

TRISTAN BAURICK

How Will Carbon Capture Transform Port Arthur, Texas?

Advances in engineering and financial incentives are putting a Gulf Coast city at the forefront of the energy transition. Can policies make good on promises to clean the environment and create jobs?

Hilton Kelley says you can understand a whole lot about his hometown from the top of City Hall. Standing at a broad, fifth-floor window, the community organizer points across Port Arthur, a small Texas city on the Gulf of Mexico, to the horizon, which is framed by clusters of smokestacks, silos, and other towering petrochemical structures, some blackened with age and soot, others gleaming with fresh steel.

“Look, that one there’s Motiva,” Kelley says of North America’s biggest refinery, initially constructed during Texas’s first oil boom, in 1902. “It takes in 630,000 barrels of oil every day, working round the clock. That rusty-looking one next to it—that’s the Valero refinery. Next is Chevron, then the Oxbow plant. Over to the west, it’s BASF from Germany. To the east, it’s the Total refinery, and they’re from France.”

For as long as Port Arthur’s current residents can remember, the refineries and chemical plants at the city’s edges have been chugging away, determining the fate of its population. Kelley, a 2011 recipient of the Goldman Environmental Prize, grew up in the segregated Black section of Port Arthur in the 1960s. He points to the streets below at places that are only memories now. “There were restaurants and stores all up and down the main street. Now look at all the open lots. That right there was a hotel. It’s gutted. And down there was a Woolworth, and a bank, and a furniture store.”

Today Port Arthur is home to 55,000 residents, the majority of whom are Black and Latino. Kelley says they benefit little from the prosperity extracted from the earth around them.

“We’re surrounded by money,” Kelley says. “We’re reaching for it, but it’s all going over our heads.”

An energy transition and a social promise

Port Arthur is poised to be a leader in the energy transition, which aims to repurpose the skills and resources of the fossil fuel industry to generate clean energy and reduce carbon emissions. There are plans for the city’s industry—all those smokestacks—to reverse their operations, capturing carbon dioxide and storing it underground. The city is home to the United States’ first successful industrial-scale carbon capture facility, the 10-year-old Air Products plant at the Valero refinery. And it will be an important hub for the new network of federally supported carbon dioxide pipelines connected to retrofitted plants and refineries and multi-billion-dollar carbon capture facilities planned across the Gulf region.

It may be the beginning of a vast project. “The volume of CO₂ we need to inject to make a tangible impact on climate change is huge,” Akhil Datta-Gupta, a petroleum engineering professor at Texas A&M University who has written about how the Gulf region’s role in the energy transition for the National Academy of Engineering’s *The Bridge*, told me. “But the oil and gas industry has the expertise, the technology, and infrastructure to play a major role in this.” Endowed with many large carbon dioxide emitters and sitting atop one of the world’s best CO₂ storage areas, Datta-Gupta says the Gulf of Mexico region is already forming hubs for carbon collection, reuse, and storage. Port Arthur is one of three such hubs in East Texas.

This ambitious technological agenda also has social goals. In August, the Biden administration announced an investment of \$1.2 billion in Bipartisan Infrastructure



VIRGINIA HANUSIK *Abandoned Oil Field, Plaquemines Parish, 2021.*



VIRGINIA HANUSIK *The Mississippi River from the Port Eads Lighthouse, 2020.*

Law funds into two facilities that will capture carbon directly from the air in Texas and Louisiana. Energy Secretary Jennifer Granholm articulated the vision: “Laying the foundation for a direct air capture industry [is] crucial to tackling climate change—transforming local economies and delivering healthier communities along the way.” Accomplishing these social goals—thousands of good-paying jobs, for example, or healthier environments—will require significant buy-in from communities like Port Arthur.

But when I visited the city this summer to report on the upcoming energy transition, I found a place still thinking about the last one. In 1901, prospectors just outside town drilled into Spindletop Hill, letting loose a black geyser of hydrocarbons that captured the world’s imagination, sparking a land rush, birthing the modern oil industry, and hastening the world’s move away from coal.

This legacy has given Texas the highest carbon dioxide emissions of any state—more than the next two states, California and Florida, combined. The 52-mile

Port Arthur Community Action Network, told me. “Why should we be entrusting the planet’s safety and our future and our health to people who have created the very problem that’s threatening us?”

When Beard met Secretary Granholm in Glasgow, Scotland, during the 2021 climate conference, he invited her to Port Arthur. The next year, he offered the invitation again when he saw her in Houston. This summer, she brought a delegation from the Department of Energy (DOE) as part of a listening tour called the Energy Justice to the People Roadshow.

Policies to encourage industry to invest in the deployment of technology to store CO₂ underground are showing early success, even though many questions about the safety and permanence of the storage remain. But above ground in Port Arthur, initiatives to assure jobs, healthy communities, and justice are lagging behind. People in high places are listening to community activists now, but as subsidies flow toward industry, residents are hoping that this energy transition leaves the city in better shape than the last one.

“We keep hearing that these companies are going to do these wonderful, great things,” John Beard Jr. told me. “Why should we be entrusting the planet’s safety and our future and our health to people who have created the very problem that’s threatening us?”

Houston Ship Channel boasts the continent’s largest collection of petrochemical plants and refineries.

Residents I spoke with worry that this new industry will play out much as the old one did, with Port Arthur bearing the burdens but enjoying few of the benefits. This summer, the city’s unemployment rate was nearly twice the national average. Port Arthur’s rates of lung cancer, kidney disease, and other health problems associated with proximity to oil and gas operations are alarmingly high. Complaints of burning eyes and irritated lungs are commonplace, as are shelter-in-place orders when accidents happen. In 2019, a chemical plant explosion in nearby Port Neches injured eight people, spurred a mandatory evacuation order over a four-mile radius, and set chemical fires that burned for a month at the facility. And when Hurricane Laura hit Port Arthur in 2020, one refinery released 90 tons of emissions, including benzene and nitrous oxide, in two days.

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A treasure map for carbon

For decades, oil companies have forced carbon dioxide into oil reservoirs to squeeze more petroleum out of them. Called enhanced oil recovery (EOR), the process has been widely used to boost production from declining oilfields in Texas’s Permian Basin. According to the Global Carbon Capture and Sequestration Institute, about 73% of the CO₂ captured each year is used for EOR. But EOR, by itself, is not a way to reduce greenhouse gas emissions, because it also produces more carbon-laden petroleum.

In the United States, EOR has been adapted to permanently store CO₂ in porous underground rock formations. Comparing the process to putting carbon in a landfill, University of Texas at Austin geologist Tip Meckel described the method to me: “You essentially push the CO₂ into the pore space in the rock. You displace any saltwater brine that’s in those pore spaces, and the CO₂ stays there like water does in a sponge.” The same conditions that hold oil, gas, and brine underground for thousands of years are used to contain CO₂ for several more millennia, he said.

Meckel has spent years assessing the underground storage capacity of the Gulf of Mexico region using vast amounts of data from records produced by oil and gas companies as they searched layers of sandstone for oil. These records offer a wealth of precise measurements of deep geologic features, the vast majority of it under waters off the coast of Texas. In 2017, Meckel published a CO₂ storage atlas of the Gulf region.

His research indicates that the coasts of Texas and Louisiana could store hundreds of billions of tons of carbon dioxide, “representing the largest national resources for CO₂ storage and a resource capable of receiving decades of annual regional emissions, and likely national emissions,” Meckel and his colleagues wrote in a 2021 report. In the push to sequester carbon, Texas started with a leg up because of its expertise in EOR—but it was the availability of data that made the process less risky. “In most parts of the country, we don’t know what the storage is like, but having literally thousands of wells drilled around the Gulf has given us so much information,” Datta-Gupta observed.

Despite this potential, the idea of massive carbon capture and storage (CCS) in the Gulf might have remained just an idea if the federal government hadn’t expanded a tax credit known as 45Q in 2018 from \$22 to \$50 per ton, and the 2022 Inflation Reduction Act further raised the credit to \$85. (Direct air capture projects can get tax credits of \$180 per ton.) Up to that point, the tax credit had mostly been employed by the wind, solar, and other renewable energy sectors, but the upgrade suddenly made carbon capture a potential moneymaker. Over 50 new carbon capture and storage projects have been announced in the past year, according to the Clean Air Task Force.

“It was a revolutionary piece of legislation,” Alex Tiller, CEO of Carbonvert, a carbon capture and storage development company, explained to me. “It hit on the right dollar amount to activate projects.” These carbon capture tax credits had existed since 2009—but the recent expansion has drawn the interest of big oil and gas companies, transforming Meckel’s atlas into a map of buried treasure.

“What [the atlas] showed is that the potential for storage is not humongous—it’s bigger,” Tiller said. “If you look at just Jefferson County [which includes Port Arthur], there’s five gigatons of CO₂ storage. It’s absolutely the best geology for storage, and it’s close to all these sources of CO₂ emissions.”

Companies are starting to capitalize on the proximity of Port Arthur’s emissions to Gulf storage. In March 2022, Tiller’s Carbonvert joined forces with oil and gas producer Talos Energy, signing the first lease agreement for a major offshore carbon sequestration project in the United States. In 2023, Chevron bought half the venture. Located about five miles from Port Arthur, the Bayou Bend project now stretches across 140,000 acres on- and offshore.

Meanwhile, the federal government has continued to add enticements. The \$1.2 trillion Bipartisan Infrastructure Law, passed in late 2021, offers billions in direct funding and loan guarantees. The US Department of Energy has given a \$71 million chunk of the bill’s funding to oil and gas companies to build three carbon capture projects in Texas and Louisiana, another \$6 million to craft plans for networks of CO₂ pipelines along the Gulf Coast, as well as the \$1.2 billion for two direct air capture projects in the Gulf.

Industry has responded with enthusiasm. With \$16.4 million from the DOE, Occidental recently broke ground on a carbon capture hub so large it will straddle three Texas counties. The proposed 55,000-acre site could store as much as 1.2 billion metric tons of carbon dioxide piped in from dozens of nearby facilities. The project, called the Bluebonnet Hub, is slated to open in 2026.

Perhaps the most ambitious project is a \$100 billion carbon capture hub Exxon Mobil has proposed along the Houston Ship Channel. The oil and gas giant is attempting to cover the project’s costs by pooling resources with 14 of its petrochemical peers and the federal government to pipe about 100 million metric tons per year under the Gulf by 2040.

The first mover

There are now more than a hundred commercial carbon capture projects being built globally, according to the International Energy Agency. But the technology and the business models are still relatively new.

Just ten years ago, when Air Products was initiating its pioneering carbon capture project at the Valero refinery in Port Arthur, the technology itself was uncertain. “The stress levels in 2012 were through the roof,” remembers Air Products engineer Srini Patibandla.

Built as a demonstration project with \$284 million from DOE in American Recovery and Reinvestment Act funds, the facility used a new process to separate carbon dioxide during the production of valuable hydrogen gas. Once separated and dried, the CO₂ is piped to an oil field south of Houston, where it is used to extract more oil from the reservoir. Yearly, the process captures a million tons of CO₂ that would have otherwise gone into the atmosphere. And over its lifetime, the project may produce an extra 60 to 90 million barrels of oil.

Before it went online, some industry experts predicted the facility would only last two years. However, it quickly exceeded its targets. A 2018 paper attributed some of the project’s success to the tight relationship among engineers working for the industry partners, contractors, and faculty from the University of Texas at Dallas and UT Austin. “It’s a matter of pride,” Patibandla said. “When you are the first mover of anything in terms of a new technology, there

is always that sense of, ‘Man, look at what we’ve done.’” Engineering aside, what has made the project financially sustainable is that the CO₂ is used to produce more oil.

Most carbon capture projects have failed to live up to their hype, says Bruce Robertson, an analyst with the Institute for Energy Economics and Financial Analysis. In a study of 13 flagship carbon capture projects, he and another analyst found that five significantly underperformed, three failed, and two did not publicly report their results.

In the handful of successful cases, he says a unique regulatory environment was key. Two Norwegian projects met their carbon capture and financial goals thanks largely to Norway’s CO₂ tax. Introduced in 1991, the tax penalizes emissions while boosting the viability of CO₂ storage. Until now, the plan in the United States has been to dangle carrots to get industry to invest in this new technology. But down the road it may take sticks, such as carefully structured taxes, to turn CO₂ sequestration into a sustainable and lucrative business.

The smell of money

On a muggy day in July, John Beard drove me past the Air Products facility. Its small collection of white tanks was dwarfed by the rest of the Valero refinery, a veritable city of pipes and stacks stretching for a mile and a half to the salt marshes of Sabine Lake and a Gulf-bound industrial canal that follows the border with Louisiana.

Beard, who spent 38 years in the petrochemical industry and nine years on Port Arthur’s city council, shook his head. “Somebody’s making some money for doing a little bit of nothing,” he said.

Beard worries carbon capture will be a lifeline for the petrochemical industry, allowing it to clean up its image while continuing to produce harmful emissions. And as for the idea of creating good-paying jobs—that’s been a complicated trade-off for him and his family.

As a child, Beard would stare at the Valero refinery from his kitchen window while he washed dishes. His father, a refinery worker, told him not to complain about the foul-

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Further, building out carbon capture facilities and pipelines could bring new dangers, particularly if the gas leaks. CO₂ is colorless, odorless, and heavier than air, enabling it to travel undetected and at lethal concentrations over large distances, Bill Caram, executive director of the Pipeline Safety Trust, said in a statement. In 2020, when a CO₂ pipeline ruptured in Satartia, Mississippi, emergency responders found people passed out or disoriented and struggling to breathe, and 45 people were hospitalized. In 2022, the Department of Transportation’s Pipeline and Hazardous Materials Safety Administration proposed a \$3.8 million fine against the pipeline company and initiated new rulemaking and research to update CO₂ pipeline regulations.

So far, much of the focus in carbon sequestration has been on engineering, but the public will need to be convinced that shipping CO₂ is safe and that underground storage is secure. As a recent Congressional Research Service report noted: “Given the fundamental need for pipelines in CCS [carbon capture and sequestration] systems, actual or perceived safety risks associated with CO₂ pipelines may limit the potential of CCS as a greenhouse gas mitigation option.”

smelling air. “He said, ‘Son, don’t turn up your nose. That’s the smell of money.’” The refineries offered a good living for the senior and junior Beards and helped support a large middle class in their mostly Black neighborhood, called West Side.

From his car, Beard pointed out the large homes of Black doctors, school administrators, and store owners—all now empty or in disrepair. The bustling theater where his mother worked, the union hall where his father strategized for better pay, and the auditorium where James Brown once performed are gone. “Just concrete slabs and weeds,” Beard said.

After desegregation, many residents left West Side, seeking homes that weren’t squeezed between refineries and railyards. Then many of the city’s affluent white residents moved to the suburbs of Nederland, Port Neches, and Groves. Since the 1960s, Port Arthur’s population has declined by more than 20%.

Automation gradually made many refinery and plant jobs obsolete. Once-plentiful positions that required little more than a high school diploma were replaced by electronic controls and sensors. The jobs that remained tended toward the technical or managerial, with higher bars for experience and education.

Today, fewer jobs are going to people of color, said Beard, who is Black. In 2017, Black workers held just 9% of oil and gas extraction jobs in the United States, but that number slipped even lower last year, to 5.6%, according to the Bureau of Labor Statistics. And during the strong oil and gas market of the past decade, Black workers were paid on average 23% less than white workers in comparable positions, according to research from University of Massachusetts Amherst sociologist Donald Tomaskovic-Devey.

Carbon capture alone is unlikely to create new jobs. Workers at Air Products told me the facility employs just six people. Most of the jobs from new carbon capture projects will be in construction rather than longer-lasting operations jobs. According to the Carbon Capture Coalition, retrofitting a refinery for capturing carbon can support about 600 temporary jobs for designers and builders—but requires only around 55 permanent positions.

Beard and Kelley agree that carbon sequestration is not likely to yield the kind of blue-collar jobs that could benefit Port Arthur. University-based carbon-capture programs, for example, are likely to produce white-collar engineers.

What they would like to see are more jobs in renewable energy available to their community—particularly, manufacturing wind turbines to supply a nascent offshore wind industry. “We should be building new facilities in our port that are dedicated to helping build and maintain all the wind turbines we’re going to see coming just south of us,” Kelley says.

In August, the Gulf’s first offshore wind lease was awarded to German energy company RWE for a 102,000-acre area. If a wind rush does materialize, it could provide a lot of jobs. A modestly sized offshore wind farm near Port Arthur could create 4,472 construction jobs and support 151 permanent positions, according to an estimate from the National Renewable Energy Laboratory and the Bureau of Ocean Energy Management. Adding manufacturing capacity could bring Port Arthur more jobs and a position as an industry leader as wind generation grows in the Gulf.

When he was a city council member, Beard helped develop a 300-acre business park that offers cheap and free land, loan assistance, and other benefits, attracting light industrial businesses including makers of firefighting equipment and machine valves. He’d like to see government entities be as aggressive at wooing renewable energy companies as they are with ones tied to fossil fuels. Enticements for companies to come to Port Arthur might include tax breaks, training programs, and low-cost leases on city or port properties.

“We want to attract clean businesses and union jobs,” Beard said. “The way you do that is sweeten the pot all the way around.”

Oil is still king

Pat Avery, president of the Greater Port Arthur Chamber of Commerce, welcomes carbon capture, but not so much for the promise of jobs.

“It’s not going to bring the kinds of jobs the refineries and petrochemical brought us,” Avery, a former human resources manager at a refinery, told me. But carbon capture and the economic boost it will give the oil and gas industry will mean more tax revenue for the city, parks, and schools, she said.

And any growth in population and commerce will steer toward Port Arthur because the surrounding region is already heavily developed and increasingly expensive, Avery predicted. The city boasts a port, underutilized infrastructure, and swaths of bare lots and crumbling buildings that, to developers, offer almost a clean slate.

“In 25 years, this will all be gentrified,” she predicted.

Although the refineries and plants don’t spread their wealth as they once did, few leaders are willing to speak critically of oil and gas—or even speak highly of its alternatives.

During a city council meeting in July, I watched Kelley pitch a neighborhood-scale solar demonstration project in West Side, but the response was cool.

“You know some people are not ready to sign on to the solar phenomenon,” councilmember Donald Frank responded at the meeting. “This is a hub for petrochemical. Oil is still king.”

Kelley struggles with this persistent reluctance to imagine a city beyond oil. He spent years working as a stuntman and actor in California before returning to Port Arthur about 20 years ago to found the Community In-Power and Development Association. He wanted to empower his community to breathe clean air, among other goals.

Kelley wants to see policies that make good on promises to clean the environment and create jobs. Tax incentives should be conditioned on jobs going to people living near carbon capture infrastructure, he says, and the level of generosity the government has shown industry should be matched with economic support for neighboring communities.

“Carbon capture and sequestration needs to come with plans that make sure the communities that have been harmed and will be harmed get some of the benefits,” Kelley says. “And those plans need to be iron-clad.”

The Biden administration’s signature environmental justice program, Justice40, directs 40% of certain federal investments toward disadvantaged communities that have been overburdened by polluting industries. Tying the Justice40 program to CCS projects was controversial. The administration’s own Environmental Justice Advisory Panel said federal investments in CCS projects shouldn’t be eligible for Justice40 because they might funnel money away from renewable energy initiatives and other projects that have greater community benefit.

Justice40 is “exciting but also nerve-racking,” Ugbaad Kosar, the environmental justice director for Carbon180, a group that advocates for direct air capture efforts, shared with me. It’s new, untested, and unlike anything the federal government has ever attempted. But Kosar says it has the potential to do real good in communities that have long been ignored.

“I’m optimistic,” she said. “As with all good policy, it all depends on implementation. That’s where the rubber meets the road.”

Something in the air

Over the past century, Port Arthur and nearby communities have often been described as a “sacrifice zone”: residents and the environment suffer so that gasoline and other petrochemicals can be sent to people elsewhere.

In 1981, *Texas Monthly* dubbed Port Arthur and neighboring communities the “Cancer Belt” after disproportionately high rates of cancer were found among men who lived or worked near the region’s chemical plants. Today, lung cancer mortality in Port Arthur is 26% higher than the Texas average, according to the Texas Department of State Health Services. Data from the Centers for Disease Control and Prevention indicate Port Arthur’s rate of chronic kidney disease, another health problem linked to oil and gas facilities, is 63% higher than the rest of the state.

Longtime Port Arthur resident Shirley Payne explained to me that her neighborhood just feels unhealthy. Recently she’s had a sinus infection that required surgery and a mysterious problem with her tongue. “It swole up so big it came out my mouth,” she said. “With all these things affecting me, I do all these tests and see all these doctors. And they tell me, ‘It’s something in the air.’ It’s something I’m breathing.”

A collection of petrochemical storage tanks, part of the infrastructure extending from Motiva, wraps around two sides of her property. Upon retiring from the local school district, Payne screened in her back porch, making it into a fresh-air living room with a swinging chair and wall-mounted TV. “But I can’t even enjoy this anymore,” she said as a cloud of dust, kicked up by a truck in the tank farm, drifted in. “This is a dead part of the house.”

In June, Secretary Granholm, Secretarial Advisor on Equity and Director of the Office of Economic Impact and Diversity Shalanda Baker, and other officials from DOE visited Payne’s house and sat on her couch. Payne says they talked for about 45 minutes, documenting how close she is to the refinery’s fence, problems she’s had with runoff, noise, dust, and water quality. “I told them, ‘Please don’t forget.’ Somebody needs to hear this, and follow up, and do something about it.”

The first thing Baker noticed about the city was the smell, she told me in an interview in September. When she was a child, Baker visited family members in Port Arthur, and she remembered that distinctive sulfuric smell. This time she

recognized it as “evidence of the concentration of facilities in that community.” The contrast between the value that the city’s refineries had generated for the oil industry and the state of the community struck her, too. “The streets should really be paved with gold in that place, given how much wealth has been created.”

In Port Arthur, she says that the plan is to create jobs and also to address the community’s concerns by holding roundtables to document problems like air quality. Then the department will act as a “convener that brings communities and industry together to really begin to talk through some of those longstanding concerns.”

Baker says that Justice40 is a policy tool that can put underserved communities “at the front of the line” to receive benefits from federal investments to mitigate climate change. More concretely, she says, the DOE is requiring applicants for funding under the Bipartisan Infrastructure Law and the Inflation Reduction Act to submit a plan for community benefits, workforce development, and pathways for more economic development. Another part of the policy toolkit is the 48(e) Inflation Reduction Act tax credit program, which offers 20% additional tax credits for small-scale wind and solar to targeted communities.

When I asked how the program would be implemented, Baker explained that Justice40 is being integrated across 146 distinct DOE programs. “In the project negotiation phase, there is work to set up ‘go, no-go’ frameworks that allow the project manager on the DOE side to actually look at whether or not the project is meeting the goals that we’ve set forth.” In addition, the department is setting up processes for evaluation and documentation.

Baker says that Justice40, based in an executive order, is intended to set a persistent direction for federal action. “We are very focused on making sure we deliver as many wins as we can during this term and that we establish the architecture for justice that will endure no matter how the winds change going forward,” she affirmed.

When I talked with Shirley Payne recently, she was happy that the energy secretary listened to her when she visited, but no one has followed up. “We’ve got the same problems we had ten years ago, and they’re getting worse.”

Payne had hoped that Granholm’s visit might spur action from local leaders or companies, but she hasn’t heard anything from them, either.

Tristan Baurick is an environment reporter with the Times-Picayune in New Orleans. His work has also appeared in Audubon magazine, the New York Times, and ProPublica.

This is the first of three articles reporting on energy, climate, and society in the Gulf of Mexico. The series is made possible by funding from the Gulf Research Program to mark the tenth anniversary of its founding.
