these estimates, $\alpha_1$ corresponds to our estimated oil production emissions factor and $\alpha_2$ is our estimated natural gas production emission factor. From this model, we estimate that a 1,000 ft$^3$ increase in natural gas production increases CO$_2$e emissions by 0.000684 metric tons and that a one-barrel increase in oil production increases CO$_2$e emissions by 0.00460 metric tons. These estimates are reported below in Table S.7. Using these estimates together with production forecasts as reported in Figure 2, results in an increase in 2030 annual natural gas emissions by roughly an order of magnitude (325 million tons CO$_2$e per year by 2030) and a decrease in oil emissions by a smaller proportion (16 million tons CO$_2$e per year by 2030). While these differences are meaningful,

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23 The EIP database does not include upstream activities, pipelines, or rail terminals, and we exclude a small number of facilities that do appear in that database, such as explosives plants.
they are not unexpected given that upstream emission factors have been found to range by as much as an order of magnitude across studies.

A.4. Uncertainty Regarding Permitted vs. Actual Emissions. Actual emissions might not equal permitted emissions. In comparison with regulated pollutants, regulators might take less care in estimating likely GHG emissions, because there are no quantitative regulatory standards for CO₂ or CH₄ in Texas and Louisiana. We compare permitted emissions from the TCEQ to those reported by facilities and published using the EPA’s GHG Reporting Program Facility Level Information on GreenHouse gases Tool (FLIGHT) system, 2017–2018 (EPA 2019), for the 40 facilities of the 327 in our database also found in FLIGHT. In Table S6, we report summary statistics for the ratio of reported emissions to permitted emissions for these facilities. On average, reported emissions are 11% higher than permitted emissions. However, this masks variation in this ratio across facility types. For example, refineries have average emissions three times the permitted amount in these two years, whereas the average ratios for all other facility types lie between 72% and 81%.

To gauge how much this variation might affect our final results, we scale our emissions estimates by the average share for refineries (355%) and for non-refineries (76%) across the two years to assess how this would affect the final emissions estimate in this study. Applying these adjustments would lower our annual emissions estimate from 541.1 million tons CO₂e to 374.1 million tons.

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24 We also show the breakdown of these ratios by facility type in Figure S6.
25 In principle, we could allow this scaling to vary among more categories of facilities, but as Figure S6 makes clear, not all facility types in our data are present in FLIGHT, and in some cases, there is only one facility, making our confidence in scaling by the ratio small.
Section B. Data Construction

Our inventory of production activities and emissions is compiled from several sources. Upstream production volumes for oil and gas from onshore basins in Texas and Louisiana and off-shore reservoirs in the Gulf of Mexico come from the Energy Information Administration (EIA 2019a). Emissions associated with these activities corresponding to vented, flared, and fugitive emissions come from Brandt, et al. (2014) and Cai, et al. (2). The list of mid- and downstream facilities and associated production volumes in our data come from a search of a variety of industry and media sources for plant opening news, listed in Tables S2 and S3. Permit data come from a database of permits (including original documents) from the Environmental Integrity Project (EIP 2019). Where permit data are not available, emission factors are taken from estimates in the literature as summarized in Table 3 from the paper and Table S1, which provides additional detail within our “Petrochemicals” category.
Panel A. Historical Oil Production

Panel B. Historical Natural Gas Production

Figure S1. Historical Oil & Gas Production by Region

Notes: Annual production estimates by region reported on left vertical axis, in aggregate for whole US on right vertical axis for panel B. Source: EIA (2019b, 2019c).
Figure S2. Natural Gas and Ethylene Market Linkages

Notes: The figure above shows how technological changes in unconventional natural gas development can induce changes in the petrochemical sector through derivative products such as ethylene. These changes result in increased equilibrium quantity of natural gas (NG$_1$ to NG$_2$) and lower natural gas prices (PG$_1$ to PG$_2$). This mechanism works through two channels: 1) increased production of natural gas increases the supply of natural gas liquids, including ethane, which are precursors to ethylene, thereby increasing supply in the ethane market from S to S’; and 2) lower natural gas prices decrease the cost of energy-intensive chemical refining processes, such as ethane cracking, thereby increasing supply of derivative products as well. This serves to increase supply (from NE$_1$ to NE$_2$) and lower prices (from PE$_1$ to PE$_2$) in the ethylene market.
Figure S3. Calculation and Application of Output-based Emission Factors in Study Analysis

Notes: The figure above describes the study methodology, which varies between upstream and downstream sources. Upstream production volumes (cubic feet per year for gas and barrels for oil) are multiplied by volumetric emission factors to account for emissions related to CH₄ that is either vented, fugitive, or flared as part of the upstream process. Mid- and Downstream analysis is conducted based on newly constructed, under construction, or planned facilities. Where permitted, we use CO₂e for each facility and where not permitted, we infer what emissions will be by constructing output-based emission factors by facility type (corresponding to types in Table 3 of the main paper) and multiplying these factors by announced production volumes.
Figure S4. Projected Oil & Gas Production by Region

Notes: Annual production estimates based on EIA reference scenario. Panel B production for EIA Southwest, Gulf Onshore, and Gulf Offshore regions. Emissions estimates are based on emissions factors from Alvarez et al. (2018). Onshore Gulf production corresponds to coastal Texas, Louisiana, Mississippi, Alabama, and Florida. Southwest production includes western Texas and eastern New Mexico.
Figure S5. Emission Factor Error Analysis
Figure S5 (cont.)
Note: Blue scatter dots indicate permitted facility production capacity ("magnitude") and permitted emissions. Only facilities with permitted emissions in our data are included. Red dotted line indicates what predicted emissions would be using the averaged emission factor for that facility type.
Figure S6. Reported vs. Permitted Emissions by Facility Type

Notes: The data above are for a subset of 40 facilities in our permit data that also report via the EPA’s Greenhouse Gas Reporting Program (GHGRP). Bars indicate average emissions reported in GHGRP for 2017 and 2018 over Permitted Emissions, where the vertical solid line corresponds to equivalence between both amounts. Error bars correspond to standard errors of average estimates. Compressor Stations and LNG Terminals have asterisks denoting that there are no error bars because there is a single matched observation.
| Facility Type                                      | Value  | Unit                        | Source                                      |
|---------------------------------------------------|--------|-----------------------------|---------------------------------------------|
| Adipic Acid unit; ADN unit; Powerhouse            | 3.53   | Mil Ton Per Year of CO2e/mmtpa | Averaged from Permit Data                   |
| Air separation unit                               | 0.66   | Mil Ton of CO2e/facility    | Averaged from Permit Data                   |
| Cracker                                           | 2.41   | Mil Ton Per Year of CO2e/mmtpa | Averaged from Permit Data                   |
| Ethane Cracker                                    | 2.99   | Mil Ton Per Year of CO2e/mmtpa | Averaged from Permit Data                   |
| Ethylene derivatives                              | 2.17   | Mil Ton Per Year of CO2e/mmtpa | Averaged from Permit Data                   |
| Fertilizer or fertilizer-related                  | 1.82   | Mil Ton Per Year of CO2e/mmtpa | Averaged from Permit Data                   |
| Formaldehyde                                      | 0.03   | Mil Ton of CO2e/mmtpa       | (Wilson 2010)                               |
| Formic Acid                                       | 8.24   | Mil Ton Per Year of CO2e/mmtpa | Averaged from Permit Data                   |
| Hydrogen                                          | 12.13  | Mil Ton of CO2e/mmtpa       | (Spath and Mann 2000)                       |
| Hyroprocessing Catalyst                           | 0.005  | Mil Ton of CO2e/facility    | Based on similar facility in GHGRP          |
| Lake Charles Chemical Project                     | 2.57   | Mil Ton Per Year of CO2e/mmtpa | Averaged from Permit Data                   |
| Liquid Nitrogen                                   | 0.28   | Mil Ton of CO2e/mmtpa       | (Malcolm Pirnie, Inc. 2007)                 |
| Methanol                                          | 1.53   | Mil Ton Per Year of CO2e/mmtpa | Averaged from Permit Data                   |
| Methyl mercaptan, ethyl mercaptan, dimethyl sulfide (DMS) and methylmercapto-proprionaldehyde (MMP) | 1.35E-07 | Mil Ton of CO2e/mmtpa       | Averaged from Permit Data                   |
| Methylene diphenyl diisocyanate                   | 0.14   | Mil Ton of CO2e/mmtpa       | Averaged from Permit Data                   |
| Polyethylene                                      | 4.08   | Mil Ton Per Year of CO2e/mmtpa | Averaged from Permit Data                   |
| Material                        | Value | Unit                        | Source                                      |
|--------------------------------|-------|-----------------------------|---------------------------------------------|
| Polyvinyl alcohol              | 0.14  | Mil Ton Per Year of CO2e/mmtpa | Averaged from Permit Data                   |
| Propanol                       | 1.09  | Mil Ton Per Year of CO2e/mmtpa | Averaged from Permit Data                   |
| Propylene                      | 0.72  | Mil Ton Per Year of CO2e/mmtpa | Averaged from Permit Data                   |
| Terminal, petrochem            | 0.12  | Mil Ton Per Year of CO2e/facility | Averaged from Permit Data                   |
Table S2. Facility Data Sources

| Source                                                                 | Release Year | Sector         | Related Facility Type       | Link                                                                 |
|-----------------------------------------------------------------------|--------------|----------------|-----------------------------|----------------------------------------------------------------------|
| Global Fossil Project Tracker                                         | 2019         | Midstream      | Pipeline, LNG Terminal      | [https://greeninfo-network.github.io/fossil_tracker/](https://greeninfo-network.github.io/fossil_tracker/) |
| American Chemistry Council, Notes on Shale Gas, Manufacturing & the Chemical Industry (February 2019). | 2019         | Downstream     | Petrochemical               | [https://www.americanchemistry.com/Policy/Energy/Shale-GasFact-Sheet-US-Chemical-Investment-Linked-to-Shale-Gas.pdf](https://www.americanchemistry.com/Policy/Energy/Shale-GasFact-Sheet-US-Chemical-Investment-Linked-to-Shale-Gas.pdf) |
| American Chemistry Council, Notes on Shale Gas, Manufacturing & the Chemical Industry (September 2018). | 2018         | Downstream     | Petrochemical               | [https://www.fitchsolutions.com/bmi-research](https://www.fitchsolutions.com/bmi-research) |
| BMI/Fitch database                                                      | 2018         | Downstream     | Petrochemical               | [https://www.americanchemistry.com/Policy/Energy/Shale-GasFact-Sheet-US-Chemical-Investment-Linked-to-Shale-Gas.pdf](https://www.americanchemistry.com/Policy/Energy/Shale-GasFact-Sheet-US-Chemical-Investment-Linked-to-Shale-Gas.pdf) |
| BMI Research, US Petrochemicals Report Q3 2018.                        | 2018         | Downstream     | Refinery, Petrochemical     | [https://www.americanchemistry.com/Policy/Energy/Shale-GasFact-Sheet-US-Chemical-Investment-Linked-to-Shale-Gas.pdf](https://www.americanchemistry.com/Policy/Energy/Shale-GasFact-Sheet-US-Chemical-Investment-Linked-to-Shale-Gas.pdf) |
| Email communications with Brett VandenHeuvel, November 2, 2018 and March 22, 2019. | 2018         | Downstream     | Petrochemical               | [https://www.americanchemistry.com/Policy/Energy/Shale-GasFact-Sheet-US-Chemical-Investment-Linked-to-Shale-Gas.pdf](https://www.americanchemistry.com/Policy/Energy/Shale-GasFact-Sheet-US-Chemical-Investment-Linked-to-Shale-Gas.pdf) |
| US Department of Energy, Natural Gas Liquids Primer (June 2018).       | 2018         | Midstream      | NGL Pipeline                | [https://www.energy.gov/sites/prod/files/2018/06/f53/NGL_Primer.pdf](https://www.energy.gov/sites/prod/files/2018/06/f53/NGL_Primer.pdf) |
| Department of Energy, Ethane Storage and Distribution Hub in the United States, Report to Congress November 2018. | 2018         | Midstream      | Pipeline                    | [https://www.energy.gov/sites/prod/files/2018/04/f50/Summary%20of%20LNG%20Export%20Applications.pdf](https://www.energy.gov/sites/prod/files/2018/04/f50/Summary%20of%20LNG%20Export%20Applications.pdf) |
| Department of Energy, Long Term Applications Received by DOE/FE to Export Domestically Produced LNG from the Lower-48 States as of April 9, 2018 (accessed November 12, 2018). | 2019         | Midstream      | Pipeline                    | [https://www.energy.gov/sites/prod/files/2019/03/f60/Summary%20of%20LNG%20Export%20Applications.pdf](https://www.energy.gov/sites/prod/files/2019/03/f60/Summary%20of%20LNG%20Export%20Applications.pdf) |
| Department of Energy, Long Term Applications Received by DOE/FE to Export Domestically Produced LNG from the Lower-48 States as of March 6, 2019 (accessed April 7, 2019). | 2018         | Midstream      | Pipeline                    | [https://www.energy.gov/sites/prod/files/2018/04/f50/Summary%20of%20LNG%20Export%20Applications.pdf](https://www.energy.gov/sites/prod/files/2018/04/f50/Summary%20of%20LNG%20Export%20Applications.pdf) |
| Earthworks, Permian Planned Infrastructure spreadsheet, October 2018.  | 2018         | Midstream,     | Petrochemical               | [https://www.energy.gov/sites/prod/files/2018/04/f50/Summary%20of%20LNG%20Export%20Applications.pdf](https://www.energy.gov/sites/prod/files/2018/04/f50/Summary%20of%20LNG%20Export%20Applications.pdf) |
| US Energy Information Agency                                           | 2019         | Upstream       |                            | [https://www.eia.gov/naturalgas/data.php](https://www.eia.gov/naturalgas/data.php) |
| Environmental Integrity Project, "Summary of Greenhouse Gas Emission Limits for Petrochemical, Natural Gas, and Fertilizer Projects: Clean Air Act New Source Review Permits and Pending Applications, January 2012 - September 2018." | 2018 & 2019  | Midstream, Downstream Various | [https://www.eia.gov/naturalgas/data.php](https://www.eia.gov/naturalgas/data.php) |
| Source                                                                 | Year   | Sector                      | Type                       | URL                                                                 |
|-----------------------------------------------------------------------|--------|-----------------------------|----------------------------|----------------------------------------------------------------------|
| Federal Energy Regulatory Commission. Pipeline database accessed 3/11/19. Terminal information data 1/29/19. | 2019   | Midstream                   | Pipeline                   | https://ferc.gov/industries/gas/indus-ac/pipelines/pending-projects.asp |
| CoalSwarm, *Global Fossil Project Tracker* developed by CoalSwarm (accessed August 2018). | 2018   | Mid and Downstream          | Various                    | https://greeninfo-network.github.io/fossil_tracker/                   |
| “Global Fossil Infrastructure Tracker.” February 2019. CoalSwarm, sent via email on March 17, 2019. | 2019   | Mid and Downstream          | Various                    | https://ferc.gov/industries/gas/indus-ac/storage.asp                  |
| Gas Processing News, *Small-Scale Methanol Technologies Offer Flexibility, Cost Effectiveness* (October 2015). | 2015   | Downstream                  | Petrochemical              | http://www.gasprocessingnews.com/features/201510/small-scale-methanol-technologies-offer-flexibility-cost-effectiveness.aspx |
| ICIS, *US Methanol Boom in Billion Dollar Investment Phase* (May 17, 2018). | 2018   | Downstream                  | Petrochemical              | https://www.icis.com/resources/news/2018/05/17/1027/2821/us-methanol-boom-in-billion-dollar-investment-phase/ |
| Oil & Gas Journal, *Worldwide Construction Update* (May 2018). | 2018   | Downstream                  | Petrochemical              | https://www.ogj.com/articles/print/volume-117/issue-1a/general-interest/grassroots-methanol-project-revived-for-louisiana.html |
| Oil & Gas Journal, *Worldwide Construction Update* (Nov 2018). | 2018   | Midstream and Downstream    | Refinery, Petrochemical, Gas Processing | https://www.ogj.com/articles/2019/03/exxonmobil-to-add-polypropylene-unit-at-baton-rouge.html?utm_source=feedburner&utm_medium=email&utm_campaign=ogj_daily_update&utm_content=2019-03-01&cid=432933199&bid=2382690 & https://www.ogj.com/articles/2019/03/exxonmobil-to-add-polypropylene-unit-at-baton-rouge.html |
### Powerpoints from: RBN Energy, Permicon Conference, October 10, 2018.

| Source                                                                 | Year | Industry   | Sector       |
|------------------------------------------------------------------------|------|------------|--------------|
| S&P Platts Global, *Logistics: Adapting to the Expected Surge in US Polyethylene Exports* (March 2018). | 2018 | Downstream | Petrochemical |
| S&P Platts Global, *Americas Petrochemical Outlook H1 2018* (January 2018). | 2019 | Downstream | Petrochemical |
| S&P Platts Global, *Americas Petrochemical Outlook H2 2018* (July 2018). | 2020 | Downstream | Petrochemical |
| S&P Platts Global, Americas Petrochemical Outlook H1 2019 (January 2019). | 2019 | Downstream | Petrochemical |
| S&P, *Market Intelligence Database.* | 20,182,019 | Downstream | Petrochemical |

### Additional Resources

- [Processing to expand Permian processing](https://www.ogi.com/articles/2019/02/sentinel-to-develop-texas-gulflink-crude-oil-export-terminal.html?cmpid=enl_ogi_ogi_daily_update_2019-02-12&pwhid)
- [Powerpoints from: RBN Energy, Permicon Conference, October 10, 2018.](https://www.platts.com/IM.Platts.Content/InsightAnalysis/IndustrySolutionPapers/s-p-petrochemical-logistics-polyethylene-052018.pdf)
- [Logistics: Adapting to the Expected Surge in US Polyethylene Exports](https://www.platts.com/IM.Platts.Content/InsightAnalysis/IndustrySolutionPapers/s-p-petrochemical-logistics-polyethylene-052018.pdf)
- [Americas Petrochemical Outlook H1 2018](https://www.platts.com/IM.Platts.Content/InsightAnalysis/IndustrySolutionPapers/americas-petrochemicals-outlook-h1-2018.pdf)
- [Americas Petrochemical Outlook H2 2018](https://stage.www.spglobal.com/platts/plattscontent/_files/en/specialreports/petrochemicals/americas-petrochemicals-outlook-h2-2018.pdf)
- [Americas Petrochemical Outlook H1 2019](https://www.spglobal.com/platts/plattscontent/_assets/_files/en/specialreports/petrochemicals/americas-petrochemicals-outlook-h1-2019.pdf)
- [Market Intelligence Database.](https://www.spglobal.com/platts/en/market-insights/latest-news/petrochemicals/022219-cp-chem-planning-58-billion-us-chemical-complex)
- [Westlake to explore increasing ethylene capacity CEO](https://www.spglobal.com/platts/en/market-insights/latest-news/petrochemicals/022018-westlake-to-explore-increasing-ethylene-capacity-ceo)
- [Braskem America polypropylene plant in Texas on target for 2020 startup CEO](https://www.spglobal.com/platts/en/market-insights/latest-news/petrochemicals/050818-braskem-america-polypropylene-plant-in-texas-on-target-for-2020-startup-ceo)
- [Eastman extends Longview steam cracker outage on ethylene economics sources](https://www.spglobal.com/platts/en/market-insights/latest-news/petrochemicals/071918-eastman-extends-longview-steam-cracker-outage-on-ethylene-economics-sources)
- [Construction underway on Dow’s Texas cracker expansion executive](https://www.spglobal.com/platts/en/market-insights/latest-news/petrochemicals/080218-construction-underway-on-dows-texas-cracker-expansion-executive)
- [Developing new cracker derivatives Phillips 66 CEO](https://www.spglobal.com/platts/en/market-insights/latest-news/petrochemicals/102618-cp-chem-developing-new-cracker-derivatives-phillips-66-ceo)
- [Shell chemical eyes expanding its olefins unit in Deer Park Texas](https://www.spglobal.com/platts/en/market-insights/latest-news/petrochemicals/121615-shell-chemical-eyes-expanding-its-olefins-unit-in-deer-park-texas)
| Source                                      | Year | Stage          | Type           | URL                                                                 |
|---------------------------------------------|------|----------------|----------------|----------------------------------------------------------------------|
| Sierra Club, *Gas Pipeline Tracker*, accessed September 2018. Sightline, *Mapping the Thin Green Line*; and other sections of www.sightline.org | 2018 | Midstream      | Pipeline        | [https://content.sierraclub.org/ourwildamerica/keeping-gas-ground](https://content.sierraclub.org/ourwildamerica/keeping-gas-ground) |
| WoodMackenzie, *Global Ethylene Map*, 2017. 2017 Greenhouse Gas Emissions from Large Facilities | 2017 | Midstream and Downstream | Various       | [https://www.sightline.org/2017/06/20/mapping-the-thin-green-line, accessed October 2018.](https://www.sightline.org/2017/06/20/mapping-the-thin-green-line, accessed October 2018.) |
| WoodMackenzie, *Global Ethylene Map*, 2017. 2017 Greenhouse Gas Emissions from Large Facilities | 2017 | Midstream and Downstream | Various       | [https://ghgdata.epa.gov/ghgp/main.do#](https://ghgdata.epa.gov/ghgp/main.do#) |
| Name                  | Title                                                                 | Release Year | Sector       | Related Facility Type | State Covered | Link                                                                 |
|-----------------------|-----------------------------------------------------------------------|--------------|--------------|-----------------------|---------------|----------------------------------------------------------------------|
| 102 Industry Report   | And they’re off! Formosa finalizes big plans                         | 2018         | Downstream   | Petrochemical         | LA            | https://www.1012industryreport.com/petrochemical/formosa-finalizes-plans-st-james-parish/ |
| 103 Industry Report   | Lotte Chemical’s Westlake cracker starts operations this month        | 2019         | Downstream   | Petrochemical         | LA            | https://www.1012industryreport.com/petrochemical/lotte-chemicals-westlake-cracker-starts-operations-this-month/ |
| 2b Consulting         | Australian Incitec Pivot to build new Ammonia facility in Louisiana, USA | 2013         | Downstream   | Petrochemical         | LA            | https://www.2b1stconsulting.com/australian-incitec-pivot-to-build-new-ammonia-facility-in-louisiana-usa/ |
| ABC7News              | Expansion at fertilizer plant in Borger providing economic boost      | 2016         | Downstream   | Petrochemical         | TX            | https://abc7amarillo.com/news/local/expansion-at-fertilizer-plant-in-borger-providing-economic-boost |
| Air liquide           | Major investment in the U.S. Air Liquide expands relationship with LyondellBasell | 2013         | Downstream   | Petrochemical         | TX            | https://en.media.airliquide.com/news/major-investment-in-the-u-s-air-liquide-expands-relationship-with-lyondellbasell-0486-56033.html |
| Air liquide           | Air Liquide breaks ground for new production facility in Beaumont, Texas | 2015         | Downstream   | Petrochemical         | TX            | https://www.airliquide.com/united-states-america/airliquide-breaks-ground-new-production-facility-beaumont-texas |
| Air Products          | Air Products Signs Contract to Supply Carbon Monoxide from Expanded Syngas Separation Unit | 2012         | Downstream   | Petrochemical         | LA            | http://www.airproducts.com/Company/newscenter/2012/11/1115-air-products-signs-contract-to-supply-carbon-monoxide-from-expanded-syngas-separation-unit.aspx |
| Air Products          | Air Products Holds Grand Opening at Its New Liquid Nitrogen Production Facility in Odessa, Texas | 2015         | Downstream   | Petrochemical         | TX            | http://www.airproducts.com/Company/newscenter/2015/11/1119-odessa-liquid-nitrogen-facility-grand-opening-ceremony.aspx |
| Air Products          | Air Products Holds Ribbon-Cutting for World-Class SMR at Covestro in Texas | 2018         | Downstream   | Petrochemical         | TX            | http://www.airproducts.com/Company/newscenter/2018/06/0620-air-products-holds-ribbon-cutting-for-world-class-smr-at-covestro-in-texas.aspx |
| Air Products          | Air Products to Build World-Scale Liquid Hydrogen Plant at its La Porte, Texas Facility | 2018         | Downstream   | Petrochemical         | TX            | http://www.airproducts.com/Company/newscenter/2018/09/0911-air-products-to-build-world-scale-liquid-hydrogen-plant-at-laporte-texas-facility.aspx |
| American Oil and Gas  | Buildout Of Processing, Midstream Infrastructure In Full Swing At Alpine High | 2019         | Midstream    | NGL Pipeline         | TX            | https://www.a ogr.com/magazine/cover-story/buildout-of-processing-midstream-infrastructure-in-full-swing-at-alpine-high |
| Ammonia Industry      | Faustina, LA — Mosaic Company                                          | 2013         | Downstream   | Petrochemical         | LA            | https://ammoniaindustry.com/faustina-la-mosaic-company/ |
| Ammonia Industry      |                                                                      |              | Downstream   | Petrochemical         | LA            | https://ammoniaindustry.com/kilona-la-am-agrigen/                      |
| Area Development | AM Agrigen Industries Eyes St. Charles Parish, Louisiana, For $1.2 Billion Granulated Urea Manufacturing Plant - Area Development | 2014 | Downstream | Petrochemical | LA | https://www.areadevelopment.com/newsItems/5-19-2014/am-agrigen-industries-manufacturing-plant-st-charles-parish-louisiana892344.shtml |
|-----------------|---------------------------------------------------------------|------|-------------|--------------|----|------------------------------------------------------------------|
| Area Development | Air Products Builds Liquid Hydrogen Plant in La Porte, Texas | 2018 | Downstream | Petrochemical | TX | http://www.areadevelopment.com/Plastics/Q3-2018/plastics-industry-flourishes-in-response-to-market-demand.shtml |
| Area Development | Plastics Industry Flourishes in Response to Market Demand | 2018 | Downstream | Petrochemical | TX | https://www.arkema.com/en/media/news/news-details/Arkema-upgrades-its-Clear-Lake-Acrylics-facility-in-North-America/ |
| Arkema | Arkema upgr   | 2017 | Downstream | Petrochemical | TX | https://www.arkema-americas.com/export/sites/americas/.content/medias/downloads/arkema-in-the-americas/arkema-beaumont-texas-overview.pdf |
| Arkema | Arkema Plant Overview | 2018 | Downstream | Petrochemical | TX | |
| BASF | BASF to build new formic acid plant in Geismar, Louisiana | 2012 | Downstream | Petrochemical | LA | https://www.basf.com/us/en/media/news-releases/2012/09/p-12-104.html |
| BIC Magazine | Shell Deer Park steam cracker suffers process upsets, taken off line | 2016 | Downstream | Petrochemical | TX | https://www.bicmagazine.com/departments/maintenance-reliability/shell-deer-park-steam-cracker-suffers-process-upsets-taken-off-line/ |
| BIC Magazine | INEOS, Sasol break ground on $500M La Porte HDPE plant | 2014 | Downstream | Petrochemical | LA | https://www.bicmagazine.com/expansions/downstream/ineos-sasol-hdpe-plant-laporte-groundbreaking/ |
| BIZ Journals | Houston company to build ethylene storage, pipeline projects | 2017 | Midstream | Petrochemical | Storage | TX | https://www.bizjournals.com/houston/news/2017/04/04/houston-company-to-build-ethylene-storage-pipeline.html |
| BIZ Journals | Refining company to expand Port Corpus Christi operations | 2018 | Downstream | Refinery | TX | https://www.ccbiznews.com/news/new-owners-bankrupt-corpus-christi-plastics-plant-restart-construction, |
| Business News | ExxonMobil withdraws ITEP requests, future Baton Rouge expansion in question | 2019 | Downstream | Refinery | LA | https://www.businessreport.com/business/exxonmobil-withdraws-itep-requests-future-expansion-in-question |
| Business Wire | JupiterMLP Receives Funding To Advance Construction of Permian-to-Gulf Coast Crude Oil Pipeline | 2018 | Midstream | Terminal Oil | TX | https://www.businesswire.com/news/home/2018017005780/en/JupiterMLP-Receives-Funding-Advance-Construction-Permian-to-Gulf-Coast |
| Business Wire | Enterprise to Build Isobutane Dehydrogenation Unit | 2017 | Downstream | PetroChemical | TX | https://www.businesswire.com/news/home/2017013005155/en/Enterprise-Build-Isobutane-Dehydrogenation-Unit |
| Source                      | Description                                                                                                                                                                                                 | Year | Sector           | Location | Details                                                                                                                                                                                                 |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Business Wire              | Oxea Builds Second Propanol Unit at Bay City, Texas                                                                                                                                                        | 2017 | Downstream      | TX       | https://www.businesswire.com/news/home/2017031605792/en/Oxea-Builds-Propanol-Unit-Bay-City-Texas                                                                                                      |
| Business Wire              | Enterprise, Western Gas Partners, and DCP Midstream Seek to Expand the Front Range Pipeline                                                                                                                 | 2018 | Midstream       | TX       | https://www.businesswire.com/news/home/2018050305433/en/Enterprise-Western-Gas-Partners-DCP-Midstream-Seek                                                                                           |
| Business Wire              | Enterprise to Develop Offshore Texas Crude Oil Export Terminal                                                                                                                                              | 2018 | Midstream       | TX       | https://www.businesswire.com/news/home/2018071005295/en/Enterprise-Develop-Offshore-Texas-Crude-Oil-Export                                                                                     |
| Caller Times               | Corpus Christi Polymers set to resume work on M&G plant in May                                                                                                                                             | 2019 | Downstream      | TX       | https://www.caller.com/story/news/local/2019/02/21/corpus-christi-polymers-set-resume-work-m-g-plant-may/2939476002/                                                                              |
| Caller Times               | Court clears way for Port of Corpus Christi’s multi-billion dollar Carlyle Group lease                                                                                                                                 | 2019 | Midstream       | TX       | https://www.caller.com/story/news/local/2019/03/25/court-lifts-stay-port-corpus-christis-multi-billion-dollar-lease-carlyle-group-harbor-island/3267873002/                                                  |
| Chemanager International   | US Arcanum Plans More Butene-1 Plants                                                                                                                                                                       | 2018 | Downstream      | TX       | https://www.chemanager-online.com/en/news/opinions/headlines/us-arcanum-plans-more-butene-1-plants                                                                                |
| Chemical and Engineering   | Covestro spending $1.7 billion on new isocyanate plant in Texas                                                                                                                                             | 2018 | Downstream      | TX       | https://cen.acs.org/business/petrochemicals/Covestro-spending-17-billion-new/966441                                                                                                              |
| Chemical Engineering for   | MOMENTIVE SPECIALTY CHEMICALS TO CONSTRUCT TWO FORMALDEHYDE PLANTS IN LOUISIANA                                                                                                                            | 2014 | Downstream      | LA       | https://www.chemengonline.com/momentive-specialty-chemicals-to-construct-two-formaldehyde-plants-in-louisiana/?printmode=1                                                                 |
| CPI                        |                                                                                                                                                                                                             |      |                  |          |                                                                                                                                                                                                      |
| Chron                      | Chevron Phillips names potential spot for new $5.8B petrochemical project                                                                                                                                 | 2019 | Downstream      | TX       | https://www.chron.com/business/energy/article/Chevron-Phillips-names-potential-spot-for-new-13633632.php                                                                                          |
| Chron                      | Joint venture proposes offshore oil terminal south of Freeport                                                                                                                                             | 2019 | Midstream       | TX       | https://www.chron.com/business/energy/article/Enbridge-JV-proposes-offshore-supertanker-13517493.php                                                                                             |
| Cision PR Newswire        | Arcanum (Raven) Announces Butene-1 Expansion Plans                                                                                                                                                         | 2018 | Downstream      | TX       | https://www.prnewswire.com/news-releases/arcanum-raven-announces-butene-1-expansion-plans-300580182.html                                                                                         |
| Cision PR Newswire        | Magellan Midstream Announces New Agreement for Condensate Splitter, Reaffirms 2017 Financial Guidance                                                                                                    | 2017 | Downstream      | TX       | https://www.prnewswire.com/news-releases/magellan-midstream-announces-new-agreement-for-condensate-splitter-reaffirms-2017-financial-guidance-300427278.html |
| Cision PR Newswire        | ONEOK Announces Second Expansion of the West Texas LPG Pipeline System                                                                                                                                    | 2018 | Midstream       | TX       | https://www.prnewswire.com/news-releases/oneok-announces-second-expansion-of-the-west-texas-lpg-pipeline-system-300709803.html                                                                  |
| Construction Box Score     | Grace and Chevron Joint Venture, ART, to Build World-Class Catalysts Plant at Grace’s Lake Charles, LA Site                                                                                               |      | Downstream      | LA       | https://www.constructionboxscore.com/project-news/grace-and-chevron-joint-venture-art-to-build-world-class-catalysts-plant-at-grace%E2%80%99s-lake-charles-la-site.aspx |
| Database                   |                                                                                                                                                                                                             |      |                  |          |                                                                                                                                                                                                      |
| Date | Source | Project/Story | Industry | Location | Link |
|------|--------|---------------|----------|----------|------|
| 2012 | CropLife | CF Industries Plans $3.8 Billion Nitrogen Fertilizer Expansion | Downstream Petrochemical | LA | [https://www.croplife.com/crop-inputs/fertilizer/cf-industries-plans-3-8-billion-nitrogen-fertilizer-expansion/](https://www.croplife.com/crop-inputs/fertilizer/cf-industries-plans-3-8-billion-nitrogen-fertilizer-expansion/) |
| 2019 | CSI Market | Huntsman’s Comment on Supply Chain | Downstream Petrochemical | TX | [https://cismarket.com/stocks/suppliers_glance.php?code=HUN](https://cismarket.com/stocks/suppliers_glance.php?code=HUN) |
| 2014 | DCP Midstream | DCP Midstream Partners – Sand Hills Pipeline (Joint Venture) | Midstream NGL Pipeline | TX | [https://www.dcpmidstream.com/getattachment/Asset-Bundles/DCP-Midstream-%E2%80%93-Sand-Hills-Pipeline-Joint-Venture/DCP-Midstream-Partners-Sand-Hills-Pipeline-factsheet.pdf.aspx](https://www.dcpmidstream.com/getattachment/Asset-Bundles/DCP-Midstream-%E2%80%93-Sand-Hills-Pipeline-Joint-Venture/DCP-Midstream-Partners-Sand-Hills-Pipeline-factsheet.pdf.aspx) |
| 2019 | Dow | Dow-About Us | Downstream Petrochemical | TX | [https://www.dow.com/en-us/about-dow/locations/texas/deer-park/about](https://www.dow.com/en-us/about-dow/locations/texas/deer-park/about) |
| 2019 | EIP | EIP Increased Emission 2019 | Midstream and Downstream, Various TX,LA | [https://www.dropbox.com/sh/dfu434fasxh5pmv/AACRUaUAq_2yu7x6_UBMixF5a?dl=0](https://www.dropbox.com/sh/dfu434fasxh5pmv/AACRUaUAq_2yu7x6_UBMixF5a?dl=0) |
| 2019 | Energy Transfer | Enterprise Product Partner - NGL Pipeline Network Application for Prevention of Significant Deterioration Air Permit Greenhouse Gas Emissions | Midstream NGL Pipeline | TX | [https://www.energytransfer.com/ops_bayou_bridge.asp](https://www.energytransfer.com/ops_bayou_bridge.asp) |
| 2019 | EPA | EPA Draft Greenhouse Gas Prevention of Significant Deterioration Preconstruction Permit for Targa Gas Processing LLC, Longhorn Gas Plant | Midstream Gas Processing Plant | TX | [https://archive.epa.gov/region6/6pd/air/pd-r/ghg/web/pdf/targa-longhorn-sob.pdf](https://archive.epa.gov/region6/6pd/air/pd-r/ghg/web/pdf/targa-longhorn-sob.pdf) |
| 2017 | EPA | LUBRIZOL DEER PARK PLANT-Facility Level Report EPA | Downstream Petrochemical | TX | [https://ghgdata.epa.gov/ghgrp/service/facilityDetail/2017?id=1000620&ds=E&et=&popup=true](https://ghgdata.epa.gov/ghgrp/service/facilityDetail/2017?id=1000620&ds=E&et=&popup=true) |
| 2018 | EUCI | U.S. expands reach as world’s top export of ethane, shipping to 10 countries in 2018 | Midstream NGL Storage | TX | [https://www.euci.com/u-s-expands-reach-as-worlds-top-export-of-ethane-shipping-to-10-countries-in-2018/](https://www.euci.com/u-s-expands-reach-as-worlds-top-export-of-ethane-shipping-to-10-countries-in-2018/) |
| 2018 | Express News | West Texas, Gulf interests snipe over oil export platform | Midstream Terminal Oil | TX | [https://www.expressnews.com/business/eagle-ford-energy/article/West-Texas-Gulf-interests-snipe-over-oil-export-13490643.php](https://www.expressnews.com/business/eagle-ford-energy/article/West-Texas-Gulf-interests-snipe-over-oil-export-13490643.php) |
| 2019 | Federal Energy Regulatory Commission | ORDER GRANTING AUTHORIZATION UNDER SECTION 3 OF THE NATURAL GAS ACT AND ISSUING CERTIFICATE | Midstream Compressor Station | LA | [https://www.ferc.gov/CalendarFiles/20150406184438-CP13-552-000.pdf](https://www.ferc.gov/CalendarFiles/20150406184438-CP13-552-000.pdf) |
| 2019 | Forbes | The Competition To Export Permian Crude Is Fierce And Controversial | Midstream Terminal Oil | TX | [https://www.forbes.com/sites/davidblackmon/2019/02/10/the-competition-to-export-permian-crude-is-fierce-and-controversial/#2b0c548a3e43](https://www.forbes.com/sites/davidblackmon/2019/02/10/the-competition-to-export-permian-crude-is-fierce-and-controversial/#2b0c548a3e43) |
| Company                        | News/Event                                                                 | Year | Sector       | Project/Plant Details                                                                 | Website                                                                                                           |
|-------------------------------|---------------------------------------------------------------------------|------|--------------|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| G Captain                     | Enterprise Planning Texas Offshore Oil Terminal Capable of Fully Loading VLCCs | 2018 | Midstream    | Terminal Oil TX                                                                       | https://gcaptain.com/enterprise-planning-texas-offshore-oil-terminal-capable-of-fully-loading-vlccs/ |
| G2X Energy                    | G2X Energy Hosts Big Lake Fuels Ground Breaking Ceremony                   | 2016 | Downstream   | Petrochemical LA                                                                     | http://g2energy.com/news-press/12-relationships/14-g2x-energy-hosts-big-lake-fuels-ground-breaking-ceremony      |
| Gas Compression Magazine      | Corpus Christi LNG Project Clears FERC Hurdle                             | 2019 | Midstream    | LNG Terminal TX                                                                       | https://gascompressionmagazine.com/2019/04/04/corp-us-christi-lng-project-clears-ferc-hurdle                  |
| Gas Processing Newa           | EPA approves new CCI condensate splitter plant, bulk terminal in Texas     |      | Downstream   | Refinery TX                                                                           | http://gasprocessingnews.com/news/epa-approves-new-cci-corpus-christi-condensate-splitter,-bulk-terminal.aspx  |
| Gas World                     | MATHESON to build Louisiana ASU to supply Lotte Chemical MEG plant         | 2016 | Downstream   | Petrochemical LA                                                                     | https://www.gasworld.com/matheson-la��2011727.article                                                           |
| Global News Wire              | Buckeye Partners, L.P. Announces Agreement to Construct South Texas Gateway Terminal | 2018 | Midstream    | Terminal Oil TX                                                                       | https://www.globenewswire.com/news-release/2018/04/24/1486713/en/Buckeye-Partners-L-P-Announces-Agreement-to-Construct-South-Texas-Gateway-Terminal.html |
| Global Syngas Technology Council | Gulf Coast Ammonia                                                        | 2017 | Downstream   | Petrochemical TX                                                                     | http://investor.grace.com/news-releases/news-release-details/grace-and-chevron-joint-venture-art-build-world-class-catalysts |
| Grace                         | Grace and Chevron Joint Venture, ART, to Build World-Class Catalysts Plant at Grace’s Lake Charles, LA Site | 2015 | Downstream   | Petrochemical LA                                                                     | http://investor.grace.com/news-releases/news-release-details/momentive-specialty-chemicals-inc-announces-construction-two-new |
| Greater New Orleans Inc       | The Mosaic Company Announces Potential $700 Million Ammonia Plant in St. James Parish | 2012 | Downstream   | Petrochemical LA                                                                     | http://gnoinc.org/news/success-story/the-mosaic-company-announces-potential-700-million-ammonia-plant-in-st-james-parish/ |
| Green Info                    | Worldwide 2050 fossil projects                                             | 2019 | Downstream, Midstream | Various TX,LA                                                      | https://greeninfo-network.github.io/fossil_tracker/                                                         |
| Hexion                        | Momentive Specialty Chemicals Inc. Announces Construction of Two New Formaldehyde Plants in Louisiana 730-mile Epic Permian-to-Corpus Pipeline in the works | 2014 | Downstream   | Petrochemical LA                                                                     | http://investors.hexion.com/news-releases/news-release-details/momentive-specialty-chemicals-inc-announces-construction-two-new |
| Houston Chronicle             | 730-mile Epic Permian-to-Corpus pipeline in the works                     | 2017 | Midstream    | Oil Pipeline TX                                                                       | https://www.houstonchronicle.com/business/egleford-energy/article/730-mile-Epic-Permian-to-Corpus-pipeline-in-the-10971947.php |
| Howard Energy Partners        | HOWARD ENERGY PARTNERS PROPOSES NEW RENEFINED PRODUCTS PIPELINE SYSTEM FROM CORPUS CHRISTI TO MONTERREY | 2016 | Midstream    | NGL Pipeline TX                                                                       | https://www.howardenergypartners.com/news/howard-energy-partners-proposes-new-refined-products-pipeline-system-from-corpus-christi-to |
| Hydrocarbon Processing        | MFG Chemical upgrades newly acquired Pasadena, TX plant                   | 2018 | Downstream   | Petrochemical LA                                                                     | https://www.hydrocarbonprocessing.com/news/2013/01/technip-to-design-mosaic-louisiana-ammonia-plant            |
| Company                        | Project Description                                                                 | Year | Sector          | Location | Details                                                                                       |
|-------------------------------|--------------------------------------------------------------------------------------|------|----------------|----------|-----------------------------------------------------------------------------------------------|
| Hydrocarbon Processing        | MFG Chemical upgrades newly acquired Pasadena, TX plant                              | 2018 | Downstream     | TX       | https://www.hydrocarbonprocessing.com/news/2018/1/mfg-chemical-upgrades-newly-acquired-pasadena-tx-plant |
| ICIS                          | DowDuPont HDPE debottleneck on track for mid-2018, EPDM unit end of 2018            | 2018 | Downstream     | LA       | https://www.icis.com/explore/resources/news/2018/05/03/10218288/dowdupont-hdpe-debottleneck-on-track-for-mid-2018-epdm-unit-end-of-2018 |
| ICIS                          | Shintech commissioning 500,000 tonne/year US ethylene plant                         | 2019 | Downstream     | LA       | https://www.icis.com/explore/resources/news/2019/02/15/10319802/shintech-commissioning-500000-tonneyear-us-ethylene-plant/ |
| Industry About                | Eunice Gas Processing and NGL Fractionation Plant Expansion                           | 2019 | Downstream     | LA       | https://www.industryabout.com/country-3/1043-usa/fertilizer-industry/17909-potashcorp-geismar-fertilizer-plant |
| Houston Central Processing    | EnLink Midstream Cajun-Sibon NGL Expansion Project Aerial Photos-Plaquemine, Louisiana | 2015 | Midstream      | TX       | https://www.louisianahelicam.com/blog/2017/7/enlink-midstream-cajun-sibon-ngl-expansion-project-aerial-photos-plaquemine-louisiana |
| Louisiana Economic Development| Incitec Pivot, Dyno Nobel And Cornerstone Chemical Announce More Than $1 Billion Project In Jefferson Parish | 2013 | Downstream     | LA       | https://www.opportunitylouisiana.com/led-news/news-releases/news/2013/04/17/incitec-pivot-dyno-nobel-and-cornerstone-chemical-announce-more-than-$1-billion-project-in-jefferson-parish |
| Louisiana Economic Development| Castleton Commodities International Announces $1.2 Billion Methanol Project In Louisiana | 2014 | Downstream     | LA       | https://www.opportunitylouisiana.com/led-news/news-releases/news/2014/10/10/castleton-commodities-international-announces-$1.2-billion-methanol-project-in-louisiana |
| Louisiana Economic Development| Tallgrass Energy and Drexel Hamilton Infrastructure Announce Plans for Plaquemines Liquid Terminal | 2018 | Midstream      | LA       | http://gov.louisiana.gov/index.cfm/newsroom/detail/1669 |
| Louisiana Office of Governor  | Wanhua Selects Louisiana Site for $1.25 Billion Chemical Complex                    | 2018 | Downstream     | LA       | https://www.lyondellbasell.com/en/news-events/corporate--financial-news/lyondellbasell-begins-construction-of-the-worlds-largest-potba-plant/ |
| LyondellBasell                | LyondellBasell Begins Construction of the World's Largest PO/TBA Plant               | 2018 | Downstream     | TX       | https://www.lyondellbasell.com/en/news-events/corporate--financial-news/lyondellbasell-begins-construction-of-the-worlds-largest-potba-plant/ |
| Company                | Project Description                                                                 | Year | Segment       | Type                        | Location |
|------------------------|--------------------------------------------------------------------------------------|------|---------------|-----------------------------|----------|
| LyondellBasell         | LyondellBasell to Expand Production Capacity of Tri-ethylene Glycol                  | 2015 | Downstream    | Petrochemical               | TX       |
| LyondellBasell         | Houston Refining-Fact Sheet                                                          |      | Downstream    | Refinery                   | TX       |
| Marathon Petroleum     | Galveston Bay Refinery                                                               | 2018 | Downstream    | Refinery                   | TX       |
| Marathon Petroleum     | Garyville Refinery                                                                   |      | Downstream    | Refinery                   | LA       |
| Marcellus Drilling News| PTT Global Ohio Cracker Grows to $10B Project w/New Partner                          | 2018 | Downstream    | Petrochemical               | TX       |
| Market Watch           | JupiterMLP Receives Funding To Advance Construction of Permian-to-Gulf Coast Crude Oil Pipeline | 2018 | Midstream     | Oil Pipeline               | TX       |
| MarketWatch            | Enterprise Begins Construction of Tenth NGL. Fractionator in Mont Belvieu Area       | 2018 | Downstream    | Fractionator               | TX       |
| Medallion Midstream    | Medallion Crude Oil Assets                                                           |      | Midstream     | Pipeline Oil               | TX       |
| Melitek                | REXtac plans to build integrated PP plant in Texas                                   | 2013 | Downstream    | Petrochemical               | TX       |
| Mosaic                 | Saint James, Louisiana (Faustina Plant)                                              | 2018 | Downstream    | Petrochemical               | LA       |
| Murex                  | Carlsbad Facility Improvements With Cetane Energy                                    | 2018 | Midstream     | Rail Terminal              | TX       |
| MyNewoerleans          | Business News from Around the State                                                  | 2013 | Downstream    | Petrochemical               | LA       |
| Natural Gas Intel      | Enterprise Converting Portion of Natural Gas Line to Y-Grade to Boost Gulf Coast Capacity | 2018 | Downstream    | Fractionator               | LA       |
| Natural Gas Intel      | Sabine Pass Trains 5, 6 Approved by FERC                                            | 2015 | Midstream     | Compressor Station         | LA       |
| Natural Gas Intel      | Enterprise Converting Portion of Natural Gas Line to Y-Grade to Boost Gulf Coast Capacity | 2018 | Midstream     | NGL Pipeline               | TX       |
| Natural Gas Intel      | Phillips 66 Launches Open Seasons For Crude Oil Projects                             | 2018 | Midstream     | Pipeline Oil               | TX       |

For Crude Oil Projects:
- Phillips 66 Launches Open Seasons For Crude Oil Projects
  [https://www.naturalgasintel.com/articles/116433-phillips-66-launches-open-seasons-for-crude-oil](https://www.naturalgasintel.com/articles/116433-phillips-66-launches-open-seasons-for-crude-oil)
- Enterprise Converting Portion of Natural Gas Line to Y-Grade to Boost Gulf Coast Capacity
  [https://www.naturalgasintel.com/articles/101896-sabine-pass-trains-5-6-approved-by-ferc](https://www.naturalgasintel.com/articles/101896-sabine-pass-trains-5-6-approved-by-ferc)
- Enterprise Converting Portion of Natural Gas Line to Y-Grade to Boost Gulf Coast Capacity
  [https://www.naturalgasintel.com/articles/116401-enterprise-converting-portion-of-natural-gas-line-to-y-grade-to-boost-gulf-coast-capacity](https://www.naturalgasintel.com/articles/116401-enterprise-converting-portion-of-natural-gas-line-to-y-grade-to-boost-gulf-coast-capacity)

For Crude Oil Projects:
- PTT Global Ohio Cracker Grows to 10B Project w/New Partner
  [https://www.marcelldrilling.com/2018/03/ptt-global-ohio-cracker-grows-to-10b-project-w-new-partner/](https://www.marcelldrilling.com/2018/03/ptt-global-ohio-cracker-grows-to-10b-project-w-new-partner/)
- JupiterMLP Receives Funding To Advance Construction of Permian-to-Gulf Coast Crude Oil Pipeline
  [https://www.marketwatch.com/press-release/jupitermlp-receives-funding-to-advance-construction-of-Permian-to-gulf-coast-crude-oil-pipeline-2018-10-17](https://www.marketwatch.com/press-release/jupitermlp-receives-funding-to-advance-construction-of-Permian-to-gulf-coast-crude-oil-pipeline-2018-10-17)
- Enterprise Begins Construction of Tenth NGL Fractionator in Mont Belvieu Area
  [https://www.marketwatch.com/press-release/enterprise-begins-construction-of-tenth-nGL-fractionator-in-mont-belvieu-area-2018-09-05](https://www.marketwatch.com/press-release/enterprise-begins-construction-of-tenth-nGL-fractionator-in-mont-belvieu-area-2018-09-05)
- Medallion Midstream
  [https://www.mosaicco.com/Who_We_Are/locations_directory_locations_by_continent_north_america_location_specialist_in_medical_technologies_news_2013/REXtac-plans-to-build-integrated-PP-plant-in-Texas](https://www.mosaicco.com/Who_We_Are/locations_directory_locations_by_continent_north_america_location_specialist_in_medical_technologies_news_2013/REXtac-plans-to-build-integrated-PP-plant-in-Texas)
- Saint James, Louisiana (Faustina Plant)
  [http://www.murexlt.com/blog/carlsbad-improvements-2018/](http://www.murexlt.com/blog/carlsbad-improvements-2018/)
- Carlsbad Facility Improvements With Cetane Energy
- Enterprise Converting Portion of Natural Gas Line to Y-Grade to Boost Gulf Coast Capacity
  [https://www.lyondellbasell.com/en/news-events/products-technology-news/lyondellbasell-to-expand-production-capacity-of-tri-ethylene-glycol](https://www.lyondellbasell.com/en/news-events/products-technology-news/lyondellbasell-to-expand-production-capacity-of-tri-ethylene-glycol)
- Houston Refining-Fact Sheet
  [https://www.lyondellbasell.com/globalassets/lyb-around-the-world/plant-sites/north-america/houston-refinery-texas/lyondellbasell_houstonrefining_factsheet.pdf?id=8555](https://www.lyondellbasell.com/globalassets/lyb-around-the-world/plant-sites/north-america/houston-refinery-texas/lyondellbasell_houstonrefining_factsheet.pdf?id=8555)
| Company          | Event Description                                                                 | Year  | Sector       | Facility Type | Location |
|------------------|-------------------------------------------------------------------------------------|-------|--------------|---------------|----------|
| Natural Intel    | Targa Building Two New Fractionation Trains at Mont Belvieu                         | 2018  | Downstream   | Fractionator  | TX       |
| Natural Intel    | Wolf Midstream Gauging Interest to Expand Permian Oil Pipeline in West Texas       | 2018  | Midstream    | Oil Pipeline  | TX       |
| Natural Intel    | New Permian-to-Gulf Coast Oil Pipelines Aim to Meet Growing Export Demand           | 2018  | Midstream    | Oil Pipeline  | LA       |
| Natural Intel    | Shell, Texas Deepwater to Refurbish HSC Rail Terminal for Growing Oil Export Trade | 2019  | Midstream    | Rail Terminal | TX       |
| Natural Intel    | ExxonMobil Continues Gulf Coast Buildout, Sanctions Natural Gas-Fed Polypropylene Unit | 2019  | Downstream   | Petrochemical | LA       |
| Natural Intel    | EnLink Boosting Mont Belvieu Takeaway, Eyeing More Growth                           | 2018  | Midstream    | Pipeline NGL  | TX       |
| Nola.com         | Monsanto’s $975 million expansion breaking ground in Luling                         | 2019  | Downstream   | Petrochemical | LA       |
| Nola.com         | Environmentalists sue the Corps for not turning over records on Formosa Plastics    | 2019  | Downstream   | Petrochemical | TX       |
| Nola.com         | Formosa fined, sued over plastic pollution in Texas: report                         | 2019  | Downstream   | Petrochemical | TX       |
| OK Chem          | Ineos Styrolution green lights ASA, ABS additions in the Americas                   | 2019  | Downstream   | Petrochemical | TX       |
| Oneok            | ONEOK ANNOUNCES ADDITIONAL NGL FRACTIONATION AND PIPELINE CAPACITY AND NATURAL GAS PROCESSING CAPACITY | 2018  | Downstream   | Fractionator  | TX       |
| Oryx Midstream   | Oryx Midstream To Build New Regional Crude Oil Transport Pipeline In The Delaware Basin | 2017  | Midstream    | Oil Pipeline  | TX       |
| Paint and Coating Industry | Kuraray Boosts EVAL Production Capacity in United States | 2016  | Downstream   | Petrochemical | TX       |
| PBF Energy       | PBF Energy (NYSE: PBF) Acquisition of Chalmette Refining, LLC                       | 2015  | Downstream   | Refinery      | LA       |

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| Source          | Title                                                                 | Year | Category         | Location | URL                                                                 |
|-----------------|-----------------------------------------------------------------------|------|------------------|----------|---------------------------------------------------------------------|
| Petrochemical Update | Insights from first wave of US ethylene projects drive second wave decisions | 2017 | Downstream       | LA       | http://analysis.petchem-update.com/engineering-and-construction/insights-first-wave-us-ethylene-projects-drive-second-wave-decisions |
| Petrochemical Update | Phillips 66 eyes second mega cracker for CP Chem joint venture        | 2018 | Downstream       | TX       | http://analysis.petchem-update.com/engineering-and-construction/phillips-66-eyes-second-mega-cracker-cp-chem-joint-venture |
| Petrochemical Update | Enterprise considers second PDH unit, expands Mont Belvieu NGL Capacity; EPC firms rack up billions of awards on energy boom | 2018 | Downstream       | TX       | http://analysis.petchem-update.com/engineering-and-construction/enterprise-considers-second-pdh-unit-expands-mont-belvieu-ngl-capacityutm_campaign=PTC%2002NOV18%20New lsetter&utm_medium=email&utm_source=Eloqua&elq TrackId=52ddf050e2724167baf2288bd80b1198&elqaid=40610& elqat=1&elqCampaignId=22340 |
| Petrochemical Update | Sasol raises cost of Lake Charles project, Canada PDH/PP facility FID made, US grows as world's leading ethane exporter | 2019 | Downstream       | LA       | http://analysis.petchem-update.com/engineering-and-construction/sasol-raises-cost-lake-charles-project-cana-pdhpp-facility-fid-made |
| Phillips 66      | Borger Refinery Stats                                                  |      | Downstream       | TX       | https://www.phillips66midstream.com/EN/Pages/beau mont-terminal.aspx |
| Phillips 67      | BEAUMONT TERMINAL Stats                                                |      | Midstream        | TX       | https://pgjonline.com/news/2018/03/targa-to-expand-grand-prix-ngl-pipeline-delaware-basin-gas-gathering-capacity |
| Pipeline and Gas Journal | Targa to Expand Grand Prix NGL Pipeline, Delaware Basin Gas Gathering Capacity | 2018 | Midstream        | TX       | https://www.rrc.state.tx.us/media/45710/2018-new-construction-reports.pdf |
| RailRoad Commission of Texas | 2018 New Construction Reports                                          | 2018 | Midstream        | TX       | https://rbnenergy.com/deep-water-part-3-trafiguras-plan-for-a-crude-oil-export-terminal-off-the-coast-of-corpus-christi |
| RBN Energy      | Deep Water, Part 3 - Trafigura's Plan For A Crude Oil Export Terminal Off The Coast Of Corpus Christi | 2018 | Midstream        | TX       | https://rbnenergy.com/oklahoma-swing-part-7-plans-for-more-crude-pipeline-capacity-out-of-cushing |
| RBN Energy      | Oklahoma Swing, Part 7 - Plans For More Crude Pipeline Capacity Out Of Cushing | 2018 | Midstream        | TX       | https://www.reuters.com/article/us-refinery-operations-lyondell-houston/lyondells-houston-refinery-production-still-14-percent-below-capacity-sources-idUSKCN1R72AV |
| Reuters         | Lyondell's Houston refinery production still 14 percent below capacity: sources | 2019 | Downstream       | TX       | https://www.reuters.com/article/us-refinery-operations-motiva-chemical/saudi-aramco-eyes-new-petrochemical-plant-in-texas-sources-idUSKCN1HD32V |
| Reuters         | Saudi Aramco eyes new petrochemical plant in Texas: sources            | 2018 | Downstream       | TX       | https://www.reuters.com/article/us-refinery-operations-motiva-expansion/motiva-mulls-doubling-of-port-arthur-texas-refineries-capacity-ceo-idUSKBN1HF00E |
| Reuters         | Motiva mulls doubling of Port Arthur, Texas refinery's capacity: CEO   | 2018 | Downstream       | TX       | https://www.reuters.com/article/us-refinery-operations-motiva-expansion/motiva-mulls-doubling-of-port-arthur-texas-refineries-capacity-ceo-idUSKBN1HF00E |
| Source                      | Event Description                                                                                     | Year | Sector       | Location | Details                                                                                                                                                                                                 |
|-----------------------------|-------------------------------------------------------------------------------------------------------|------|--------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Seeking Alpha               | Buckeye Partners sees South Texas Gateway export JV costing up to $500M                              | 2019 | Midstream    | TX       | https://seekingalpha.com/news/3423340-buckeye-partners-sees-south-texas-gateway-export-jv-costing-500m                                                                                                    |
| Sempra Energy               | Cameron LNG Liquefaction Project in Louisiana Progresses with Pipeline Expansion                     | 2017 | Midstream    | NGL Pipeline | LA https://www.sempra.com/en/media/news/press-release/usa-17-billion-investment-expands-total-lou...                                                                                                       |
| Sourcewatch                 | Center for Media and Democracy                                                                      | 2019 | Midstream    | LNG Terminal | TX,LA https://www.sourcewatch.org/                                                                                                                                                                        |
| Spectra Energy              | The Stratton Ridge Project provides shippers with firm transportation service to deliver new incremental production from the growing shale plays to train 3 for Freeport LNG. | 2018 | Midstream    | Gas Pipeline | LA https://www.spectraenergypartners.com/operations/new-projects/stratton-ridge-project                                                                                                                  |
| Splash 247                  | VLCC terminals set to spread far and wide across the US Gulf                                        | 2018 | Midstream    | Oil Terminal |                                                                 https://splash247.com/vlcc-terminals-set-to-spread-far-and-wide-across-the-us-gulf/                                                                                                                    |
| Targa Resources             | J.P. Morgan Energy Conference June 20, 2018                                                         | 2018 | Midstream    | Gas Processing Plant | TX https://targaresources.gcs-web.com/static-files/05790a3d-1e67-4672-92bc-3b99c12b5fa2                                                                                                               |
| The Acadiana Advocate       | Bayou Bridge Pipeline ready for service April 1, companies say                                    | 2019 | Midstream    | Pipeline Oil | LA https://www.theadvocate.com/baton_rouge/news/business/article_1fad33b2-430e-52b3-878e-a9b6f65f78a5.html                                                                                                    |
| The Acadiana Advocate       | Air Liquide building $170 million unit to supply St. James Parish plant                              | 2015 | Downstream   | Petrochemical | LA https://www.theadvocate.com/baton_rouge/news/business/article_6c7173fc-b982-11e7-9d19-2fde7c615001.html                                                                                                    |
| The Acadiana Advocate       | Praxair builds $150 million syngas plant for BASF in Geismar                                       | 2017 | Downstream   | Petrochemical | LA https://www.theadvocate.com/baton_rouge/news/business/article_6c7173fc-b982-11e7-9d19-2fde7c615001.html                                                                                                    |
| The Examiner                | Air Liquide adds new air separation plant                                                           | 2016 | Downstream   | Petrochemical | TX http://theexaminer.com/stories/news/air-liquide-adds-new-air-separation-plant                                                                                                                        |
| The Morning Call            | Air Products to build second gas plant in Arkansas                                                  | 2019 | Downstream   | Petrochemical | TX https://www.mcall.com/business/me-biz-air-products-arkansas-air-separation-unit-20190422-igz6azwzvzi4xi5wizp34qtdm-story.html                                                                    |
| Total                       | USA: $1.7 billion investment to expand Total's petrochemical activities in Texas                     | 2017 | Downstream   | Petrochemical | TX https://www.total.com/en/media/news/press-releases/usa-17-billion-investment-expand-total-petrochemical-activities-texas                                                                                   |
| Victoria Va Advocate        | Invista announces plans to add new $500 million unit to Victoria plant                              | 2013 | Downstream   | Petrochemical | TX https://www.victoriaadvocate.com/news/business/invista-announces-plans-to-add-new-million-unit-to-victoria/article_798a903b-35a7-5c16-a6e5-574a52a3530f.html |
| Wood Based Panels International | Huntsman begins work on 4000 tonne/year Louisiana MDI expansion                                        | 2014 | Downstream   | Petrochemical | LA http://www.wbpionline.com/news/huntsman-begins-work-on-4000-tonne-year-louisiana-mdi-expansion-4415192/                                                                                              |
| World Maritime News Energy Policy | Sentinel Proposing Texas VLCC Crude Export Terminal                                                | 2019 | Midstream    | Oil Terminal | TX https://www.worldmaritimenes.com/archives/271213/sentinel-proposing-texas-vlcc-crude-export-terminal/                                                                                               |
|                           | Gulf of Mexico Congestion Risk                                                                     | 2018 | Midstream    | Terminal Oil | TX https://energypolicy.columbia.edu/research/commentary/gulf-mexico-congestion-risk                                                                                                                   |
Table S5. Comparison of Analysis to Data Based on Permit Applications

|                          | CO2e Emissions (mil. tons) | No. of Facilities | Average Emissions per Facility |
|--------------------------|-----------------------------|-------------------|-------------------------------|
|                          | Permits This Paper Permits This Paper Permits This Paper | Permits This Paper Permits This Paper | Permits This Paper Permits This Paper |
| Compressor Stat.         | 11.0 11.0                   | 12 13             | 0.92 0.85                     |
| Petrochemical            | 88.2 206.3                  | 66 129            | 1.34 1.60                     |
| Refinery                 | 12.4 32.9                   | 14 27             | 0.89 1.22                     |
| Terminal, LNG            | 65.4 101.0                  | 12 18             | 5.45 5.61                     |
| Terminal, Oil            | 0.3 3.3                     | 2 12              | 0.16 0.28                     |
| **Total**                | **177.5 354.5**             | **106 199**       | **1.67 1.78**                 |

*Notes:* “Permits” reflect data from an archive of TX Commission for Environmental Quality and the LA Department of Environmental Quality permits and correspond to emissions as indicated in permit applications. “This Paper” corresponds to all facilities identified in our inventory in the same categories as the “Permits” data and the corresponding emissions calculated as presented in Table 4 in the main paper.

Table S6. Ratio of US EPA GHGRP Reported Emissions to Permitted Emissions

|                    | 2017 | 2018 | 2017-2018 |
|--------------------|------|------|-----------|
| Average            | 108% | 115% | 111%      |
| Average Refining   | 360% | 351% | 355%      |
| Average w/o Refining | 72% | 81%  | 76%       |
| Minimum            | 4%   | 5%   | 5%        |
| Maximum            | 1,395% | 1,345% | 1,370% |

*Notes: *This table reports sample statistics for the ratio of emissions reported by facility operators to the US EPA GHGRP to the emissions permitted for the facility by the TCEQ for the subset of facilities in this study that also appear in the GHGRP. The second row reports this ratio only for refining facilities and the third row reports the ratio for non-refining facilities because of the substantial difference between ratios that can be seen from Figure S6.
Table S7. Alternate Emission Factor Regression Estimates using Alvarez, et al. (2018) Data

| Dependent Variable | (1)          | (2)          | (3)          | (4)          | (5)          | (6)          |
|--------------------|--------------|--------------|--------------|--------------|--------------|--------------|
| TW_GAS             | 0.000733***  | 0.000652***  | 0.000825***  | 0.000684***  |              |              |
|                    | (9.35e-05)   | (0.000101)   | (0.000102)   | (0.000110)   |              |              |
| TW_OIL             | 0.00593***   | 0.00274**    | 0.00815***   | 0.00460***   |              |              |
|                    | (0.00125)    | (0.00130)    | (0.00136)    | (0.00143)    |              |              |
| Constant           | 154,993***   | 165,668***   | 146,806***   | 21,966       | 18,717       | 20,118       |
|                    | (14,455)     | (15,216)     | (14,918)     | (297,411)    | (306,263)    | (294,447)    |
| Observations       | 505          | 505          | 505          | 505          | 505          | 505          |
| R-squared          | 0.109        | 0.043        | 0.117        | 0.231        | 0.184        | 0.248        |
| BASIN FEs          | NO           | NO           | NO           | YES          | YES          | YES          |

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Each column of this table corresponds to a separate regression with a different specification. TW_GAS measures total natural gas production in thousands of cubic feet. TW_OIL measures total oil production in barrels. The dependent variable in each regression is CO$_2$e emissions in tons, where methane emissions are converted to CO$_2$e using a GWP of 32.
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