ILR Worker Institute

Combatting Climate Change, Reversing Inequality: A Climate Jobs Program for Texas

Combatting Climate Change, Reversing Inequality: A Climate Jobs Program for Texas

July 2021

Authors

Lara R. Skinner, *Director, Labor Leading on Climate Initiative, Worker Institute at Cornell University, ILR School*
J. Mijin Cha, *Assistant Professor, Urban and Environmental Policy, Occidental College*
Hunter Moskowitz, *Research Assistant, Worker Institute at Cornell University; Northeastern University*
Matt Phillips, *Research Assistant*

Zach Cunningham, Anita Raman and Avalon Hoek Spaans provided support, graphics and editing for this report.

Acknowledgements

In early 2020, the Worker Institute's Labor Leading on Climate Initiative, in partnership with the Climate Jobs National Resource Center, the Texas AFL-CIO, and the Texas Climate Jobs Project, began a comprehensive research, educational and policy process to develop a vision and framework for simultaneously addressing the crises of climate change and inequality in Texas through high-impact job creation strategies. Over the past year, Lara Skinner has conducted outreach to numerous leaders of the labor and environmental movements as well as policymakers and experts in the climate, energy and labor fields to better understand the challenges and opportunities that climate change and climate protection efforts present to Texas's workers and unions.

The Worker Institute would like to thank the Texas AFL-CIO, the Texas Climate Jobs Project, and the many unions and labor federations that showed great leadership and commitment by participating in this Labor Leading on Climate "Climate Jobs" initiative over the past year. We would like to thank the leaders and staff of those unions that provided critical insight and feedback throughout the process.

Special thanks to Amalgamated Transit Union (ATU) Local 1338, American Federation of Government Employees (AFGE) Local 1003, American Federation of State, County, and Municipal Employees (AFSCME) Local 1624, Association of Flight Attendants-Communications Workers of America (AFA-CWA), Communications Workers of America (CWA) District 6, El Paso Building and Construction Trades Council, Harris County Labor Assembly, Insulators Local 22, International Brotherhood of Electrical Workers (IBEW) Local 220, International Brotherhood of Electrical Workers (IBEW) Local 66, International Brotherhood of Electrical Workers (IBEW) Local 479, International Brotherhood of Electrical Workers (IBEW) Local 520, International Union of Operating Engineers (IUOE) Local 564, LIUNA S.W. District Council, National Nurses United (NNU), Texas, Pipefitters Local Union 211, Plumbers Union (UA) Local 68, Seafarers International Union's Gulf Coast Region, Service Employees International Union (SEIU) Texas, United Steelworkers (USW) District 13, Texas Gulf Coast Area Labor Federation, Texas Federation of Teachers, Texas Pipe Trades, Texas State Building Trades, Texas State Council of Machinists, Texas State Employees Union-Communications Workers of America (TSEU-CWA), Transport Workers Union, Young Active Labor Leaders (YALL), and UAW Region 8.

The authors, of course, take full responsibility for any shortcomings of the report.

Table of Contents

Introduction

Texas is currently confronted by three major, intersecting crises: the COVID-19 public health pandemic and ensuing economic crisis; a growing crisis of inequality of income, wealth, race and power; and the worsening climate crisis, which continues to take its toll on Texans through hurricanes, major flood events, wildfires, debilitating heat waves and the significant economic cost of these extreme weather events. These crises both expose and deepen existing inequalities, disproportionately impacting working families, women, Black, Indigenous and people of color (BIPOC) communities, immigrants, and the most vulnerable in our society.

A well-designed recovery from the COVID-19 global health pandemic, however, can simultaneously tackle these intersecting crises. We can put people to work in high-quality, family- and community-sustaining careers, and we can build the 21st century infrastructure we need to tackle the climate crisis and drastically reduce greenhouse gas emissions and pollution. Indeed, in order to avoid the worst impacts of the climate crisis, it is essential that our economic recovery focus on developing a climate-friendly economy. Moreover, there are significant jobs and economic development opportunities related to building a clean energy economy. One study shows that 25 million jobs will be created in the U.S. over the next three decades by electrifying our building and transportation sectors, manufacturing electric vehicles and other low-carbon products, installing solar, wind and other renewables, making our homes and buildings highly-efficient, massively expanding and improving public transit, and much more.[1]

Conversely, a clean, low-carbon economy built with low-wage, low-quality jobs will only exacerbate our current crisis of inequality. The new clean energy economy can support good jobs with good benefits and a pipeline for historically disadvantaged communities to high-quality, paid on-the-job training programs that lead to career advancement. Currently, the vast majority of energy efficiency, solar and wind work is non-union, and the work can be low-wage and low-quality, even as the safety requirements of solar electrical systems, for example, necesitate well-trained, highly-skilled workers.[2]

A well-funded, comprehensive "Just Transition" is important, too. In Texas, over 450,000 people work in the fossil fuel industry, making up more than 3% of Texas's economy.[3] As Texas shifts to a low-carbon economy, it is critical that the workers and communities who have been at the center of powering Texas's economy for decades are protected and supported. For younger workers, it is particularly important that they have high-quality careers to transition to.

The following report examines the crises of inequality and climate change in Texas and makes a series of "climate jobs" recommendations that can help Texas simultaneously combat climate change, create high-quality jobs, and build more equitable and resilient communities. Considering Texas's current labor and employment landscape as well as its climate and energy profile, these recommendations identify concrete, jobs-driven strategies that can put Texas on the path to building an equitable, clean energy economy that will tackle the climate crisis and improve working and living conditions for all Texans. Importantly, these recommendations can be tested at the city and county level then scaled to the state levels based on their demonstrated effectiveness.

Tackling the Intersecting Crises of COVID-19, Inequality and Climate Change

In November 2020, Texas's unemployment rate hit 8.1% - more than double its rate in November 2019. In counties with significant oil and gas production, like Starr County, unemployment rose to 18.5%.[4] Sadly, many Texans reported that they struggled to receive unemployment benefits because the state's unemployment office did not have the staffing or

capacity to handle the surge in claims. Almost 350,000 Texans did not qualify for additional pandemic support because they earned too little or did not indicate in their unemployment applications that they lost their job due to the pandemic.[5] Across the U.S., record numbers of Americans are reporting that they do not have enough money to put food on the table, pay rent and mortgages, or cover other household expenses.[6]

The COVID-19 crisis has both exposed and deepened the crisis of inequality facing Texas and the U.S. Inequality of income, wealth, power, race, opportunity and hope is on par with Great Depression era levels. Even before the pandemic, working families in Texas suffered from some of the worst income, wealth and racial inequalities in the country. When Texas's economy is booming, income and wealth is still concentrated at the top. The top 1% of income earners make 26.9 times more than the bottom 99%. And inequality has been worsening in Texas, not improving. The wealthiest 5% in Texas have increased their wealth by 96% over the past twenty years, while the bottom 20% has lost 10% of their wealth.[7]

Texas has some of the worst racial inequality in the country, too. Houston is the second most residentially segregated city in the country, and Dallas follows close behind at fourth.[8] Houston also has some of the worst air pollution in the country, disproportionately impacting low-income and communities of color. This segregation reinforces inequalities by concentrating opportunities for work, prosperity, social mobility and clean air to certain areas. The income, wealth and racial disparity in Texas is particularly evident when looking at college graduation rates – only 9% of low-income and minority students graduate from college.[9]

The inequality crisis in Texas has been driven in the last 20 years by two main factors: 1) Texas has not passed a minimum wage that exceeds the federal minimum wage, which means many Texans work in low-paying jobs that have not kept pace with the rising costs of housing, transportation, education and more; 2) only 4.8% of Texas workers belonged to unions in 2020, which is half the national average of 10.7%.[10] Because of Texas's Right to Work law, it is extremely difficult for workers in Texas to organize for better working conditions, wages and benefits or a collective and democratic voice on the job. Related to these issues, over 17% of Texans do not have health insurance – the highest rate of uninsured people in the U.S.[11]

While inequality worsens in Texas, so does the climate crisis. 2020 turned out to be the hottest year on record, and climate scientists now warn that the U.S. must make major reductions in its greenhouse gas emissions and pollution by 2030 to avoid catastrophic impacts from a warming world. The 2020 hurricane season was the worst on record with twelve hurricanes slamming the Atlantic Coast.[12] In the Western U.S., warmer, dryer conditions led to another nightmare fire season.

Texas has a particularly important role to play in addressing the climate crisis because Texas emits more greenhouse gas emissions and pollution than any other U.S. state. In fact, Texas produces more than twice as many emissions as California, a state with 10 million more people.[13]

At the same time, Texas has built more wind power than any other U.S. state – 30 gigawatts. In fact, only 4 countries have built more wind power than Texas. Texas also houses approximately 40 wind manufacturing facilities and an outsized number of electric vehicle manufacturers.[14] Texas is also on the verge of building the largest solar project in the country, as well as a high-speed rail train from Dallas to Houston. These activities hint at the opportunity the clean energy economy presents for Texas. These opportunities could be fully captured if future efforts include: a strong commitment to ambitious climate

action that will reduce greenhouse gas emissions and pollution; high-quality jobs that are family-supporting and community-sustaining; and building a more fair and equitable economy, particularly for frontline and historically disadvantaged communities.

Given the large size of its population, economy, and greenhouse gas emissions, advancing a "climate jobs" program in Texas has the potential for significant, positive impacts. Well-known for its oil and gas industry for decades, Texas now has the opportunity to become the world's leader in building an economy that tackles climate change, reduces pollution, creates many high-quality jobs in new clean energy sectors, and creates more resilient and equitable communities. Building this low-carbon, equitable economy will require major shifts, but it can be done in a way that centers the needs and interests of working families in Texas and maximizes the major economic development opportunities associated with the new clean-energy economy. This report outlines a set of recommendations that can start Texas down this path.

Climate Jobs Recommendations

Energy	• Install 20 GW of Solar Energy by 2030 and 40 GW by 2040 • Install 70 GW of Wind Energy by 2030 and 100 GW by 2040 • Install 5 GW of Geothermal Energy by 2030 • Encourage Futher Development of Distributed Energy and Storage • Upgrade Transmission for Renewable Energy
Industry	• Utilize 45Q Tax Credit to Deploy Direct Air Capture and Storage Projects
Transportation	• Electrify School Buses along with State and Local Vehicle Fleets by 2040 • Build a High-Speed Rail Network between Texas' Five Largest Cities.
Carbon-Free Schools	• Retrofit and Install Solar with Storage on Public Schools by 2035
Buildings	• Reduce Energy Use in Existing Buildings by 30% by 2035 and by 40% by 2045 and Mandate Net-Zero Emissions for New Construction by 2050
Communications	• Universal Broadband Coverage for all Texas Residents by 2035
Labor	• Ensure High-Quality, Union Jobs in Texas
Just Transition	• Create a Multi-Stakeholder Just Transition Commission and Evaluate Previous Plant Closures

Climate Change in Texas

Climate change has already impacted Texas with increasing temperatures, intensifying extreme weather events, rising sea levels, and declining crop yields. Future projections indicate that Texas can expect disruptions to the economy, agriculture, and climate that will severely impact workers and their livelihoods. Already, the Southeastern Great Plains of the United States has experienced temperature increases of between 1°F and 2°F. Over the course of this century, temperatures will increase by between 4.4°F and 8.4°F.[15] Days with temperatures over 100°F in Austin will increase between 25 days and 50 days by midcentury.[16] Workers who labor outside in construction, agricultural, and energy jobs may face health impacts and lost wages due to higher temperatures and hotter weather.[17] Climate change in Texas will cause more frequent and severe droughts.[18] During the 2011 drought, Texas received 11.2 inches of precipitation in 11 months, the lowest ever recorded, and this resulted in $7.32 billion in economic damage. Droughts may exacerbate water availability issues in Texas. Due to increasing water shortages, a record drought in 2060 could leave half of Texas's population with a water shortage.[19]

Texas has also felt the impacts of other extreme weather events. While Texas has and will continue to experience major droughts, events with intense rainfall pose another threat to the climate and economy of Texas. Over the next century, heavy precipitation events will increase in frequency and severity.[20] Storms already cause 5% to 7% more rainfall than storms at the beginning of the last century.[21] In 2017, Hurricane Harvey brought devastation onto Texas. It lasted 117 hours and Texas received over 60 inches of precipitation. The storm caused approximately $125 billion in damage, the second most of any hurricane in U.S. history, and killed 70 people.[22] The damage brought by these storms will only grow.

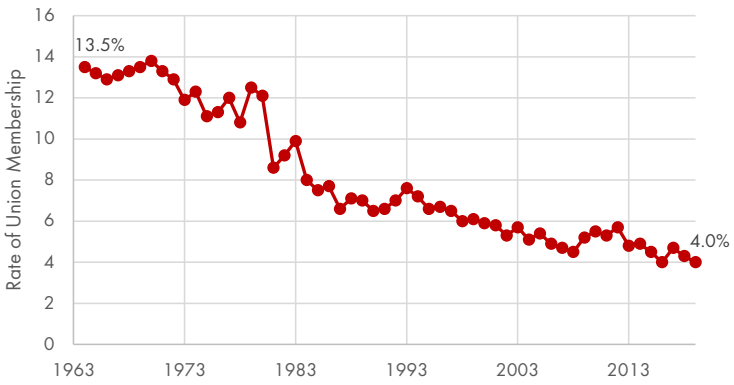
Agriculture in Texas may be especially vulnerable to climate change. Reduced water due to droughts can cause devastation to local farmers who lack adequate irrigation. During the drought years of the past decade, Matagorda County in Texas lost 20,000 acres of rice production.[23] The combination of droughts and other severe weather, such as extreme rainfall, may endanger agricultural yields across Texas. One study found that cropped acres in Texas could decline by 20% by 2090 and farm income could decrease by 30% to 45%.[24]

Texas also faces the ongoing threat of coastal flooding due to sea level rise. Over the last 100 years, the sea level along the Texas coastline has risen by 5 to 17 inches depending on the geography of the coast. This rise has accelerated twice as fast as the global average. By 2100, the sea level may increase by 1 to 4 feet, with possible increases of up to 8 feet under certain scenarios. Coastal flooding endangers vital roads, infrastructure, hospitals, power plants, hazardous waste disposal facilities, and water treatment services. In Texas, oil refineries and plants which supply water are especially threatened. By 2030, $21 billion of coastal property will be put at risk during high tides.[25] Already, sea level rise has eliminated $76.4 million in relative coastal property value from 2005 to 2017, with areas such as Galveston and Jamaica Beach experiencing the highest losses.[26]

Inequality in Texas

Over the past decades, the gap between workers and the wealthiest residents of Texas has grown dramatically. Texas ranks among the highest states in income inequality. The top twenty percent of households earn 8.6 times as much as the bottom twenty percent.[27] Wages in Texas for most workers have not kept up with growth. Median real wages in Texas grew by less than $2,000 from 2000 to 2018, an increase of only 5.3% over nineteen years. [28] A huge swath of workers in Texas labor in low-wage jobs. A 2016 report found that 5.3 million workers,

Unionization Rate in Texas from 1964 to 2019



or 47.5% of the workforce, earned less than $15 per hour.[29] Low wage work has also contributed to poverty. In 2019, 13.6% of Texas residents lived in poverty including 19.2% of children.[30] Many Texans have minimal savings, and 42.2% of Texans could not meet their basic needs for three months if they lost their job.[31] The decline of union membership has also fostered inequality within Texas. Unions raise wages through collective power and bargaining agreements. Their weakening across the United States has contributed to the economic decline of working people. In 1964, 13.5% of workers in Texas belonged to unions. This figure has decreased over the decades to 4% in 2018.[32]

Inequality in Texas also exists across race, ethnicity, and gender. Latina women in Texas earn 46 cents for every dollar a man makes, one of the largest gaps in the country.[33] In 2019, white workers earned an average salary of $52,496 as compared to $39,944 for black workers and $36,595 for Hispanic workers.[34] In addition, vast inequalities occur in transportation. Black workers in Texas spend 9% more time travelling to work, Asian workers spend 14% more time commuting, and Hispanic workers spend 6.4% more time travelling than white workers.[35] Inequalities in transportation place additional burdens on families of color, keep workers out of certain jobs, and reinforce housing segregation.

TEXAS AT A GLANCE

COVID-19, Inequality and Climate Change in Texas

8% **STATE UNEMPLOYMENT RATE**

in November 2020 and in areas dependent on oil and gas, like Starr County, unemployment was 18.5%

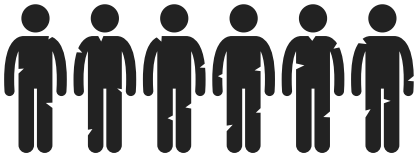
4.8%
of Texas workers are unionized

vs.

10.7%
of U.S. workers are unionized

The top 5% have gained wealth, and the bottom 20% have lost wealth over the last two decades.

THE TOP 1% EARNS 27x MORE



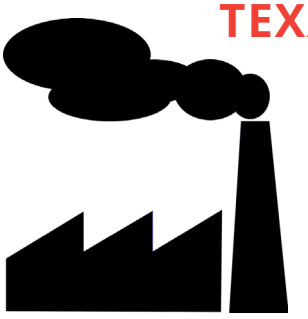
THAN THE BOTTOM 99%

17%
of Texans are
UNINSURED

This is the highest in the nation.

NO RECENT INCREASE IN MINIMUM WAGE

Low-paying jobs are not keeping up with the cost of living.

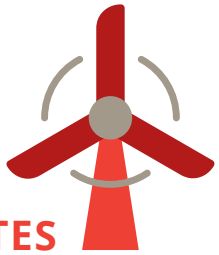


TEXAS EMITS THE MOST GHG EMISSIONS

...AND HAS THE MOST WIND POWER

Texas produces more than twice as many emissions as California

Only 4 countries have built more wind power than Texas



OF ANY STATE IN THE UNITED STATES

HOUSTON #2
DALLAS #4

MOST RACIALLY SEGREGATED PLACES IN THE COUNTRY

9%

of low-income and minority students graduate from college

Energy in Texas

Texas's energy sector relies on the production of fossil fuels. In 2018, Texas emitted 823 million metric tons of $C0_2$ ($MMTC0_2$) from fossil fuels.[36] This amounted to more emissions produced than the countries of the United Kingdom and Algeria combined, nations with almost four times the population and a 60% higher GDP. [37] Texas's largest production of fossil fuel emerges from the industrial sector that includes oil production and other petrochemical manufacturing. The industrial sector generates 42.4% of Texas's total emissions, followed by the transportation sector with 29.8%. One explanation for the large amount of transportation emissions emerges from the increase in vehicle and motor fuel usage. Since 1950, net motor fuel use has increased by 800% in Texas.[38]

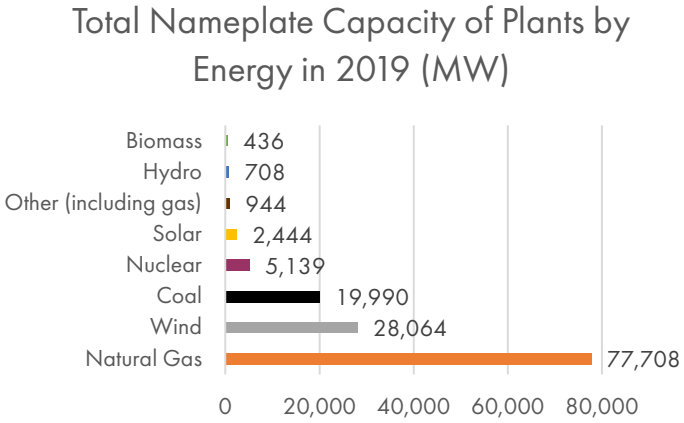
Sector	Total Emissions	Percentage of Total
Commercial	14.8	1.8%
Industrial	348.7	42.4%
Residential	13.4	1.6%
Transportation	245.3	29.8%
Electric Power	201.1	24.4%
Total	823.3	-

The electrical power sector has also contributed to 24.4% of total fossil fuel emissions in Texas. Texas's electricity mix demonstrates how the electrical sector relies heavily on fossil fuels. In 2018, natural gas generated 50.2% of electrical generation and coal generated 23.4% of electricity within the state. Wind, solar, and hydro only amounted to 16.9% of electrical generation. For buildings, the residential sector produced 1.6% of Texas's fossil fuel emissions and the commercial sector released 1.8% of emissions.

The fossil fuel industry in Texas also employs a large number of workers across the state. According to data from the U.S. Bureau of Labor Statistics (BLS), 450,000 workers labored in the fossil fuel industry in 2019.[39]

Texas consumes and produces a huge amount of fossil fuels that have dangerous impacts on the environment. At least 90.4% of energy consumed by Texans in 2018 came from fossil fuels.[40] Even with growing renewables in the state, the vast majority of Texans rely on fossil fuels for their energy. Texas's most notable impact on the environment emerges from its fossil fuel production. In 2018, Texas produced 10.4 million cubic feet of natural gas, 23.7 million short tons of coal, and 1.9 billion barrels of oil.[41] Assuming these resources had been consumed in homes and businesses, it would have produced 1.29 billion metric tons of $C0_2$. This is the equivalent of 25% of total emissions for the United States in 2019 or 3.9% of the world's total emissions.[42] Texas continues to rely on fossil fuels and contribute to the production of gases that cause climate change.

Texas has one of the largest electrical grids in the United States that relies chiefly on fossil fuels. The peak demand of the Texas Interconnection, which manages 90% of the load in Texas, was 75 GW in 2019.[43] According to the Energy Information Administration, 484 generating facilities resided in Texas in 2019. The total nameplate capacity of all generators was 135.4 GW. The difference between peak demand and installed capacity arises due to the infrequent operation of some plants and the difference in capacity factors among energy systems. Fossil fuels form the largest portion of the installed capacity in Texas. Total coal generators carry a nameplate capacity of 20 GW and total natural gas plants have a nameplate capacity of 77.7 GW. The state also operates 5 GW of nuclear and 440 MW of biomass, although biomass plants commonly produce carbon emissions.



Texas also has one of the largest renewable energy industries in the country. In 2019, Texas possessed 178 utility-scale wind farms with a nameplate capacity of 28 GW. This is the most amount of wind power of any state, and it grew to over 30 GW in 2020. Texas also operates 63 utility-scale solar facilities that produced 2.4 GW of solar energy and amassed a statewide total of 6.7 GW of solar energy, including distributed energy in December of 2020.[44] Both solar and wind in Texas have enormous potential for expansion. A study from the National Renewable Energy Laboratory (NREL) found that Texas has 20,565 GW of utility-scale solar potential and 1,902 GW of onshore wind potential energy.[45] Solar and wind power also compliment each other in Texas, as peak solar production occurs in the summer and peak production of wind occurs in the winter.[46] Texas also has the potential for 271 GW of offshore wind.[47]

With manufacturing of offshore wind components already occuring in the gulf, Texas could see major job creation in this sector, if pursued. The renewable energy industry employs a considerable number of workers in Texas. 209,000 workers labored in the renewable energy industry in 2019 in all occupations, including professional, construction, operations, and maintenance jobs.[48] Given the amount of energy that Texas consumes and its advanced production of solar and wind power, Texas could play a significant role in encouraging the development of a domestic solar and wind manufacturing supply chain. This would help protect the U.S.'s energy supply and create a large number of high-quality manufacturing and assembly jobs. Local and federal domestic content manufacturing requirements and incentives would help locate these facilities in Texas and throughout the U.S.

The Texas state government has taken minimal steps toward encouraging renewable energy. The state's Renewable Portfolio Standard (RPS) order in 2009 mandated 5,880 MW of renewable energy by 2015. The RPS also included a goal that 500 MW of renewable energy should be supplied from non-Wind energy and set a target of 10,000 MW of renewable energy by 2025. Texas has surpassed all of these orders and goals.[49] In addition, the state has sponsored some smaller renewable energy programs, such as the Loanstar Revolving Loan Program, that provides low-interest financing for public schools to retrofit buildings.[50]

Utility-Scale Solar

Recommendation: 20 GW of Solar by 2030, 40 GW by 2040

Install a total of 20 GW of utility-scale solar by 2030 and 40 GW of solar by 2040.

A mandate for the installation of utility-scale solar in Texas will fight climate change, improve air quality, and create high-quality energy jobs across the state. 40 GW of solar energy would produce nearly one-third of Texas's current nameplate capacity of electricity. Utility-scale solar is also one of the cheapest forms of energy with a lower levelized cost of energy than gas, coal, or nuclear electricity.[51] Texas has an abundant area for the deployment of utility-scale solar, with over 20,500 GW of potential generation.[52] Developing 40 GW of solar power also positions Texas and the U.S. to reclaim a portion of the solar manufacturing and assembly industry, which could provide many high-quality jobs beyond the construction, operations and maintenance of solar power.

Carbon Impact: The deployment of 40 GW solar energy generation will reduce carbon emissions in Texas by 41 million metric tons per year.[53]

Quality Job Creation and Economic Impact: The installation of 40 GW will produce significant job creation, including 35,412 direct jobs over 20 years during the development of the solar projects.[54]

Onshore Wind Energy

Recommendation: 70 GW of Wind by 2030, 100 GW by 2045

Install a total of 70 GW of wind capacity by 2030 and 100 GW by 2045.

Onshore wind is Texas's greatest potential energy resource. The state produced 28% of the total wind energy in the United States in 2019, and Texas's capacity could vastly expand.[55] Installing an additional 100 GW of wind by 2045 would generate economic and environmental benefits and create hundreds of thousands of jobs across the state.

Carbon Impact: Increasing capacity to 100 GW of wind energy would significantly reduce Texas's carbon dioxide emissions, avoiding approximately 113 million metric tons of CO_2 annually, the equivalent of taking 24 million cars off the road.[56]

Quality Job Creation and Economic Impact: Increasing the state's wind energy capacity to 100 GW would create approximately 455,000 direct jobs over 25 years. This expansion of renewable wind energy would cost approximately $96 billion over 25 years.[57]

Geothermal

Recommendation: 5 GW of Geothermal Energy by 2030[58]

Install a total of 5 GW of Geothermal Energy by 2030.

Texas is uniquely positioned to develop significant geothermal energy. Major cities like Austin, El Paso, San Antonio and Dallas are near major geothermal resources with temperatures of at least 122°F.[59] Geothermal is particularly promising in Texas because its extensive network of oil and gas wells provide a great opportunity to develop geothermal at abandoned well sites. Geothermal energy and ground-source heat pumps are a highly-efficient way to heat and cool buildings, especially schools and commercial buildings. An extensive network of underground pipes, filled with a heat-transferring fluid, uses the warm, constant temperature of the earth as a heat source during cold months and a heat sink during colder months. Texas has 384 GW of potential geothermal energy.[60]

The development of geothermal energy in Texas will create many high-quality construction jobs and additional economic benefits and provide a clean, renewable source of power that lowers greenhouse gas emissions and pollution.

Carbon Impact: Emissions could be reduced by over 8.4 million metric tons of $C0_2$ per year by installing 5 GW of geothermal as compared to natural gas.[61]

Economic Impact and High-Quality Job Creation: Installing 5 GW of geothermal energy will create 62,500 direct jobs over 10 years.[62]

Distributed Energy and Storage

Recommendation: Encourage Distributed Energy and Storage

Encourage Development of Distributed Energy Resources such as Solar and Energy Storage to Spur High-Quality Job Creation and Enhance the Resiliency of Texas's Energy System.

Distributed sources of electricity generation and storage are essential to building a renewables-based energy system in Texas that is resilient, reliable, affordable, and climate-friendly. In order to spur the development of distributed energy and storage, Texas can set a mandate, such as a Renewable Portfolio Standard (RPS), specifically for distributed sources of electricity and storage.

Distributed generation is power that is produced near where it will be consumed. It includes residential sources like solar rooftop and combined heat and power systems as well as commercial and industrial systems that use solar, small-scale wind and other sources in a microgrid electricity system. Because the power is consumed near where it's produced, very little energy is lost in transmission, making distributed systems highly efficient.

The development of distributed sources of power and storage will create jobs in installation and construction, including for electricians, engineers, scientists, technicians and mechanical support workers.

Upgrade Transmission

Recommendation: Upgrade Transmission for Renewable Energy

Improve Transmission Network to Accommodate 70 GW Increases in Solar and Wind Energy by 2035

In order to sustain new wind and solar investments, Texas will need to upgrade its grid and build new infastructure to meet the demands of the renewable energy industry. Electric Reliability Council of Texas (ERCOT) has already identified constraints on renewable energy in Far West Texas, the Panhandle, South Texas, and West Texas that will require further transmission upgrades. Texas must meet the growing renewable energy sector and the recommendations laid out in this report and the state requires improved energy systems. As a starting place, Texas must invest in upgrades and new infastructure to prepare for 95 GW of new renewable energy by 2035. This project will include improvements in lines, towers, substations, reactive compensation, and new facilities.[63] Winter storms in February of 2021 also demonstrated the need to focus on the resiliency of Texas's grid. More weatherization work may be needed to prepare for the future impacts of climate change.

Economic Impact and High Quality Job Creation: An investment to prepare for 70 GW of renewable energy by 2035 would cost $42 billion and create 44,300 direct jobs over the course of 15 years.[64]

Industry

The majority of Texas's greenhouse gas emissions come from the industrial sector – 42.4%. These emissions are largely produced by Texas's oil and gas industry, the largest in the nation. This important sector of Texas's economy employs over 450,000 Texans who work in oil and gas extraction, refining, petrochemical production and other manufacturing operations.

Tackling the climate crisis and reducing greenhouse gas emissions and pollution in Texas requires significantly reducing emissions in Texas's industrial sector. Indeed, reducing industrial emissions provides Texas with the opportunity to become an international leader in decarbonized industrial activity. It is a transition that all states and countries will need to make, and Texas could lead the way.

In the short-term, the state should do as much as possible to improve the efficiency of this sector, which will help to reduce greenhouse gas emissions and pollution. Much more can be done to minimize methane leakage and flaring, detect and repair other types of wasteful and harmful leaks, and utilize more efficient engines and cleaner fuels in existing production processes. Identifying and repairing these leaks is a good source of job creation as well. A 2020 study estimated that flaring from the oil and gas industry in the Permian Basin produced enough gas to power 7 million U.S. homes.[65] A combination of strong state mandates to reduce emissions from flaring and leakage, and the industrial sector overall, as well as federal and state subsidies to encourage the use of more efficient and cleaner processes would help reduce emissions from Texas's industrial sector and maintain the many jobs these industries provide in Texas.

Even with greater efficiency practices, more will need to be done to reduce emissions in Texas's industrial sector. Europe, in particular, is exploring how best to decarbonize important industrial processes that provide the building blocks for many parts of our economy, such as steel, concrete, and chemicals. For example, can these processes be powered by hydrogen, and are there alternative materials and techniques that can be used to produce concrete, steel and other products? Further examination of how to decarbonize these processes should look carefully at the jobs implications and how best to maintain the high-levels of employment that these industries currently provide.

In addition to improving the efficiency of Texas's industrial sector and exploring ways to decarbonize important industrial processes, most science-based emissions reduction scenarios rely on some levels of direct air capture or carbon capture and storage to reduce emissions to net-zero by 2045 or 2050. This is particularly relevant in Texas, where these technologies can help maintain these important industrial processes without continuing to release harmful carbon dioxide and other greenhouse gas emissions into the atmosphere. Given the size of Texas's industrial sector, Texas is an ideal place to develop and deploy these technologies, testing and improving the efficacy and financial feasibility of these projects. There are currently 15 direct air capture plants operating worldwide, and more large-scale demonstration projects are needed to refine the technology and reduce capture costs. The greater Houston area is already exploring the potential to create a zero-carbon industrial hub that would combine current and new industrial development with new net-zero technologies like hydrogen-cell transport, clean fuel ports, and carbon capture and storage.

Another major source of emissions and pollution in Texas is its large industrial ports. Both port workers and adjacent communities suffer from the significant pollution produced by ships and the many drayage vehicles that help transfer shipping containers from

ships to truck or rail. A concerted effort to decarbonize Texas's ports would help address climate change, clean up the air and water surrounding the ports, improve public health and show the rest of the world how Texas can have a thriving, clean industrial economy that provides many high-quality jobs. Some ports around the world are already exploring how to electrify ships and drayage vehicles or use other zero-emissions sources like hydrogen powered by renewables. Texas's Emissions Reduction Plan (TERP) funds as well as other incentives could help encourage this important transition.

With proper planning and investment in cutting-edge technologies, Texas could be on the forefront of reducing emissions from hard-to-decarbonize industrial processes in a way that creates new jobs and protects and supports the workers and communities currently working in this industry.

Direct Air Capture and Storage

Recommendation: Allow the Federal 45Q Tax Credit to be Used to Encourage Rapid Development and Deployment of Carbon Capture Utilization and Storage and Direct Air Capture Demonstration Projects for High-Carbon Industries

The State of Texas, as well as individual cities and counties, can help advance the development and deployment of carbon capture and storage projects for industrial purposes through expedited planning, permitting and funding, including through utilization of the 45Q tax credit.

An important step in encouraging the development and deployment of direct air capture projects is allowing companies to access the federal 45Q tax credit for saline storage projects. This tax credit provides a $50 per ton tax credit for carbon capture and saline storage. Saline storage, in comparison to geological storage in oil and gas fields through enhanced oil recovery, provides a greater net climate benefit because it does not require incremental oil production. Currently, there is a lack of clarity over state regulation of saline geologic storage including which agency in Texas oversees the permitting of these projects. Texas lawmakers can take action to resolve this uncertainty and encourage the development and deployment of direct air and saline storage projects. Any taxpayer incentives that are provided to enhance the development of carbon capture and storage should include enhanced monitoring for safety, security, and affordability.

Transportation

The largest source of carbon dioxide and greenhouse gas emissions in the U.S. is the transportation sector, accounting for 28% of emissions.[66] More than half of these emissions come from light-duty vehicles, including cars, SUVs and pick-up trucks.[67] The rest emerges from other types of transportation and transportation emissions - ships, commercial aircraft, freight trucks, pipelines and lubricants. Emissions from the transportation sector have also been increasing more quickly than any other sector, largely due to a growing demand for travel. Indeed, vehicle miles traveled (VMT) by light-duty vehicles (cars and light-duty trucks) increased by 46% from 1990 to 2018. [68] And in spite of the growing climate crisis, the average fuel economy among new vehicles in the U.S. declined from 1990 to 2004, largely because of increasing sales of light-duty trucks. However, the average fuel economy of new vehicles in the U.S. has been improving since 2005.[69]

In Texas, the transportation sector produced 245 million metric tons of CO_2 in 2017. [70] That's far more than any other U.S. state, including California, a state with 10 million more people than Texas. Texas's transportation emissions have been climbing rapidly, increasing 52% since 1990. [71] A recent study shows that cities in Texas such as Dallas and Houston produce the largest commuter climate impact in the nation because such a large share of commuters drive rather than walk, bike or take public transit to work.[72] Accordingly, Houston has some of the worst air pollution in the U.S., which increases residents' risk for respiratory, cardiovascular and other serious health issues.[73] Limited public transit options also mean that transit-dependent individuals and families, mostly low-income and communities of color, struggle to get to work and other essential places. In Houston, for example, nearly 40% of the population is transit-dependent. [74] An over-reliance on vehicles also means that Texas loses a significant number of residents to traffic deaths each year. On average, ten people die every day in Texas due to a motor vehicle accident – a total of 70,000 people have lost their lives in the last twenty years.[75]

To effectively address the climate crisis, Texas will need to significantly reduce its transportation emissions. Fortunately, reducing emissions from the transportation sector can also create good jobs, improve air quality, improve safety, and provide Texans with greater access to jobs and essential services.

There are three main ways to reduce transportation emissions: 1) dramatically improve the fuel and energy efficiency of vehicles, namely zero-emission vehicles (ZEVs); 2) electrify and massively improve and expand public transit, including buses, bus rapid transit and express bus service, trains and light-rail; and 3) reduce the demand for travel through pedestrian, bike and transit-friendly urban development.

In Texas, building a dense, high-quality, and affordable public transit network, including high-speed rail between Texas's major cities, will provide an attractive alternative to private vehicles. This shift will also create thousands of high-quality jobs in the construction, operations and maintenance of the public transit network as well as reduce greenhouse gas emissions, pollution, and traffic injuries and deaths. Indeed, investment in public transit creates more jobs per million of dollars invested than most all other economic sectors.[76]

Setting ambitious targets for converting Texas's vehicle fleet to electric, starting with the state and local government fleet, is the other major way that Texas will reduce its greenhouse gas emissions and address climate change. Although Texas does not currently possess the charging infrastructure to support a major shift to electric vehicles, this can change quickly, especially as most vehicle manufacturers make major announcements to convert their vehicle

line-up to electric. Texas is also a major center for auto manufacturing, which gives the state an important advantage to be a major site for electric vehicle manufacturing. Navistar, Tesla, Hyliion Holdings, Ayro and Volcan have all begun or announced plans to manufacture electric vehicles and electric vehicle parts in central Texas.[77] Because taxpayer dollars often support the development of electric vehicle manufacturing facilities in Texas, it is important to ensure these funds support high-quality job creation, particularly in disadvantaged communities. Texas can link its public investment in electric vehicle manufacturing facilities to requirements around domestic content manufacturing and assembly, ensuring employers respect labor law and workers' right to organize and collectively bargain, and providing a pipeline from local, disadvantaged communities to state-certified training programs and high-quality manufacturing careers The construction of a border to border, dense and effective electric vehicle charging infrastructure in Texas can create many high-quality jobs, too, particularly for utility line workers who will install the transmission lines to support chargers and for electricians who will install and maintain the charging stations.

Vastly improving Texas's transportation system is important to reducing greenhouse gas emissions and pollution, and it is a major economic development opportunity for the state. Ambitious and strategic investments in electric vehicle manufacturing, electric vehicle charging infrastructure, and a 21st century public transit system have great potential to put Texas on the forefront of reducing greenhouse gases and pollution, improving public health and safety, creating thousands of high-quality jobs, and providing better access to jobs for disadvantaged communities. Texas can tackle the intersecting crises of COVID-19, climate change, and inequality through effective policies that maximize high-quality job creation and economic development. The transportation sector produces other added benefits, such as improving air quality, safety, and job access, that will significantly improve the lives of working families in Texas.

State Fleet Electrification

Recommendation: Electrify State and Local Vehicle Fleets by 2040

Transition 100% of Texas's non-emergency, light-duty state and local vehicle fleet to electric by 2030 and the entire fleet to electric by 2040.

Converting Texas's state and local vehicle fleet to electric will significantly reduce greenhouse gas emissions and pollution, save money for residents, and create many high-quality jobs.

Carbon Impact: Texas has 30,296 vehicles in its state and local vehicle fleet that travel about 358 million miles per year, consuming almost 21 million gallons of fuel. Fueling and maintaining this fleet costs the state $106 million a year. If Texas converts the non-emergency, light-duty segment of its fleet (about 17,598 vehicles) to 100% electric by 2030, the state will save taxpayers $314 million and reduce yearly CO_2 emissions by 91,262 metric tons in 2030. If it electrifies the entire fleet, it will reduce carbon emissions by 157,000 metric tons per year.[78]

Quality Job Creation and Economic Impact: To support the conversion to electric vehicles, Texas will need to install approximately 8,799 charging stations, which can create 1,307 jobs in construction and electrical line upgrades and new installations.[79] In-state manufacturing of these EVs can create 3,401 direct, indirect and induced jobs.[80]

Electric Vehicle Supply Chain Opportunity

GASOLINE VEHICLE KEY COMPONENTS	ELECTRIC VEHICLE KEY COMPONENTS
Electronic Control Module	Electric Traction Motor
Internal Combustion Engine	Power Electronics Controller
Fuel Injection System	Traction Battery Pack
Battery	Battery
Complex Transmission	Simplified Transmission
Fuel Line	Thermal Cooling System
Exhaust System	DC/DC Converter
Fuel Tank and Pump	Onboard Charger
Vehicle Frame	Vehicle Frame

OPPORTUNITY TO LOCALIZE THE SUPPLY CHAIN FOR ELECTRIC VEHICLES THROUGH:

DOMESTIC MATERIAL ACQUISITION

MANUFACTURING

ASSEMBLY

WITH EXISTING EV MANUFACTURING AND ASSEMBLY OCCURRING IN CENTRAL TEXAS

High-Speed Rail

Recommendation: Construct a High-Speed Rail Network

Construct an efficient, climate-friendly high-speed rail network between Texas' five largest cities.

Almost a third of Texas's global greenhouse gas emissions and pollution arise from the transportation sector. Building a high-speed rail (HSR) network between Texas's five largest cities (Dallas-Fort Worth, Austin, Houston, San Antonio and El Paso) can create many good jobs, reduce congestion, emissions and pollution, and provide a clean, fast and safe transportation option for Texas's residents.

Carbon Impact: HSR is the most efficient and lowest carbon emitting mode of transportation. It reduces pollution, congestion and greenhouse gas emissions, especially if powered by renewable energy. HSR is particularly effective at replacing short-haul flights (trips under 500 miles), as the technology is faster and much more climate-friendly than short air travel. High-speed rail produces one-twelfth the CO_2 emissions per seat as an airline flight. An HSR network will save 639,000 CO_2 emissions per year in Texas. [81]

Quality Job Creation and Economic Impact: Planning is already underway for Texas's $15 billion, 205 mph bullet train from Houston to Dallas, reducing the travel time between these two cities to 90 minutes.[82] Building an HSR network between the five largest cities in Texas can create 115,00 direct construction jobs and hundreds of permanent operations and maintenance jobs.[83]

School Bus Electrification

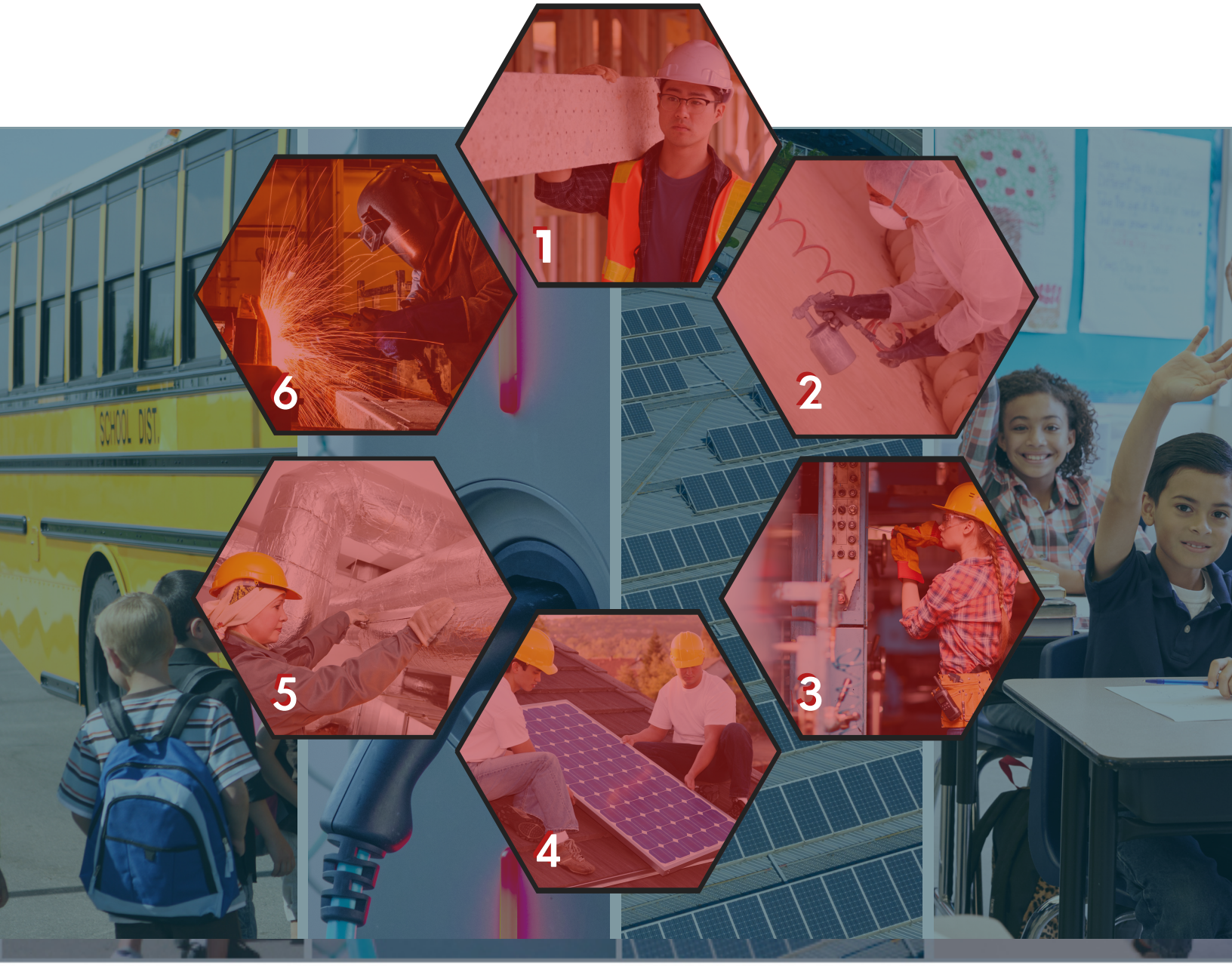
Recommendation: Electrify the School Bus Fleet of Texas by 2040

Replace 50% of the current school bus fleet with electric school buses by 2030 and 100% of the current fleet by 2040

In total, Texas has nearly 50,000 school buses that are instrumental for ensuring a good education for the state's future.[84] However, school buses produce a huge amount of greenhouse gases that contribute to climate change, especially when idling.[85] School buses also emit air pollutants that can be harmful to the health of children.[86] Replacing 50% of the current fleet with electrical vehicles by 2030 and 100% of the current fleet by 2040 would fight climate change. Manufacturing electrical vehicles could create high-quality jobs in the state that provide employment for working families. Additional jobs would be created if EV charging station were installed at every school.

Carbon Impact: Replacing 100% of the fleet's buses with electric buses would reduce annual emissions by over 1 million metric tons of $C0_2$ per year.[87]

Quality Job Creation and Economic Impact: If all electric buses are manufactured in Texas, replacing 100% of the fleet's buses could create 8,300 direct jobs. If five EV chargers are installed at all 8,900 schools, it could create 6,600 direct jobs across the state.[88]



Carbon-Free Schools

Electrifying and transitioning schools and school transportation systems to be carbon-free will create safer and more efficient spaces for our children while creating good jobs for our communities including:

(1) Construction Laborers and Managers, Operating Engineers (2) Painters (3) Electricians, Electrical Power Line Installers and Repairers (4) Roofers (5) Insulation Workers, HVAC installers (6) Welders, Glaziers, and Structural Iron and Steel Workers

Carbon-Free Schools

Recommendation: Retrofit and Install Solar with Storage on Public Schools by 2035

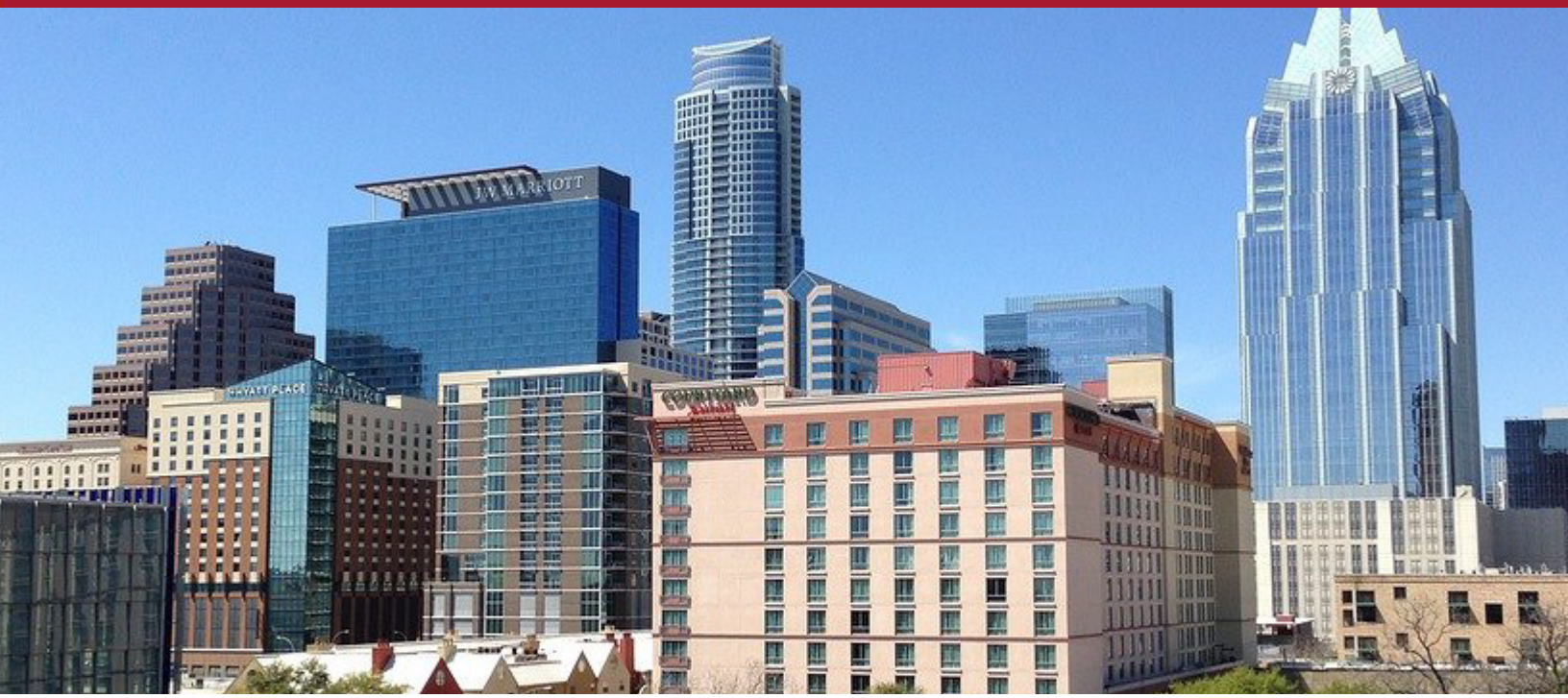
Retrofit and install solar panels systems with storage on all Texas public K-12 schools by 2035.

This initiative will provide renewable energy to all of Texas's public schools, lower carbon emissions and energy waste, and improve air quality. Retrofitting schools and installing solar systems with storage will reduce energy costs and save taxpayers money. These measures will also create high-quality jobs across the state of Texas.

Carbon Impact: Retrofitting all 8,900 public schools in Texas would save schools in Texas 171 million KWh of electricity annually and save 6 million metric tons of $C0_2$. A 100KW solar system generating energy on all public schools will reduce $C0_2$ emissions in Texas by 673,000 metric tons per year.[89]

Quality Job Creation and Economic Impact: Retrofitting all public schools in Texas will cost $13.3 billion and create 84,000 direct jobs. Installing a solar system on every K-12 public school in Texas will cost $1.6 billion and create 9,000 direct jobs.[90]

Buildings



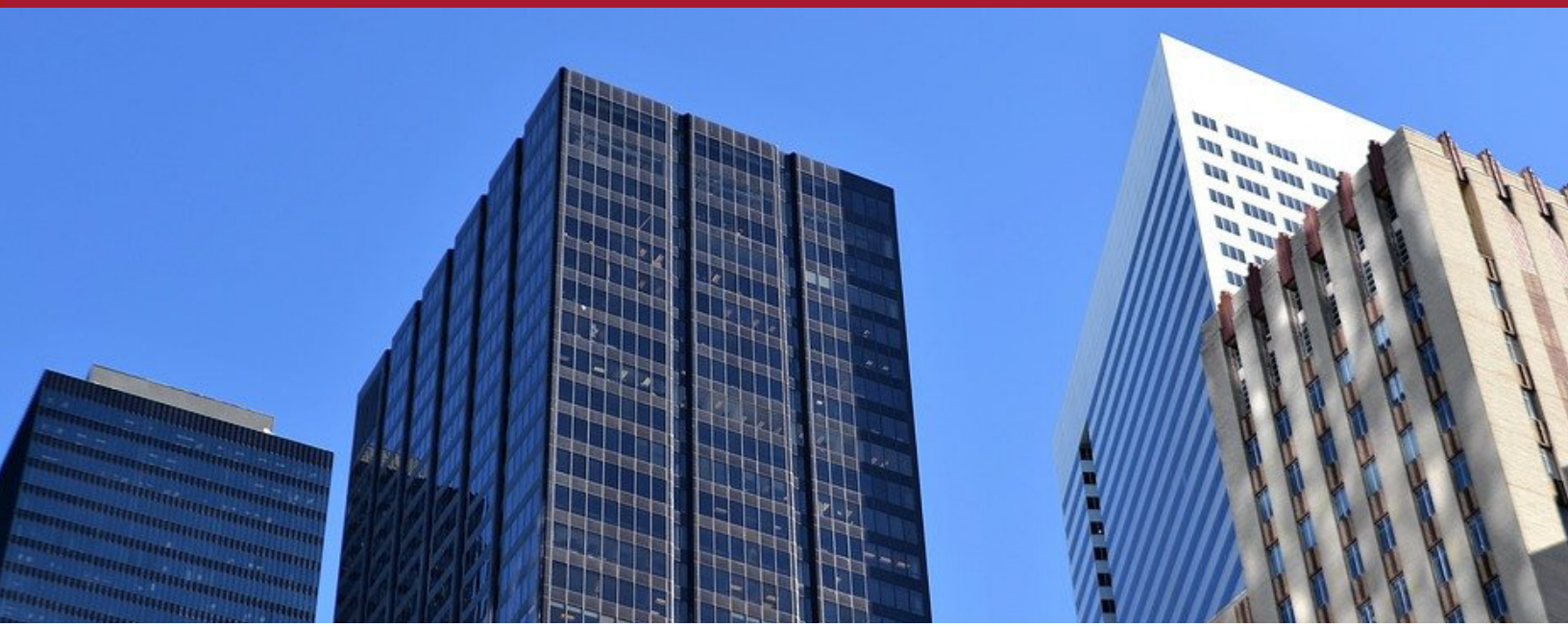
Buildings present an incredible opportunity for greenhouse gas emissions reductions and job creation. Worldwide, buildings account for approximately 40% of the world's energy use, and simple fixes, such as tuning existing heating and cooling systems or mechanical insulation, would generally improve building energy efficiency by at least 20%.[91] A deep building retrofit that analyzes the whole building and adopts more substantial system changes, such as replacing heating and cooling systems, could reduce energy use by up to 50%.[92]

Commercial and residential buildings are responsible for nearly 28 million tons of carbon dioxide emissions every year. Leaky windows, poor HVAC, and inadequate insulation results in millions of KW of lost energy. Older buildings are less efficient, and without proper retrofitting, significant amounts of electricity is wasted. In the summer, half of Texas's electricity load can go just to cooling buildings, and the same is true for the winter due to electric heating requirements. As a result, to shift away from peak demand, which requires the use of expensive and polluting power plants designed specifically to meet peak electricity demand, energy use must be reduced. These conditions point to a tremendous need for large-scale building retrofits in the state. In fact, Texas has the most energy efficiency potential of any state.[93]

Making buildings more energy efficienct enjoys bi-partisan support. Governor Rick Perry signed an omnibus energy efficiency bill in 2007, HB 3693. The goals of the bill were modest, such as reducing electricity consumption by 5% for six consecutive years, but it shows that building retrofits and increasing energy efficiency are not just important for stopping the worst impacts of climate change. These measures are also politically popular.[94] Energy efficiency measures can be implemented through policy and through regulatory measures, such as upgrading building codes for existing and new buildings.

Texas has taken steps to make its buildings more efficient and reduce electricity use. More ambitious, bold measures will substantially reduce greenhouse gas emissions, create good, high-quality jobs, and energy cost savings.

Energy Efficient Buildings



Recommendation: Reduce Energy Use and Build Towards Net-Zero Construction

Reduce energy use in all existing buildings by 30% by 2035 and by 40% by 2045 and mandate net-zero emissions for new construction by 2050.

Texas has the most energy efficiency potential of any state. A recent report written for the Department of Energy found that Texas could reduce its electricity use by nearly 20% in residential, commercial, and industrial sectors by 2035 with existing technology. A lack of policy drivers hinders the state's energy efficiency initiatives and blocks substantial energy savings.

Net-zero construction is the trend in the buildings sector, and updates to building codes to reflect these changes would be a more streamlined, efficient way to integrate net zero measures into new construction.

Carbon Impact: Reducing energy use by 40% would result in the elimination of 11 million metric tons of CO_2 annually.[95]

Quality Job Creation and Economic Impact: The potential for job creation in energy efficiency is tremendous given the building square footage in the state. Retrofitting public universities in Texas, for example, would cover 39 million square feet, cost $818 million, and create 5,400 jobs.[96]

Equitable Broadband for All

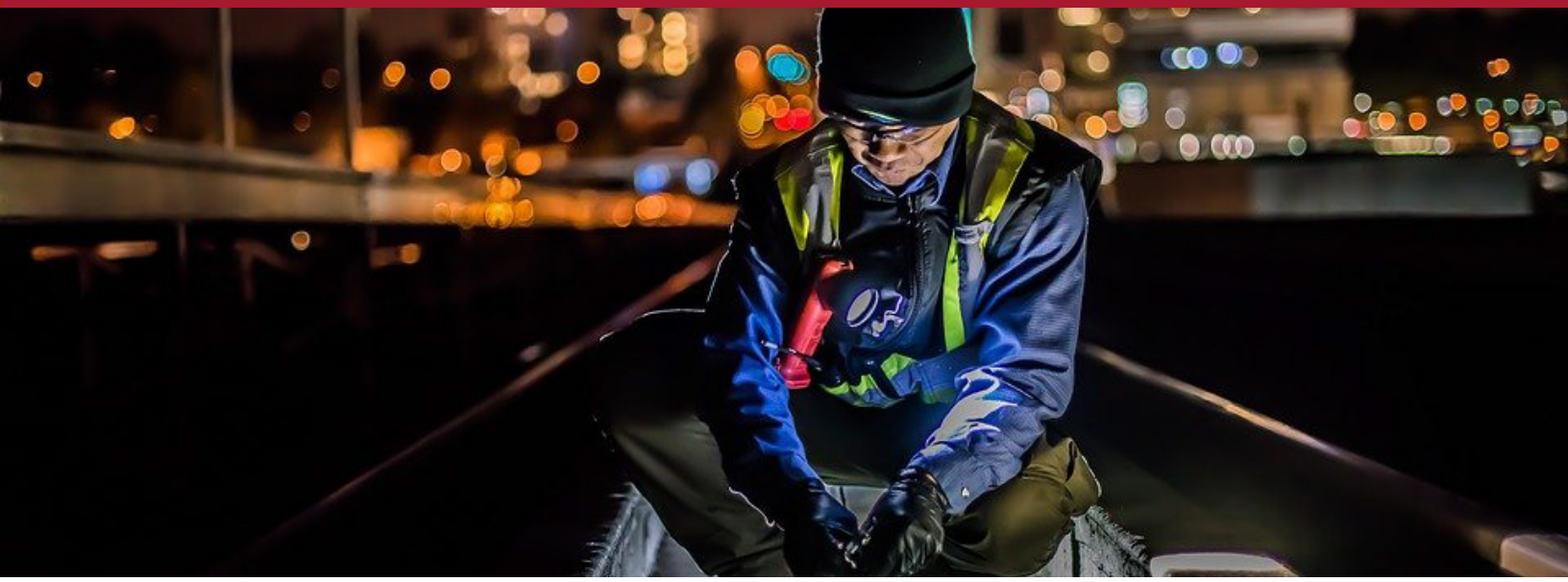
Recommendation: Install high-quality broadband access to all homes and regions of Texas by 2035.

As Texas transitions to a clean energy economy, universal and affordable broadband will allow all residents access to education, information, and jobs needed for an equitable and diversified economy. Huge swaths of Texas, especially rural areas and low-income urban areas, lack adequate access to broadband or have poor connections. According to a 2020 report from the Governor's Broadband Development Council, approximately 926,859 residents have no access to broadband in their homes.[97] The vast majority (823,920) of these residents live in rural Texas. Meanwhile, urban residents in low-income neighborhoods often face a monopoly cable provider that can charge high rates, or a second choice of slow DSL from a telecommunications provider that has failed to upgrade their service infrastructure.[98] Fiber infrastructure for broadband is needed as current wireless or mobile technology is not sufficient to provide adequate home internet service.[99] Renewable energy systems, building monitoring, precision agriculture and conservation, healthcare systems, and transportation infrastructure all rely on stable internet connections.[100] In addition, lack of broadband service also exposes the stark inequalities that exist in Texas, as Black and Latino residents have less access to broadband than white residents.[101]

Texas should embrace universal broadband as a key part of undertaking an equitable transition to a clean energy economy. Expanding broadband access will also create jobs for highly-skilled workers across the state in construction, maintenance, and support of broadband infrastructure. To ensure these are high-quality, family and community-sustaining jobs, Texas's broadband funding programs should prioritize high-road employers that utilize a workforce that meets high standards of safety training, relevant certification and licensure, existing Texas-based workforce, and targeted hire programs that prioritize local, traditionally marginalized communities.

Economic Impact and High-Quality Job Creation: Providing broadband access to all Texans would cost $8.3 billion and create 12,444 direct jobs across the state.[102]

Ensuring Climate Jobs are High-Quality, Union Jobs



Creating High-Quality, Union Jobs in Texas

Addressing the climate crisis and reducing greenhouse gas emissions and pollution provides an important opportunity for Texas to address its crisis of inequality by creating high-quality, family and community sustaining careers in new clean energy industries. This report lays out a series of "climate jobs" recommendations that can maximize emissions reduction and job creation in the building, energy and transport sectors. To further strengthen the positive impact of these recommendations, the state of Texas can use a number of mechanisms to ensure that new jobs in the clean energy sector are high-quality jobs with good wages and benefits, including the following:

- Adopt Davis-Bacon Requirements: Federal funds will flow to U.S. states under the Biden Administration. Texas needs to be as ready as possible to accept those dollars and meet federal expectations.

- Attach more stringent labor standards to federal programs and funds to help Texas implement better labor standards.

- Adopt strict Department of Labor apprenticeship and craft training requirements and Community Workforce Agreements: Unions and management have the best certified training programs. These requirements give unions an advantage.

- Ensure federal and state prevailing wage laws are complied with when public funds are used, and explore potential to set higher local and county-level prevailing wages or living wages for workers living in poverty.

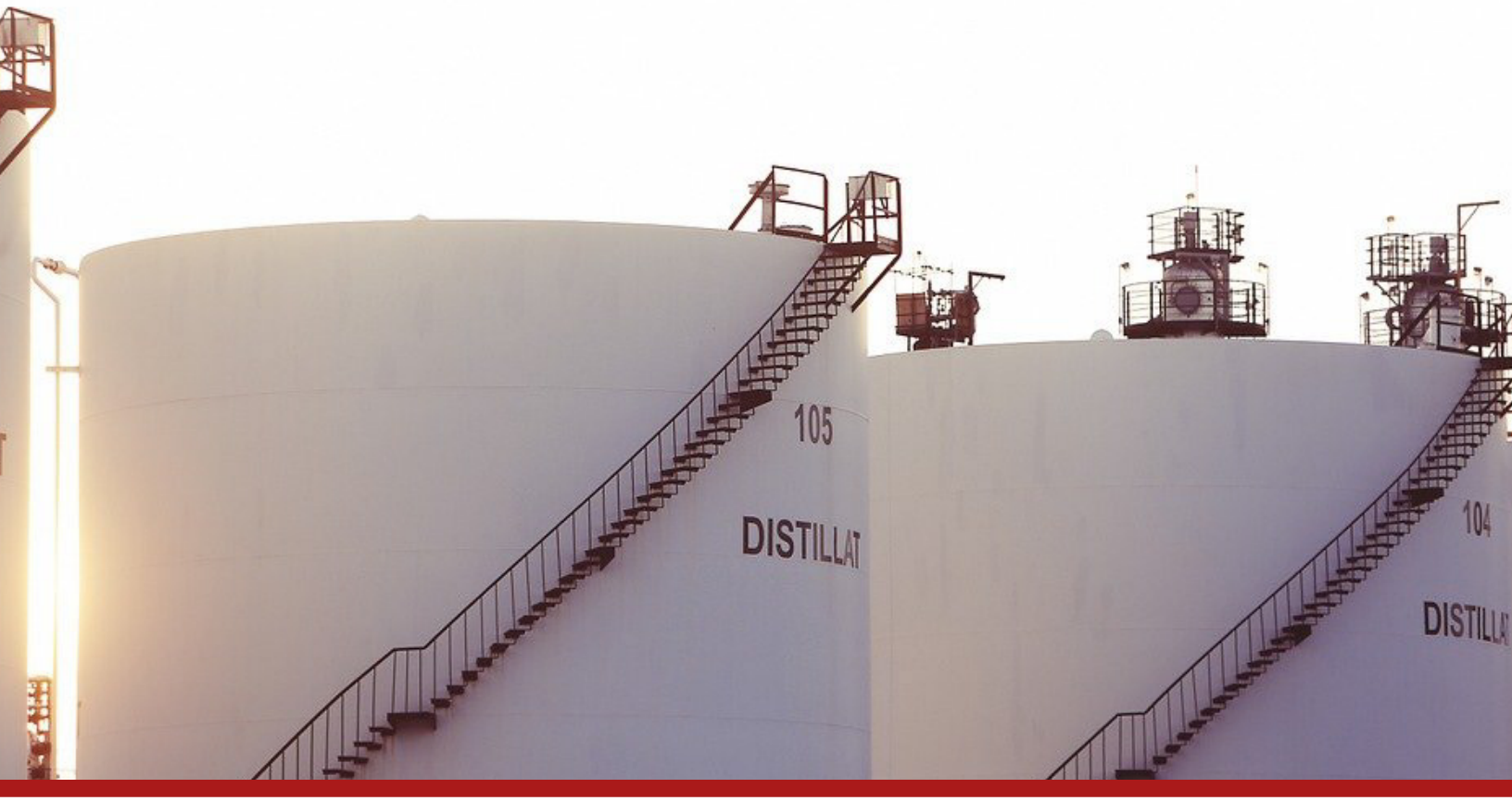
- Develop and implement unique industry standards that labor-management partnerships can quickly and easily meet. For example, there is currently no national standard or certification for electric vehicle charging station installation and maintenance. Unions could develop and provide this. Houston has mandated that trained operators have to run 70% of non-residential buildings by 2030, a regulation which could be implemented across the state.[103]

Just Transition

While necessary to stop the worst impacts of climate change, decreasing fossil fuel use will have an impact on workers and communities across the state. The oil and gas industry has a long history in Texas and fossil fuels are tied to the state's identity. This history must be acknowledged and the contribution of oil and gas workers to the state's economy, and to the nation's economic growth, must be honored. Most importantly, the burden of any energy transition should not be borne by workers and communities.

Understanding and addressing the negative economic impacts from transitioning away from fossil fuels is often referred to as "just transition." The idea emerged from the late labor leader, Tony Mazzocchi, who argued that some industries were too dangerous for society, and the workers in those industries should be supported as they transition away from the industrial activity. As a term, just transition can be contentious and used as an indicator of imminent job loss. This concern is understandable, as every previous transition, such as deindustrialization, left workers and communities largely unsupported.

There is no reason an economic transition must be unjust. Workers can, and must, be supported through wage and benefits support, opportunities to retrain, and whatever other supports are needed to thrive. Moreover, there must be something for workers to transition into. Training programs must lead to jobs that pay family sustaining wages, provide benefits, and a career pathway. Communities must have support to mitigate the loss of oil and gas revenue and investment in new industries and ensure that public services continue to be fully funded throughout the transition period and beyond. We can learn from previous industrial transitions and stop the pattern of unjust transitions.



Just Transition

Recommendation: Plan and Fund a Just Transition

Create a multi-stakeholder Just Transition Commission and Evaluate Previous Plant Closures

Texas's transition to a low-carbon economy will have significant labor, employment and economic impacts that need to be carefully examined and taken into consideration as Texas strives to meet its climate protection and renewable energy goals. This transition should not come on the backs of the thousands of workers and communities that have powered Texas's economy for decades.

To provide support for workers and communities as fossil fuel activities and internal combustion engine manufacturing decline, a multi-stakeholder Just Transition Commission should be established to understand the scope of transition, supports needed, and potential new industries. These efforts must have meaningful labor, environmental justice, and community representation. The Commission could take the form of the Just Transition Task Force created in New York State or the Office of Just Transition created in Colorado. The Commission should be fully-resourced and hold public meetings across the state to hear from impacted workers and communities.

As part of its charge, the Commission should analyze the socio-economic impacts of previous plant closures to understand what happened to the workers at the plants, whether displaced workers were re-employed, and whether communities were able to replace lost revenue. By implemented these Climate Jobs and Just Transition recommendations, Texas will proactively grow its clean energy economy, create many high-quality jobs, address climate change, and clean up its air and water. Without this action, Texas will no longer be an international leader in the energy sector. Instead, Texas's economy and future will be at significant risk from climate change, pollution and job loss. Now is the time to make a pivotal shift to address climate change, reduce greenhouse gas emissions and make Texas an international leader in the clean energy economy with high-quality jobs that will define a generation's livelihoods.

Advancing a Climate Jobs Agenda in Texas Cities and Counties

In addressing climate recommendations for cities and counties, this section will focus on the cities of Houston, Dallas, and San Antonio. These cities were chosen as examples of areas where policies that address climate change and create high-quality jobs could be advanced at the local level. However, many of the recommendations and ideas in this section could be applied to any local area in Texas. These policies include net-zero emissions for new construction, reducing energy usage in buildings, setting goals for overall carbon reductions, acquiring specific amounts of solar and wind energy, utilziing clean energy for municipal governments, converting buses and government vehicles to electric, and reducing vehicle miles travelled. Recommendations for ensuring that jobs are high-quality should also be applied across the state.

Creating High-Quality, Community-Sustaining Jobs

- Spur local manufacturing of electric school buses, transit buses, and vehicles through a Buy Texas program that requires local manufacturing and high-quality job creation.

- Build the electric vehicle charging infrastructure with highly-trained, skilled workers from local and targeted populations through Community Workforce Agreements and the utilization of certified apprentices.

- As municipally-owned power entities, such as Austin Energy and CPS Energy, transition from fossil fuel to renewable power generation, workers at the existing power generators should have first opportunity to work at new renewable energy facilities. Taxpayers' investment in these new clean energy generating facilities should also create high-quality, family and community sustaining jobs through prevailing wage, Project Labor and Community Workforce agreements, as well as labor neutrality and peace on non-construction, permanent jobs.

Houston

Houston[104]

In April 2020, the City of Houston released an ambitious Climate Action Plan to reach carbon neutrality by 2050. These recommendations build on this plan by expediting Houston's emissions reductions while ensuring these efforts result in high-quality job creation and greater equity for all Houston residents.

Buildings

- Enact a net zero-emissions standard for new construction. Beyond codifying green building codes, this measure will ensure new buildings are built with the latest technology and do not contribute to carbon emissions.
- Set a goal of 25% reduction in energy usage in Houston's buildings by 2050.

Transportation

- Convert 100% of Houston's school bus, municipal vehicle and public transit fleet to zero-emissions electric by 2030. Houston has already set a goal that 30% of new car sales be electric by 2030.
- Reduce Vehicle Miles Traveled (VMT) 30% by 2030 by aggressively implementing Houston's $7.5 billion METRONext plan and other improvements and expansions to public transit, walking and biking lanes, and affordability for targeted populations.

Energy

- Set a mandate of 100% net-zero carbon emissions 2040. Houston is working towards aligning with the IPCC and achieving 100% net-zero carbon emissions by 2050. It could accelerate this timeline to reduce the impacts of climate change on city residents.
- Continue to set specific targets for increasing wind and solar capacity. Houston already has a goal of 5 million MWh local solar per year by 2050, and could expand or hasten the adoption of renewable energy.

Dallas

Dallas[105]

Buildings

- Ensure buildings are operated by trained building operators. This will align with Dallas's goal of establishing a building efficiency and electrification program, while working with the building trades to provide high-quality upgrades.

Transportation

- Converting 100% of Dallas's school bus, municipal vehicle, and public transit bus fleet to electric by 2030 will drive significant emissions and pollution reduction and job creation in construction, utilities and manufacturing. Dallas's municipal vehicle fleet is currently composed of 4% efficient vehicles; Everman Independent School District recently purchased three zero-emissions electric school buses; and approximately 7 out of 700 of Dallas's DART buses are electric.

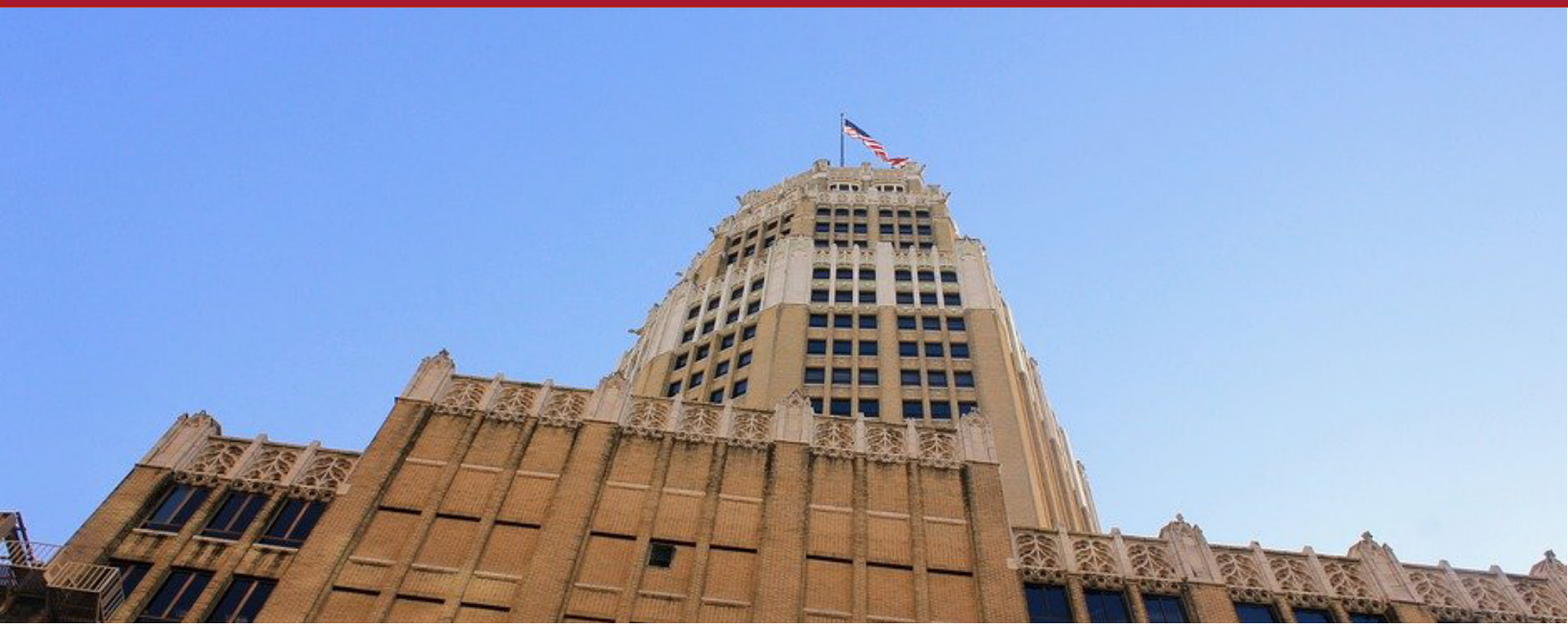
- Reduce Vehicle Miles Traveled (VMT) by 30% by 2030 by aggressively expanding Dallas's light rail and bus routes, increasing frequency and reliability of service, and deepening affordability for targeted populations.

Energy

- Set a mandate of 100% net-zero carbon emissions by 2040. Dallas is already working to achieve 100% net-zero carbon emissions by 2050 as outlined by the Intergovernmental Panel on Climate Change (IPCC), but could speed up the timeline to reduce the impacts of climate change by adding additional bus routes, increasing frequency and reliability of service, and deepening affordability for targeted populations.

- Continue to set specific targets for increasing wind and solar capacity. Dallas has already set a goal of 3.6 million MWh of solar by 2050 and could expand on this timeline more quickly.

San Antonio



San Antonio[106]

Buildings

- Move forward with net zero standard for new construction by 2030 to align with other cities. San Antonio has a target of net zero through the building code by 2040.

- Reduce energy usage in all buildings in the city by 25% in 2050.

Transportation

- Convert 100% of the San Antonio's school bus, municipal vehicle, and public transit bus fleet to electric by 2030. San Antonio has already received federal funding and Volkswagen settlement money to purchase zero-emissions electric buses and committed to add 25 electric vehicles to its municipal fleet by 2021.

- Building on Advanced Transportation District Proposition A, prioritize significant improvements and expansions to San Antonio's public transit system, including expanding routes, especially with rapid transit services, more frequent and reliable service, and greater affordability for target populations.

Energy

- Set a mandate of 100% net-zero carbon emissions by 2040. San Antonio is already working to achieve 100% carbon neutrality by 2050 and could accelerate this timeline to reduce the impact of climate change on city residents.

- Set specific targets for solar and wind energy for the city of San Antonio. The city could acquire an additional 15 million MWh of solar or wind energy by 2030.

- Acquire 100% renewable energy for municipal energy by 2026.

Climate Policy Local Implementation Potential

LOCATION	BUILDING RETROFITS	GRID UPDATES	HIGH-SPEED RAIL	WIND	SOLAR	ELECTRIC VEHICLES	ELECTRIC BUSES
AUSTIN	✓		✓		✓	✓	✓
DALLAS	✓		✓		✓	✓	✓
EL PASO	✓		✓		✓	✓	✓
HOUSTON	✓		✓		✓	✓	✓
SAN ANTONIO	✓		✓		✓	✓	✓
NORTH TEXAS	✓	✓	✓		✓*	✓**	✓
SOUTH TEXAS	✓	✓	✓		✓*	✓**	✓
WEST TEXAS	✓	✓	✓	✓*	✓*	✓**	✓

*UTILITY-SCALE **EV MANUFACTURING

Total Job Creation

Recommendation	Years for Job Creation	Direct Jobs	Indirect Jobs[107]	Induced Jobs
Retrofit K-12 Schools	20 Years	83,854	54,572	55,903
Solar on K-12 Schools	25 Years	8,874	6,615	6,131
Retrofit Public Universities	20 Years	5,432	3,535	3,622
40 GW of Solar Installed	20 Years	335,412	250,034	231,739
100 GW of Wind Installed	25 Years	454,678	425,656	348,264
5 GW of Geothermal Installed	10 Years	62,500	53,750	46,250
High Speed Rail	25 Years	116,005	84,756	75,603
8,799 EV Charging Stations	15 Years	1,307	1,479	2,133
EV Manufacturing	15 Years	398	1,160	1,843
Transmission	15 Years	44,297	176,772	73,133
EV Bus Chargers	20 Years	8,309	24,184	38,446
EV Bus Manufacturing	20 Years	6,565	7,429	10,712
Rural and Complex Broadband	15 Years	12,444	35,410	20,127
Total	**-**	**1,140,186**	**1,125,434**	**913,981**

Job Types

Industry	Recommendations	Common Occupation Classifications
Solar Energy	Install 40 GW of Utility-Scale Solar Energy; Install a 100kW Solar System on all K-12 Public Schools	Construction laborers, Operating Engineers, Construction Managers, Welders, Glaziers, Structural Iron and Steel Workers, Electricians, Electrical and Electronics Repairers, Power Plant Operators, Roofers, Coating and Painting Machine Setters, Computer-Controlled Machine Tool Operators, Electrical and Electronic Equipment Assemblers, Scientists, and Engineers.[108]
Wind Energy	Install 100 GW of Onshore Wind Energy	Construction Laborers, Operating Engineers, Crane and Tower Operators, Electricians, Machinists, Team Assemblers, Welders, Engineers, Scientists, Computer-Controlled Machine Tool Operators, Industrial Production Managers.[109]
EV Charging	Install 8,799 EV Chargers	Urban and Regional Planners, Electrical Power-Line Installers and Repairers, and Electricians.[110]
EV Manufacturing	In-state EV Manufacturing	Electrical and Electronic Equipment Assemblers, Engine and Machine Assemblers, Team Assemblers, Computer-Controlled Machine Tool Operators, Machinists, Industrial Production Managers, Scientists, Engineers, Drafters, and Industrial Designers. [111]
High-Speed Rail	High-Speed Rail Between Five Texas Cities	Construction Laborers, Operating Engineers, Construction Carpenters, Cement Masons, Rail Car Repairers, Iron and Steel Workers, Cleaners of Vehicles and Equipment, Railroad Conductors and Yardmasters, Mining Machine Operators, Crane and Tower Operators, Engineering Managers, and Electricians.[112]
Building Retrofits	Retrofit all K-12 Public Schools; Retrofit All Public Universities	Construction Laborers, Construction Managers, Operating Engineers, Electricians, HVAC Installers, Plumbers and Pipefitters, Insulation Workers, Painters, Roofers, Glaziers, Architects, and Engineers.[113]
Transmission	Upgrade Transmission for Renewable Energy	Electrical Power-Line Installers and Repairers, Power Plant Operators, Other Installation and Repair, Electrical and Electronics Engineers, and Electrical and Electronic Equipment Mechanics and Repairers.[114]

Total Annual Emissions Reduction

Recommendation	Potential emissions reduction in metric tons of CO_2 or CO_2e[115]	Number of equivalent passenger vehicles driven in one year[116]	Number of equivalent homes' energy use for one year
Install 100MW of Onshore Wind Energy	112,988,385	24,410,414	13,038,124
Install 40 MW of Solary Energy	41,011,881	8,860,353	4,732,504
Install 5 GW of Geothermal Energy	8,461,284	1,840,159	1,018,935
Solar on Schools	672,598	145,310	77,613
Retrofit K-12 Schools	6,384,571	1,379,346	736,738
Retrofit Public Universiites	392,407	84,777	45,281
Reduce Energy Usage in Buildings by 40%	11,280,000	2,436,971	1,301,639
Electrify State and Local Fleet	157,113	33,943	18,130
High Speed Rail	638,728	137,993	73,705
EV Buses	1,107,626	239,295	127,813

Endnotes

Endnotes

1 Griffith et. al. "Mobilizing For a Zero Carbon America: Jobs, Jobs, Jobs, and More Jobs A Jobs and Employment Study Report. "Rewire America. July 29, 2020. https://static1.squarespace.com/static/5e540e7fb9d1816038da0314/t/5f209173294b6f5ee41ea278/1595969952405/Jobs_White_Paper_Compressed_Release.pdf

2 NASEO & EFI. "United States Energy and Employment Report." 2020. https://www.usenergyjobs.org/

3 See Energy section and footnotes for further details.

4 Texas Workforce Committee. "Unemployment Rate, 8.1 Percent in November." February, 2021. www.twc.texas.gov/news/unemployment-rate-81-percent-november.

5 Ferman, Mitchell. "In Texas, $300 in Extra Unemployment Payments Won't Go to Many." Texas Tribune, 26 Aug. 2020, www.texastribune.org/2020/08/24/300-unemployment-texas.

6 Center on Budget and Policy Priorities. "Tracking the COVID-19 Recession's Effects on Food, Housing, and Employment Hardships" January, 2021. www.cbpp.org/research/poverty-and-inequality/tracking-the-COVID-19-recessions-effects-on-food-housing-and.

7 McNichol, Elizabeth et. al. "Pulling Apart: A State-By-State Analysis of Income Trends." Center on Budget and Policy Priorities and Economic Policy Institute. 2012. https://www.cbpp.org/sites/default/files/atoms/files/11-15-12sfp.pdf

8 "The Rise of Residential Segregation by Income." Pew Research Center's Social & Demographic Trends Project. August, 2020, www.pewsocialtrends.org/2012/08/01/the-rise-of-residential-segregation-by-income.

9 Raj Salhotra. "Growing Inequality of Opportunity in Texas: Causes and Solutions." John Marshall Law Review, vol. 51, no. 2, 2018: pp. 309-340.

10 BLS. "Union Members Summary." January, 2021. https://www.bls.gov/news.release/union2.nr0.htm

11 Salhotra, 2018.

12 National Oceanic and Atmospheric Administration "Record-breaking Atlantic Hurricane Season Draws to an End." November. 2020, www.noaa.gov/media-release/record-breaking-atlantic-hurricane-season-draws-to-end.

13 EPA. "State CO2 Emissions from Fossil Fuel Combustion, 1990-2018." Summer 2020. https://www.epa.gov/statelocalenergy/state-co2-emissions-fossil-fuel-combustion-1990-2018

14 AWEA. "Wind Energy in Texas." 2020. https://www.awea.org/Awea/media/Resources/StateFact-

Sheets/Texas.pd

15 U.S. Global Change Research Program. "Chapter Four: The Great Plains," in "Fourth National Climate Assessment." 2018. https://nca2018.globalchange.gov/chapter/23/

16 Hayhore, Katherine. "Climate Change Projections for the City of Austin." Atmos Research and Consulting. April 2014. http://austintexas.gov/sites/default/files/files/Sustainability/atmos_research.pdf

17 Under a moderate/higher emissions scenario, workers can expect to see a 9.0% decrease in labor productivity due to climate change. Kjellstrom, Todd et. al. "The Direct Impact of Climate Change on Regional Labor Productivity." Archives of Environmental & Occupational Health 64, no. 4, 2009: 217-227; The Southern Great Plains can expect to be most hard hit, losing 6% of annual labor hours over the course of the century. U.S. Global Change Research Program, 1013.

18 Hayhoe, 9; U.S. Global Change Research Program.

19 U.S. Global Change Research Program, 1004.

20 U.S. Global Change Research Program, 996.

21 U.S. Global Change Research Program, 994.

22 NOAA. "Hurricane Costs." 2020. https://coast.noaa.gov/states/fast-facts/hurricane-costs.html; Sebastiaan N. Jonkman, Sebastiann et al. "Brief Communication: Loss of Life due to Hurricane Harvey." Natural Hazards and Earth System Sciences 18, no.4, 2018: 1073.

23 U.S. Global Change Research Program, 997.

24 McCarl, Bruce. "Climate Change and Texas Agriculture." in eds. Schmandt, Jurgen. The Impact of Global Warming on Texas. University of Texas Press, 2011.

25 U.S. Global Change Research Program, 1005

26 First Street Foundation. "Sea Level Rise Washes Away $76.4 Million in Texas Home Values." April 23, 2019. https://firststreet.org/press/sea-level-rise-washes-away-76-4-million-in-texas-home-values/

27 McNichol, Elizabeth et. al. 2012

28 Data from annual median wages from the QWEC of the BLS for the State of Texas. Real wage calculations made by using the CPI-W from the Social Security Office in 2018 dollars.

29 Economic Policy Instittue and Oxfam America. "Few Rewards: An Agenda to Give America's Working Poor a Raise." 2016. https://s3.amazonaws.com/oxfam-us/www/static/media/files/Few_Rewards_Report_2016_web.

pdf

30 Data according to the American Community Survey for 2019, United States Census Bureau. "2019 Poverty Rate in the United States." September 17th, 2020. https://www.census.gov/library/visualizations/interactive/2019-poverty-rate.html

31 Texas statistics from customizing data from Prosperity Now, Texas has a liquid asset poverty rate of 42.2%: Prosperity Now. "State Income and Policy Report: Texas." 2019. https://scorecard.prosperitynow.org/reports#report-state-profile/48

32 All data from Hirsch, Barry T. and David A. Macpherson. "Union Membership and Coverage Database." unionstats.com. Original methodology at: Barry T. Hirsch and David A. Macpherson, "Union Membership and Coverage Database from the Current Population Survey: Note," Industrial and Labor Relations Review, Vol. 56, No. 2, January 2003, pp. 349-54 (updated annually at unionstats.com).

33 National Women's Law Center. "Lifetime Wage Gap Losses for Latina Women State Rankings: 2019." March 2020. https://nwlc.org/wp-content/uploads/2020/03/Latina-Women-Overall-Lifetime-Losses-2020.pdf

34 All data from the American Community Survey 1-Year Estimate of the Census Bureau for 2019. We use the word "Hispanic" as delineated by the Census Bureau.

35 Ibid.

36 All emissions data from EPA. "State CO2 Emissions from Fossil Fuel Combustion, 1990-2018." Summer 2020. https://www.epa.gov/statelocalenergy/state-co2-emissions-fossil-fuel-combustion-1990-2018

37 The United Kingdom emitted 379.15 MMTC02 and Algeria emitted 159.93 MMTC02 in 2017, Muntean M. et al. "Fossil Fuel C02 Emissions of all World Countries." Joint Research Centre at the European Commission. 2018. https://op.europa.eu/en/publication-detail/-/publication/41811494-f131-11e8-9982-01aa75ed71a1/language-en; Algeria and United Kingdom combined population was approximately 107 million in 2017 and combined GDP was $2.8 trillion according to the World Bank. Texas' population was 28 million in 2017 and had a GDP of 1.7 trillion in 2017 according to the Texas State Library and Archives and the Bureau of Economic Analysis.

38 Net motor fuel usage was 2.29 million gallons in 1950, it rose to 20.52 million gallons in 2018. Office of the Highway Policy Information of the Federal Highway Administration, USDOT. "Net Motor-Fuel Volume Taxed by State, 1950 – 2018." February 2020. https://www.fhwa.dot.gov/policyinformation/statistics/2018/mf202.cfm. Over the same time span, population increased by about 370% according to Texas State Library and Archives Commission, "United States and Texas Populations 1850-2017." 2020.

39 Data from the BLS, Quarterly Census of Wages and Employment, averages for September of 2019. The

following NAICS categories were chosen to represent the fossil fuel industry: 211 Oil and Gas Extraction, 2121 Coal Mining, 213112 Support Activities for Oil and Gas operations, 213111 Drilling Oil and Gas Well, 221112 Fossil Fuel Electric Generation, 2212 Natural Gas Distribution, 324 Petro and Coal Products Manufacturing, 23712 Oil and Pipeline Gas Production, 486 Pipeline Transportation, 427 Perto Merchant Wholesalers.

40 This calculation excludes net electricity imports or the flow of interstate eletricity. EIA. "Primary Energy Consumption Estimates, 2018." https://www.eia.gov/state/seds/sep_sum/html/pdf/sum_btu_totcb.pdf

41 This calculation excludes net electricity imports or the flow of interstate eletricity. EIA. "Primary Energy Consumption Estimates, 2018." https://www.eia.gov/state/seds/sep_sum/html/pdf/sum_btu_totcb.pdf

42 The US's emissions in 2019 were 5.13 billion metric tons. EIA. "U.S. Energy-Related Carbon Dioxide Emissions, 2019." September 2020. https://www.eia.gov/environment/emissions/carbon/. Worldwide emissions were 33.3 billion metric tons of emissions in 2019. International Energy Agency, "Global C02 Emissions in 2020." February 2020. https://www.iea.org/articles/global-co2-emissions-in-2019

43 ERCOT. "Fact Sheet." November 2020. http://www.ercot.com/content/wcm/lists/197391/ERCOT_Fact_Sheet_11.10.20.pdf

44 All nameplate capacity data from the EIA. "Detailed State Data." September 2020. https://www.eia.gov/electricity/data/state/. Updated solar information from SEIA. "State Solar Spotlight: Texas." December 2020. https://www.seia.org/sites/default/files/2020-12/Texas.pdf. Updated wind data from the third quarter of 2020 shows 30,904 MW of wind energy: AWEA, 2020

45 Lopez, Anthony et. al. "U.S. Renewable Energy Technical Potentials: A GIS-Based Analysis." NREL. July 2012. https://www.nrel.gov/docs/fy12osti/51946.pdf

46 Slusarewicz, Joanna H. & Daniel S. Cohan. Renewables: Wind, Water, and Solar *5*, no. *7*, 2018: 1-13.

47 Lopez et. al, 2012.

48 12,000 workers labored in solar electric generation, 26,000 in wind electric generation, 1,800 in hydroelectric generation, and 169,000 in energy efficiency. Clean automobiles excluded from this calculation. NASEO & EFI. "2020 U.S. Energy & Employment Report: Energy Employment by State." 2020. https://www.usenergyjobs.org/2020-state-reports

49 Public Utility Commission of Texas. "§25.173. Goal for Renewable Energy." January 2009. http://www.puc.texas.gov/agency/rulesnlaws/subrules/electric/25.173/25.173ei.aspx

50 Texas State Energy Conservation Office. "Loanstar Program Technical Guidebook: Volume I." September 2020, https://comptroller.texas.gov/programs/seco/funding/loanstar/guidelines.php

51 Utility scale solar costs $28/MWh to $42/MWh as compared to $65 to $159/MWh for coal, $129 to $198/MWh for nuclear and $44 to 73/MWh for combined gas cycle. Lazards. "Levelized Cost of Energy and Levelized Cost of Storage – 2020." October, 2020. https://www.lazard.com/perspective/levelized-cost-of-energy-and-levelized-cost-of-storage-2020/

52 Lopez, Anthony et. al, 2012.

53 Caluclated using EPA's AVoided Emissions and geneRation Tool (AVERT): EPA. "Voided Emissions and geneRation Tool (AVERT)." September 2020. https://www.epa.gov/statelocalenergy/avoided-emissions-and-generation-tool-avert

54 Calculated using $1,848/KW for average construction cost. EIA. "Construction Cost Data for Electric Generators Installed in 2018." August 2020. https://www.eia.gov/electricity/generatorcosts/; Job numbers per million invested from Pollin, Robert, Garrett-Peltier, Heidi, Heintz, James and Bracken Hendricks. "A U.S. Program for Controlling Climate Changeand Expanding Job Opportunities." PERI Umass Amherst and CAP. September 2014. http://www.peri.umass.edu/fileadmin/pdf/Green_Growth_2014/GreenGrowthReport-PERI-Sept2014.pdf. 5.5 direct jobs per million dollars invested, 4.1 indirect jobs per million dollars invested, and 3.8 induced jobs per million dollars invested.

55 EIA. "Texas State Energy Profile." March, 2020. https://www.eia.gov/state/print.php?sid=TX#:~:text=Texas%20State%20Energy%20Profile&text=Texas%20leads%20the%20nation%20in,nuclear%20power%20plants%20since%202014.

56 Calculated using EPA AVERT tool, 2020. Cars from EPA. "Greenhouse Gas Equivalencies Calculator." March, 2020. https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

57 Calcualted using $1,382/KW for average construction cost, EIA "Construction Cost Data for Electric Generators Installed in 2018." August 2020. Job numbers from Pollin et. al, 2014: 4.7 direct jobs per million dollars invested, 4.4 indirect jobs per million dollars invested, and 3.6 induced jobs per million dollars invested.

58 Photo credits Geothermal Resources Council.

59 U.S. Department of Energy. "Geothermal Technologies Program: Texas." April 2006. https://www.nrel.gov/docs/fy06osti/38242.pdf

60 Lopez, Anthony et. al, 2012.

61 Assumes a capacity factor of 74.3%, EIA. "Electric Power Monthly: Table 6.07.B. Capacity Factors for Utility

Scale Generators Primarily Using Non-Fossil Fuels." Accessed: April 2021. https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_6_07_b. Geothermal saves 260g/KWh as compared to natural gas according to Schutz, Felina et al. "Geothermal Electricity: Potential for CO2 Mitigation ." GEO-ELEC. November 2013. http://www.geoelec.eu/wp-content/uploads/2014/02/D4.6.pdf

62 Calculated using $2,500/KW for average construction cost. DOE Office of Energy Efficiency & Renewable Energy "Geothermal FAQs." Energy, accessed Mar. 2021, www.energy.gov/eere/geothermal/geothermal-faqs; Job numbers per million invested from Pollin, et al, 2014: 5.0 direct jobs per million dollars invested, 4.3 indirect jobs per million dollars invested, and 3.7 induced jobs per million dollars invested.

63 See ERCOT. "Report on Existing and Potential Electric System Constraints and Needs." December 2019. http://www.ercot.com/content/wcm/lists/172485/2019_Constraints_and_Needs.pdf. Also see Andrade, Juan and Baldick, Ross, "Estimation of Transmission Costs for New Generation," White Paper UTEI/2016-09-2, 2017, http://energy.utexas.edu/the-full-cost-of-electricity-fce/

64 Transmission cost of $597/KW from Andrade and Bladick, 2017, pp. 22. Job numbers per million invested from Bivens, 2019 for Transmission: 1.1 direct jobs per million dollars invested, 4.2 indirect jobs per million dollars invested, and 1.8 induced jobs per million dollars invested.

65 Zhang, Yuzhong, et al. "Quantifying Methane Emissions from the Largest Oil-Producing Basin in the United States from Space." Sci. Adv., vol. 6, no. 17, 1 Apr. 2020.

66 EPA. "Inventory of U.S. Greenhouse Gas Emissions and Sinks." April, 2020. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks

67 EPA. "Fast Facts on Transportation Greenhouse Gas Emissions." June 2020. https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100ZK4P.pdf

68 EPA. "Sources of Greenhouse Gas Emissions." April, 2020. https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions

69 Ibid.

70 Texas DOT. "Statewide On-Road Greenhouse Gas Emissions Analysis and Climate Change Assessment." October 2018. https://ftp.dot.state.tx.us/pub/txdot-info/env/toolkit/725-01-rpt.pdf.

71 Ibid.

72 Muller, Joann. "Texas Commuters Have Highest Climate Impact." Axios, 17 Jan. 2020, www.axios.com/texas-commuters-highest-climate-impact-a1bd5e9a-d317-4043-9eab-68ea9467716e.html.

73 Park, Alex. "Air pollution poses health risk to Houstonians, study finds." Chron, 3 July 2018, www.chron.

com/local/article/New-study-finds-Houstonians-health-at-risk-from-13044068.php.

74 Jiao, Jungfeng and Aaron Nichols. "Identifying Transit Deserts in Texas Cities." Center for Sustainable Development, University of Texas at Austin. 2015. https://soa.utexas.edu/sites/default/disk/Texas%20Transit%20Deserts%20(Center%20for%20Sustainable%20Development).pdf

75 Texas Dot. "#EndTheStreakTX." November 2019. https://www.txdot.gov/inside-txdot/media-center/psas/end-streak.html

76 APTA. "Economic Impact of Public Transportation Investment: 2020 Update." April 2020. https://www.apta.com/wp-content/uploads/APTA-Economic-Impact-Public-Transit-2020.pdf

77 Cronin, Mike. "Infinitum Electric CEO Lays Out Hiring, Production Goals as Startup Expands into Central Texas' Hot EV sector." Austin Business Journal, 16 Dec. 2020, www.bizjournals.com/austin/news/2020/12/16/infinitum-electric-manufacturing-hiring.html.

78 Carbon reduction calculations from U.S. DOE Alternative Fuels Data Center. "Emissions from Hybrid and Plug-In Electric Vehicles." https://afdc.energy.gov/vehicles/electric_emissions.html. Assumes Texas and zero emissions for eletric vehicles in 2045.

79 Assuming 8,799 charges at cost of $39,097 per fast charger and 3-5 chargers per site. Nicholas, Michaels. "Estimating Electric Vehicle Charging Infrastructure Costs Across Major U.S. Metropolitan Areas." ICCT. August 2019; 14.3 jobs per million dollars invested according to IEA. "Sustainable Recovery." June 2020. https://www.iea.org/reports/sustainable-recovery; broken into 3.8 direct jobs per million dollars invested, 4.3 indirect jobs per million dollars invested, and 6.2 induced jobs per million dollars invested, according to Transportation and Manufacturing multiplier from Bivens, Josh. "Updated employment Multipliers for the U.S. Economy. EPI. January, 2019. https://files.epi.org/pdf/160282.pdf.

80 Cost per car of $19,627 from Miller, Joe. "Electric Car Costs to Remain Higher than Traditional Engines." Financial Times, Aug. 2020, www.ft.com/content/a7e58ce7-4fab-424a-b1fa-f833ce948cb7; See IEA, 2020 for 5.7 jobs per million dollar invested, broken into .7 direct jobs per million dollars invested, 2.0 indirect jobs per million dollars invested, and 3.1 induced jobs per million dollars invested, accordin to Bivens, 2019.

81 Texas rail from El Paso to Austin, and Fort Worth to San Antonio would measure 1,002 miles. $C0_2$ reduction calculated from examining LGV Mediterranée in France for reduction of 637 $MTC0_2$/mile: Baron T., Martinetti G. and D. Pépion. "Carbon Footprint of High Speed Rail." UIC. November 2011. https://www.nyteknik.se/tekniknyheter/article6886799.ece/BINARY/Carbon%20Footprint%20of%20High%20Speed%20Rail%20UIC.pdf.

82 Hethcock, Bill. "Drilling down on the $15 Billion Texas Bullet Train." Dallas Business Journal, 20 Dec. 2017, www.bizjournals.com/dallas/news/2017/12/20/drilling-down-on-the-15-billiontexas-bullet-train.html.

83 Investment per kilometer of $18,000,000 for construction and 35,624 for operation. Barron et. al. "Economic Analysis of High Speed Rail in Europe." Fundacion BBVA. https://www.fbbva.es/wp-content/uploads/2017/05/dat/DE_2012_economic_analysis_high_speed_rail.pdf. Jobs number from Pollin et. al, 2014. Construction: 4.9 direct jobs per million dollars invested, 3.6 indirect jobs per million dollars invested, and 3.2 induced jobs per million dollars invested. Operation: 17.2 direct jobs per million dollars invested, 2.5 indirect jobs per million dollars invested, and 7.9 induced jobs per million dollars invested.

84 School Bus Fleet and Bobit Business Media. "U.S. State by State Transportation Statistics 2018-19." 2021. https://www.schoolbusfleet.com/download?id=10131920&dl=1

85 Rome, Christopher. "An Analysis of School Bus Emissions and Idling." George Institute of Technology. 2011.

86 EPA. "Clean School Bus USA." August 2010. https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100ABRA.pdf

87 This is calcualted using FTA's Transit Greenhouse Gas (GHG) Emissions Estimator: FTA. "Transit Greenhouse Gas (GHG) Emissions Estimator." November, 2016. https://www.transit.dot.gov/regulations-and-guidance/environmental-programs/ftas-transit-greenhouse-gas-emissions-estimator; For total miles of 341,228,039 see School Bus Fleet and Bibit Business Media, 2021.

88 For school bus manufacturing and EV charging number, see methodology from "State Fleet Electrification." 8,838 schools according to: Texas Education Agency. "2020 Comprehensive Biennial Report on Texas Public Schools." December 2020, pp. 179. https://tea.texas.gov/sites/default/files/comp_annual_biennial_2020.pdf

89 Carbon reductions using EPA's AVERT model. 15 KWh saved per square foot according to Cindy Regnier P.E et. al. "Systems Retrofit Trends in Commercial Buildings: Opening Up Opportunities for Deeper Savings." Lawrence Berkley National Labratory. https://buildings.lbl.gov/sites/default/files/Regnier%20C%20-%20System%20Retrofit%20Trends%20Study%20Updated%205-8-20%20Final.pdf. Carbon emissions avings calculated from EPA's Carbon Equivalency Calculator. Total square footage of 602,000,000 acccording to Filardo, Mary (2016). State of Our Schools: America's K–12 Facilities 2016. Washington, D.C.: 21st Century School Fund. https://kapost-files-prod.s3.amazonaws.com/published/56f02c3d626415b792000008/2016-state-of-our-schools-report.pdf?kui=wo7vkgV0wW0LGSjxek0N5A.

90 Solar construction costs calculated using $1,848/KW from EIA. "Construction Cost Data for Electric Generators Installed in 2018." Job numbers per million invested from Pollin et. al, 2014. 5.5 direct jobs per million dollars invested, 4.1 indirect jobs per million dollars invested, and 3.8 induced jobs per million dollars invested; Building retofits assumed $22.11/suare foot from Less, Brennan and Iann Walker. "A Meta-Analysis of Single-Family Deep Energy Retrofit Performance in the U.S." 2014. Lawrence Berkley National Labratory. https://www.osti.gov/servlets/purl/1129577. Job numbers per million invested from Pollin et. al, 2014. 6.3 direct jobs per million dollars invested, 4.1 indirect jobs per million dollars invested, and 4.2 induced jobs per million dollars invested.

91 Biello, David. "Building Retrofits: Tapping The Energy-Saving Potential." November, 2011. Yale Environment 360. https://e360.yale.edu/features/green_architecture_building_retrofits_tap_energy_saving_potential

92 Rocky Mountain Instiutte. "Deep Energy Retrofit 101."

93 Department of Energy. "U.S. Energy Efficiency Potential Maps." 2016. https://www.energy.gov/eere/slsc/us-energy-efficiency-potential-maps

94 For full text of the bill see Texas House of Representative. "H.B. No. 3693. And Act Relating to Energy Demand...." 2007. H.B. No. 3693

95 See EPA, 2020. A total of buildings emissions from fossil fuels is 28.2 million metric tons of $C0_2$.

96 39 million square feet of university buildings according to Texas Higher Education Coordinating Board. "Texas Public Universities'Data and Performance Report." June 2002. http://www.thecb.state.tx.us/DocID/PDF/0464.PDF. Retrofit of $22.11/Square foot from Less and Walker, 2014. Job numbers per million invested from Pollin et. al, 2014. 6.3 direct jobs per million dollars invested, 4.1 indirect jobs per million dollars invested, and 4.2 induced jobs per million dollars invested.

97 Governor's Broadband Development Council. "2020 Texas Report." Office of the Governor, Economic Development and Tourism. 2020. https://gov.texas.gov/uploads/files/press/2020_Texas_Report_-_Governors_Broadband_Development_Council.pdf

98 Federal Communications Commission. "Internet Access Services: Status as of December 31, 2018." Industry Analysis Division, Office of Economics and Analytics, September 2020. https://docs.fcc.gov/public/attachments/DOC-366980A1.pdf

99 CTC Technology & Energy. "Mobile Broadband Service Is Not an Adequate Substitute for Wireline

100 Rachel Smith and Lesley Jantarsami. "Four Ways that Rural Broadband Fights Climate Change." Bipartisan Policy Center. June 2020. https://bipartisanpolicy.org/blog/four-ways-that-rural-broadband-fights-climate-change/

101 Spencer Grubb and Shannon Halbrook. "Broadband Expansion in Texas: Bringing Fast Internet to More Texans." Fiscal Notes, Texas Comptroller. February 2021. https://comptroller.texas.gov/economy/fiscal-notes/2021/feb/broadband.php

102 Cost of fiber deployment is $6,545 per household in less dense households for 37,004 households and $27,390 per household for 296,067 households in rural areas as showin in Governor's Broadband Development Council, 2020. Cost numbers from averages on Unserved Model 1 in New Mexico Department of Information Technology. "State of New Mexico Broadband Strategic Plan and Rural Broadband Assessment." June 2020. https://www.ctcnet.us/wp-content/uploads/2020/07/New-Mexico-Broadband-Strategic-Plan-20200616.pdf, 40. Job numbers per million invested from Bivens, 2019 for Wired Communications: 1.5 direct jobs per million dollars invested, 4.2 indirect jobs per million dollars invested, and 2.4 induced jobs per million dollars invested.

103 City of Houston. "Houston Climate Action Plan." April 2020, pp.21. http://www.greenhoustontx.gov/climateactionplan/CAP-April2020-Spreadsheet.pdf

104 City of Houston, 2020.

105 See City of Dallas. "Dallas Comprehensive Environmental and Climate Action Plan." May 2020. https://27aabd9a-6024-4b39-ba78-f6074e2fc631.filesusr.com/ugd/349b65_e4f9a262cebf41258fd-4343d9af0504f.pdf

106 See City of San Antonio. "SA Climate Ready: A Pathway for Climate Action and Adaption." October 2019. https://www.sanantonio.gov/Portals/0/Files/Sustainability/SAClimateReady/SACRReportOctober2019.pdf

107 See footnotes in each recommendation for further information on how direct, indirect, and induced jobs were calculated.

108 Hamilton, James. "Careers in Solar Power." BLS. https://www.bls.gov/green/solar_power/

109 Hamilton, James and Drew Liming. "Careers in Wind Energy." BLS. https://www.bls.gov/green/wind_energy/#:~:text=The%20following%20is%20a%20partial,materials%20engineers%2C%20and%20mechanical%20engineers.

110 Hamilton, James. "Careers in Electric Vehicles." BLS. https://www.bls.gov/green/electric_vehicles/

111 Ibid.

112 Mineta Transportation Institute. "Estimating Workforce Development Needs for High-Speed Rail in California." March 2012, pp. 33. https://transweb.sjsu.edu/sites/default/files/1027-california-high-speed-rail-workforce-needs.pdf

113 Liming, Drew. "Careers in Green Construction." BLS. https://www.bls.gov/green/construction/

114 BLS. "May 2017 National Industry-Specific Occupational Employment and Wage Estimates: NAICS 221100 - Electric Power Generation, Transmission and Distribution/" March 30, 2018. https://www.bls.gov/oes/2017/may/naics4_221100.html

115 See footnotes in each recommendation for further informaiton on how carbon emissions reductions were calculated.

116 Homes and cars equivalencies are from EPA's Carbon Equivalency Calculator.

117 U.S. Department of Energy. "Internal Revenue Code Tax Fact Sheet." October 2019. https://www.energy.gov/sites/prod/files/2019/10/f67/Internal%20Revenue%20Code%20Tax%20Fact%20Sheet.pdf

118 Figueroa, Maria, Jeff Grabelsky, and J. Ryan Lamare. "Community Workforce Agreements: A Tool to Grow the Union Market and to Expand Access to Lifetime Careers in the Unionized Building Trades." Labor Studies Journal

Glossary of Terms

45Q Tax Credit	Tax Credit that provides an incentive per ton for geological storage, enhanced oil recovery, direct air capture, enhance natural gas recovery, and other similar projects. Often complemented by state programs.[117]
Community Workforce Agreement (CWA)	An agreement made between building trade unions and employer during the development of a local construction or infrastructure project designed to encourage the hiring of local or marginalized people for work on the project often through apprenticeship programs.[118]
Davis-Bacon Requirement	Requirement that contractors receiving federal funds or support working on projects at public buildings or public works pay workers local prevailing wages with fringe benefits.[119]
Energy Information Agency (EIA)	Government agency under the Department of Energy that provides statistics on energy usage, production, and consumption.
International Panel on Climate Change (IPCC)	United Nations organization that releases scientific assessments on the worldwide impact of climate change and strategies for mitigation. Thousands of scientists from around the world contribute to its findings.
Million Metric Tons of Carbon Dixoide Emissions ($MMTC0_2$)	Measurement of carbon emissions often utilized for determining the amount of greenhouse gases emitted from energy production and extraction using the metric system.
National Renewable Energy Lab (NREL)	Federal goverment lab in Colorado that undertakes research into renewable energy, energy efficiency, and other energy technology.
Project Labor Agreement (PLA)	Collective bargaining agreements negotiated between contractors and building trades unions for the duration of a single construction project that cover basic terms of employment and ensure work on project remains union.[120]

About

ILR Worker Institute

The Worker Institute at Cornell engages in research and education on contemporary labor issues, to generate innovative thinking and solutions to problems related to work, economy and society. The institute brings together researchers, educators and students with practitioners in labor, business and policymaking to confront growing economic and social inequalities, in the interests of working people and their families. A core value of the Worker Institute is that collective representation and workers' rights are vital to a fair economy, robust democracy and just society.

Website: https://www.ilr.cornell.edu/worker-institute/

ILR Worker Institute