

State MRP Toplines: AZ



STATE TOPLINES: AZ

Methodology: Please see end of document for full methods.

Percentages are modeled MRP estimates derived from the September 2021 infrastructure and methane survey. For more information on sampling procedures, statistical models and margins of error, please refer to the methodology section at the end of this document

Q1x1...Do you have a favorable or unfavorable opinion of each of the following sources of energy? - Solar energy

Response	Percent
Very favorable	56%
Somewhat favorable	30%
Somewhat unfavorable	6%
Very unfavorable	3%
Not sure	5%

Q1x2...Do you have a favorable or unfavorable opinion of each of the following sources of energy? - Wind energy

Response	Percent
Very favorable	49%
Somewhat favorable	31%
Somewhat unfavorable	8%
Very unfavorable	5%
Not sure	8%

Q1x3...Do you have a favorable or unfavorable opinion of each of the following sources of energy? - Natural gas

Response	Percent
Very favorable	34%
Somewhat favorable	41%
Somewhat unfavorable	12%
Very unfavorable	5%
Not sure	8%

Q1x4...Do you have a favorable or unfavorable opinion of each of the following sources of energy? - Oil

Response	Percent
Very favorable	17%
Somewhat favorable	33%
Somewhat unfavorable	22%
Very unfavorable	18%
Not sure	10%

Q1x5...Do you have a favorable or unfavorable opinion of each of the following sources of energy? - Coal

Response	Percent
Very favorable	12%
Somewhat favorable	27%
Somewhat unfavorable	25%
Very unfavorable	25%
Not sure	11%

Q1x6...Do you have a favorable or unfavorable opinion of each of the following sources of energy? - Nuclear energy

Response	Percent
Very favorable	22%
Somewhat favorable	26%
Somewhat unfavorable	20%
Very unfavorable	17%
Not sure	16%

Q1x7...Do you have a favorable or unfavorable opinion of each of the following sources of energy? - Biofuels, such as ethanol produced from grasses and corn

Response	Percent
Very favorable	20%
Somewhat favorable	42%
Somewhat unfavorable	12%
Very unfavorable	6%
Not sure	19%

Q1x8...Do you have a favorable or unfavorable opinion of each of the following sources of energy? - Methane

Response	Percent
Very favorable	7%
Somewhat favorable	20%
Somewhat unfavorable	22%
Very unfavorable	19%
Not sure	32%

Q2...Right now, which of the following do you think should be the most important priority for addressing the United States' energy needs?

Response	Percent
Building more natural gas power plants	15%
Building more nuclear power plants	11%
Developing more renewable energy sources, such as wind and solar	63%
Not sure	12%

Q3...Do you agree or disagree with the following statement? The primary goal of U.S. energy policy should be achieving 100% clean energy.

Response	Percent
Strongly agree	41%
Somewhat agree	32%
Somewhat disagree	12%
Strongly disagree	9%
Not sure	6%

Q4...Generally speaking, which do you think is more likely to produce a greater number of good jobs for Americans?

Response	Percent
Increasing domestic production of fossil fuels such as oil and gas	30%
Increasing domestic production of renewable energy such as wind and solar	53%
Not sure	17%

Q5...To the best of your knowledge, is energy generated from renewable sources, such as wind and solar, more or less expensive than natural gas, or are they about the same?

Response	Percent
More expensive	30%
Less expensive	33%
About the same	17%
Not sure	19%

Q6x1...Do you consider each of the following to be a reliable source of energy, or not? - Renewable energy, such as wind and solar

Response	Percent
No, it is not reliable	23%
Not sure	12%
Yes, it is reliable	65%

Q6x2...Do you consider each of the following to be a reliable source of energy, or not? - Natural gas

Response	Percent
No, it is not reliable	13%
Not sure	14%
Yes, it is reliable	73%

Q6x3...Do you consider each of the following to be a reliable source of energy, or not? - Nuclear energy

Response	Percent
No, it is not reliable	22%
Not sure	30%
Yes, it is reliable	48%

Q7...Do you support or oppose requiring electric utility companies in the United States to generate 100% of their electricity from renewable sources, like wind and solar, by the year 2035?

Response	Percent
Strongly support	34%
Somewhat support	31%
Somewhat oppose	11%
Strongly oppose	15%
Not sure	8%

Q8...As you may know, Congress is considering a proposal to provide financial incentives to electric utility companies in the United States that increase the amount of electricity they generate from clean, renewable sources. The proposal would also impose financial penalties on electric utility companies that do not increase their use of clean, renewable sources. Do you support or oppose this proposal?

Response	Percent
Strongly support	31%
Somewhat support	30%
Somewhat oppose	13%
Strongly oppose	15%
Not sure	11%

Q10...Do you support or oppose offering tax incentives or rebates to homeowners, landlords, and businesses interested in switching from natural gas to electric appliances (such as efficient electric water heaters, heat pump installations, and electric induction cooktops)?

Response	Percent
Strongly support	27%
Somewhat support	35%
Somewhat oppose	13%
Strongly oppose	9%
Not sure	16%

Q11...When thinking about purchasing or renting a new home, condominium or apartment, would you prefer...?

Response	Percent
All electric appliances for home heating	42%
All natural gas appliances for home heating	32%
Doesnt make a difference either way	26%

Q12...Regardless of what you currently use, would you prefer to use a gas stove or an electric stove for cooking, or does it not matter either way?

Response	Percent
Gas stove	45%
Electric stove	39%

Q13...To the best of your knowledge, which of the following fuel sources is primarily composed of methane?

Response	Percent
Biofuels, such as ethanol produced from grasses and corn	20%
Coal	5%
Natural gas	33%
Not sure	36%
Nuclear energy	3%
Oil	3%

Q14...In general, how clean or polluting do you think methane is?

Response	Percent
Very clean	8%
Somewhat clean	17%
Somewhat polluting	25%
Very polluting	17%
Not sure	32%

Q15...Just your best guess, in the last 10 years, do you think there has been more or less methane pollution, or has the amount of methane pollution stayed the same?

Response	Percent
More methane pollution	45%
About the same amount of methane pollution	39%
Less methane pollution	16%

Q16...As you may know, the amount of methane pollution that has been emitted has increased significantly over the last 10 years, and methane pollution from the fossil fuel industry has increased at least 40% in the last 10 years. Do you think this increase in methane pollution is having a large effect, a moderate effect, a small effect, or no real effect on climate change?

Response	Percent
Large effect	34%
Moderate effect	30%
Small effect	13%
No real effect	11%
Not sure	13%

Q17...As you may know, there's a debate going on in the federal government about whether to require oil and gas companies to reduce methane leaks from wells, pipelines and storage facilities. Supporters of this requirement say oil and gas companies have failed to do it on their own, and emissions from methane leaks are skyrocketing. Opponents of this requirement say oil and gas companies save money when they minimize methane leaks so they don't need burdensome government regulation to make these changes. What about you? Do you support or oppose requiring oil and gas companies to install technology to reduce methane leaks?

Response	Percent
Strongly support	42%
Somewhat support	30%
Somewhat oppose	10%
Strongly oppose	6%
Not sure	12%

Q18...As you may know, Congress recently voted to reinstate regulations on methane pollution, which require oil and gas companies to detect and plug methane leaks in their equipment and infrastructure. Do you support or oppose reinstating these regulations on methane pollution?

Response	Percent
Strongly support	42%
Somewhat support	31%
Somewhat oppose	8%
Strongly oppose	6%
Not sure	13%

Q19...As you may know, the U.S. Environmental Protection Agency (EPA) is working on new methane regulations that would go even further to control methane emissions than the regulations recently reinstated by Congress. Do you support or oppose the EPA taking this action?

Response	Percent
Strongly support	34%
Somewhat support	30%
Somewhat oppose	10%
Strongly oppose	12%
Not sure	15%

Q20...Below are two statements about natural gas. Which comes closest to your own view, even if neither is exactly right?

Response	Percent
The United States should embrace natural gas as a foundational fuel for heating, cooking and producing electricity. It can and should be used for decades to come because it is abundant, cheap, and cl	44%
The United States should reduce our use of fossil fuels like natural gas and instead produce electricity with renewable energy, such as solar and wind, and transition to electric heating, air conditi	56%

Q21...As you may know, scientists have found methane emissions from natural gas, including from leaks in gas pipelines and infrastructure, are a leading cause of climate change. Some local governments have responded by requiring builders of new homes and buildings to use heating and cooking appliances that run on electricity – produced increasingly by renewable energy – instead of fossil fuels such as natural gas. Do you support or oppose local governments requiring new homes and buildings to run entirely on electricity instead of using natural gas?

Response	Percent
Strongly support	27%
Somewhat support	29%
Somewhat oppose	17%
Strongly oppose	15%
Not sure	12%

Q22...Do you support or oppose your local government requiring all newly constructed homes and buildings to be wired so they are ready for electric appliances and electric vehicle charging, even if they are also fitted for natural gas?

Response	Percent
Strongly support	31%
Somewhat support	34%
Somewhat oppose	12%
Strongly oppose	11%
Not sure	13%

Q23...Do you support or oppose exporting more natural gas produced in the United States to countries overseas?

Response	Percent
Strongly support	13%
Somewhat support	23%
Somewhat oppose	21%
Strongly oppose	20%
Not sure	23%

Q24...If more natural gas produced in the United States is exported to countries overseas, do you think it will increase or decrease domestic gas prices, or will it have no impact at all?

Response	Percent
Increase	46%
Decrease	22%
No impact at all	33%

Q25...As part of coronavirus recovery, Congress is considering multi-trillion-dollar economic stimulus legislation that prioritizes investments in clean energy infrastructure and technologies. Do you support or oppose Congress passing this legislation?

Response	Percent
Strongly support	29%
Somewhat support	25%
Somewhat oppose	12%
Strongly oppose	20%
Not sure	13%

Q26...As you may know, President Biden and most Democrats in Congress support enacting multi-trillion-dollar economic stimulus legislation that prioritizes investments in clean energy infrastructure and technologies, while most Republicans in Congress oppose it. Should Democrats use their majority in Congress to pass this legislation even if no Republicans will vote for it, or not?

Response	Percent
No, Democrats should not pass this legislation if no Republicans will vote for it	47%
Yes, Democrats should pass this legislation even if no Republicans will vote for it	53%

Q27x1...Below is a list of investments that some members of Congress have suggested should be part of an infrastructure bill. Do you support or oppose each of the following? - Expanding tax credits and other incentives to increase production of renewable energy such as solar and wind

Response	Percent
Strongly support	34%
Somewhat support	32%
Somewhat oppose	12%
Strongly oppose	12%
Not sure	11%

Q27x2...Below is a list of investments that some members of Congress have suggested should be part of an infrastructure bill. Do you support or oppose each of the following? - Building new power lines to transport renewable energy produced in the United States

Response	Percent
Strongly support	37%
Somewhat support	34%
Somewhat oppose	9%
Strongly oppose	8%
Not sure	11%

Q27x3...Below is a list of investments that some members of Congress have suggested should be part of an infrastructure bill. Do you support or oppose each of the following? - Funding projects to transition to all-electric buildings that do not use fossil fuels

Response	Percent
Strongly support	27%
Somewhat support	28%
Somewhat oppose	14%
Strongly oppose	17%
Not sure	13%

Q27x4...Below is a list of investments that some members of Congress have suggested should be part of an infrastructure bill. Do you support or oppose each of the following? - Expanding tax credits and rebates for all-electric cars, trucks, and charging stations

Response	Percent
Strongly support	28%
Somewhat support	30%
Somewhat oppose	15%
Strongly oppose	14%
Not sure	13%

Q27x5...Below is a list of investments that some members of Congress have suggested should be part of an infrastructure bill. Do you support or oppose each of the following? - Assisting states and regions recovering from recent extreme weather and climate disasters

Response	Percent
Strongly support	39%
Somewhat support	38%
Somewhat oppose	7%
Strongly oppose	7%
Not sure	9%

Q27x6...Below is a list of investments that some members of Congress have suggested should be part of an infrastructure bill. Do you support or oppose each of the following? -Building public charging stations for electric vehicles

Response	Percent
Strongly support	32%
Somewhat support	34%
Somewhat oppose	14%
Strongly oppose	9%
Not sure	10%

Q27x7...Below is a list of investments that some members of Congress have suggested should be part of an infrastructure bill. Do you support or oppose each of the following? - Building public transportation options such as high-speed rail, subway and light rail systems, electric buses, and bicycle lanes

Response	Percent
Strongly support	35%
Somewhat support	35%
Somewhat oppose	12%
Strongly oppose	7%
Not sure	11%

Q27x8...Below is a list of investments that some members of Congress have suggested should be part of an infrastructure bill. Do you support or oppose each of the following? - Building and reinforcing infrastructure to withstand the effects of climate change and protect vulnerable communities from extreme weather dangers like severe flooding and hurricanes

Response	Percent
Strongly support	40%
Somewhat support	32%
Somewhat oppose	9%
Strongly oppose	9%
Not sure	11%

Q28x1...As you may know, Congress is considering raising taxes to pay for new spending on infrastructure in the United States. Do you support or oppose the following as ways to pay for additional infrastructure spending? - Raising taxes on corporations

Response	Percent
Strongly support	38%
Somewhat support	23%
Somewhat oppose	14%
Strongly oppose	15%
Not sure	10%

Q28x2...As you may know, Congress is considering raising taxes to pay for new spending on infrastructure in the United States. Do you support or oppose the following as ways to pay for additional infrastructure spending? - Raising taxes on individuals making more than \$452,700 a year and married couples making more than \$509,300 a year

Response	Percent
Strongly support	39%
Somewhat support	25%
Somewhat oppose	13%
Strongly oppose	14%
Not sure	10%

Q28x3...As you may know, Congress is considering raising taxes to pay for new spending on infrastructure in the United States. Do you support or oppose the following as ways to pay for additional infrastructure spending? - Enacting an annual wealth tax, which would tax individuals 2% on their net worth over \$50 million

Response	Percent
Strongly support	45%
Somewhat support	22%
Somewhat oppose	10%
Strongly oppose	12%
Not sure	10%

Q28x4...As you may know, Congress is considering raising taxes to pay for new spending on infrastructure in the United States. Do you support or oppose the following as ways to pay for additional infrastructure spending? - Requiring fossil fuel companies to pay a tax on their carbon pollution

Response	Percent
Strongly support	37%
Somewhat support	24%
Somewhat oppose	11%
Strongly oppose	17%
Not sure	11%

Q28x5...As you may know, Congress is considering raising taxes to pay for new spending on infrastructure in the United States. Do you support or oppose the following as ways to pay for additional infrastructure spending? - Increasing the gasoline tax to adjust for inflation

Response	Percent
Strongly support	13%
Somewhat support	19%
Somewhat oppose	22%
Strongly oppose	35%
Not sure	11%

Q28x6...As you may know, Congress is considering raising taxes to pay for new spending on infrastructure in the United States. Do you support or oppose the following as ways to pay for additional infrastructure spending? - Increasing taxes on capital gains, or income made from investments, for individuals making more than \$1 million a year

Response	Percent
Strongly support	42%
Somewhat support	23%
Somewhat oppose	11%
Strongly oppose	15%
Not sure	9%

Q29...Do you support or oppose creation of a jobs program that would employ currently unemployed oil and gas workers to safely close down tens of thousands of abandoned oil and gas wells, which are a source of water and methane pollution?

Response	Percent
Strongly support	37%
Somewhat support	29%
Somewhat oppose	10%
Strongly oppose	9%
Not sure	15%

Q30...If a jobs program to employ currently unemployed oil and gas workers to plug and secure tens of thousands of abandoned oil and gas wells were created, would you support or oppose requiring oil and gas companies to pay for at least some of the costs of this program?

Response	Percent
Strongly support	33%
Somewhat support	30%
Somewhat oppose	10%
Strongly oppose	11%
Not sure	15%

Q31x1...Please indicate how likely you would be to vote for a candidate for political office who supports the policies listed below. If you don't care about a specific issue or policy or don't know enough, just say so. - Providing a multi-trillion-dollar federal economic stimulus that prioritizes investments in clean energy infrastructure

Response	Percent
I would ONLY vote for a candidate who supports this policy	18%
I would be more likely to vote for a candidate who supports this policy	40%
I would be less likely to vote for a candidate who supports this policy	12%
I would NEVER vote for a candidate who supports this policy	14%

Q31x2...Please indicate how likely you would be to vote for a candidate for political office who supports the policies listed below. If you don't care about a specific issue or policy or don't know enough, just say so. - Adopting stronger regulations on methane pollution

Response	Percent
I would ONLY vote for a candidate who supports this policy	17%
I would be more likely to vote for a candidate who supports this policy	44%
I would be less likely to vote for a candidate who supports this policy	13%
I would NEVER vote for a candidate who supports this policy	8%

Q31x3...Please indicate how likely you would be to vote for a candidate for political office who supports the policies listed below. If you don't care about a specific issue or policy or don't know enough, just say so. - Providing financial incentives to electric utility companies in the United States that increase the amount of electricity they generate from clean, renewable sources, and imposing financial penalties on electric utilities that do not.

Response	Percent
I would ONLY vote for a candidate who supports this policy	17%
I would be more likely to vote for a candidate who supports this policy	44%
I would be less likely to vote for a candidate who supports this policy	13%
I would NEVER vote for a candidate who supports this policy	11%

Q31x4...Please indicate how likely you would be to vote for a candidate for political office who supports the policies listed below. If you don't care about a specific issue or policy or don't know enough, just say so. - Requiring fossil fuel companies to pay a tax on their carbon pollution

Response	Percent
I would ONLY vote for a candidate who supports this policy	17%
I would be more likely to vote for a candidate who supports this policy	44%
I would be less likely to vote for a candidate who supports this policy	13%
I would NEVER vote for a candidate who supports this policy	12%

National Poll Methodology

Poll number: pr2126

Interview Dates: September 25-28, 2021

Sample Population: 4673 registered voters in the United States.

Sample Selection: Scientific online poll - stratified sample of panel respondents.

Weighting Parameters: The sample was weighted based on the U.S. Census Bureau's Voting and Registration Supplement to the Current Population Survey for registered voters in the United States based on age, gender, race, educational attainment, census region, and Hispanic ethnicity. The sample was also balanced by reported 2020 presidential vote.

This topline provides weighted percentages, as well as the unweighted N-size for the total sample. Due to the effects of weighting and rounding, figures may or may not add up to 100%. The standard deviation of the weights was: 0.2056567. The maximum weight was: 2.0379626. The minimum weight was: 0.3607888. 95% of the weights were between 0.5705089, 1.436137.

Margin of Error: The 95% credibility interval for this survey is +/- 1.4%, which includes the square root of the design effect (DEFT): 1.0209239.

Citation: Climate Nexus Polling, Yale Program on Climate Change Communication, George Mason University (2021). Infrastructure and Methane [Data Set].

State MRP Methodology

Climate Nexus utilizes MRP to develop state and local public opinion estimates from national survey data.

Multilevel modeling and poststratification (MRP) is an analytical methodology designed to provide accurate, detailed estimates of public opinions for small geographic areas. The method emerged in recent decades from political science and has been widely shown to produce estimates more accurate than any competing approaches. An MRP analysis involves two stages. First, individual survey responses are modeled as a function of demographics, location, and geographic covariates (the "multilevel regression model"). In this way, unique geographic variability from local residents (while controlling for their demographic characteristics) can be captured and used to estimate opinions for nearby places. The second step is poststratification, where the fitted estimates for each demographic-geographic respondent type are weighted by their actual (census-based) population counts for a given area. Percentages of respondents with a particular preference can then be estimated for every state, county, or other geographic unit.

MRP has been referred to as the "gold standard" for estimating sub-national opinion (Selb and Munzert 2011, 456), but in some contexts, dis-aggregation may be preferred when sample sizes are large enough and close to random. In particular, studies aimed at assessing causal effects on public opinion should generally use disaggregation rather than a model-based method such as MRP (Caughey and Warshaw, 2019).

Nexus employs an advanced version of MRP, called multilevel regression and synthetic post-stratification (MRSP)¹ to calculate estimates. This approach has been shown to increase the prediction and precision of sub-national public opinion estimation beyond traditional MRP by using synthetic joint distributions that are created on the marginal distributions. In comparison, traditional MRP utilizes "true" joint distributions, or stratas, such as the interaction of age + gender + race, and is therefore limited to few variables. As an alternative, we use a technique called multidimensional iterative proportional fitting (mipfp) to develop cell proportions for each demographic type, which is an exercise in spatial micro-simulation.

By sidestepping the stringent data requirements of traditional MRP, we are able to develop dynamic and robust predictive models that include more predictive variables to better assess public opinion within small geographic boundaries. Once compiled, we use a generalized mixed effects regression model to develop the predicted estimates for each population strata, and then we post stratify to take the weighted sum across all cells to make inferences about each state.

We use the N=4673 person national survey data to fit a generalized mixed effects model:

$$\hat{y} = Pr(y_i = 1) = \text{logit}^{-1}(\alpha_{j|i} + \beta x_i + \epsilon_i)$$

where

$$\text{logit}^{-1}(\alpha) = \frac{\exp(\alpha)}{\exp(\alpha) + 1}$$

where distributions of the random effect covariates (individual-level predictors $y \sim (1|a) + (1|b) + \dots (1|n)$) are drawn with mean zero and estimated variance:

$$\begin{aligned} \alpha_j^{race} &\sim N(0, \sigma_{race}^2), for j = 1, \dots, 3 \\ \alpha_l^{education} &\sim N(0, \sigma_{education}^2), for l = 1, \dots, 4 \\ \alpha_m^{gender} &\sim N(0, \sigma_{gender}^2), for m = 1, \dots, 2 \\ \alpha_s^{state+DC} &\sim N(0, \sigma_{state+DC}^2), for s = 1, \dots, 51 \\ \alpha_h^{Hispanic} &\sim N(0, \sigma_{Hispanic}^2), for h = 1, \dots, 2 \\ \alpha_r^{Censusreg} &\sim N(0, \sigma_{Censusreg}^2), for r = 1, \dots, 9 \end{aligned}$$

In the model, each individual's response is a function of their individual level demographic variables, state/congressional district grouping variables, and interactions. The individual-level covariates are specified as random effects and have varying intercepts. Group-level predictors (such as 2020 state election returns, percent of same sex households in a district, total CO2 emissions, and the percent that drive alone in a particular state - covariates that are useful in estimating questions related to climate change) do not have varying intercepts or slopes. Covariates are chosen to maximize the model's "r-squared", or predictive power in the sense that they are useful in understanding the variance we witness in the outcome variable.

Each stratum or "type of individual" in the state is estimated using multidimensional iterative proportional fitting (mipfp), which calculates the synthetic joint distribution derived from the marginal distributions of the individual level covariates obtained from the Census (gender, race, Hispanic ethnicity, and educational attainment) and modeled party id score for each state in the state resulting in 144 stratoms:

$$N_{stratsByState} = 2(gender) * 3(race) * 4(education) * 2(Hispanic) * 3(PartyID) = 144$$

MRP Model Specs

For individual i , with the following indexes for each demographic variable in the model, the state model, can typically be defined:

$$\hat{y} = Pr(y_i = 1) = \text{logit}^{-1}(\beta_0 + \alpha_{j[i]}^{race} + \alpha_{i[i]}^{education} + \alpha_{s[i]}^{state+DC} + \alpha_{p[i]}^{partyID} + \alpha_{r[i]}^{region} \alpha_{m[i]}^{gender} + \alpha_{h[i]}^{Hispanic} + \alpha_{election2020} + \alpha_{TotalCO2} + \alpha_{PercentSameSexHH} + \alpha_{pctDriveAlone}. scl)$$

where non random effects covariates can be standardized.

The prediction for each strata, that is, the prediction for each "type of person" is then weighted by the population frequency of the cell (poststratification).

State Model & Prediction Differences (IF APPLICABLE)

Due to the fact that the state and CD models have different random effects parameters and geographic outcome variables, it is likely that we find different in-group estimates that do not allow for comparison across the MRSP models. As a result of the varying random effects parameters (in-group variation that allows shifts in the slope or intercept of a variable), a state's overall MRSP estimate may vary from the average estimate across all CD MRSP estimates in a given state. This is evident in at-large district states where the state MRSP prediction outcome does not equal the CD-level prediction.

While we do expect at-large district estimates from the CD model to fall within the average margin of error of the state model (see below for section on margins of error), to minimize confusion, all at-large district estimates will equal the state model prediction.

MRP Confidence Intervals / Margins of Error

To capture model uncertainty in predictions at the 95% confidence level from multilevel models (merMod objects (<https://www.rdocumentation.org/packages/lme4/versions/1.0-4/topics/merMod-class>)), we utilize `merTools::predictInterval()`. By drawing a sampling distribution for the random and the fixed effects and then estimating the fitted value across that distribution, it is possible to generate a prediction interval for fitted values that includes all variation in the model except for variation in the covariance parameters. This is a much faster alternative than bootstrapping for models fit to medium to large data sets.

To estimate the overall margin of error ($\hat{\theta}$) for each geographic unit (utilizing a `draw::compute` approach), where the function $g(x)$ yields an MRP estimate for a given state, we iterate the `merTools::predictInterval()` process 999 times for each survey question then calculate the confidence interval at the 95% confidence level for each subgroup within a state. The margin of error for **each** subgroup can be calculated by subtracting the lower bound of the confidence interval from the upper bound, and dividing by two. To calculate the state's overall margin of error for a given survey question we multiply each subgroup's margin of error by the n-size (or percent of the population) of that group and divide it by the sum of those weighted margins of error (the weighted mean by the proportion of that subgroup):

$$\bar{x} = \frac{\sum_{i=1}^n (x_i * w_i)}{\sum_{i=1}^n w_i}$$

The average range of the MoE across modeled answer options are between:

- State level estimate MoE: +/- 6-11%

Because each estimate for a specific answer choice in the survey is a modeled outcome variable with its own corresponding confidence interval, questions may or may not add up to 100%. If they do not, we normalize results to help with interpretation.

Sub-national MRP crosstab models for Party Identification (IF APPLICABLE)

To develop cross tabs for particular a demographic group (i.e. PartyID), we first calculate the proportion of that demographic type in a given geographic region using `mipfp`, we then filter for the specific subgroup (different levels within categories such as gender, educational attainment, race, etc.) and develop new post-stratification weights by taking the cell weighted proportion and dividing it by the sum of the weights of that subgroup. In the final step, we sum the post-stratified predicted probabilities for each subgroup.

If a demographic type does not have Census proportions (such as proportions of self identified Republicans in a given state, which isn't tracked by the Census) we first develop an MRSP model to calculate the proportion of individuals that fit that demographic type, much like predicting any other survey question or outcome variable. We then use those proportions as given population percentages in a given state and can then filter, divide the sum of the weights of that variable, post-stratify, and sum across each cell.

We follow the process below to estimate opinions of a given subgroup.

$$m = \text{poststratificationweights of sub} - \text{population}$$

$$\hat{y} = Pr(y_i = 1) = \text{logit}^{-1}(\alpha_{j[i]} + \beta x_i + \epsilon_i)$$

$$\text{logit}^{-1} = \frac{\exp(a)}{1 + \exp(a)}$$

$$\widehat{\text{weightedStatePred}} = \sum_{k=1}^n \text{logit}^{-1}(\alpha_{j[i]} + \beta x_i + \epsilon_i) * \frac{m_i}{\sum m}$$

For this poll we included modeled partyID proportions for each state, included it into the MRSP model resulting in 144 nested subgroups that we predict on by state:

$$N_{stratsByState} = 2(\text{gender}) * 3(\text{race}) * 4(\text{education}) * 2(\text{Hispanic}) * 3(\text{PartyID}) = 144$$

The full partisan state model can be defined:

$$\hat{y} = Pr(y_i = 1) = \text{logit}^{-1}(\beta_0 + \alpha_{j[i]}^{race} + \alpha_{i[i]}^{education} + \alpha_{s[i]}^{state+DC} + \alpha_{r[i]}^{region} + \alpha_{p[i]}^{partyID3} \alpha_{m[i]}^{gender} + \alpha_{h[i]}^{Hispanic} + \alpha_{election2020} + \alpha_{TotalCO2} + \alpha_{PercentSameSexHH} + \alpha_{pctDriveAlone}. scl)$$

1. http://www.ucl.ac.uk/~uctqtl/myUCL/Research_files/MrP_methods_8.pdf (http://www.ucl.ac.uk/~uctqtl/myUCL/Research_files/MrP_methods_8.pdf) ↗