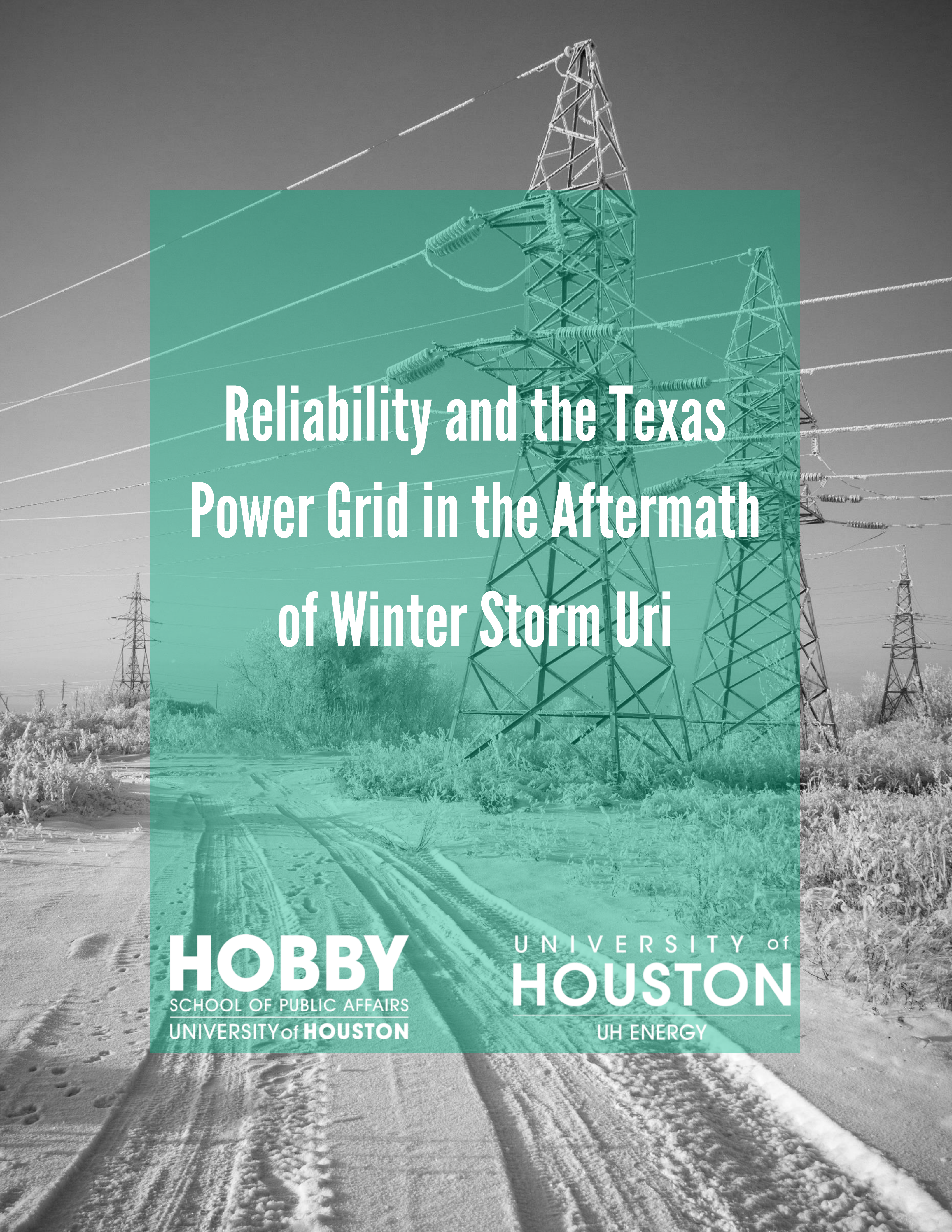

Reliability and the Texas Power Grid in the Aftermath of Winter Storm Uri

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Executive Summary

During the third week of February, Winter Storm Uri brought freezing temperatures to the state of Texas. Unprepared and unequipped to handle the extreme weather, power generators failed to meet the higher demand from Texans trying to keep warm. Much of the state went without power for prolonged periods of time, leaving behind sizable losses of lives and costing Texans at least $195 billion. The failure of the electricity grid raised Texans' concerns about the ability of the system to withstand future extreme weather events, whether heat or cold, and whether the political leaders are willing and able to address the issues.

The University of Houston's Hobby School of Public Affairs and UH Energy conducted a survey to understand Texans' experiences and their support for the regulatory framework of the Texas grid in the aftermath of the winter storm that crippled the state's electricity system. The survey, fielded between May 13-25, 2021, included a sample of 1,500 respondents representative of residents from across the state of Texas. The survey asked respondents about their experiences during Winter Storm Uri, their confidence in state leaders and existing laws and regulations to address the vulnerabilities in Texas' electric system, their tolerance for power outages and higher prices, the importance of a secure and reliable electricity supply, as well as their willingness to pay for the required policy interventions to make the grid more resilient to the effects of severe weather events.

These key themes emerged from survey responses:

- The impact of Winter storm Uris across the state was massive:
  - Over two-thirds of respondents lost power between Sunday, February 14 and Saturday, February 20.
  - Respondents were without power between 1 and 120 hours, for an average of 46 hours.
  - Respondents in major urban centers like Dallas-Fort Worth, Austin, and Houston saw clusters of long consecutive hours -upwards of 30 hours - without power.
  - 30% of respondents experienced damages to their homes, such as broken pipes and water damage. Among respondents who suffered losses, 70% reported having

completed the repairs by the time of the survey. The majority of homeowners surveyed (57%) incurred less than $1,000 in out-of-pocket expenses.

- Respondents found fault in the current regulatory system and attributed blame to leaders and power generators for the power grid's failure:
  - A majority agreed that current laws and regulations in Texas are insufficient to tackle issues related to the electric grid failures. Democrats and Independents were more likely to point to deficits in the regulatory framework than Republicans.
  - 40% of respondents disagreed that the Texas state government will adequately tackle issues related to the electric grid. Republicans were the most likely to agree, as were respondents older than 65.
  - Lack of weatherization of power generators (62%) and natural gas equipment (50%), severe weather (58%), and lack of oversight over power generation plants (51%) were identified by a majority of respondents as causes of the electricity grid failure.
- Reliability was one of two important factors that should be accounted for in deciding which methods of electricity production should be used; it was chosen by 40% of respondents. The second most selected factor was cost (26%), followed by preventing climate change and efficiency in production.
  - Democrats were less likely to select reliability and cost compared to Republicans and Independents, and more likely, by large margin, to select preventing climate change as one of two important factors.
  - 41% of respondents said that it is never acceptable for power outages to occur, while 31% and 26% said it was acceptable once and 2-3 times per year, respectively. 44% stated that outages lasting several hours are a significant problem. Older age groups valued reliability the most: 48% and 53% of those aged 45-64 and 65^{+}, respectively, said that it is never acceptable for the power to go out.
  - Respondents appeared more tolerable of power outages in the winter than summer, but overall respondents revealed low tolerance for power outages lasting an hour or more. For those who were willing to tolerate an outage of two days, the median compensation deemed appropriate was $500.
  - 37% said they were not at all likely to purchase a standby generator and 22% said they were very likely. However, when respondents were informed of approximate costs, those percentage of those not at all likely increased to 50%.
- When asked who should pay to protect the Texas electric grid from the effects of severe weather, 45% of respondents said energy producers. Just under a quarter of respondents said policies that result in higher costs should not be enacted. Republicans were less likely than Democrats and Independents to say that energy producers should pay to protect the grid and more likely to say that consumers should pay through their electric bills.

- A majority of respondents agreed that solar and wind power would make substantial contributions to reliable and secure electricity supply in Texas in the future. Yet there are important partisan and age differences in respondents' assessments:
  - Democrats were more likely to agree on the importance of renewables. Still, 42% of Republicans and 52% of Independents also agreed on the importance of solar power. Disagreement between Republicans and Democrats - and to a lesser extent Independents - was greatest for the importance of coal and wind power in electricity production.
  - Younger respondents were more likely to agree that wind and solar power would be important for reliable electricity supply: 69% of respondents between the ages of 18 and 29 agreed that solar and wind power were important; agreement decreased with age: 58% of 30-44 year olds, 51% of respondents aged 45-64, and 47% of those 65^{+} agreed. Respondents older than 65 were most likely to agree on the importance of natural gas across the board, whether onshore, offshore, unconventional, or conventional.
- Respondents were asked about their preferences for alternative configurations of the electricity system, including proposed policies and investments, tolerance over different levels of power outages, and willingness to pay for the extra costs required for a reliable power supply:
  - Unsurprisingly, respondents preferred no increase in cost (paying less to paying more) and preferred fewer interruptions to their power. The most preferred option was full service (no interruptions), followed by rolling blackouts on and off for up to 2 hours.
  - Regarding policy preferences, we asked respondents to compare four options: (1) merging the Texas electric grid with one of the two national grids; (2) requiring the weatherization or winterization of the electricity system, including at gas wellheads and processing plants; (3) maintaining a minimum reserve capacity; and (4) increasing the renewable energy supply compared to doing nothing. The most preferred policy was the weatherization or winterization of the electricity system, followed by increasing the renewable energy supply.
  - Although respondents preferred not to see the price of electricity increase, they were willing to pay more to see a reduction in power outages relative to the status quo and to see a policy that required the weatherization and winterization of the electricity system, including at gas wellheads and processing plants. Even a 70% increase in price per kWh combined with reducing outages to 2 hours or less and requiring winterization is preferred to doing nothing (no new policy) and continuing to experience rolling blackouts up to 12 hours.

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Introduction

Beginning February 13, Winter Storm Uri brought the state of Texas to a standstill. Between February 14-20, 2021, Texas experienced an unprecedented collapse of its electrical generation and distribution system, causing more than 10 million Texans to lose power for multiple days amidst freezing and below-freezing temperatures. At its peak, the storm left 4.5 million homes and businesses without power, killed at least 151 people, and cost at least $195 billion. In response, several bills were introduced this legislative session to address problems facing Texas' electric grid and reliable electricity service. But only two - SB2 and SB3 - became law.

The Electric Reliability Council of Texas (ERCOT) operates the Texas Interconnection and supplies electricity to most of the state. As a state-specific grid, lying solely within Texas' borders, ERCOT is not subject to much of the Federal Energy Regulatory Commission's (FERC) regulations. In addition, "ERCOT is unique in that the balancing authority, interconnection, and regional transmission are all the same entity and physical system."[1] The Texas state government had not - at least until the passage of SB3 - required power plants to weatherize or winterize their equipment as other states have done; nor has it required or maintained a minimum reserve capacity. Past efforts to mitigate some of the risks of the system failing during severe weather, such as in the wake of the February 2011 freeze, largely fell on deaf ears.[2] Although power plants were encouraged to winterize their equipment, many, lacking the financial or legal/regulatory incentives to do so, did not.[3]

On June 14, 2021 - exactly four months after Winter Storm Uri - ERCOT asked Texans to conserve electricity for the third time this year.[4] Texas was once again facing tight grid conditions due to power plant outages and record demand for electricity amidst near-record temperatures across much of Texas.[5] According to ERCOT, the forced outages at power plants represents 11,000 MW of generation, 8,000 MW of which is from thermal power sources like natural gas, or enough to power approximately 2.2 million homes. Although recent legislation (SB3) will require changes to the grid, it will be years before changes are implemented.

[1]Mason Willrich, *Modernizing America's Electricity Infrastructure* (Cambridge, MA, MIT Press, 2017), 281.

[2]Mimi Swartz,"Ed Hirs Has Been Predicting This Mess for Years."Texas Monthly, February 19, 2021.

[3]Ed Hirs, "Why the Texas Power Market Failed," Yale Insights, March 23, 2021.

[4]"Tight grid conditions expected due to high number of forced generation outages." ERCOT, June 14, 2021.

[5]Erin Douglas, "Texas grid operator urges electricity conservation as many power generators are unexpectedly offline and temperatures rise," The Texas Tribune, June 14, 2021.

Critics argue that the legislation does not go far enough to address the underlying issues that left millions without power in February or Texas' aging electricity infrastructure. Even with the recent legislation, it is clear that additional investments in and updates to Texas' fragile electricity infrastructure need to be made. However, any new policies aimed at protecting the Texas electrical grid from the effects of severe weather will have to be paid for by companies, the state, and ultimately consumers. It is important to know, therefore, which policies Texas residents support and their willingness to pay secure and reliable electricity service.

To understand Texans' preferences for reliable electricity and future power generation, the Hobby School of Public Affairs at the University of Houston together with UH Energy conducted an online survey of Texas residents aged 18 years and older. The survey provides important lessons for the future of the electricity system in Texas: recurring severe weather events will continue to pose threats to the reliable supply of energy, creating disruptions and human and material losses. Addressing these problems is costly and will require regulatory changes and massive investments. The survey and report reveal Texans' preferences for new policies and willingness to incur some of the costs of a reliable and secure electricity supply.

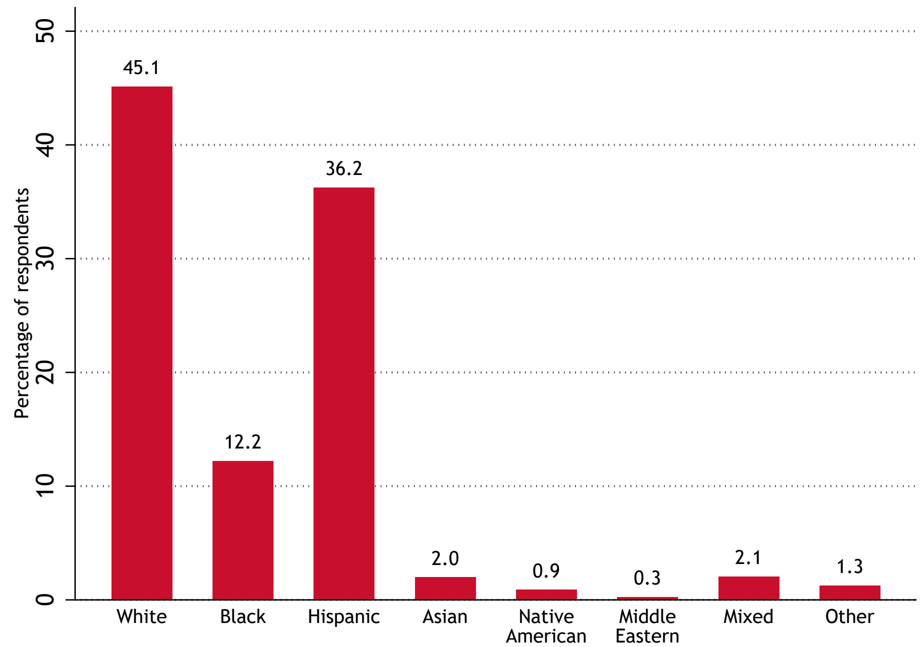
Respondents were clearly frustrated with regulators and electricity companies following Winter Storm Uri. Yet, they also understand that consumers will likely pay at least some of the costs to protect the Texas grid from the effects of severe weather. In particular, when offered a menu of policy options and power outage lengths, Texans entertained the possibility of paying a few extra cents per kWh of electricity consumed.

1.1 Overview of respondents

This report includes responses from a survey conducted by the Hobby School of Public Affairs and UH Energy. The survey recorded the experiences of Texas residents during Winter Storm Uri and how Texans evaluate different policy proposals aimed at protecting the Texas electric grid from severe weather and reducing unplanned blackouts. The survey was fielded between May 13-24, 2021. It surveyed 1,500 individuals aged 18 and above; the sample is representative of the residents of Texas.

Of the 1,500 respondents, 51% were female and 49% male. Figure 1.1 shows the distribution of respondents by race and ethnicity. Forty-five percent of respondents identified as white, 36% as Hispanic, and 12% as Black, with the remaining identifying as Asian, Middle Eastern, mixed race, and other.

Figure 1.1: What racial or ethnic group best describes you?



The largest proportion (32%) of respondents had a high school degree, 30% had some college or an Associate's degree, and 28% have a college or post-graduate degree.

Table 1.1: What is the highest level of education you have completed?

Education	No.	%
No high school	144	9.6
High school graduate	481	32.1
Some college	286	19.1
2-year college	168	11.2
4-year college	280	18.6
Post-grad	141	9.4
Total	1,500	100.0

Nearly a third of respondents were aged 35-64, 23% between the ages of 18 and 29, 28% between 30 and 44, and finally 17% over 65 and older.

Table 1.2: Age groups of respondents

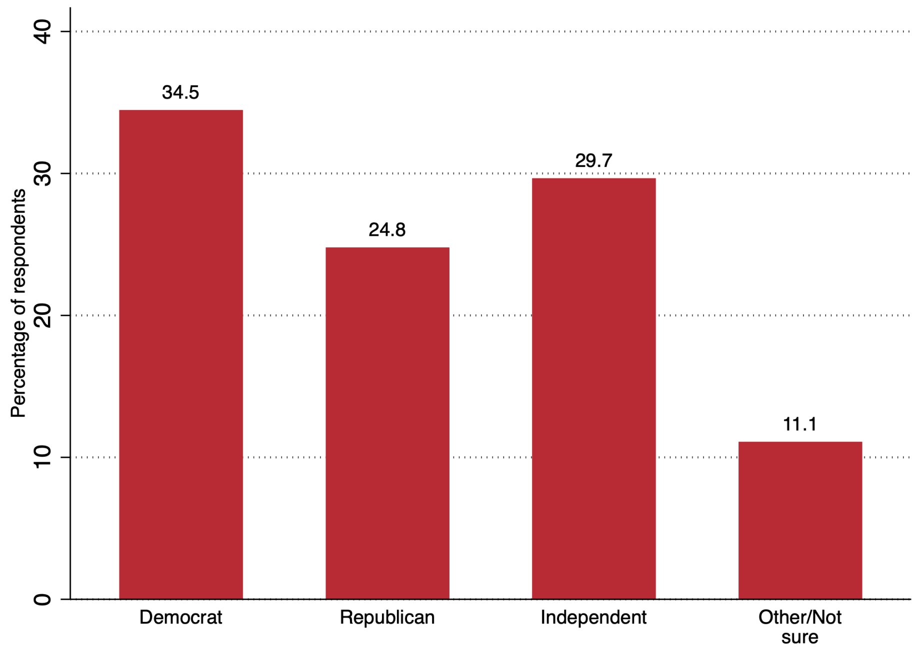
	No.	%
18-29	346	23.1
30-44	423	28.2
45-64	475	31.7
65+	256	17.0
Total	1,500	100.0

Table 1.3: In the 2020 election for president, who did you vote for?

	No.	%
Joe Biden	587	39.2
Donald Trump	559	37.3
Someone else	46	3.0
Did not vote	308	20.5
Total	1,499	100.0

The Presidential vote choice expressed by survey respondents roughly mirrored the distribution of the electoral vote preferences for the 2020 election within the margin of error. Among those who were willing, eligible, and registered to vote, 50% of respondents voted for Joe Biden and 50% Donald Trump (Table 1.3). Figure 1.2 shows the distribution of respondents by party identification. Thirty-four percent identified as Democrat, 25% as Republican, 30% as Independent, and the remaining 11% identified as other or were not sure.

Figure 1.2: In the 2020 election for president, who did you vote for?



The ensuing sections present the results from our analysis of survey responses. The full set of questions and responses is presented in Appendix 8.

Texans' Experiences with Winter Storm Uri

In this section, we examine respondents' experiences with Winter Storm Uri, their understanding of the reasons for the electric grid failure, and their confidence in the Texas government, as well as current laws and regulations, to tackle the issues related to the electric grid failures this past February. As much of the state went without power for prolonged periods of time, concerns grew among Texans about what this could mean for future extreme weather events and about the state government's willingness and ability to address these issues.

Respondents were asked questions regarding the loss of power to their homes, whether their residences sustained damage, such as broken pipes, as well as whether they incurred out-of-pocket expenses as a result of blackouts. As the winter storm was unfolding, controversy grew among Texans over who was responsible for the prolonged power outages across the state. Part of that controversy could be rooted in lack of information, but it was also fueled by conflicting statements from elected officials and political leaders attributing or trying to diffuse blame. The survey gauged respondents' knowledge of which agency supplies power to the majority of the state and asked who they blamed for the power grid failure. Finally, given growing concerns about the ability of the power grid to withstand extreme weather events in the future, we asked respondents about their confidence in their state elected officials and current legislation to ensure these issues would no longer affect Texans like they did this past February.

2.1 Loss of power

Figure 2.1 shows the percentage of respondents who reported losing power during Winter Storm Uri between Sunday, February 14 and Saturday, February 20, 2021. Two in three respondents said they lost power at some point during the storm, while the remaining third reported that they did not lose power. These responses are in line with a previous study conducted by the Hobby School in March 2021 where 69% of respondents indicated they lost electricity and 31% said they did not.[1]

[1] See The Winter Storm of 2021: https://uh.edu/hobby/winter2021/storm.pdf. The data from previous survey was also collected by YouGov using the same methodology described in the Technical Note (Appendix 7). The differences in the percentage of respondents reporting power outages in both surveys are within the surveys' margins of error.

Figure 2.1: Did your home lose power during the winter storm between Sunday, February 14 and Saturday, February 20?

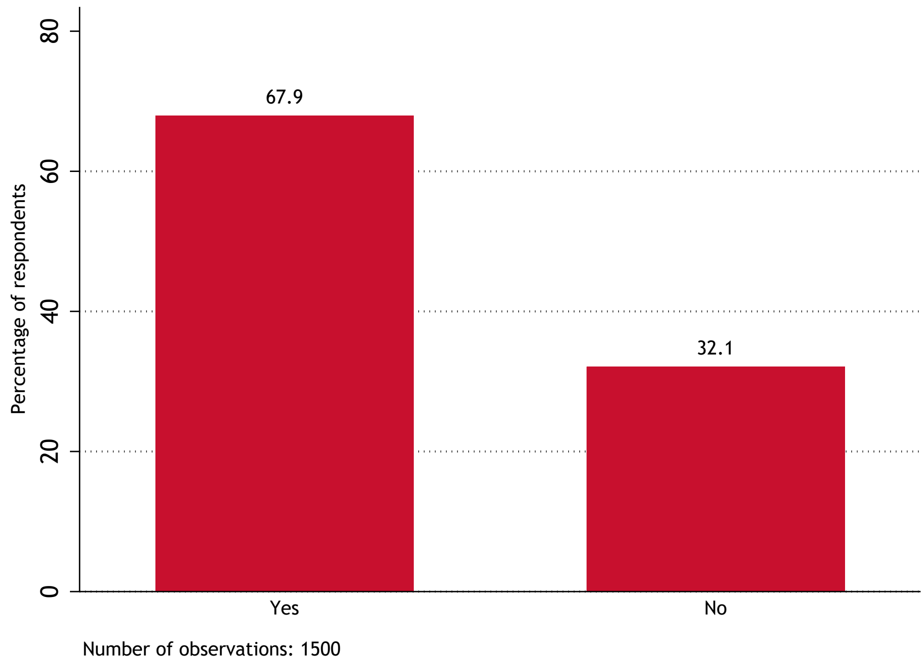


Figure 2.2 shows the distribution of respondents by total number of hours without power during the winter storm. Among those who reported to have lost power during the storm, the largest percentage of respondents (23%) reported to be without power for 10 hours or less for the duration of the storm. The second largest percentage of respondents (16%) said they were without power between 71 and 80 hours in total. Nearly 46% of respondents reported to have been without power between 11 and 70 hours, while the remaining 15% of respondents reported to have gone more than 80 hours without power during Winter Storm Uri.

The results of this survey, conducted three months later, were comparable to the Hobby School's previous study conducted a few weeks after the winter storm.[2] A notable difference was among respondents who answered they lost power between 71 to 80-hour total range. The percentage of respondents who chose this range of total hours lost nearly doubled in this survey from the previous one (16% and 8%, respectively).

[2]Ibid fn. 1

Figure 2.2: Between Sunday, February 14 and Saturday, February 20, for about how many hours were you without electricity?

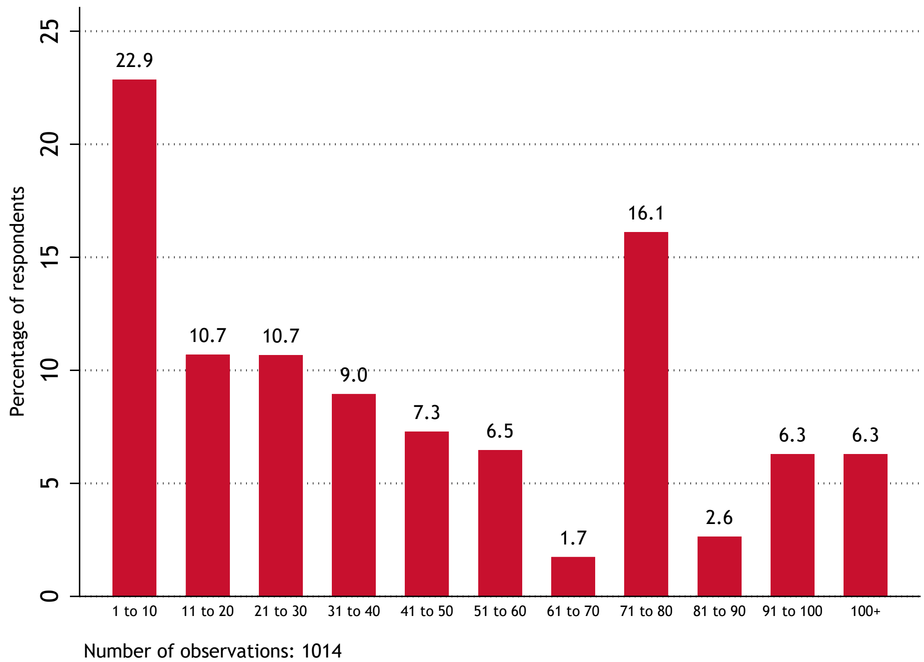
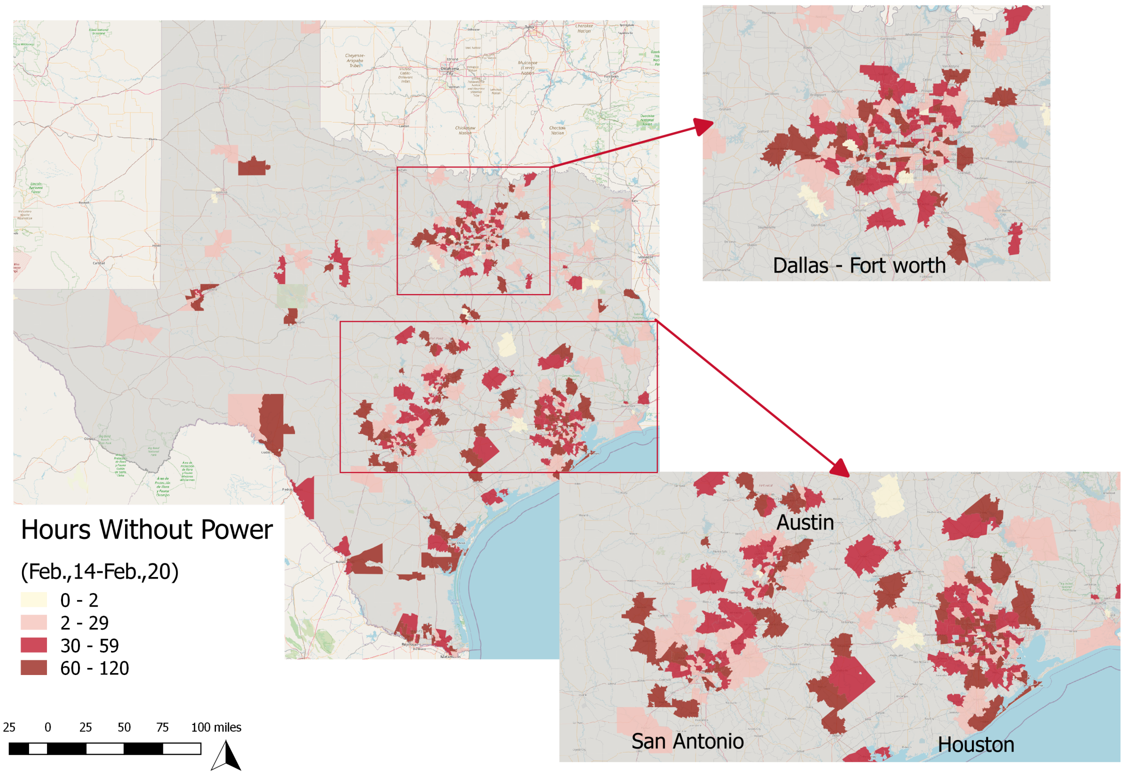


Figure 2.3 maps the geographic distribution of reported hours of power loss by zip code. Along the southern border, there were a number of zip codes that went without power for upwards of 30 hours. Larger urban centers, like Houston, Austin, and Dallas-Fort Worth, also saw a number of zip codes without power for more than 30 hours. From the zip codes covered by the survey, those in San Antonio, Austin, and Houston areas all went without power for more than 2 hours. In the Dallas-Fort Worth area, by contrast, there were some zip codes that were without power for less than 2 hours.

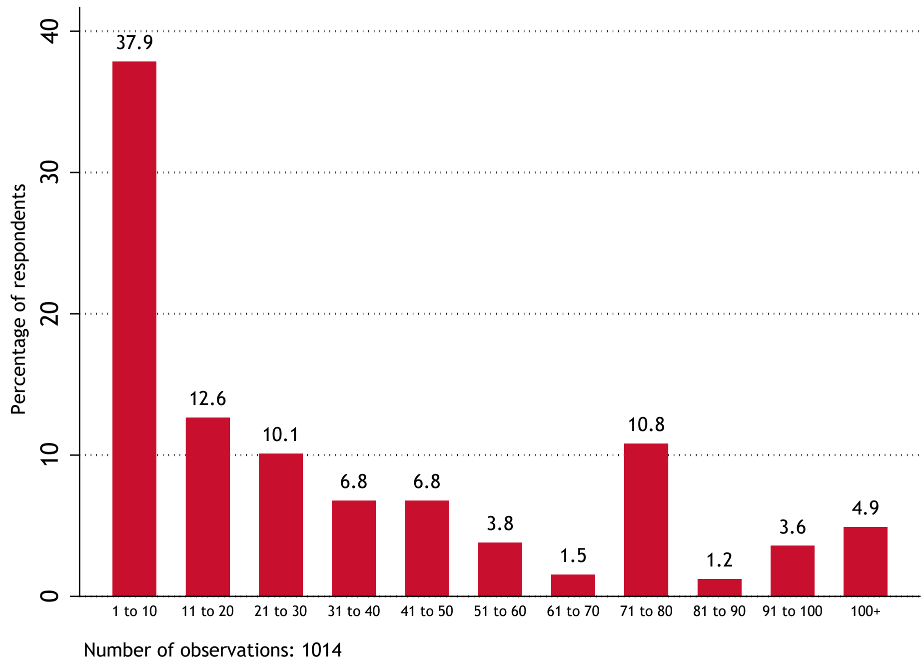
Figure 2.3: Average hours without power in Texas between Sunday, February 14 and Saturday, February 20 by zip code



The survey also asked respondents the longest single consecutive period during the storm that they were without power. Figure 2.4 shows over a third of respondents reported to have been consecutively without power between 1 and 10 hours; nearly 40% of respondents experienced consecutive loss of power between 11 and 60 hours, while about 17% reported being without consecutively without power between 61 and 100 hours. About 5% of respondents lost power for over 100 consecutive hours. When comparing this survey to the March survey, the percentages were within a couple of percentages points of each other.[3]

[3] Ibid. fn. 1

Figure 2.4: During this period what was the longest consecutive number of hours during which you were without electricity? Please enter a number between 1 and 120 hours.



2.2 Damages to homes and extent of damage

Nearly a third (30%) of respondents said that they sustained damages to their homes during the winter storm; the distribution is presented in Figure 2.5. Among those respondents who owned their current residence at the time of the storm, 32% reported damages such as broken pipes or water damage, while 25% of those who rented their residence claimed to have experience some type of damage to their residences (Table 2.1).

Figure 2.5: Did you and your household experience any damage to your home, such as broken pipes or water damage?

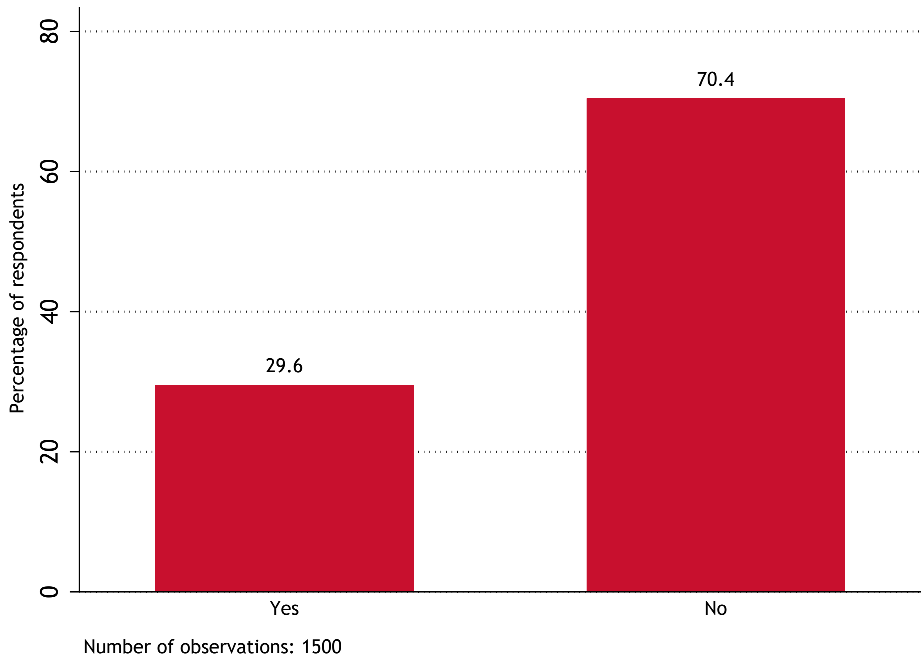
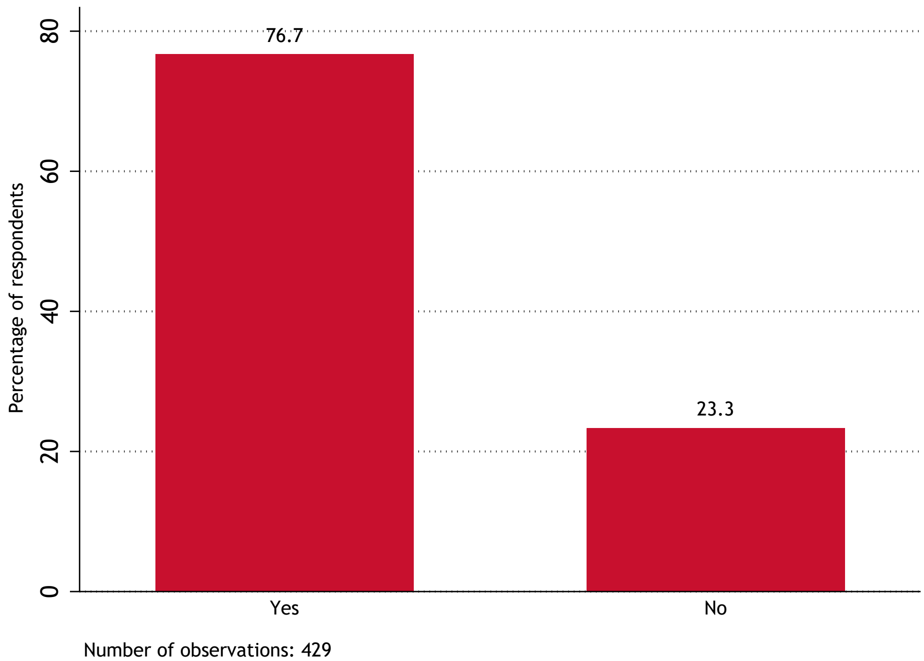


Table 2.1: Distribution of household damage by home ownership

	Own or rent current residence?					
	Own		**Rent**		**Other**	
	No.	%	No.	%	No.	%
Yes	290	31.9	117	24.5	36	32.0
No	620	68.1	360	75.5	77	68.0
Total	910	100.0	477	100.0	114	100.0

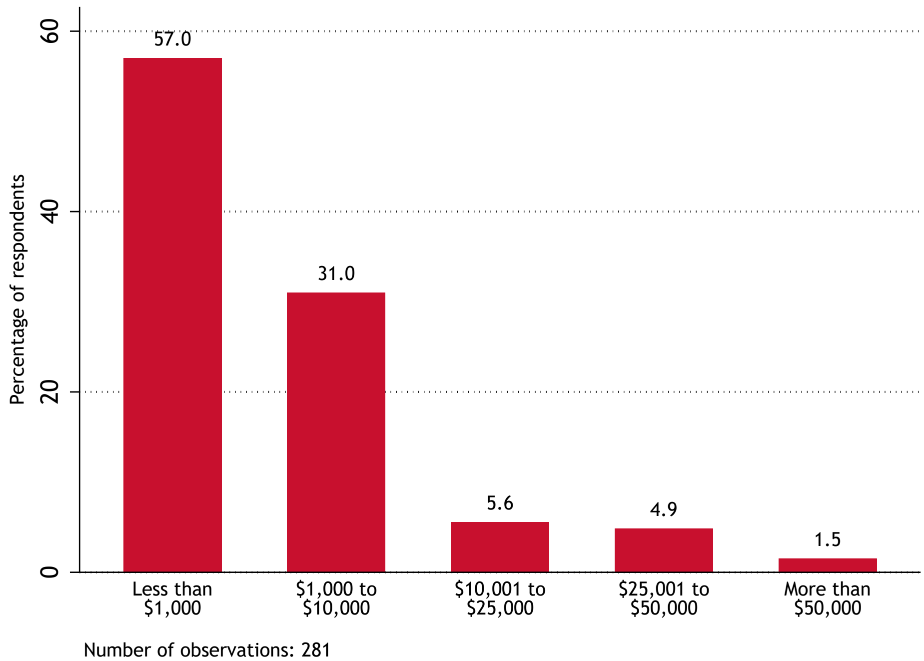
Among those respondents who sustained damage to their homes, the survey asked whether the necessary repairs had been completed. As shown in Figure 2.6, over three-quarters (77%) of those respondents had completed repairs; however, 23% indicated that there were still necessary repairs to be made.

Figure 2.6: Have the necessary repairs been completed?



Additionally, for homeowners who sustained damages to their homes, the survey asked if they had out-of-pocket expenses as a result of the winter storm that would not be reimbursed through their insurance (see Figure 2.7). The majority of respondents (57%) said they had $1,000 or less of out-of-pocket expenses. Nearly one-third of respondents (31%) said they had between $1,000 and $10,000, while 11% said they had between $10,001 and $50,000 in out-of-pocket expenses. A very small percentage of respondents said they expected to incur more than $50,000 in out-of-pocket expenses (2%).

Figure 2.7: Do you have out-of-pocket expenses related to the blackout that will not be reimbursed by insurance, for example, lost food, wages, and/or repairs?



2.3 Understanding the reasons for electric grid failure

The survey asked Texans what they believed to be the primary reasons for the electrical grid failure during Winter Storm Uri. Among the seven options, the lack of weatherization or winterization of power generators was chosen the most (62%). Next, respondents believed that severe weather and the lack of oversight over power-generation plants were to blame for the electric grid failure (58% and 51%, respectively). Half of respondents (50%) believed that the electric grid failure was caused by the lack of weatherization or winterization of natural gas equipment, 46% of respondents attributed the failure to the independence of Texas' electric grid, and 22% of respondents blamed the reliance on renewable energy.

Figure 2.8: From what you've read or heard, which of the following do you believe are responsible for the electricity grid failure during the winter storm this past February? Select all that apply.

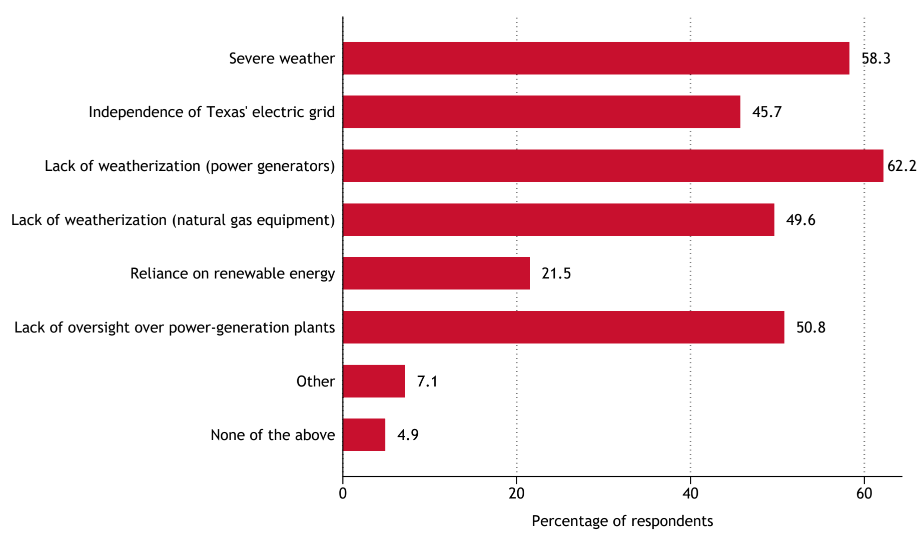
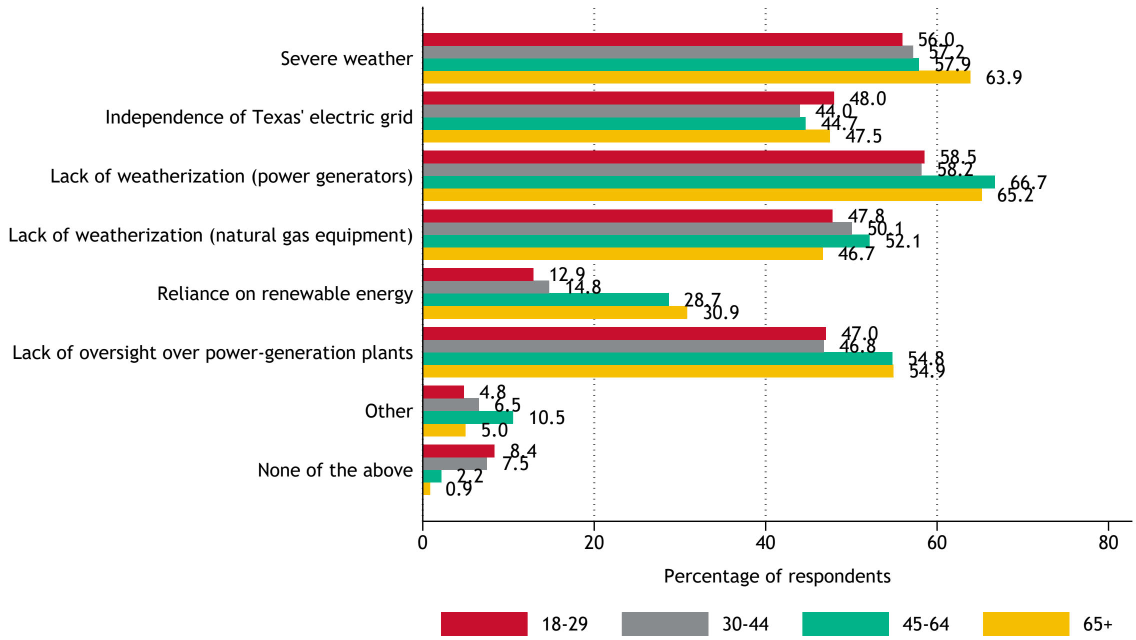


Figure 2.9 shows that respondents of all age groups believed the lack of weatherization of power generators was the most responsible for the electric grid failures during the winter storm. Respondents aged between 45 and 64 were the most likely to blame the lack of weatherization of power generators (67%). Severe weather was the second most chosen answer among all ages. Respondents in the oldest age group (65 and older) were most likely to blame the severe weather experienced during the storm for the electric grid failure; there was a seven-point percentage gap between the oldest and youngest age groups.

Reliance on renewable energy showed the largest percentage gap between the oldest and youngest age groups by 18 percentage points. By contrast, the smallest gap between age groups was the belief that the independence of Texas' electric grid was the culprit of the grid failure during the winter storm. Those in the 18-29 age range were the most likely to believe the independence of the grid was the cause of the grid failure among all four age groups, while those aged between 30-44 and 45-64 (44% and 45%, respectively) answered within one-percentage point from each other.

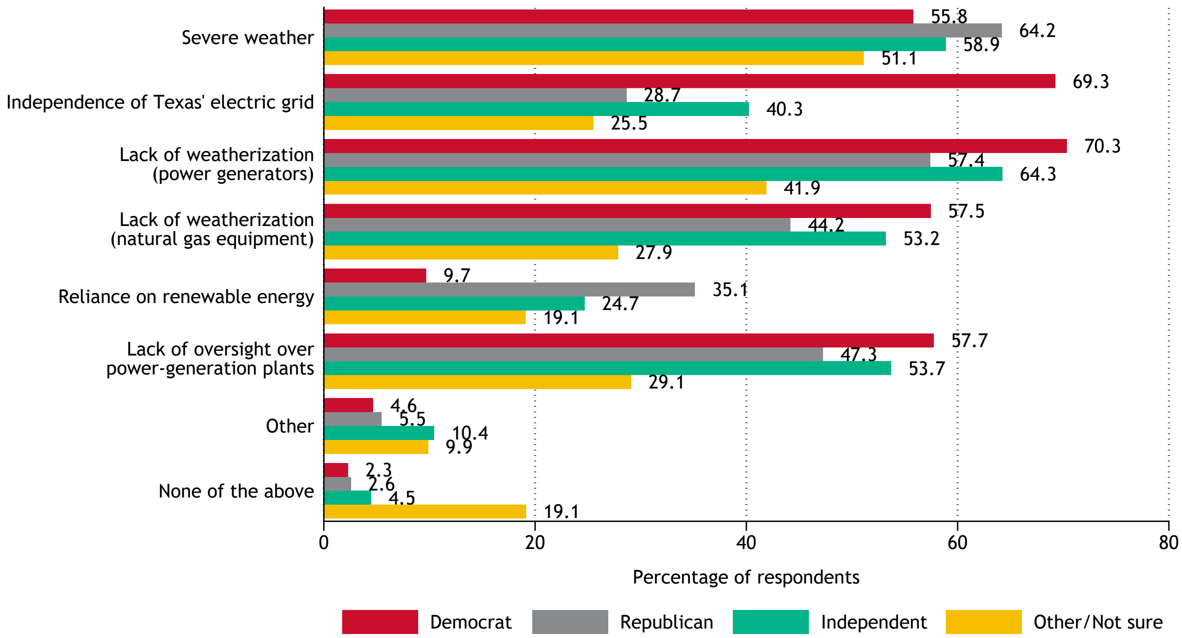
Figure 2.9: Belief of responsibility for the electricity grid failure during the winter storm this past February by age



Furthermore, as shown in Figure 2.10, 70% of Democrats and 64% of Independents agreed that the largest liability was the lack of weatherization of power generators closely followed by the independence of Texas' electric grid (69% and 40%, respectively). Republicans were most likely to place blame on severe weather (64%) and least likely to believe that the independence of Texas' electric grid was the cause of the electricity grid failure (29%) (besides those who chose other or not sure).

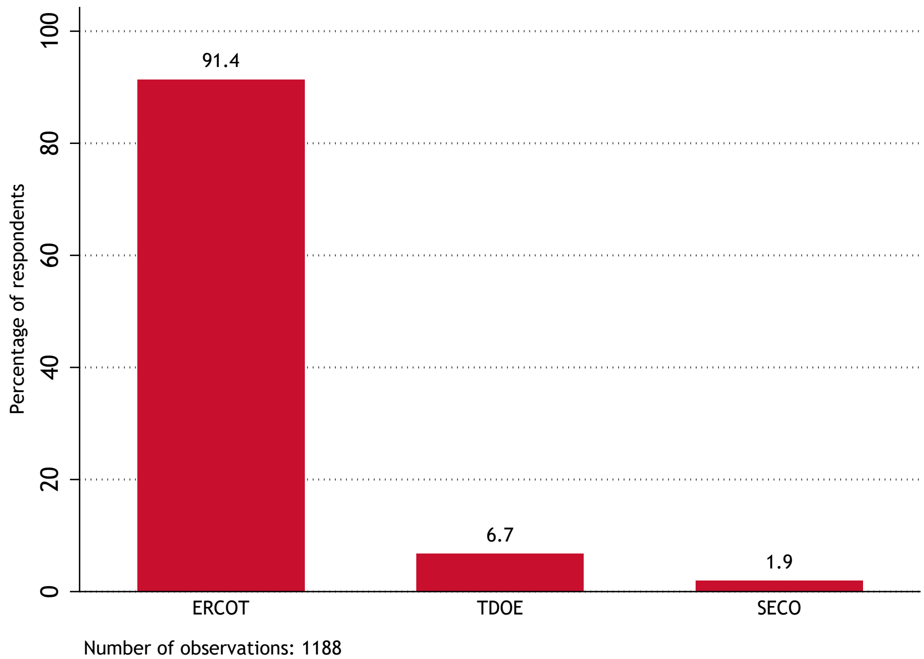
The independence of Texas' electric grid has been a polarizing issue among Texans and policymakers since February through the end of the regular session of the 87th Texas Legislature. The survey shows that there was a 41 percentage point gap between respondents who identified as Republicans and those who identified as Democrats. However, the belief that severe weather was responsible for the storm showed similar results among those in each party identification group. There was a three-point gap between Democrats and Independents and a eight-point gap between Democrats and Republicans.

Figure 2.10: Belief of responsibility for the electricity grid failure during the winter storm this past February by party identification



Finally, when it comes to knowledge of which agency operates the Texas electric grid (Texas Interconnection), most respondents (91%) correctly identified that the Electric Reliability Council of Texas (ERCOT) operates and supplies power to most of Texas customers (see Figure 2.11). Only 7% thought the Texas Department of Energy (TDOE) supplied power to the state, while less than 2% believed the electric grid supplier was the Texas State Energy Conservation Office (SECO).

Figure 2.11: Do you know which agency operates the Texas Interconnection (the Texas electricity grid) and supplies power to most of the state of Texas customers?



2.4 Confidence in laws and government

The survey asked respondents if they agreed whether the Texas government could adequately tackle issues related to the electric failures and whether the current laws and regulations in Texas were insufficient to resolve these issues. Figure 2.12 shows the proportion of respondents who agreed or disagreed with the Texas government and the ability of current laws and regulations to handle issues related to the electric grid failure during the winter storm. When it comes to the state government's ability to mediate or resolve issues experienced during Winter Storm Uri, 33% of respondents agreed that the Texas government could handle these issues. However, 39% disagreed that the state government was capable of resolving the issues relating to the electric grid failures, and 28% were neutral.

On the other hand, over half of respondents (52%) believed that current laws and regulations in Texas were inadequate to mitigate the issues caused by the electric grid failure across the state. Less than one-fifth of respondents (17%) believed that current laws and regulations could resolve these problems, while 31% were neutral.

Figure 2.12: To what extent do you agree or disagree with each of the following statements about electricity generation in Texas?

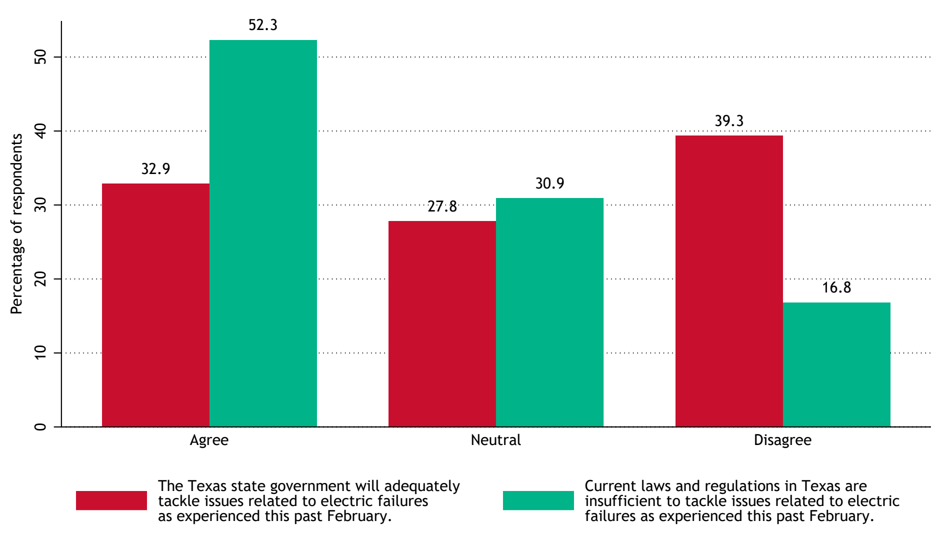


Table 2.2 shows how confident respondents were in the Texas government to tackle issues related to the electric grid failures by party identification. The majority of respondents identified as a Democrat (63%) were not confident the Texas government's ability to resolve issues related to the electric grid failures. Less than one-fifth of Democratic respondents (18%) agreed that the state government was capable of tackling those issues, while 20% remained neutral. Counter to Democrats, the majority of respondents who identified as Republican (64%) were confident that the Texas government could adequately tackle these issues, and only 13% disagreed. Slightly more than one-fifth (23%) of Republicans were neutral on the issue. Those who identified as Independent were nearly evenly split with 31% who agreed, 39% disagreed, and 30% remained neutral. Lastly, respondents who identified other or were not sure which, if any party, they identified with were more likely to remain neutral (57%).

Table 2.2: I feel confident that the Texas state government will adequately tackle issues related to electric failures as experienced this past February

	Democrat	**Republican**	**Independent**	**Other/ Not sure**	**Total**
	%	%	%	%	%
Agree	17.7	63.5	31.2	16.3	32.9
Neutral	19.6	23.1	30.4	56.7	27.8
Disagree	62.7	13.4	38.5	27.0	39.3
Total	100.0	100.0	100.0	100.0	100.0

Similar to Democrats who were not confident in the ability of the Texas government to handle the issues involving the electric grid failure, nearly three-fourths of Democrats (72%) believed that the current laws and regulations are insufficient to tackle these issues (see Table 2.3). Less than 10% of Democrats were confident in the current laws to tackle these problems and 18% remained neutral.

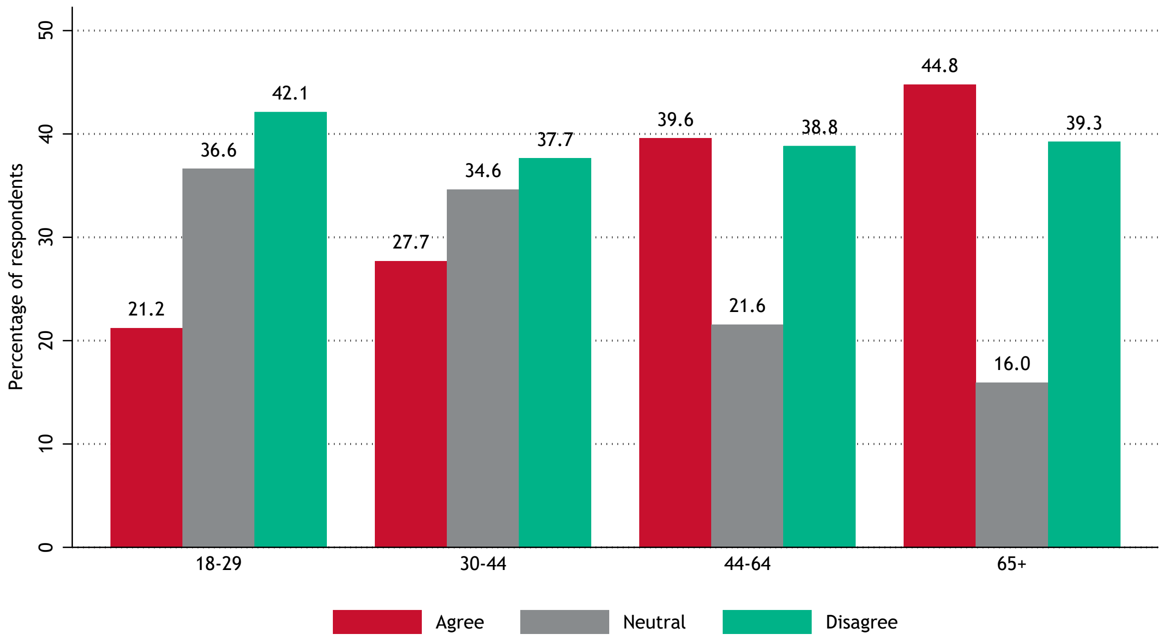
On the other hand, Republicans were less confident in the current laws and regulations to tackle the electric grid issues than they were in the Texas government, in general, to handle these problems. Slightly more than a third of Republican respondents either agreed or were neutral that the current laws and regulations were insufficient (35% and 36%, respectively). About 29% of Republicans were confident in the current laws. Among Independents, about half of these respondents (50%) believed that the current laws and regulations were insufficient to tackle the electric grid problems, and a third of Independents were neutral. Only a small percentage of Independents (17%) believed that the current legislation was sufficient. Similar to those who identified as other or were not sure about their party identification in Table 2.2, the majority of those in this group (52%) remained neutral, and slightly more than a third (36%) agreed that the policies were insufficient to fix the electric grid failure issues.

Table 2.3: I feel that current laws and regulations in Texas are insufficient to tackle issues related to electric failures as experienced this past February

	Democrat	**Republican**	**Independent**	**Other/ Not sure**	**Total**
	%	%	%	%	%
Agree	72.4	35.2	49.5	35.6	52.3
Neutral	18.1	36.1	33.4	52.2	30.9
Disagree	9.6	28.7	17.0	12.2	16.8
Total	100.0	100.0	100.0	100.0	100.0

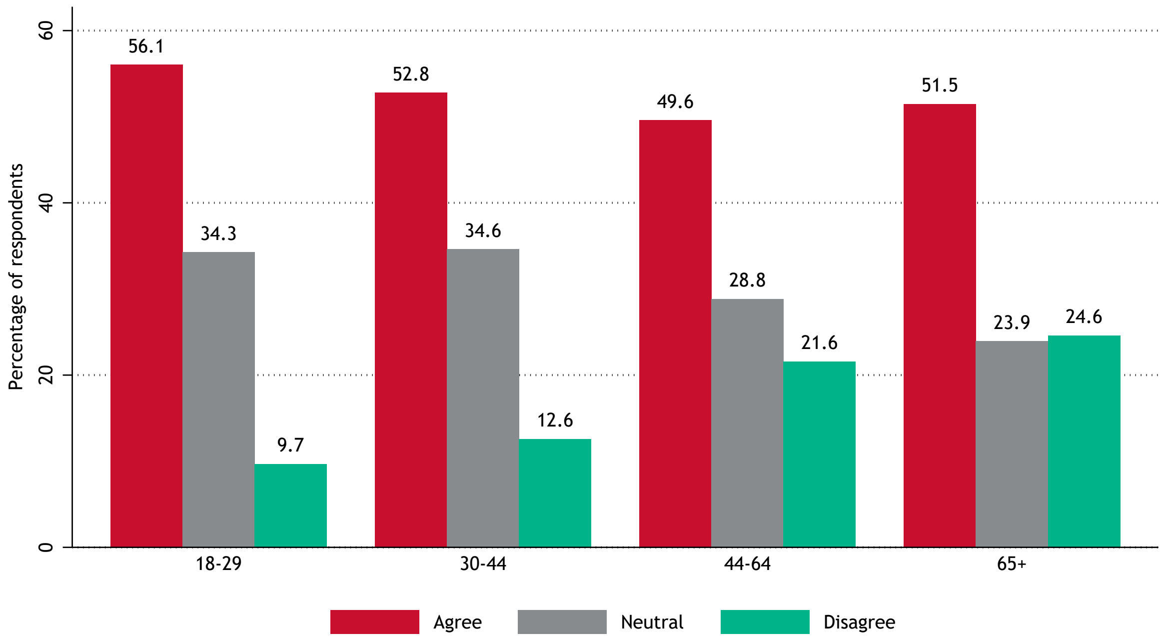
When looking at trust in the Texas government to handle the issues related to the winter storm, those in the Gen Z and Millennial age groups are less likely to agree that the Texas state government can adequately tackle these issues than those in the 45 to 64 and 65 and older age groups (see Figure 2.13). Nevertheless, over a third of each age group disagreed that Texas' government could mitigate these issues. Those in the 18 to 29 age group were most likely to disagree (42%) than any other age group.

Figure 2.13: Belief that the Texas state government will adequately tackle issues related to electric failures as experienced this past February by age



Similar to those who did not believe the Texas government could adequately tackle the issues caused by the winter storm, Figure 2.14 shows that at least half of respondents in each of the four age groups were not confident that the current laws and regulations could alleviate issues relating to Texas' electric grid. Respondents 65 and older were the most likely to agree that current laws and regulations could tackle issues related to electric failures, while those between 18-29 were the least likely to agree, with about a 15 percentage point difference between these age groups.

Figure 2.14: Belief that the current laws and regulations in Texas are insufficient to tackle issues related to electric failures as experienced this past February by age.



Months after the electric grid failure during Winter Storm Uri, Texans remain frustrated and uncertain of the ability of power generators and state lawmakers. During the regular session of the 87th Texas Legislature, policymakers were able to pass Senate Bills 2 and 3 into law, which aimed at mitigating issues with Texas' power grid. However, these bills might only be putting a patch on a couple of areas of concern: winterization of some parts of the electric supply chain and the creation of an emergency alert system. Yet the Legislature seems to have punted on reliable access to electricity at critical times, on which we found consumers placed a high value.

Senate Bill 3 (SB3) was touted as an attempt to overhaul Texas' electricity industry and infrastructure. The legislation has two main components. First, it mandates that the Texas Railroad Commission come up with rules that natural gas pipelines and electricity generators designated as critical by the agency need to follow in preparation for extreme weather events. The bill requires the weatherization of energy transmission and generation equipment and also imposes fines of up to $1,000,000 for failing to comply. Experts suggest that the fines are not sufficient to incentivize operators and energy producers to prepare their facilities for severe weather events.[4]

Second, it instructs the Department of Public Safety to establish a statewide emergency alert system to inform Texans about procedures and rolling blackouts during extreme weather events

[4]Mark Chediak and Josh Saul, "Texas Shuns Radical Changes to Power Grid After Deadly Freeze," Bloomberg, May 28, 2021.

where power usage is expected to increase dramatically.[5] Additionally, SB3 prohibits indexed retail electric plans, which can fluctuate rates based on the cost of wholesale electricity. [6] Lastly, SB3 creates a Critical Infrastructure Resiliency Fund (consisting of legislative appropriations and special revenue sources such as sales taxes, gasoline and fuel taxes, franchise taxes, oil and natural gas production taxes, among others) that would offer grants to companies designated as critical, which need to weatherize their equipment.

On the same day, the Texas Legislature also passed Senate Bill 2 (SB2), which addresses more administrative issues with ERCOT and the Public Utility Commission of Texas (PUC). This bill requires any changes ERCOT makes to protocols to be presented to the PUC before adoption and implementation to give the PUC commissioners an opportunity to veto any amendments proposed by ERCOT.[7]

Legislation like SB2 and SB3 were passed in response to voters' frustration during a busy legislative session that happened to fall in the midst of the February winter storm. However, the response from policymakers still falls short on addressing the main concern of Texans: reliability. While these bills may seem like a victory for some Texans, others feel there is much to be done to ensure that power generators are updated, suppliers work quickly to weatherize power generators and transmission lines, and the state is better equipped to handle future power crises. In addition, there appears to be loopholes when it comes to compliance and implementation, such as outlining what measures need to be implemented, which facilities are subject to the mandates, and what is a reasonable timeline for weatherization. The outcome suggests that the public demands were not strong enough against the influence of the industry lobby. With ERCOT's looming threat of rolling blackouts going into an extremely hot summer,[8] many Texans are worried that the electric grid that powers most of the state will not be prepared or equipped to handle a higher demand for electricity.

[5] For more information, see Senate Bill 3

[6] Shawn Mulcahy and Erin Douglas. "Sweeping legislation to overhaul state's electricity market in response to winter storm heads to Texas House after Senate's unanimous approval." The Texas Tribune, March 29, 2021.

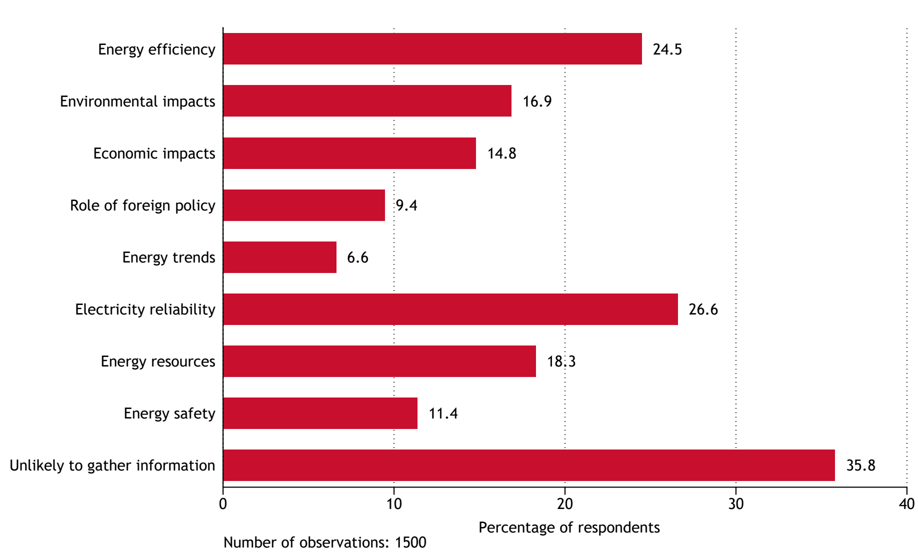
[7] For more information, see Senate Bill 2 Analysis

[8] Ibid. fn 5

Reliability and Future of Texas Electricity Grid

In this section, we examine Texans' attitudes toward reliable electricity. We also gauge respondents' evaluation of the contributions various energy sources should make in securing reliable electricity in the future. A salient concern among Texans is access to a reliable supply of electricity, which is defined as "the ability of a power system to provide service to customers while maintaining the quality and price of electricity at an acceptable level."[1] The survey asked respondents to choose two topics they would be most likely to gather information about, the results of which are displayed in Figure 3.1.

Figure 3.1: Given your day-to-day habits, interests, and general attitude toward energy, which two of the following topic areas are you most likely to proactively gather information over the next 6 months. Please select two.



[1] K. N. Tinnium, P. Rastgoufard and P. F. Duvoisin, "Cost-benefit analysis of electric power system reliability," *Proceedings of 26th Southeastern Symposium on System Theory*, (1994): 468-472.

Although the largest share of respondents (36%) reported that they were not likely to gather any energy-related information, 27% and 25% responded that they look like to get more information about energy reliability and efficiency, respectively. Among those who were likely to seek information, energy resources was the third most selected topic.

3.1 Reliable electricity service

Figures 3.2 and 3.3 show Texans' opinions regarding energy reliability. When respondents were asked about their opinion on the acceptable frequency for power outages to occur (Figure 3.2), 41% answered that outages are never acceptable, 57% responded that an outage is acceptable a few times per year, 31% thought once a year, and 26% of respondents thought 2-4 times per year. However, nearly half of the latter group of respondents (47%) considered power outages to be a significant problem when they last several hours.

Figure 3.2: In your opinion, how frequently is it acceptable for power outages to occur? Please select two.

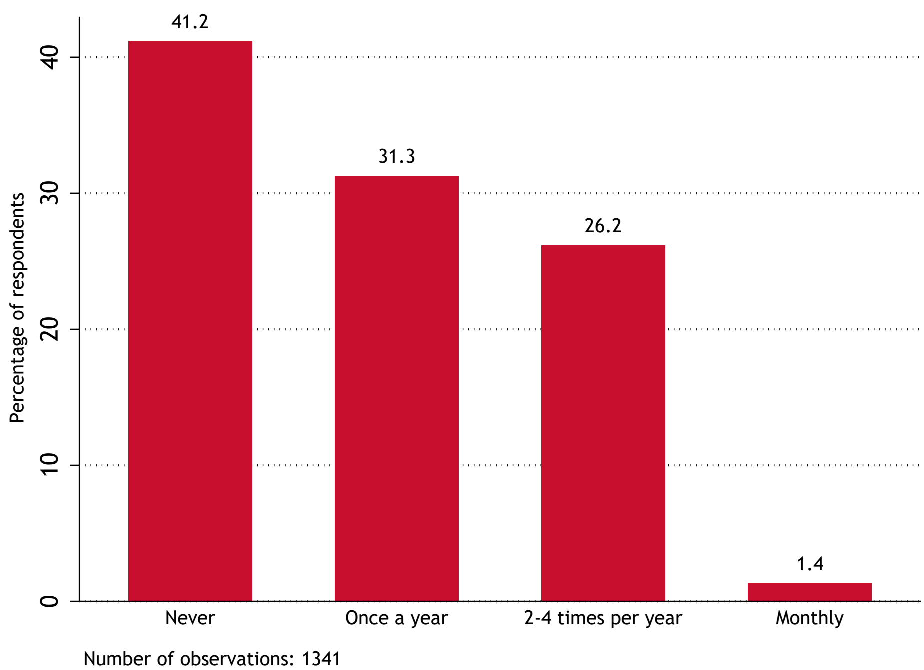
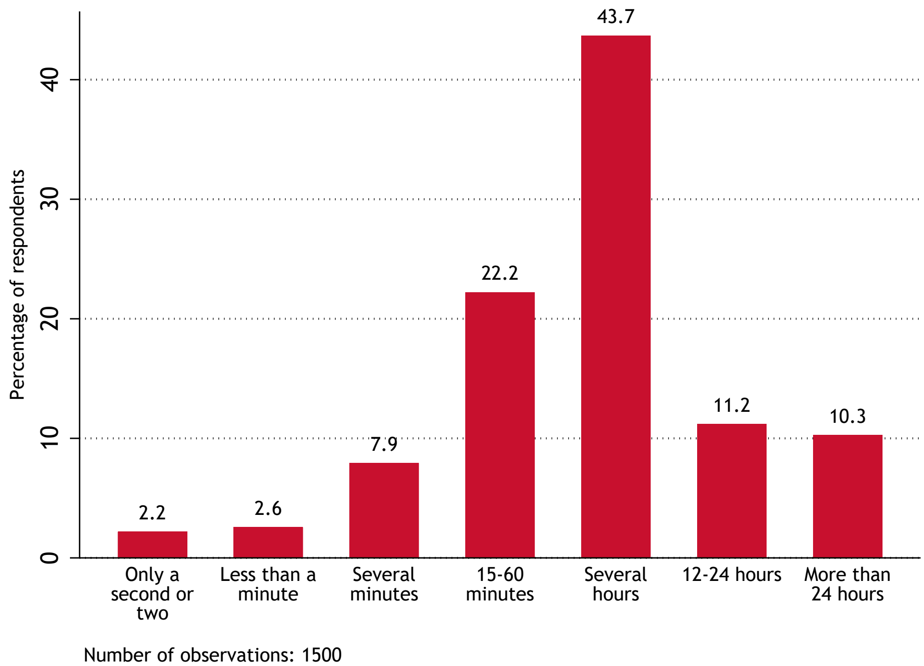
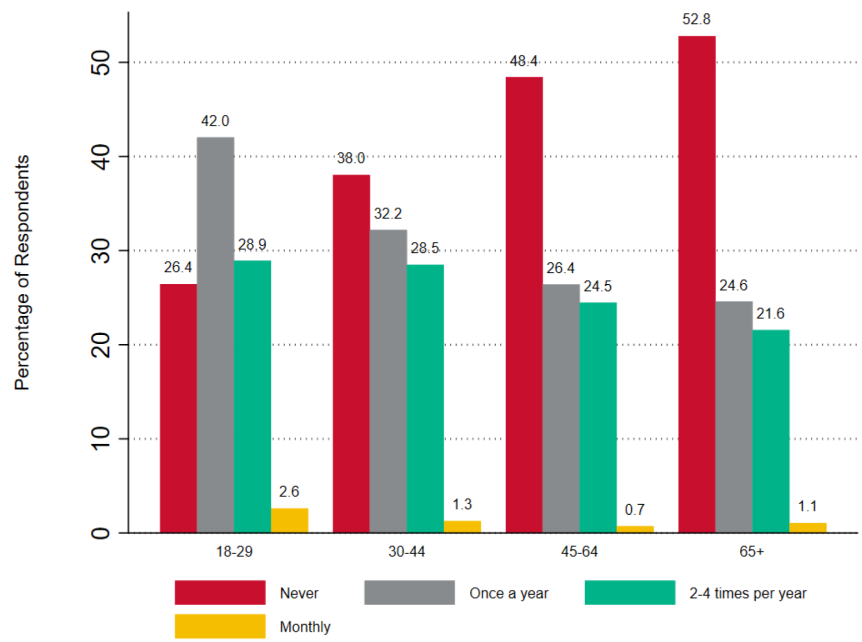


Figure 3.3: In your opinion, when are power outages a significant problem? When the outage lasts …



Moreover, 44% of the total respondents thought that power outages become a significant problem when they last several hours and 22% when they last 15 to 60 minutes. On the other hand, 22% of respondents thought that power outages that last more than 12 hours are a significant problem, and the remaining 5% thought that they are a problem when they last less than a minute.

Figure 3.4: Acceptable power outages per year by age groups



Similarly, groups that are often considered vulnerable appear to value reliability the most. Older respondents and those with lower educational attainment were less likely to find longer power outages frequencies acceptable (Figure 3.4). Likewise, younger Texans and those with higher education levels had a slightly higher acceptance towards 1, 2-4, or monthly outages per year.

Figures 3.5 and 3.6 show respondents opinions on the acceptable number of outages per year and length of an outage by party identification. Respondents, regardless of their party identification, largely agreed on how often it is acceptable for power outages to occur (3.5). Forty-three percent of Democrats, 41% of Republicans, 40% of Independents, and 38% of those identifying as other said it was never acceptable. Independents were slightly more tolerable of outages once a year as were those identifying as other of outages 2-3 times per year.

We see similar distributions across the four party ID groups when examining opinions about when power outages are a significant problem. Within each party category, the assessment that power outages lasting several hours were problematic was the most common response, followed by outages lasting between 15 and 60 minutes. Republicans and respondents who identified as other or were not sure about their party identification were slightly more tolerable of outages lasting more than several hours when compared to Democrats and Independents; but overall, irrespective of their partisan alignments, respondents reported similar attitudes towards the acceptable number of outages per year and the length at which outages become a significant problem.

Figure 3.5: Acceptable power outages per year by party identification

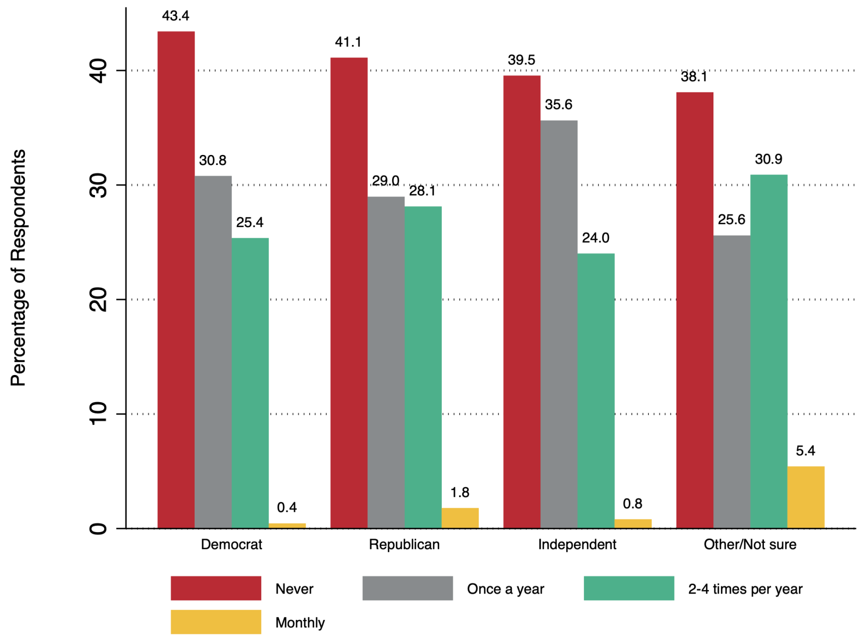
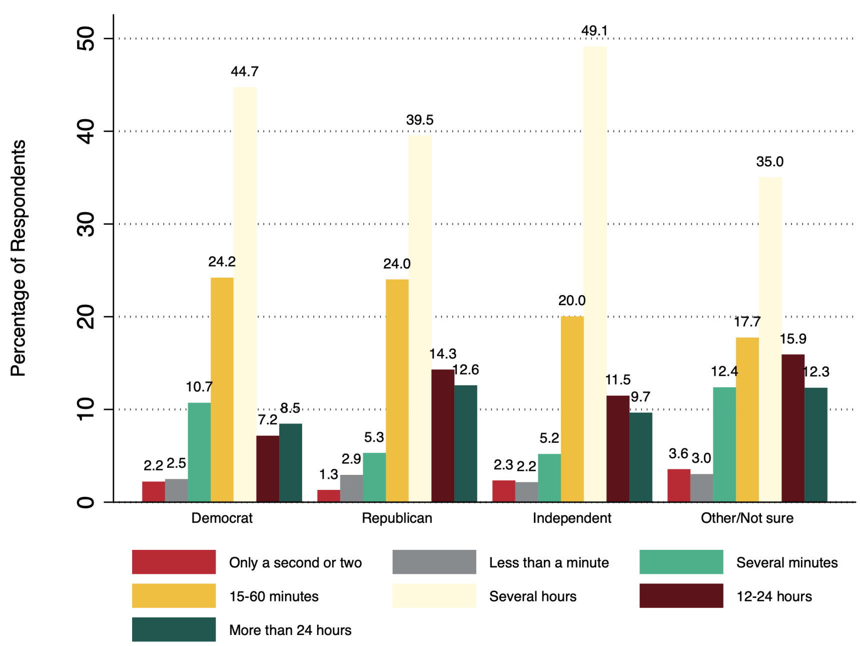


Figure 3.6: Opinion on when are power outages a significant problem by party identification

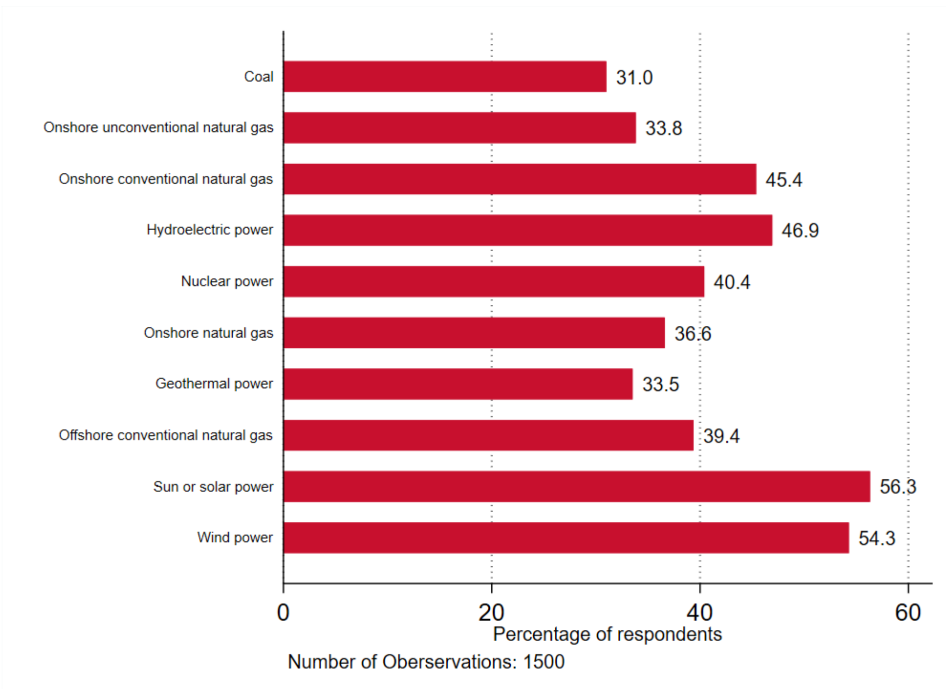


3.2 Future of energy in Texas

The survey also gauged respondents' preferences about the future of Texas' electricity supply. We asked respondents the extent they agreed or disagreed that ten different energy sources would make a substantial contribution to reliable and secure electricity supply in Texas in the future. As can be seen in Figure 3.7, the majority of respondents agreed that renewables - solar (56%) and wind (54%) power - will make a substantial contribution. A large proportion of respondents also agreed that hydroelectric power (47%) and onshore conventional natural gas (45%) will make substantial contributions to Texas' future supply of reliable and secure electricity.

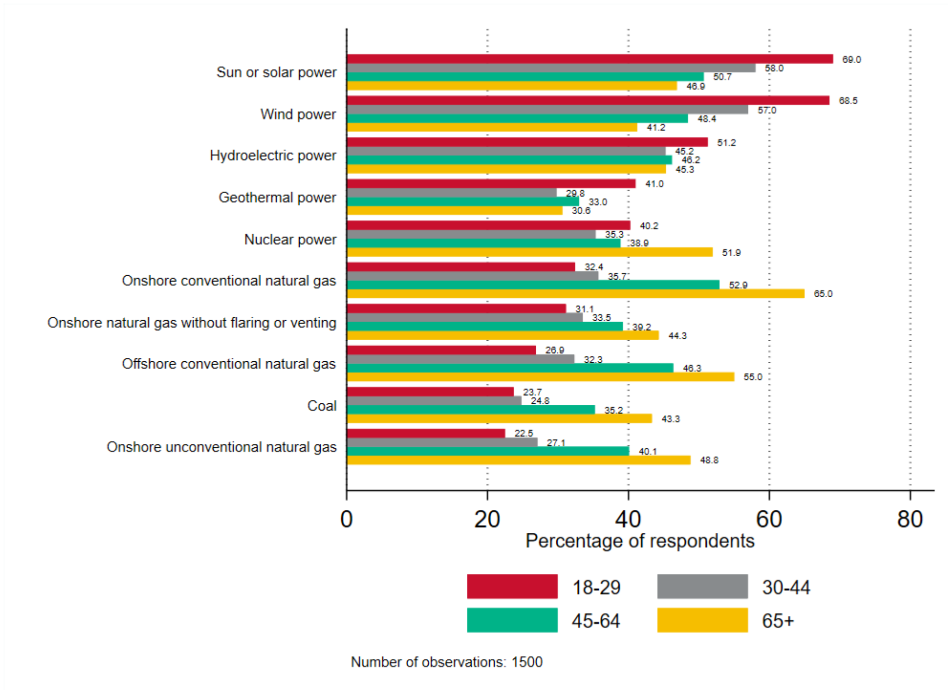
About a third of respondents agreed the energy sources that would be important in the future were onshore unconventional natural gas typically produced via hydraulic fracturing (fracking), geothermal power, and coal.

Figure 3.7: To what extent do you agree or disagree that the following energy sources will make a substantial contribution to reliable and secure electricity supply in Texas in the future?



While a majority of respondents agreed that renewable energy will play an important role in making electricity in Texas secure and reliable, we do see significant differences across age groups (Figure 3.8). Younger age groups were more likely to agree that green and renewable energy sources will be most significant for future electricity supply. Indeed, solar, wind, and hydroelectric power, all green or renewable energy sources, are the only energy sources that a majority of those in the youngest age group agree will make a substantial contribution to Texas' future electricity supply.

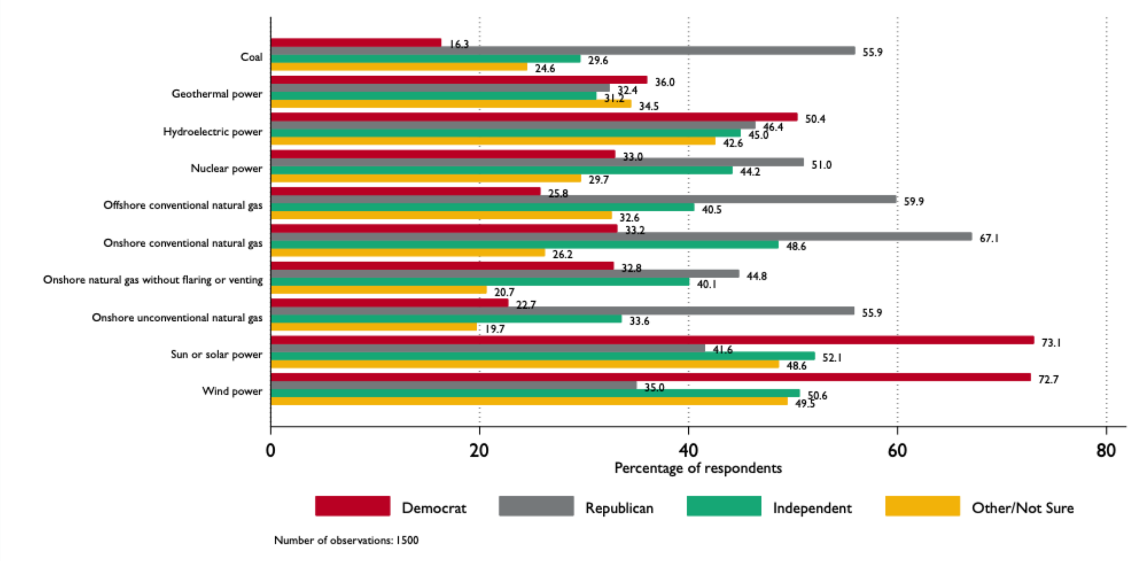
Figure 3.8: Agreement with the importance of energy sources by age groups



Respondents 65 and older were the most likely to agree that onshore (both conventional and unconventional) and offshore natural gas will make important contributions to Texas' electricity supply; the youngest age group, by contrast, were the least likely to agree. Coal shows the biggest generation gap between the oldest and youngest age group with a 25 percentage point gap.

In addition to differences across age groups, we also see differences between respondents according to party identification. Figure 3.9 shows how Democrats, Republicans, Independents, and those who identify as other, saw the importance of ten energy sources for ensuring the reliability of electricity in Texas.

Figure 3.9: Agreement with the importance of energy sources by party identification



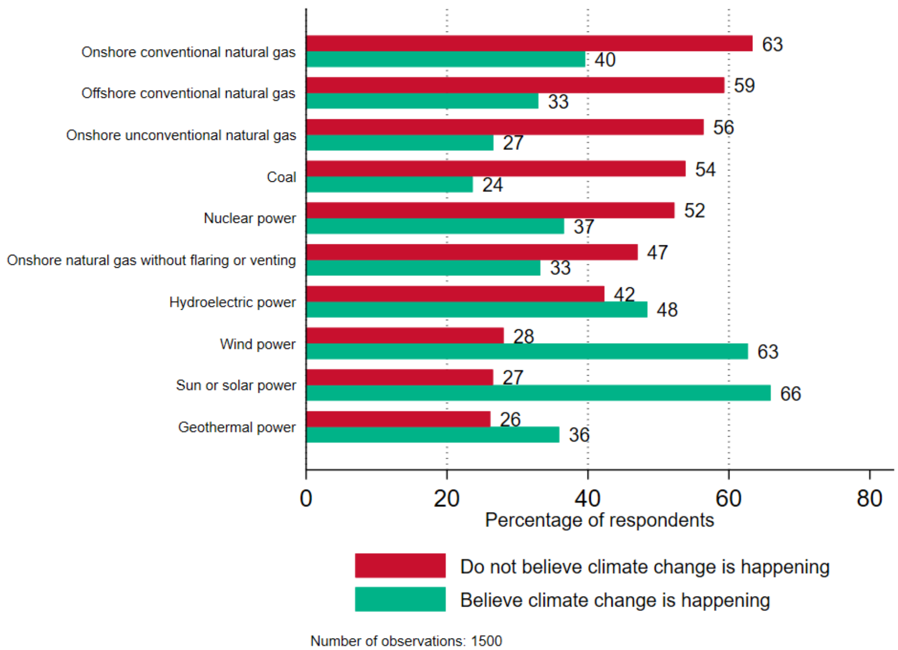
While almost three-quarters of Democrats agreed that solar and wind power would contribute to reliable electricity, less than 50% of Republicans responded similarly. Just over 50% of Independents and just under 50% of those identifying as other agreed that solar and wind power would make important contributions. Republicans were much more likely to select coal as an important contributor to reliable and secure energy, nearly double the percentage of Independents and those as who identified as other and 3.5 times more than Democrats. Indeed, coal as well as wind power reveal the largest level of disagreement between Republicans and Democrats, with 40- and 38-point percentage gaps, respectively.

Approximately 34 percentage point differences in support between Democrats and Republicans are also observed for onshore and offshore conventional natural gas and onshore unconventional natural gas typically produced via hydraulic fracturing (fracking). In terms of natural gas, the level of disagreement was smallest for onshore natural gas produced without flaring or venting: 33% of Democrats, 45% of Republicans, and 40% of Independents agreed that it would make a substantial contribution to reliable and secure electricity supply in Texas in the future; those identifying as other showed the lowest level of support for onshore natural gas produced without venting or flaring.

The level of agreement across the four groups was highest for hydroelectric and geothermal power, though the level of agreement was overall lower. Half of all Democrats, 46% of Republicans, 45% of Independents, and 43% of those identifying as other agreed that hydroelectric power would make a substantial contribution to reliable and secure electricity supply in Texas in the future. Similarly, 36% of Democrats, 32% of Republicans, 31% of Independents, and 35% of the fourth, other category agreed that geothermal power would contribute substantially to reliable electricity in the future.

We also looked at whether respondents thought a particular energy source will make a significant contribution by whether they believe climate change is happening. In many ways, the distributions observed in Figure 3.10 mirror those along the partisan divide reported above in Figure 3.9. Respondents who did not believe climate change was happening were most likely to emphasize natural gas and coal for a reliable and secure electricity supply compared to respondents who believed in climate change. Those that believed climate change was happening, by contrast, were more likely to agree that solar and wind power would contribute substantially to reliable electricity than those who do not.

Figure 3.10: Agreement with the importance of energy sources by belief in climate change



Finally, respondents were asked which two factors should be considered when deciding the future of electricity production in Texas. From Figure 3.11, we see that Texans are again exhibiting their concern about reliability. Forty-percent of respondents said that the reliability of electricity supplies was one of two important factors. The second most common factor was cost (26%), followed by helping to prevent climate change (20%) and efficiency in production (19%).

Figure 3.11: From what you know or have heard, which of these factors, if any, would you say are the 2 most important for deciding which methods of electricity production should be used in Texas in the future? Please select two.

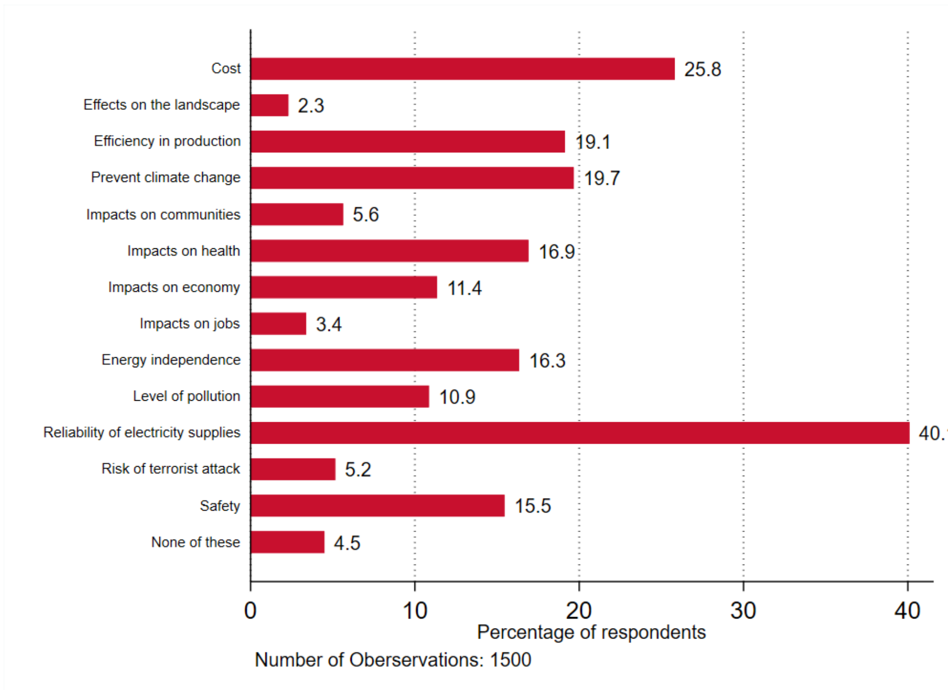
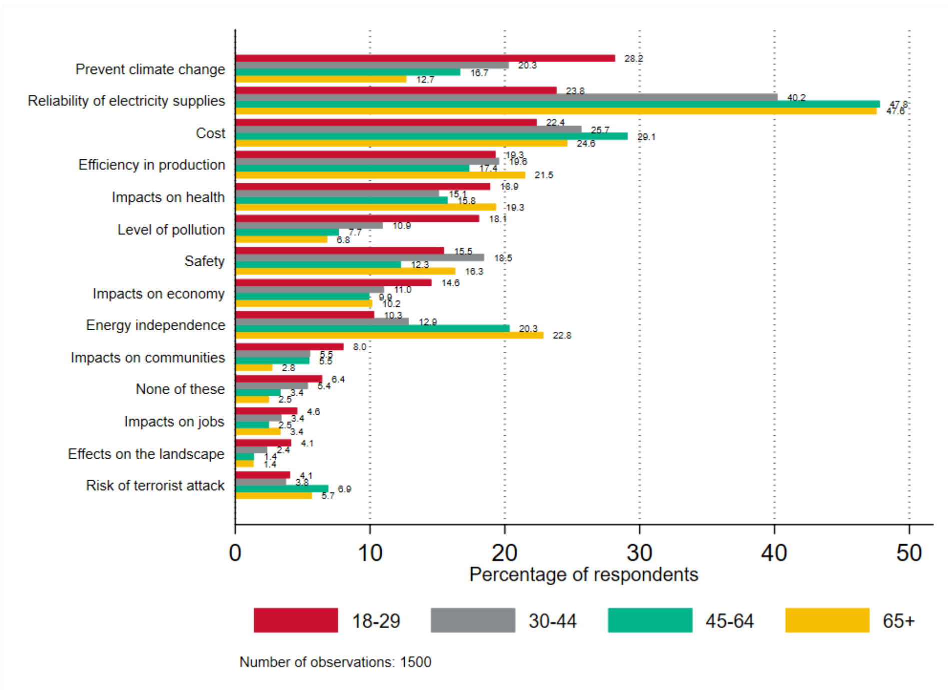


Figure 3.12 shows how age groups emphasized the various factors to consider in electricity production. The youngest age group was most likely to prioritize climate change. Twenty-eight percent of respondents aged 18-29 selected preventing climate change as one of two factors for deciding future electricity production, compared to 20%, 17%, and 13% of those aged 30-44, 45-64, and 65^{+}, respectively. Respondents in the youngest age group exhibited the least consensus, with 18-24% selecting each level of pollution (18%), impacts on health (19%), efficiency in production (19%), cost (22%), and reliability of electricity supplies (24%).

Older age groups, particularly those older than 45, were more likely to prioritize reliability of electricity supplies. Forty-eight percent of respondents aged 45 and older, 40% of those aged 30 to 44, and 24% of respondents in the youngest age group said that the reliability of electricity supplies was one of two important factors.

Figure 3.12: Distribution of decision factors by age groups

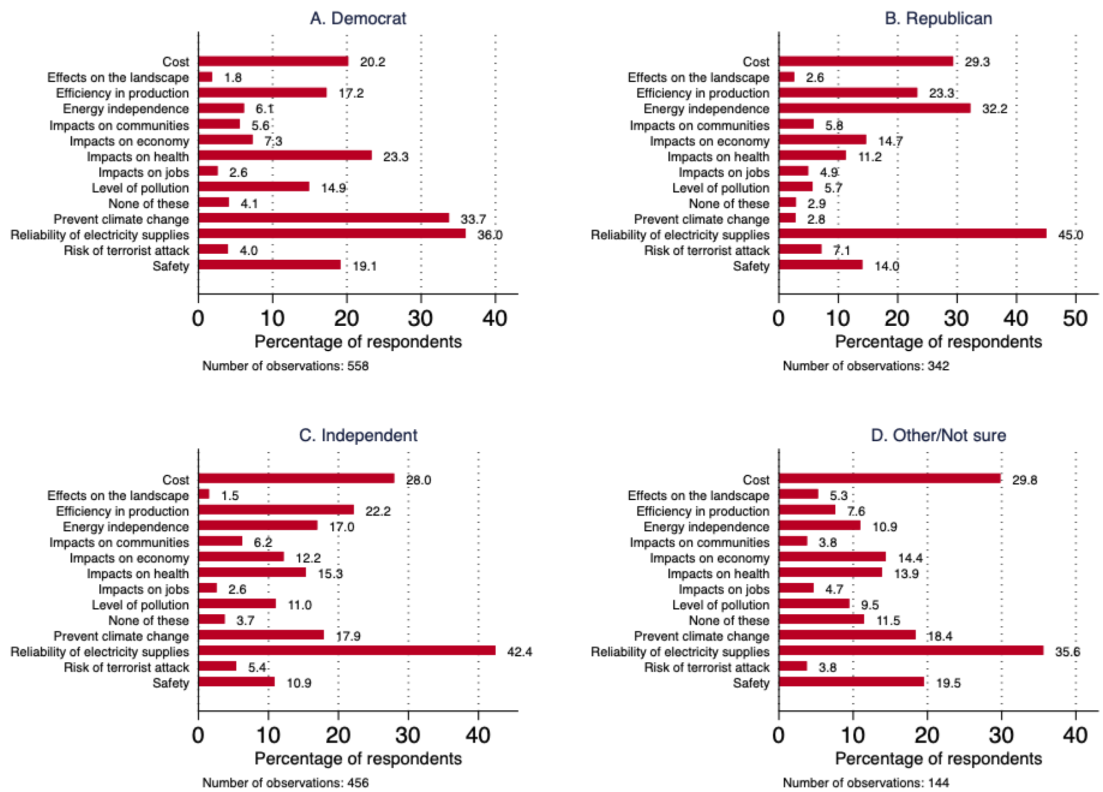


Finally, we looked at how the factors respondents prioritized varied according to their party identification (Figure 3.13). For all four party identification groups, reliability was a top priority. Forty-five percent of Republicans, 42% of Independents, 36% of Democrats, and 36% of the other category selected the reliability of electricity supplies as one of two factors. Republicans also prioritized energy independence (32%) and cost (29%) as factors for determining which methods of electricity production should be used. Likewise, cost was the second most select option among Independents and those identifying as other. Efficiency in production ranked among Independents' top three, with 22% selecting it as one of two important factors, while safety was the third most selected option among respondents identifying as other.

Reliability of electricity supply was also a priority for Democrats, with 36% selecting it as one of two important factors that should be considered. Among Democrats, the second most important factor was preventing climate change, revealing a stark difference in priorities between Democrats - and to a lesser extent Independents - and Republicans. While 34% of Democrats and 18% of Independents and those identifying as other prioritized preventing climate change, only 3% of Republicans did so.

For Democrats, Republicans, and Independents impact on the jobs market and effects on the landscape were not seen as important considerations. Opinions were, not surprisingly, more disparate among respondents who were not sure of their party ID or identified as other.

Figure 3.13: Distribution of decision factors by party identification



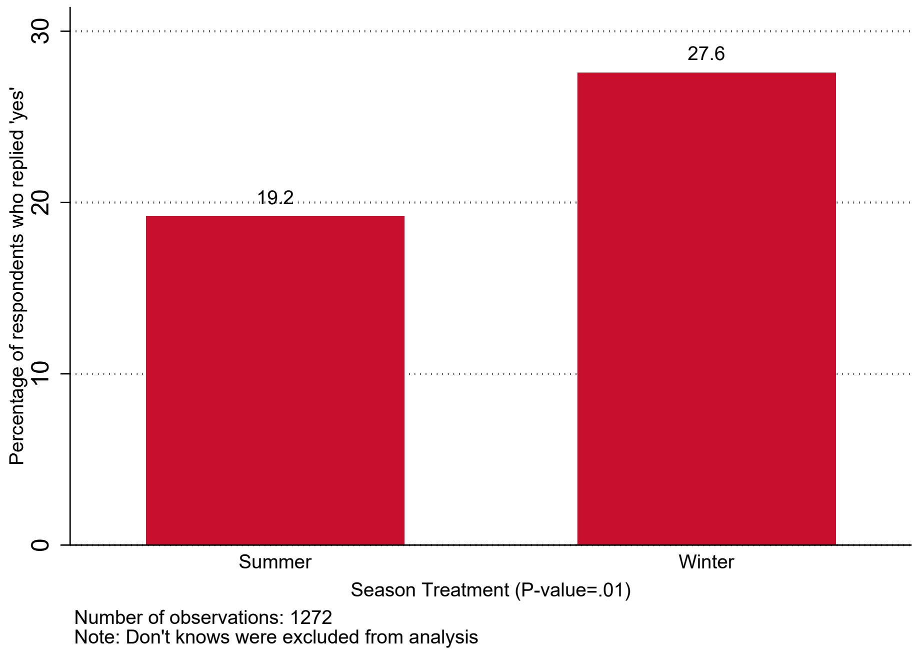
Willingness to Pay for Reliable Electricity Service

4.1 Power outages and willingness to pay in summer and winter

We presented respondents two different power outage scenarios to assess their opportunity costs of having a stable power supply. First, respondents were presented with a hypothetical scenario for a two-day power outage during the summer or during the winter seasons: 741 respondents were randomly assigned to hypothetical two-day power outage during the summer and 759 were assigned to a winter two-day power outage scenario. We then asked if respondents would be willing to experience two days without power if the utility company paid them, and how much they would expect to receive from the utility company for a two-day outage.

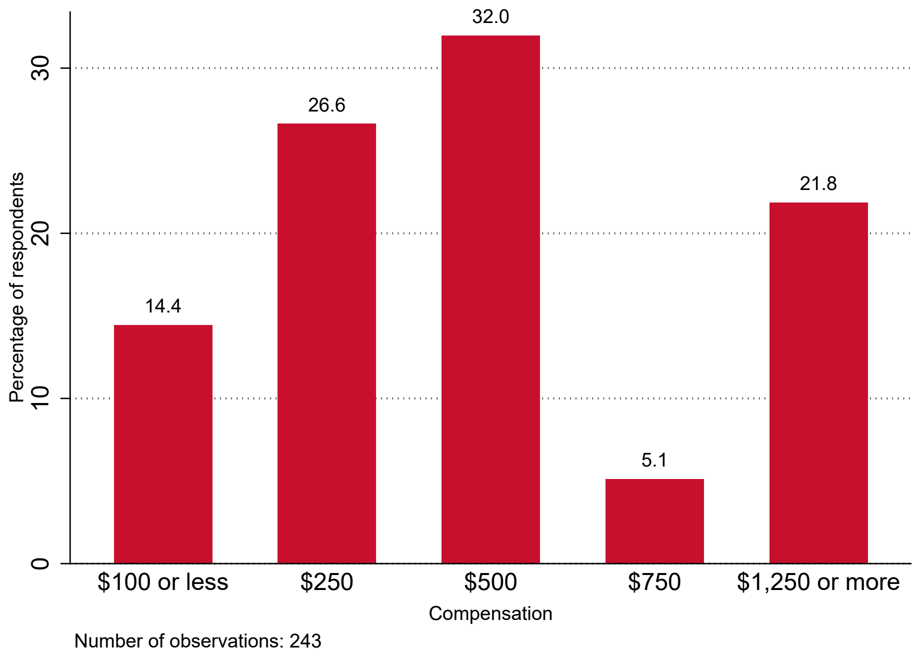
Figure 4.1 presents the distribution of respondents' willingness to experience a two-day power outage during the summer or the winter season if they received some compensation from their electric company. Respondents who selected don't know were excluded from the analysis. About 19% of respondents were willing to experience a power outage for 48 hours in the summer if their utility company compensated them, while a higher percentage of respondents (28%) were willing to experience the same scenario in the winter, a statistically significant difference. This suggests that if compensated, Texans would be more willing to experience a power outage in the winter rather than the summer.

Figure 4.1: Are you willing to experience a power outage of two days (during the summer or winter) if your electric utility company paid you?



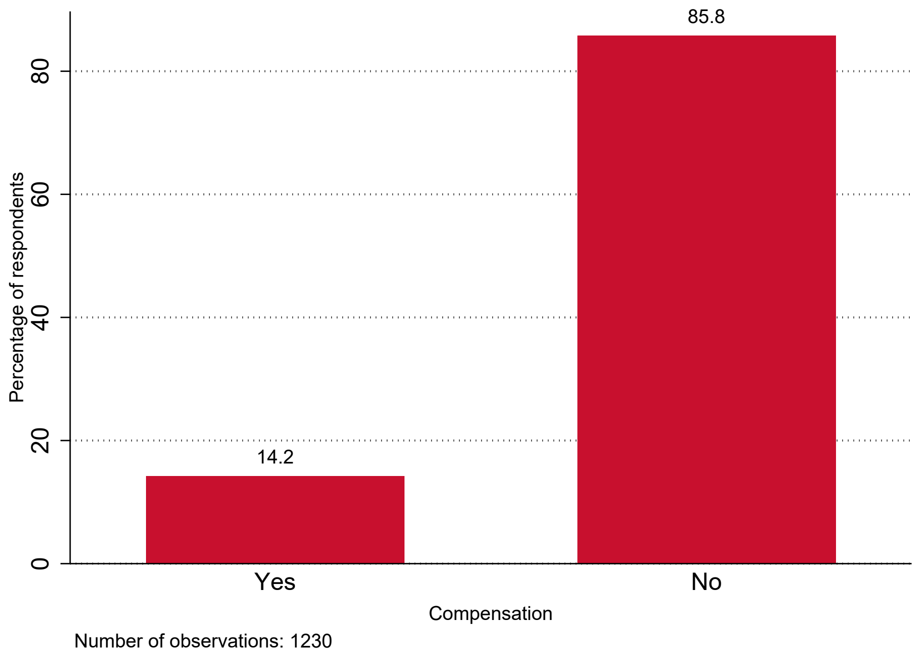
A possible policy to mitigate the effect of power outages on households is by compensating consumers financially based on the length of the outages. To assess their preferences we asked respondents how much they would be willing to accept for experiencing a power outage lasting two days. Figure 4.2 plots the distribution of acceptable compensations for those willing to experience a two-day outage. About 14% of respondents were willing to accept $100 or less as compensation for a two-day power outage. More than half of respondents (59%) were willing to accept between $250-$500, 5% were willing to accept $750, whereas more than one-fifth of respondents would only accept $1250 or more to ease the stress of experiencing a two-day power outage.

Figure 4.2: How much money do you think is appropriate for a power outage of two days?



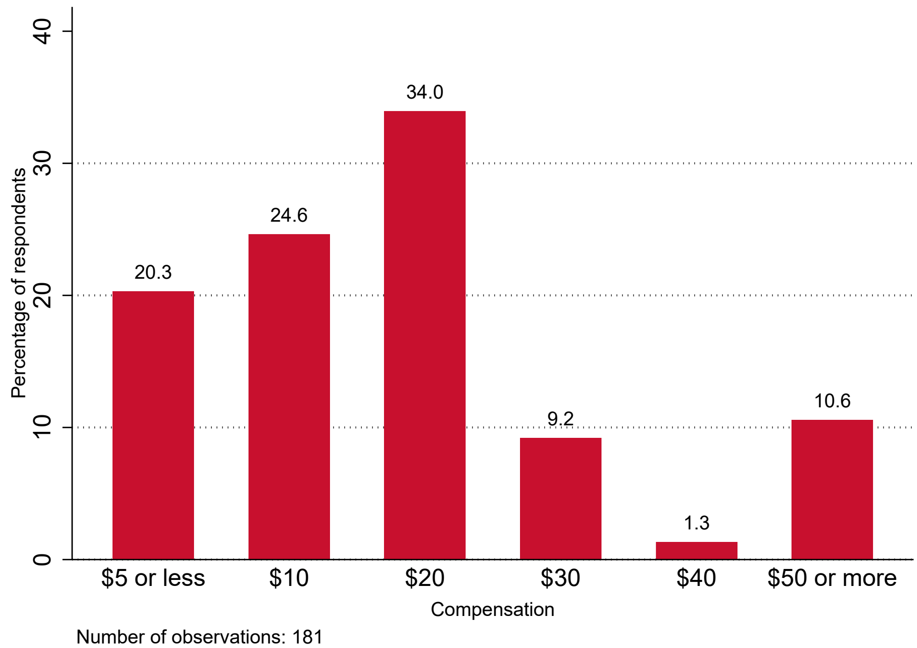
Respondents were then asked if they were willing to pay an extra cost per month if power outages could be kept to four hours or less. Figure 4.3 presents the summary of responses. Out of 1230 respondents, 14% were willing to accept some costs while 86% were unwilling to pay an additional fee to keep outages to four hours or less. Our analysis shows a larger percentage of respondents were reluctant to pay an extra cost to keep the length of power outages to under four hours.

Figure 4.3: Are you willing to pay an extra cost per month if power outages could be kept to 4 hours or less?



To estimate the cost of stable electricity from respondents who were willing to pay to avoid long outages, we asked how much it would cost to keep power outages at four hours or less. Figure 4.4 presents the distribution. About one out of five respondents chose \$5 or less; one-quarter of respondents reported a willingness to pay \$10, 34% would pay \$20, about 11% picked a range between \$30-\$40, and 11% of respondents entertained paying \$50 or more to keep power outages to less than four hours.

Figure 4.4: How much money per month do you think is appropriate to keep outages to 4 hours or less?



In summary, the vast majority of respondents were unwilling to pay extra costs to avoid a power outage lasting more than four hours. However, of the 14% that indicated a willingness to pay more, 54% were willing to pay $20 or more extra per month on their electricity bill to keep outages to four hours or less.

4.2 Self-insuring against unreliable electricity service

After the February winter storm, many Texans have considered purchasing standby generators to avoid experiencing unstable electricity service.[1] Yet, standby generators are expensive and costly to install and maintain; these costs depend on the size and voltage of the power-generator. To gauge whether Texans would self-insure against disruptions in the supply of electricity, we asked how likely the were to purchase a standby generator. We also wanted to gauge whether this decision would be affected by information about the costs of purchasing, installing, and maintaining a standby generator. We randomly split the 1,500 respondents into two groups: the control group of 780 respondents were asked their likelihood of purchasing a generator without providing any additional information. The other sub-sample of 720 respondents, randomly assigned to the treatment group, were provided the following information: "A standby generator for small- to medium-sized

[1] Paul Takahashi, "As generators fly off the shelves after winter storm, some Texans opt to build their own DIY version,"Houston Chronicle, June 14, 2021.

homes can cost between $2,000 to $6,000 with maintenance costs ranging from $150-300 per year."[2]

Table 4.1: You may have heard that some Texans are purchasing standby generators to protect themselves against unreliable electricity service. How likely are you to purchase and install a backup electricity generator for your home?

	Control group No information		**Treatment group Information about costs**	
	No.	%	No.	%
Not at all likely	285	36.6	358	49.8
Somewhat likely	322	41.3	245	34.0
Very Likely	172	22.1	117	16.2
Total	780	100	720	100

Table 4.1 presents the results from our analysis. Respondents who were presented with information about the costs of purchasing and maintaining a standby generator were less likely to purchase one. While 37% of respondents in the control group were not at all likely to purchase a generator, the proportion increased to 50% among respondents in the treatment group. Twenty-two percent of respondents who did not receive information about the costs of generators said they would be very likely to purchase one, compared to only 16% in the treatment group. A majority of respondents stated that they were not very likely to purchase a generator when provided with information about the purchase and maintenance costs.

[2]Information on costs was obtained from HomeAdvisor, accessed on April 13, 2021 and Popular Mechanics, accessed on April 13, 2021.

Choice Experiment and Support for New Policies

5.1 Support for policies to mitigate power failures

Using a different empirical strategy, we analyzed respondents' preferences for different policies to mitigate future outages and their willingness to pay to enact these policies.[1] Each respondent was asked to make four sequential choices between two different policy profiles (Policy A or Policy B) at a time. Each profile had three attributes: policy, cost, and the outage length. For each of the four decisions respondents had to make between Policy A and Policy B, we varied the levels of each attribute.

The levels for the policy attribute were: (1) no policy change and no new investment; (2) merge the Texas electrical grid with one of the two national grids; (3) require the weatherization or winterization of the electricity system, including at gas wellheads and processing plants; (4) maintain a minimum reserve capacity; and (5) increase the renewable energy supply. The length of the outage associated with the policy included: (1) full service (no interruptions); (2) rolling blackouts or intermittent service on-and-off for up to 2 hours; (3) rolling blackouts or intermittent service on and off from 2 up to 12 hours; and (4) power outage for more than 12 hours. Finally, the levels for the increase in cost per kWh were: (1) no increase in cost per kWh; (2) 1 cent more per kWh (12% increase over the 2019 average household electricity bill); (3) 2 cents more per kWh (23% increase); (4) 4 cents more per kWh (47% increase); and (5) 6 cents more per kWh (70% increase). Figure 5.1 presents an example choice set from the conjoint choice experiment included in this study. Each respondent was asked to choose between different policy alternatives of randomly generated attribute levels like the one shown in Figure 5.1.

[1] The technique is known as choice-based conjoint analysis; it is used to assess preferences over profiles containing multiple levels of multiple attributes. Respondents are asked to compare and choose among pairs of proposals containing different levels of the attributes assigned randomly to each round of choices. By pooling multiple responses of respondents over a series of comparisons, the choice-based conjoint analysis allows for a comparison of the importance of each of the multiple attributes and levels for the average respondent. See Green, P. E. and V. Srinivasan (1978), "Conjoint Analysis in Consumer Research," P. E. Green et al. (2001), "Thirty Years of Conjoint Analysis" and E. Ofek and V. Srinivasan (2002), "How Much Does the Market Value an Improvement in a Product Attribute?"

Figure 5.1: Example of policy profiles as shown to respondents

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A number of policies have been proposed to protect the state of Texas from the effects of severe weather affecting its energy supply and delivery. Each proposal will need to be paid for in order to guarantee power outages are kept to the stated levels. In 2019, Texans spent an average of $103 per month on electricity (at 8.6 cents per kWh) and experienced power outages for about 4 hours per year. In the following screens you will be presented profiles of two hypothetical alternatives for protecting the Texas electrical grid from the effects of severe weather and their expected costs. Which of the two alternatives, A or B, would you be more likely to choose? Please consider each pair independently.

Attribute	Policy A	Policy B
Policy	Require the winterization / weatherization of the electricity system	Merge the Texas electrical grid with ono of the two national grids
Cost	2 cents more per kWh - 23% Increase	6 cents more per kWh - 70% increase
Outage Hours	Rolling blackouts/ intermittent service (on and off for up to 2 hours)	Rolling blackouts/ intermittent service (on and off for up to 12 hours)

O Policy A

O Policy B

Each individual responded to four rounds of a pairwise comparison of two profiles with randomly selected policy, hours of outage, and cost options. In each trial, respondents had to choose their preferred policy profile, either Policy A or B, from the pairwise comparison. Table 5.1 shows the number of times each attribute level was shown to respondents and the number and proportion of times it was chosen by respondents relative to other levels of the attribute (in combination with the other attributes). For example, Table 5.1 suggests that on average respondents were 27 percentage points more likely to prefer no service interruptions over rolling blackouts of up to 12 hours. As expected, the difference in respondents' likelihood of choosing no increase in price over an increase of 6 cents per kWh to support policy interventions aimed at shortening the extent of blackouts was roughly 26 percentage points. This suggests that, on average, when respondents are offered different policy options they seemed to be willing to accept a 6 cent increase in the kWh cost of electricity to move from 12-hour long blackouts to no blackouts at all. In section 5.3 we further explore respondents' willingness to pay for different policies and outage levels.

Table 5.1: Distribution of alternatives and alternative levels chosen

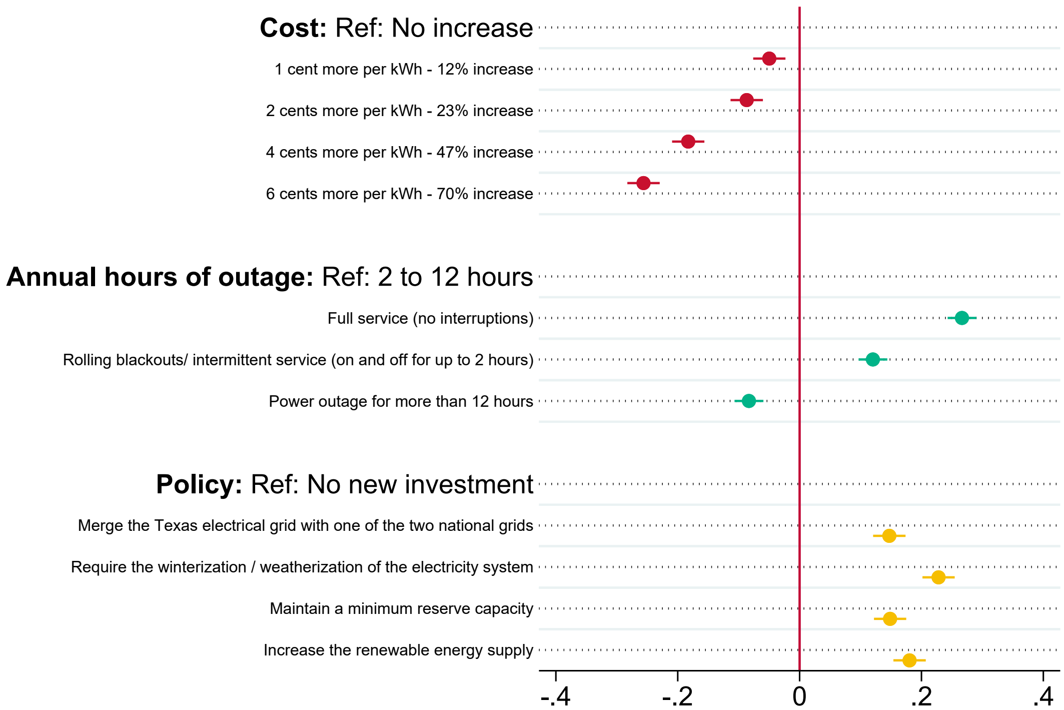
	Occurence No.	**Chosen** No.	**Percent Chosen** %
Cost: Increase in price per kWh required for policy			
No increase in price per kWh	2,358	1,448	61.41
1 cent more per kWh (12% increase)	2,428	1,386	57.08
2 cents more per kWh (23% increase)	2,397	1,270	52.98
4 cents more per kWh (47% increase)	2,421	1,040	42.96
6 cents more per kWh (70% increase)	2,396	856	35.73
Outage: Maximum length of outage in hours when electricity demand exceeds capacity			
Full service/no interruptions	3,013	2,077	68.93
Rolling blackouts for up to 2 hours	3,022	1,654	54.73
Rolling blackouts for up to 12 hours	3,007	1,263	42.00
Power outage for more than 12 hours	2,958	1,006	34.01
Policy: policy proposed to protect Texas from effects of severe weather			
Do Nothing/no new investment	2,359	843	35.74
Merge the Texas grid with one of the two national grids	2,378	1,193	50.17
Require winterization/weatherization of the electricity system	2,434	1,430	58.75
Maintain a minimum reserve capacity (backup power)	2,437	1,243	51.00
Increase the renewable energy supply	2,392	1,291	54.00

We further analyzed responses using a statistical technique designed to analyze responses to conjoint experiments.[2] Figure 5.2 shows the results: the red dots graph the estimated coefficient for the corresponding level relative to the baseline for each attribute, while the lines extending from the dots represent the 95% confidence intervals. The reference level for the cost of the policy was no increase in the cost per kWh. A coefficient smaller than zero implies that the attribute level is less likely to be chosen relative to the reference level.

The top panel of Figure 5.2 presents the cost attribute levels. As expected, respondents prefer no increase in cost per kWh relative to an increase of any magnitude on the price per kWh. Consistently, the higher the cost per kWh, the less likely the option is be preferred. Moreover, the coefficients for each increase in price are statistically different from each other except for the first two: the confidence intervals overlap for 1 cent more per kWh (12% increase in price) and 2 cents more per kWh (23% increase), meaning they are statistically indistinguishable.

[2]The model specification consists of a linear mixed model with random effect per respondent and trial.

Figure 5.2: Results of conjoint experiment: Average Marginal Component Effect (AMCE)



Regarding the second attribute - the expected hours of outage - we set rolling blackouts from 2 up to 12 hours as the reference category because it is the closest response to the current status quo in the state of Texas.[3] As can be seen from the figure, respondents prefer fewer hours of power outage. The most preferred option was full service (no interruptions), followed by rolling blackouts on and off for up to 2 hours, rolling blackouts on and off from 2 up to 12 hours (reference category), and finally power outages for more than 12 hours.

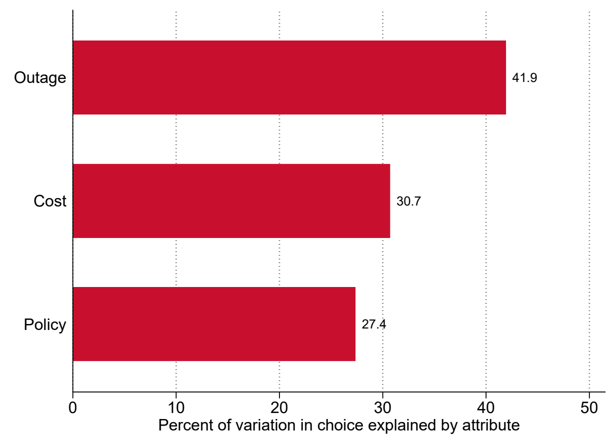
Finally, concerning the preference over the type of policy to be adopted, we set the status quo (no policy and no new investment) as the reference category. All policies had a higher level of support than the reference category, meaning that Texans preferred some government action to tackle the challenges of the Texas' power grid. The most preferred policy was the weatherization or winterization of the electricity system, including at gas wellheads and processing plants. The second most preferred policy was increasing the renewable energy supply, followed by requiring a minimum reserve capacity and merging the Texas electrical grid with one of the two national grids. These latter three policies are all preferred to the status quo of no new investment, but the differences among the later three policies are not statistically significant. The policy preferences of respondents largely mirror those of respondents in the previous Winter Storm Survey, which found the most preferred policies to be requiring the electric generators to fully weatherize, requiring electricity generators to maintain reserve capacity, and requiring natural

[3] https://poweroutage.report/texas

gas pipelines to fully weatherize. Nearly four-fifths of all respondents supported these three policies.

In addition, we estimated the "Relative Importance" (RI) of the attributes of the conjoint. To do this, we calculated the difference between the highest and the lowest coefficients in the analysis presented in Figure 5.2 for each attribute. Then, the obtained range of each attribute was divided by the sum of the ranges of the three attributes included in the conjoint. Figure 5.3 presents the results of our estimation for the entire sample. The attribute with the largest RI was the number of hours of outage presented in the profiles (41.9% of RI), followed by the cost (30.7% of RI), and finally, the policy proposed in the profile (27.4%).

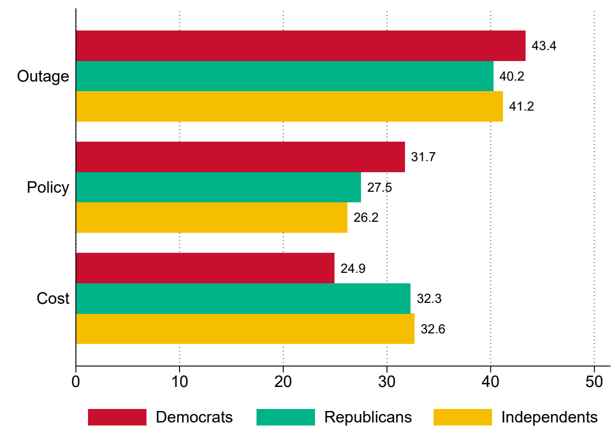
Figure 5.3: Relative importance of attributes



In Figure 5.4 we conducted the RI analysis by sub-sampling the respondents by party identification.[4] Figure 5.4 shows the results of the estimation. For all three groups, Democrats, Republicans, and Independents, the most relatively important attribute in the experiment were the annual hours of outage (43.4%, 40.2%, and 41.2% of RI, respectively). For Democrats, the second most important attribute was the policy (31.7% of RI). For Republicans and Independents, by contrast, the second most important attribute was the cost (32.3%, and 32.6% of RI, respectively). Finally, the least important attribute for Democrats was cost (24.9% of RI), while for Republicans and Independents, it was the policy (27.5% and 26.2% of RI, respectively).

[4]For this analysis we just included those respondents who answered either Democrats, Republicans, or Independent. Those that selected other, not sure, and don't know were excluded from this analysis.

Figure 5.4: Relative importance of attributes by party identification



5.2 Who should pay for proposed policies?

In the previous section, we asked respondents about their willingness to pay for the various policies that have been proposed to protect the Texas electric grid from the effects of severe weather. Since any new policy would have to be paid for, we asked respondents how the policies proposed to protect the Texas electric grid from the effects of severe weather should be paid for. The responses are presented in Table 5.2.

Table 5.2: In your opinion, how do you think policies proposed to protect the Texas electric grid from effects of severe weather should be paid for?

	No.	%
Sales taxes	151	10.1
Property taxes	111	7.4
Consumers through electric bills	210	14.0
Energy producers	668	44.5
Don’t enact policies that result in higher cost	360	24.0
Total	1,500	

The largest share of respondents (46%) said that energy producers should bear the burden paying to protect the Texas grid from the effects of severe weather. About 17% of respondents thought the revenues from sale (10%) and property (7%) taxes could be used to pay for protecting the Texas grid from the effects of severe weather, while 14% thought the costs should be included in consumers’ monthly bills. About one-quarter thought that the government should not enforce a policy that will increase their electricity costs.

We further analyzed respondents' opinions about paying for these policies by their party identification, the results of which are reported in Table 5.3.

Table 5.3: Paying for policies to protect the Texas electric grid from severe weather by party identification

	Party ID									
	Democrat		**Republican**		**Independent**		**Other/ Not Sure**		**Total**	
	No.	%	No.	%	No.	%	No.	%		
Sales taxes	56	10.9	36	9.7	33	7.4	26	15.8	151	10.1
Property taxes	53	10.2	26	7.0	20	4.4	13	7.5	111	7.4
Consumers through electric bills	53	10.2	75	20.2	71	15.9	11	6.8	210	14.0
Energy producers	262	50.7	133	35.7	213	47.9	59	35.7	668	45.6
Don't enact policies that result in higher cost	93	18.0	102	27.3	108	24.3	57	34.1	360	24.0
Total	517		372		445		166		1,500	

More than half of Democrats, 36% of Republicans, and 48% of Independents thought energy producers should incur the costs of protecting the Texas electric grid. About 10% of Democrats, 20% of Republicans, and 16% Independents and 7% of respondents who are in the other/unsure category said that the costs should be included in consumer bills. Republicans (27%) and Independents (24%) were slightly more likely than Democrats (18%) to think that the government should not enact any policies that result in higher costs. Overall, sales and property taxes had the lowest support across all groups, with respondents in the others/unsure category more likely to support using taxes to fund the protection of the Texas electric grid.

5.3 Willingness to pay for reliable energy supply

In the Winter Storm Survey fielded in March, respondents were asked whether they supported sixteen policies that had been proposed to protect the state's energy supply and delivery from the effects of severe weather. These policies included adding a consumer fee for natural gas pipeline weatherization, merging the Texas grid with other national grid(s), requiring electricity generators to fully weatherize, and requiring electricity generators to maintain reserve power capacity.

In the previous survey, only 32% somewhat or strongly supported allowing electricity generators to charge consumers an additional monthly fee to pay for weatherizing natural gas pipelines, and less than a quarter of respondents supported allowing electricity generators to charge consumers fees to pay for weatherizing facilities and increasing reserve capacity. Less than 20% of respondents in the latest survey said that consumers should pay more on their electric bills to protect the grid (see Table 5.3).

In addition, the previous survey asked respondents directly how much more per month they would be willing to pay on their monthly electricity bill to protect the Texas electric grid from the effects of severe weather. The results indicated that Texans were unwilling to incur the costs themselves to avoid failures like experienced during Winter Storm Uri from happening again. Fifty-one percent of respondents said they would not be willing to pay any additional amount per month, and only a quarter said they would be ready to pay $5 more. Less than 10% of respondents said they would be willing to pay $20 or more per month to protect the Texas electric grid from the effects of severe weather.

Similarly, as shown in Figure 4.3 above, only 14% of respondents were willing to pay an extra cost per month to keep power outages to four hours or less. Of those willing to pay more per month, 34% said they would pay $20 more, 25% said $10, and 20% would be willing to pay $5 or less. Few respondents were willing to pay more than $20 per month.

Based on the statistical model shown in Figure 5.1, we were able to compute predicted probabilities of different hypothetical policy scenarios; a few examples of those potential scenarios are shown in Table 5.4. In Table 5.4, *Scenario A* represents a profile with the the reference levels of the attributes (equivalent to the current status quo): (1) no policy or no new investment; (2) no increase in the price per kWh; and (3) rolling blackouts for up to 12 hours. The policy for Scenarios B-E would require weatherization or winterization of the electricity system (including supply), but each scenario varies the amount of the increase in price per kWh and/or the outage levels when electricity demand exceeds capacity.

The status quo profile (*Scenario A*) was chosen 39% of the time when paired to all other alternatives. By contrast, *Scenario B* combining winterization, shorter outages, and a 1 cent per kWh increase in cost, was chosen 70% of the time relative to other combinations, or 30 percentage points more than the status quo. The probability of *Scenario C* being chosen, which includes a price increase of 2 cents per kWh, was 66%. Thus, *Scenario C* was more likely to be chosen than the status quo (*Scenario A*), but less likely to be chosen than *Scenario B*.

Table 5.4: Predicted probabilities of accepting policies

Hypothetical Scenario	Policy	Increase in price per kWh	Length of power outage	Predicted Probability
A	No policy change	No cost increase	Up to 12 hours	39.7%
B	Winterization	1 cent more per kWh 12% increase	Up to 2 hours	69.6%
C	Winterization	2 cents more per kWh 23% increase	Up to 2 hours	65.9%
D	Winterization	4 cent more per kWh 47% increase	No interruptions	70.9%
E	Winterization	6 cents more per kWh 63.6% increase	No interruptions	63.6%
F	Winterization	6 cent more per kWh 63.3% increase	Up to 2 hours	48.9%
G	Maintain a Minimum Reserve	2 cents more per kWh 23% increase	Up to 2 hours	61.3%
H	Maintain a Minimum Reserve	4 cents more per kWh 47% increase	Up to 2 hours	56.2%
I	Maintain a Minimum Reserve	6 cents more per kWh 63.6% increase	Up to 2 hours	40.98%

Additionally, *Scenario D* with no interruptions and a higher cost per kWh was chosen 71% of the time; higher costs of 6 cents per kWh with no interruptions (*Scenario E*) was preferred 63% of the time relative to scenarios with alternative combinations of policies and outages. Even though *Scenario E* represents a 70% increase in the price of electricity per kWh over the average 8.6 kWh that Texans spent on electricity in 2019,[5] the scenario was still preferred to the status quo of no new policy or no investment. *Scenario F* combines (1) winterization with (2) the maximum possible increase in the cost per kWh, 6 cents more (64% increase) and (3) the minimum possible improvement in the length of power outages, rolling blackouts for up to 2 hours. Although *Scenario F* shows the minimum possible improvement at the maximum increase in the cost, the scenario was still preferred 49% of the time it appeared, 10% more often than the *status quo*.

A comparison of the status quo with *Scenarios B* and *D*, where winterization is combined with shorter outages, uncovers some interesting findings. First, on average, both scenarios were more likely to be chosen over the status quo (by over 30 percentage points in each case). Contrasting with the previous survey results, the current analysis shows that individuals may be more willing to pay when they are presented with information about a specific policy that could protect the Texas electric grid from the effects of severe weather and the expected effect of that policy. When asked directly in the previous survey if they would be willing to pay more on their monthly electricity bill, 51% of the respondents answered that they were not willing to pay more. In this analysis, by contrast, we found that individuals were more likely to choose an alternative when they had

[5] U.S. Energy Information Administration, November 2, 2020.

information on which policy and its effect on the length of power outages, even if it meant paying more per kWh for electricity each month.

Secondly, *Scenario D*, with an increase of 4 cents per kWh and no interruptions to power, was slightly preferred to *Scenario B*, with only a 1 cent increase per kWh but with rolling blackouts for up to 2 hours. This suggests that Texans are willing to pay to protect the Texas electric grid from the effects of severe weather under certain conditions and that that they would tolerate moderate levels of outage (intermittent service, on and off for up to 2 hours).

In *Scenarios G-I*, we predicted the probability of choosing three hypothetical profiles with (1) maintaining a minimum reserve capacity as the policy option and (2) rolling blackouts for up 2 hours as the outage level. *Scenario G*, with an increase of 2 cents in the price per kWh, was selected 61% of the time. A policy profile containing the attributes presented in *Scenario H* was chosen 56% of the time. The hypothetical *Scenario I*, on the other hand, was chosen 41% of the time. The probability of choosing this profile is comparable to respondents' choice of the status quo profile (*Scenario A*), suggesting that respondents would be willing to pay up to 6 cents to enact a policy that requires maintaining a minimum reserve capacity and keeps outages to less than 2 hours.

Conclusion

Extended blackouts during winter storms, like those seen this past February, and concerns about power failures during peak demand times in summer months suggest that Texas' power grid is not resilient. Texans have voiced their concerns and frustration, and are ready to attribute blame to power generators, regulators, and elected officials for not delivering much valued reliable access to power.

The survey found that nearly half of respondents believed that current laws are insufficient to tackle issues related to electric grid failures as experienced this past February. However, older respondents were more likely than the younger ones to believe in the capacity of the Texas state government to adequately mitigate issues related to electric grid failures; respondents aged 18-29 and Democrats were the least confident.

Respondents also identified the primary reasons of the electric grid failure during Winter Storm Uri to be the lack of weatherization or winterization of power generators (62%), severe weather (58%), and lack of oversight over power-generation plants (51%). Older respondents were the most likely to say that the reliance on renewable energy was responsible for the electric grid failure, while younger respondents were most likely to attribute blame to the independence of Texas' electric grid, followed closely by severe weather.

During Winter Storm Uri, the survey found that two-thirds of respondents lost power during that week and the majority of these respondents lost power between 1 and 40 hours. More than a third lost power for over 71 hours. Thirty percent of respondents experienced damage to their homes, the majority of whom were homeowners. However, by the time of the survey, 76% of these respondents had completed the repairs needed.

Reliability emerged as a main concern of respondents, especially among older age groups and those with lower education levels. The study found that more than half of respondents are likely to gather information on energy reliability and efficiency in the future. When the respondents were asked about energy sources, we found significant differences between age groups and party identification. Younger age groups were more likely than older ones to agree that green and renewable energy sources will be most significant for the electricity supply in the future. Likewise, almost three-quarters of Democrats agreed that solar and wind power would contribute to reliable electricity, while less than 50% of Republicans responded similarly.

The study also found that, as expected, respondents preferred the least possible amount of hours of outage, followed by rolling blackouts on and off for up to 2 hours. Respondents were willing to incur an extra cost to avoid a power outage; however, they also believed that the electric utility company should compensate them for extended power outages.

Recent events are testing Texans' frustrations with the power grid one more time. The advisory to conserve energy sent out by ERCOT on June 14 in response to the unplanned power plant outages in the midst of a heat wave suggest that reliable supply of electricity is far from guaranteed. Our analysis of the survey responses suggests that, while frustrated with power generators and regulators, Texans understand that the reliability of the energy supply is a public good that the current regulatory framework in Texas has failed to deliver.

The survey provides important lessons for the future of the electricity system in Texas: recurring severe weather events will continue to pose threats to the reliable supply of energy, creating disruptions and human and material losses. Reliable energy is a public good that the current system cannot guarantee. While some individuals will self-insure against continued unreliability, many others cannot. When respondents were informed of the approximate cost to purchase and maintain a standby generator, only 16% said they were very likely to purchase one.

Addressing the problem with the Texas electric grid and market structure is costly, requiring regulatory changes and massive investments. While Texans value access to cheap electricity, they also understand that preparing the electric grid to withstand extremely hot or cold weather requires sizable investments. Respondents to our survey preferred power companies and the state of Texas to pay. Yet, respondents also seemed to understand that eventually power generators and the government will need to recover the cost of the investments and policy interventions. That awareness is reflected in their responses: they expressed a willingness to pay extra to fund specific policy changes, such as requiring the winterization of the system or maintaining minimum reserves of electricity, in order to reduce power outages.

With the passage of SB3, consumers will already be paying but without guarantees of future reliability. The cost of $6.5 billion in state-backed bonds that the SB3 will make available to utility companies will be passed on to consumers through higher utility bills.[1] Although SB3 will require power generators and transmissions lines to be weatherized, with fines ranging from $5,000 to $1,000,000 for failure to comply, the timeline for these infrastructure updates is unclear. Moreover, the new legislation does not require new gas wellheads be weatherized as recommended by the Dallas Fed and others.[2] It will be up to regulators whether parts of the natural gas supply chain are "critical" and thus subject to the weatherization requirement.

[1] Isabella Zou, "Texas power generation companies will have to better prepare for extreme weather under bills Gov. Greg Abbott signed into law," The Texas Tribune, June 8, 2021.

[2] Garrett Golding, Anil Kumar and Karel Mertens, "Cost of Texas' 2021 Deep Freeze Justifies Weatherization," Federal Reserve Bank of Dallas, April 15, 2021.

References

Chediak, Mark and Saul, Josh "Texas Shuns Radical Changes to Power Grid After Deadly Freeze." *Bloomberg*, May 29, 2021.

Douglas, Erin "Texas grid operator urges electricity conservation as many power generators are unexpectedly offline and temperatures rise." *The Texas Tribune*, June 14, 2021, https://www.texastribune.org/2021/06/14/texas-power-grid-conserve-ercot/

ERCOT "Tight grid conditions expected due to high number of forced generation outages." *ERCOT*, June 14, 2021 http://www.ercot.com/news/releases/show/233037

Garrett Golding, Anil Kumar and Karel Mertens "Cost of Texas' 2021 Deep Freeze Justifies Weatherization," *Federal Reserve Bank of Dallas*, April 15, 2021, https://www.dallasfed.org/research/economics/2021/0415.aspx

"2021 Generator Repair Costs." *HomeAdvisor*, https://www.homeadvisor.com/cost/electrical/repair-a-generator/, accessed April 13, 2021.

Green, Paul E. and Venkatachary Srinivasan. 1978. Conjoint Analysis in Consumer Research: Issues and Outlook. *Journal of Consumer Research*, 5 (September): 103–123, https://doi.org/10.1086/208721

Green, Paul E., Abba M. Krieger, and Yoram Wind (2001). Thirty Years of Conjoint Analysis: Reflections and Prospects. *Interfaces*, 31 (May/June): 56–73, www.jstor.org/stable/25062702

Hirs, Ed " Why the Texas Power Market Failed." *Yale Insights*, March 23, 2021, https://insights.som.yale.edu/insights/why-the-texas-power-market-failed

Hobby School "The Winter Storm of 2021," *Hobby School of Public Affairs*, 2021, https://uh.edu/hobby/winter2021/storm.pdf

Hobby School "Consumers Attribute Failure of the Texas Power Grid to Flaw in Texas Laws," *Hobby School of Public Affairs*, 2021, https://uh.edu/hobby/electricgrid/

Hondorp, Gabrielle. “These 5 Best Standby Generators Can Help You Weather Any Storm.” *Popular Mechanics*, September 21, 2020, https://www.popularmechanics.com/home/a34059872/best-home-standby-generators/.

Mulcahy, Shawn and Douglas, Erin. “Weeping legislation to overhaul state’s electricity market in response towinter storm heads to Texas House after Senate’s unanimous approval.” *The Texas Tribune*, March 29, 2021, https://www.texastribune.org/2021/03/29/texas-senate-electricity-power/

Ofek, Elie, and V. Srinivasan (2002). “How Much Does the Market Value an Improvement in a Product Attribute?” *Marketing Science* 21 (4) Fall 2002: 398-411, https://doi.org/10.1287/mksc.21.4.398.130

Swartz, Mimi “Ed Hirs Has Been Predicting This Mess for Years." *Texas Monthly*, February 19, 2021, https://www.texasmonthly.com/news-politics/ed-hirs-predicting-blackouts/

Tinnium, K. N., Rastgoufard P. and Duvoisin, P.F. “Cost-benefit analysis of electric power system reliability.” *Proceedings of 26th Southeastern Symposium on System Theory* (1994): 468-472, doi: 10.1109/SSST.1994.287831.

EIA “State Electricity Profiles: Texas Electricity Profile, 2019,"*U.S. Energy Information Administration*, November 2, 2020, https://www.eia.gov/electricity/state/texas/

Willrich, Mason. “Modernizing America’s Electricity Infrastructure.” *Cambridge, MA, MIT Press* (2017): 281, doi:

Zou, Isabella “Texas power generation companies will have to better prepare for extreme weather under bills Gov. Greg Abbott signed into law.” *The Texas Tribune*, June 8, 2021, https://www.texastribune.org/2021/06/08/greg-abbott-texas-power-grid-ercot/

Appendix A: Technical Note

The Hobby School of Public Affairs and UH Energy entrusted the fielding of the survey to YouGov. The survey was fielded online between May 13 and May 24, 2021. YouGov matched the 1,500 respondents to a sampling frame based on gender, age, race/ethnicity, and years of education that was constructed from the 2018 American Community Survey's (ACS) Texas sample. Respondents were selected within each strata using weighted sampling with replacements. YouGov used propensity scores to weight the matched cases to the sampling frame. The weights for the Texas sample were post-stratified according to 2016 and 2020 Presidential vote choices and a four-way stratification of gender, age, race/ethnicity, and education. The resulting sample is 1,500 respondents. The margin of error (adjusted for weighting) for your survey is $\pm$ 3.38. The margins of error for other sub-samples (e.g., age, partisan alignment, racial and ethnic groups) vary and exceeds 3.38%. Note that sampling error is only one of many potential sources of error in this or any other public opinion poll.

Appendix B: Summary Tables for Survey Questions

This appendix provides summary statistics for all questions used in the report and for demographic characteristics of the 1,500 respondents. Don't know responses were excluded for most of the survey questions.

Table B1: What racial or ethnic group best describes you?

	No.	%
White	677	45.1
Hispanic/Latinx	544	36.2
Black	183	12.2
Asian	30	2.0
Other	67	4.4
Total	1,500	100.0

Table B2: Are you of Spanish, Latino, or Hispanic origin or descent?

	No.	%
Yes	97	9.4
No	935	90.6
Total	1,032	100.0

Table B3: What is your gender?

	No.	%
Female	765	51.0
Male	735	49.0
Total	1,500	100.0

Table B4: Respondent age categories

	No.	%
18-29	346	23.1
30-44	423	28.2
45-64	475	31.7
65+	256	17.0
Total	1,500	100.0

Table B5: Highest level of education attained

	No.	%
High school or less	625	41.7
Some college	454	30.3
College degree	280	18.6
Post-grad	141	9.4
Total	1,500	100.0

Table B6: Family income level

	No.	%
>$100,000	412	27.5
$20,000-39,999	295	19.7
<$20,000	266	17.7
$40,000-59,999	234	15.6
$60,000-79,999	189	12.6
$80,000-99,999	104	6.9
Total	1,500	100.0

Table B7: Party ID

	No.	%
Democrat	517	34.5
Republican	372	24.8
Independent	445	29.7
Other/Not sure	116	11.1
Total	1,500	100.0

Table B8: Ideology

	No.	%
Very liberal	163	10.9
Liberal	233	15.5
Moderate	462	30.8
Conservative	286	19.1
Very conservative	204	13.6
Not sure	152	10.2
Total	1,500	100.0

Table B9: What is your employment status?

	No.	%
Full-time	555	37.0
Retired	259	17.3
Unemployed	174	11.6
Part-time	146	9.8
Homemaker	134	8.9
Permanently disabled	93	6.2
Student	82	5.5
Other	33	2.2
Temporarily laid off	22	1.5
Total	1,500	100.0

Table B10: What is your marital status?

	No.	%
Never married	479	32.0
Domestic/civil partnership	85	5.7
Married	671	44.7
Separated	30	2.0
Divorced	174	11.6
Widowed	61	4.0
Total	1,500	100.0

Table B11: Do you own or rent your current residence? For the purpose of the survey, you own your home even if you have outstanding debt that you owe on your mortgage loan.

	No.	%
Own	910	60.6
Rent	477	31.8
Other	114	7.6
Total	1,500	100.0

Table B12: Did you lose power during the winter storm?

	No.	%
Yes	1,019	67.9
No	481	32.1
Total	1,500	100.0

Table B13: Total number of hours without electricity

	No.	%
1 to 10	232	22.9
11 to 20	108	10.7
21 to 30	108	10.7
31 to 40	91	9.0
41 to 50	74	7.3
51 to 60	66	6.5
61 to 70	18	1.7
71 to 80	163	16.1
81 to 90	27	2.6
91 to 100	64	6.3
100+	64	6.3
Total	1,014	100.0

Table B14: Longest consecutive number of hours without electricity

	No.	%
1 to 10	384	37.9
11 to 20	128	12.6
21 to 30	102	10.1
31 to 40	69	6.8
41 to 50	69	6.8
51 to 60	39	3.8
61 to 70	16	1.5
71 to 80	110	10.8
81 to 90	12	1.2
91 to 100	36	3.6
100+	50	4.9
Total	1,014	100.0

Table B15: Did you experience damage to your home during the storm?

	No.	%
Yes	443	29.6
No	1,057	70.4
Total	1,500	100.0

Table B16: Have the necessary repairs been completed?

	No.	%
Yes	329	76.7
No	100	23.3
Total	429	100.0

Table B17: Did you have out-of-pocket expenses related to blackout?

	No.	%
Less than $1,000	160	57.0
$1,000 to $10,000	87	31.0
$10,001 to $25,000	16	5.6
$25,001 to $50,000	14	4.9
More than $50,000	4	1.5
Total	281	100.0

Table B18: From what you've read or heard, which of the following do you believe are responsible for the electricity grid failure during the winter storm this past February? **Severe weather**

	No.	%
Yes	874	58.3
No	626	41.7
Total	1,500	100.0

Table B19: From what you've read or heard, which of the following do you believe are responsible for the electricity grid failure during the winter storm this past February? **The independence of Texas' electric grid from the nation's two other grids**

	No.	%
Yes	686	45.7
No	814	54.3
Total	1,500	100.0

Table B20: From what you've read or heard, which of the following do you believe are responsible for the electricity grid failure during the winter storm this past February? **Lack of weatherization or winterization of power generators**

	No.	%
Yes	933	62.2
No	567	37.8
Total	1,500	100.0

Table B21: From what you've read or heard, which of the following do you believe are responsible for the electricity grid failure during the winter storm this past February? **Lack of weatherization or winterization of natural gas industry equipment**

	No.	%
Yes	744	49.6
No	756	50.4
Total	1,500	100.0

Table B22: From what you've read or heard, which of the following do you believe are responsible for the electricity grid failure during the winter storm this past February? **Reliance on renewable energy**

	No.	%
Yes	322	21.5
No	1,178	78.5
Total	1,500	100.0

Table B23: From what you've read or heard, which of the following do you believe are responsible for the electricity grid failure during the winter storm this past February? **Lack of oversight over power-generation plants**

	No.	%
Yes	762	50.8
No	738	49.2
Total	1,500	100.0

Table B24: From what you've read or heard, which of the following do you believe are responsible for the electricity grid failure during the winter storm this past February? **Other**

	No.	%
Yes	107	7.1
No	1,393	92.9
Total	1,500	100.0

Table B25: From what you've read or heard, which of the following do you believe are responsible for the electricity grid failure during the winter storm this past February? **None of the above**

	No.	%
Yes	73	4.9
No	1,427	95.1
Total	1,500	100.0

Table B26: Do you know which agency operates the Texas Interconnection (the Texas electricity grid) and supplies power to most of the state of Texas customers?

	No.	%
Electric Reliability Council of Texas (ERCOT)	1,085	91.4
Texas Department of Energy (TDOE)	80	6.7
Texas State Energy Conservation Office (SECO)	23	1.9
Total	1,188	100.0

Table B27: To what extent do you agree or disagree that the following energy sources will make a substantial contribution to reliable and secure electricity supply in Texas in the future? **Coal**

	No.	%
Agree	465	31.0
Neither agree nor disagree	539	35.9
Disagree	496	33.1
Total	1,500	100.0

Table B28: To what extent do you agree or disagree that the following energy sources will make a substantial contribution to reliable and secure electricity supply in Texas in the future? **Onshore unconventional natural gas typically produced via hydraulic fracturing (fracking)**

	No.	%
Agree	507	33.8
Neither agree nor disagree	626	41.7
Disagree	367	24.4
Total	1,500	100.0

Table B29: To what extent do you agree or disagree that the following energy sources will make a substantial contribution to reliable and secure electricity supply in Texas in the future? **Onshore conventional natural gas**

	No.	%
Agree	681	45.4
Neither agree nor disagree	650	43.4
Disagree	169	11.3
Total	1,500	100.0

Table B30: To what extent do you agree or disagree that the following energy sources will make a substantial contribution to reliable and secure electricity supply in Texas in the future? **Hydroelectric power**

	No.	%
Agree	704	46.9
Neither agree nor disagree	632	42.1
Disagree	164	10.9
Total	1,500	100.0

Table B31: To what extent do you agree or disagree that the following energy sources will make a substantial contribution to reliable and secure electricity supply in Texas in the future? **Nuclear power**

	No.	%
Agree	606	40.4
Neither agree nor disagree	595	39.7
Disagree	299	19.9
Total	1,500	100.0

Table B32: To what extent do you agree or disagree that the following energy sources will make a substantial contribution to reliable and secure electricity supply in Texas in the future? **Onshore natural gas produced without flaring or venting**

	No.	%
Agree	549	36.6
Neither agree nor disagree	772	51.5
Disagree	178	11.9
Total	1,499	100.0

Table B33: To what extent do you agree or disagree that the following energy sources will make a substantial contribution to reliable and secure electricity supply in Texas in the future? **Geothermal power**

	No.	%
Agree	503	33.5
Neither agree nor disagree	789	52.6
Disagree	208	13.9
Total	1,500	100.0

Table B34: To what extent do you agree or disagree that the following energy sources will make a substantial contribution to reliable and secure electricity supply in Texas in the future? **Offshore conventional natural gas**

	No.	%
Agree	591	39.4
Neither agree nor disagree	675	45.0
Disagree	235	15.7
Total	1,500	100.0

Table B35: To what extent do you agree or disagree that the following energy sources will make a substantial contribution to reliable and secure electricity supply in Texas in the future? **Sun or solar power**

	No.	%
Agree	845	56.3
Neither agree nor disagree	412	27.5
Disagree	243	16.2
Total	1,500	100.0

Table B36: To what extent do you agree or disagree that the following energy sources will make a substantial contribution to reliable and secure electricity supply in Texas in the future? **Wind power**

	No.	%
Agree	814	54.3
Neither agree nor disagree	416	27.7
Disagree	270	18.0
Total	1,499	100.0

Table B37: Given your day-to-day habits, interests, and general attitude toward energy, which two of the following topic areas are you most likely to proactively gather information over the next 6 months. **Energy efficiency**

	No.	%
Yes	367	24.5
No	1,133	75.5
Total	1,500	100.0

Table B38: Given your day-to-day habits, interests, and general attitude toward energy, which two of the following topic areas are you most likely to proactively gather information over the next 6 months. **Environmental impacts of energy production and distribution**

	No.	%
Yes	253	16.9
No	1,247	83.1
Total	1,500	100.0

Table B39: Given your day-to-day habits, interests, and general attitude toward energy, which two of the following topic areas are you most likely to proactively gather information over the next 6 months. **Economic impacts of energy production and distribution**

	No.	%
Yes	222	14.8
No	1,278	85.2
Total	1,500	100.0

Table B40: Given your day-to-day habits, interests, and general attitude toward energy, which two of the following topic areas are you most likely to proactively gather information over the next 6 months. **Role of foreign policy in energy decisions**

	No.	%
Yes	142	9.5
No	1,358	90.5
Total	1,500	100.0

Table B41: Given your day-to-day habits, interests, and general attitude toward energy, which two of the following topic areas are you most likely to proactively gather information over the next 6 months. **Energy trends**

	No.	%
Yes	99	6.6
No	1,401	93.4
Total	1,500	100.0

Table B42: Given your day-to-day habits, interests, and general attitude toward energy, which two of the following topic areas are you most likely to proactively gather information over the next 6 months. **Electricity reliability**

	No.	%
Yes	399	26.6
No	1,101	73.4
Total	1,500	100.0

Table B43: Given your day-to-day habits, interests, and general attitude toward energy, which two of the following topic areas are you most likely to proactively gather information over the next 6 months. **Energy resources**

Energy resources	No.	%
No	1,226	81.7
Yes	274	18.3
Total	1,500	100.0

Table B44: Given your day-to-day habits, interests, and general attitude toward energy, which two of the following topic areas are you most likely to proactively gather information over the next 6 months. **Energy safety**

	No.	%
Yes	170	11.4
No	1,330	88.6
Total	1,500	100.0

Table B45: Given your day-to-day habits, interests, and general attitude toward energy, which two of the following topic areas are you most likely to proactively gather information over the next 6 months. **I'm unlikely to gather any information on energy**

	No.	%
Yes	537	35.8
No	963	64.2
Total	1,500	100.0

Table B46: Have you experienced power outages in the past three years before the winter storm in February 2021?

	No.	%
No	419	29.3
A few times	776	54.1
More than twice a year	187	13.0
Often	51	3.6
Total	1,433	100.0

Table B47: In your opinion, how frequently is it acceptable for power outages to occur?

	No.	%
Never	552	41.2
Once a year	419	31.3
2-4 times per year	351	26.2
Monthly	18	1.4
Total	1,341	100.0

Table B48: In your opinion, when are power outages a significant problem? When the outage lasts…

	No.	%
Only a second or two	33	2.2
Less than a minute	38	2.6
Several minutes	119	7.9
15-60 minutes	333	22.2
Several hours	655	43.7
12-24 hours	168	11.2
More than 24 hours	154	10.3
Total	1,500	100.0

Table B49: Are you willing to experience a power outage of two days during the summer if your electric utility company paid you?

	No.	%
Yes	117	15.7
No	491	66.3
Don't know	133	18.0
Total	741	100.0

Table B50: Are you willing to experience a power outage of two days during the winter if your electric utility company paid you?

	No.	%
Yes	175	23.1
No	460	60.6
Don't know	124	16.3
Total	759	100.0

Table B51: How much money do you think is appropriate for a power outage of two days?

	No.	%
$100 or less	35	14.4
$250	65	26.6
$500	78	32.0
$750	12	5.1
$1,250 or more	53	21.8
Total	243	100.0

Table B52: Are you willing to pay an extra cost per month if power outages could be kept to 4 hours or less?

	No.	%
Yes	170	11.4
No	1,027	68.4
Don't know	303	20.2
Total	1,500	100.0

Table B53: How much money per month do you think is appropriate to keep outages to 4 hours or less?

	No.	%
$5 or less	37	20.3
$10	45	24.6
$20	61	34.0
$30	17	9.2
$40	2	1.3
$50 or more	19	10.6
Total	181	100.0

Table B54: To what extent do you agree or disagree with each of the following statements about electricity generation in Texas? **I feel confident that the Texas state government will adequately tackle issues related to electric failures as experienced this past February**

	No.	%
Agree	493	32.9
Neutral	416	27.8
Disagree	590	39.3
Total	1,499	100.0

Table B55: To what extent do you agree or disagree with each of the following statements about electricity generation in Texas? **I feel that current laws and regulations in Texas are insufficient to tackle issues related to electric failures as experienced this past February**

	No.	%
Agree	785	52.3
Neutral	463	30.9
Disagree	252	16.8
Total	1,500	100.0

Table B56: From what you know or have heard, which two of these factors, if any, would you say are the most important for deciding which methods of electricity production should be used in Texas in the future? **Cost**

	No.	%
Yes	387	25.8
No	1,113	74.2
Total	1,500	100.0

Table B57: From what you know or have heard, which two of these factors, if any, would you say are the most important for deciding which methods of electricity production should be used in Texas in the future? **Effects on the landscape**

	No.	%
Yes	34	2.3
No	1,466	97.7
Total	1,500	100.0

Table B58: From what you know or have heard, which two of these factors, if any, would you say are the most important for deciding which methods of electricity production should be used in Texas in the future? **Efficiency in production**

	No.	%
Yes	287	19.1
No	1,213	80.9
Total	1,500	100.0

Table B59: From what you know or have heard, which two of these factors, if any, would you say are the most important for deciding which methods of electricity production should be used in Texas in the future? **Helping to prevent climate change**

	No.	%
Yes	295	19.7
No	1,205	80.3
Total	1,500	100.0

Table B60: From what you know or have heard, which two of these factors, if any, would you say are the most important for deciding which methods of electricity production should be used in Texas in the future? **Impacts on communities living nearby**

	No.	%
Yes	84	5.6
No	1,416	94.4
Total	1,500	100.0

Table B61: From what you know or have heard, which two of these factors, if any, would you say are the most important for deciding which methods of electricity production should be used in Texas in the future? **Impacts on human health**

	No.	%
Yes	254	16.9
No	1,246	83.1
Total	1,500	100.0

Table B62: From what you know or have heard, which two of these factors, if any, would you say are the most important for deciding which methods of electricity production should be used in Texas in the future? **Impacts on the economy**

	No.	%
Yes	170	11.4
No	1,330	88.6
Total	1,500	100.0

Table B63: From what you know or have heard, which two of these factors, if any, would you say are the most important for deciding which methods of electricity production should be used in Texas in the future? **Impacts on the jobs market**

	No.	%
Yes	51	3.4
No	1,449	96.6
Total	1,500	100.0

Table B64: From what you know or have heard, which two of these factors, if any, would you say are the most important for deciding which methods of electricity production should be used in Texas in the future? **Independence from other countries' fuels**

	No.	%
Yes	245	16.3
No	1,255	83.7
Total	1,500	100.0

Table B65: From what you know or have heard, which two of these factors, if any, would you say are the most important for deciding which methods of electricity production should be used in Texas in the future? **Level of pollution**

	No.	%
Yes	163	10.9
No	1,337	89.1
Total	1,500	100.0

Table B66: From what you know or have heard, which two of these factors, if any, would you say are the most important for deciding which methods of electricity production should be used in Texas in the future? **Reliability of electricity supplies**

	No.	%
Yes	601	40.1
No	899	59.9
Total	1,500	100.0

Table B67: From what you know or have heard, which two of these factors, if any, would you say are the most important for deciding which methods of electricity production should be used in Texas in the future? **Risk of terrorist attack**

	No.	%
Yes	77	5.2
No	1,423	94.8
Total	1,500	100.0

Table B68: From what you know or have heard, which two of these factors, if any, would you say are the most important for deciding which methods of electricity production should be used in Texas in the future? **Safety**

	No.	%
Yes	232	15.5
No	1,268	84.5
Total	1,500	100.0

Table B69: From what you know or have heard, which two of these factors, if any, would you say are the most important for deciding which methods of electricity production should be used in Texas in the future? **None of these**

	No.	%
Yes	67	4.5
No	1,433	95.5
Total	1,500	100.0

Table B70: In your opinion, how do you think policies proposed to protect the Texas electric grid from effects of severe weather should be paid for?

	No.	%
Property taxes	111	7.4
Sales taxes	152	10.1
Consumers through electric bills	210	14.0
Energy producers	668	44.5
Do not enact policies that result in higher cost	360	24.0
Total	1,500	100.0

Table B71: You may have heard that some Texans are purchasing standby generators to protect themselves against unreliable electricity service. How likely are you to purchase and install a backup electricity generator for your home? **Control Group - No information about costs**

	No.	%
Very likely	169	22.1
Somewhat likely	317	41.3
Not at all likely	280	36.6
Total	766	100.0

Table B72: You may have heard that some Texans are purchasing standby generators to protect themselves against unreliable electricity service. A standby generator for small-to medium-sized homes can cost between $2,000 to $6,000 with maintenance costs ranging from $150-300 per year with an annual service contract. How likely are you to purchase and install a backup electricity generator for your home? **Treatment Group - Information about generator purchase and maintenance costs**

	No.	%
Very likely	119	16.2
Somewhat likely	250	34.0
Not at all likely	365	49.8
Total	734	100.0

Table B73: You may have heard that the world's temperature has been changing over the past 100 years, a phenomenon referred to as climate change. What is your personal opinion regarding whether or not this phenomenon is happening?

	No.	%
Climate change is happening	1,134	75.6
Climate change is not happening	366	24.4
Total	1,500	100.0

Table B74: Assuming that climate change is happening, please indicate which of the following statements you most agree with. Climate change is..

	No.	%
Human activities	461	30.8
Natural changes in environment	412	27.5
Human activities & natural changes to environment	626	41.8
Total	1,500	100.0

Table B75: How much do you think climate change will harm you personally?

	No.	%
Not at all	351	23.4
Only a little	391	26.1
A moderate amount	503	33.5
A great deal	255	17.0
Total	1,500	100.0

Table B76: How much do you think climate change will harm future generations?

	No.	%
Not at all	232	15.5
Only a little	277	18.5
A moderate amount	351	23.4
A great deal	639	42.6
Total	1,500	100.0

Table B77: Which of the following applies best to you?

	No.	%
Life-long Texan	905	60.4
Moved from another state/country	595	39.6
Total	1,500	100.0

Table B78: If you moved from another state/country, please indicate the year you moved to Texas.

	No.	%
1900-1960	14	1.0
1961-1970	30	2.0
1971-1980	57	3.8
1981-1990	84	5.6
1991-2000	82	5.4
2001-2010	145	9.6
2011-2020	1,089	72.6
Total	1,500	100.0

Table B79: Moved from another state/country

	No.	%
Outside the US	88	14.0
Alabama	9	1.5
Arizona	16	2.6
Arkansas	14	2.2
California	66	10.6
Colorado	12	1.9
Florida	23	3.7
Georgia	15	2.4
Hawaii	12	1.9
Idaho	4	0.6
Illinois	33	5.4
Indiana	12	1.9
Iowa	10	1.6
Kansas	8	1.2
Kentucky	4	0.7
Louisiana	33	5.3
Maryland	6	1.0
Massachusetts	8	1.3
Michigan	23	3.7
Minnesota	8	1.3
Mississippi	3	0.5
Missouri	7	1.2
Nebraska	3	0.5
Nevada	5	0.9
New Jersey	19	3.0
New Mexico	14	2.3
New York	35	5.6
North Carolina	7	1.1
Ohio	12	2.0
Oklahoma	20	3.1
Oregon	5	0.8
Pennsylvania	13	2.0
South Dakota	3	0.4
Tennessee	4	0.6
Utah	6	1.0
Virginia	8	1.3
Washington	6	1.0
Wisconsin	6	0.9
Other	15	2.6
Prefer not to say	28	4.4
Total	624	100.0

Table B80: Total number of years lived in Texas

	No.	%
Less than 10 years	183	29.3
10 to 20 years	165	26.5
21 to 30 years	86	13.9
31 to 40 years	89	14.3
41 to 50 years	60	9.6
More than 50 years	40	6.5
Total	623	100.0

Table B81: What is your occupation?

	No.	%
Architecture and Engineering Occupations	30	2.0
Arts, Design, Entertainment, Sports, and Media Occupations	46	3.1
Building and Grounds Cleaning and Maintenance Occupations	27	1.8
Business and Financial Operations Occupations	68	4.6
Community and Social Services Occupations	36	2.4
Computer and Mathematical Occupations	85	5.7
Construction and Extraction Occupations	72	4.8
Education, Training, and Library Occupations	122	8.2
Farming, Fishing, and Forestry Occupations	26	1.8
Food Preparation and Serving Related Occupations	97	6.5
Healthcare Practitioners and Technical Occupations	51	3.4
Healthcare Support Occupations	74	5.0
Installation, Maintenance, and Repair Occupations	39	2.6
Legal Occupations	42	2.8
Life, Physical, and Social Science Occupations	23	1.6
Management Occupations	129	8.6
Military Specific Occupations	26	1.7
Office and Administrative Support Occupations	135	9.0
Personal Care and Service Occupations	82	5.5
Protective Service Occupations	16	1.1
Sales and Related Occupations	187	12.5
Transportation and Material Moving Occupations	82	5.5
Total	1,494	100.0

Table B82: Which of the following better describes the sector of your current (or last) employment?

	No.	%
Agriculture, Forestry, and Fishing	27	1.8
Communications	52	3.5
Construction	84	5.6
Finance, Insurance, and Real Estate	67	4.5
Manufacturing	71	4.7
Mining	18	1.2
Other services	761	50.8
Public Administration	82	5.5
Retail Trade	193	12.9
Transportation	97	6.5
Utilities (Electric, Gas, and Sanitary Service)	24	1.6
Wholesale Trade	21	1.4
Total	1,498	100.0

Table B83: Suppose that you are the only income earner in the family, and you have a good job guaranteed to give you your current (family) income every year for life. You are given the opportunity to take a new and equally good job, with a 50–50 chance it will double your (family) income and a 50–50 chance that it will cut by half your (family) income. Would you take the new job?

	No.	%
Yes, take new job	324	21.6
No, keep current job	784	52.3
Don't know/Not sure	392	26.1
Total	1,500	100.0

Table B84: Imagine a hypothetical scenario in which you receive a guaranteed payment of $10 or you get to enter a lottery with a 50% chance of winning $50 and a 50% chance of winning nothing. Which do you choose?

	No.	%
Guaranteed payment of $25	1,120	74.7
Lottery with 50% chance of winning $50	379	25.3
Total	1,499	100.0

Table B85: In the 2020 election for president, who did you vote for?

	No.	%
Joe Biden	587	39.2
Donald Trump	559	37.3
Someone else	46	3.0
Did not vote	308	20.5
Total	1,499	100.0