Executive Summary

The fate of the earth may depend on U.S. success in reducing greenhouse gas emissions. And the fate of U.S. climate policy may depend on its success in addressing the fears that it will cause economic harm. Resistance to new initiatives has been based on geography as much as on party lines, with the greatest concerns about economic impacts of climate policy coming from states with carbon-intensive economies and coal-dependent electricity systems.

This report examines the underlying differences between states that will determine how they are affected by climate policy. It models the effects of carbon prices on households by income level and by state, including the net economic effect under a system that returns most of the carbon revenues to households. It also looks at policy choices that could reduce the impact on each state's residents and ease their transition to a lower-emissions lifestyle.

Any U.S. climate policy will have to be designed both to protect the earth's climate by reducing emissions, and to protect American households from undue economic losses. Our model shows that these two objectives can almost be separated from each other. Roughly speaking, emission reduction depends on the price of carbon, while the economic impact on households depends on the uses of carbon revenues. These two policy levers can be adjusted independently, to achieve the desired environmental *and* economic outcomes.

Our model finds that the policies considered in current legislative proposals are not ambitious enough to achieve either goal. None of the bills currently under serious discussion would impose a high enough price to achieve the 17- to 20-percent reductions in greenhouse gas emissions (from 2005 levels) that they seek by 2020. Likewise, none of the leading bills return enough of the carbon revenues to households to ensure desirable distributional outcomes. It is not difficult to build a better proposal: A carbon price that rises to $75 per metric ton of carbon dioxide (mT CO_2) by 2020, with 85 percent of the revenues returned on a per capita basis, would do the trick. (The price can be achieved either through a cap-and-trade system or a carbon tax; the distinction between these two policy approaches does not matter for our analysis.)

To keep the carbon price lower and still meet the announced emission targets, it would be necessary to step up the efforts to reduce carbon emissions through non-market mechanisms. Expanded energy efficiency programs and accelerated investment in alternatives to coal plants are some of the most promising options. These efforts could be targeted to states that are most dependent on coal-burning power plants at present, since this is where carbon prices weigh most heavily on households – and where the opportunities for emission reduction are greatest.

Our analysis builds on a substantial body of research on climate policy options and their potential effects on household incomes and on employment. It reinforces a broad consensus that carbon policies will disproportionately affect lower-income households – a "regressive" impact – unless measures are taken to counteract this effect. On this question, our model comes to the same basic conclusions as have other similar models: Carbon costs would be regressive if imposed without a rebate to households; permit giveaways (which effectively give carbon revenues to selected industries, rather than to households) would make climate policies more regressive. We also reviewed multiple approaches to estimating the job creation potential of "green" energy and energy-

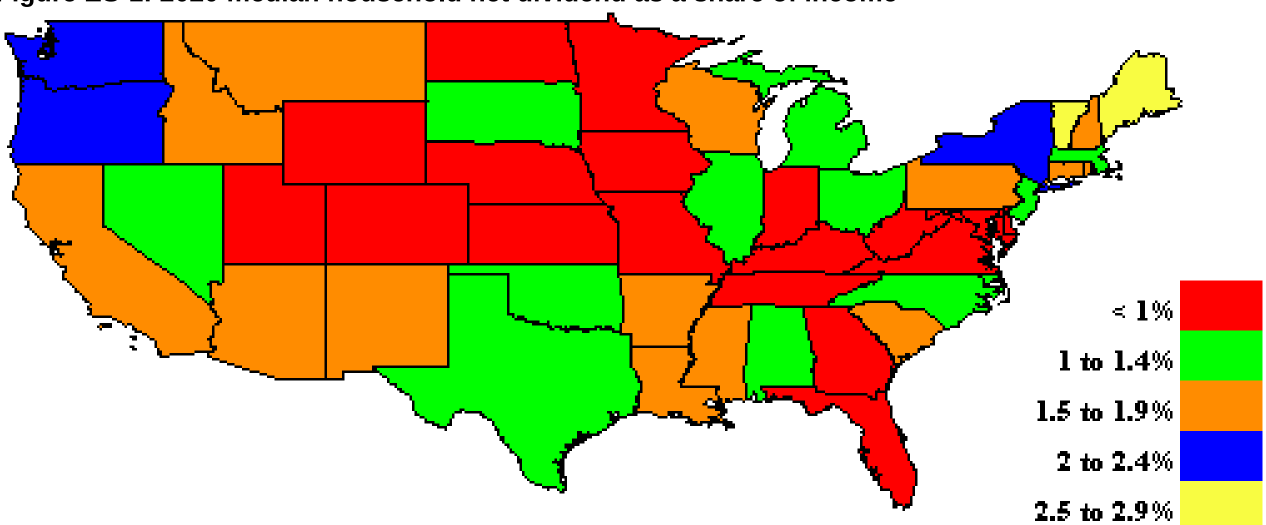
efficiency investments; several studies project a need for roughly $90,000 in investment per full-time job.

Emission Reduction in 2020

We modeled two scenarios. One assumes a $25/mT CO_2 price in 2015, representing the range of prices contemplated in many current proposals; the other assumes a $75/mT CO_2 price in 2020, beyond the range of current proposals, but roughly what is required to meet proposed emission reduction targets for 2020. For simplicity of exposition, this summary reports only the results for 2020. In that year, at the $75 carbon price, a median-income U.S. household would pay 3.8 percent of its income in carbon costs. On a state-by-state basis, the cost to the median-income household would vary from 2.5 percent of income in New York to 5.3 percent in Kentucky.

If that carbon price of $75 in 2020 were combined with a rebate of 85 percent of total carbon revenues, almost everyone would come out ahead. The national median-income household would receive a net gain of 1.4 percent of its income. Median-income households in each state would have gains ranging from 0.5 percent in Virginia, Minnesota, and Wyoming, up to 2.6 percent in Vermont.

Figure ES-1: 2020 median household net dividend as a share of income



Note: Values rounded to the nearest tenth of a percent. Median household net dividend as a share of income is 1.3 percent for Alaska, 1.0 for Hawaii, and 0.6 for the District of Columbia.

Many alternative rebate schemes could be considered; the one alternative that should *not* be adopted is a cash rebate in proportion to carbon costs. While this may seem tempting at first glance, it would undermine the market incentive effect that is the rationale for the carbon price. Other measures, however, could address the needs of the hardest-hit states without masking the role of the carbon price as a market incentive. Our model assumes that money will be invested in energy efficiency, distributed to states in proportion to their current CO_2 emissions from electricity use. In our 2020 scenario, $60 billion would be left over after giving households their rebates; $12 billion of that amount is invested in energy efficiency. Vermont would get $3 million, while Texas would get $1.2 billion.

Assuming that one new job is created for every $90,000 of green investment, our modeled efficiency program would create more than 130,000 jobs. Texas would gain the most, 13,000 jobs, while

Vermont would gain 28. Those job gains would help offset job losses as coal-powered plants shut down and other changes occur due to carbon policy; for 11 states, that would mean the difference between a net job loss and a net gain. If just one-fifth of the remaining carbon revenue were spent on additional green employment in the states where it is most needed, all states would have net job gains from carbon policy. At the same time, those green investments could help states reduce their per capita emissions — and thus reduce the economic impact of the price on carbon.

Carbon policy won't just affect states differently; it will also have different impacts on households depending on their income. Lower-income households spend a larger share of their incomes than the rich, who can afford to save and invest more, and a larger share of their spending is on electricity, home heating, gasoline, and food, rather than on services, which are less carbon-intensive. As a result, lower-income households will be more heavily affected by a price on carbon. This is why we, and many others, have explored proposals for rebates to offset the regressive impact of carbon prices.

Beyond Price Incentives

There are limits to the effects of price incentives; households can't adjust their spending overnight to avoid higher-carbon choices. Buying a new car or a new boiler is costly, and even if the price of electricity goes up sharply, a household can't just turn off all appliances and lights. To measure responses to price change, economists use a ratio called the "price elasticity of demand," defined as the percentage change in purchases that result from a 1-percent change in price. When this ratio is close to zero for a product or service, demand is said to be "inelastic."

Most households' demand for gasoline, heating oil, and electricity is very inelastic, especially in the short run, so it is not reasonable to anticipate rapid changes in consumer spending in these areas due to carbon prices alone. In the long run, demand is more elastic and changes in spending will be greater; eventually, most people do replace their cars, and they do buy more energy-efficient appliances. State and federal policy can expand consumers' choices, thereby making demand more elastic. By providing lower-carbon energy options, supporting weatherization and other energy-efficiency programs, improving public transportation, and making it easier to walk or ride a bike, the public sector can make price incentives more effective.

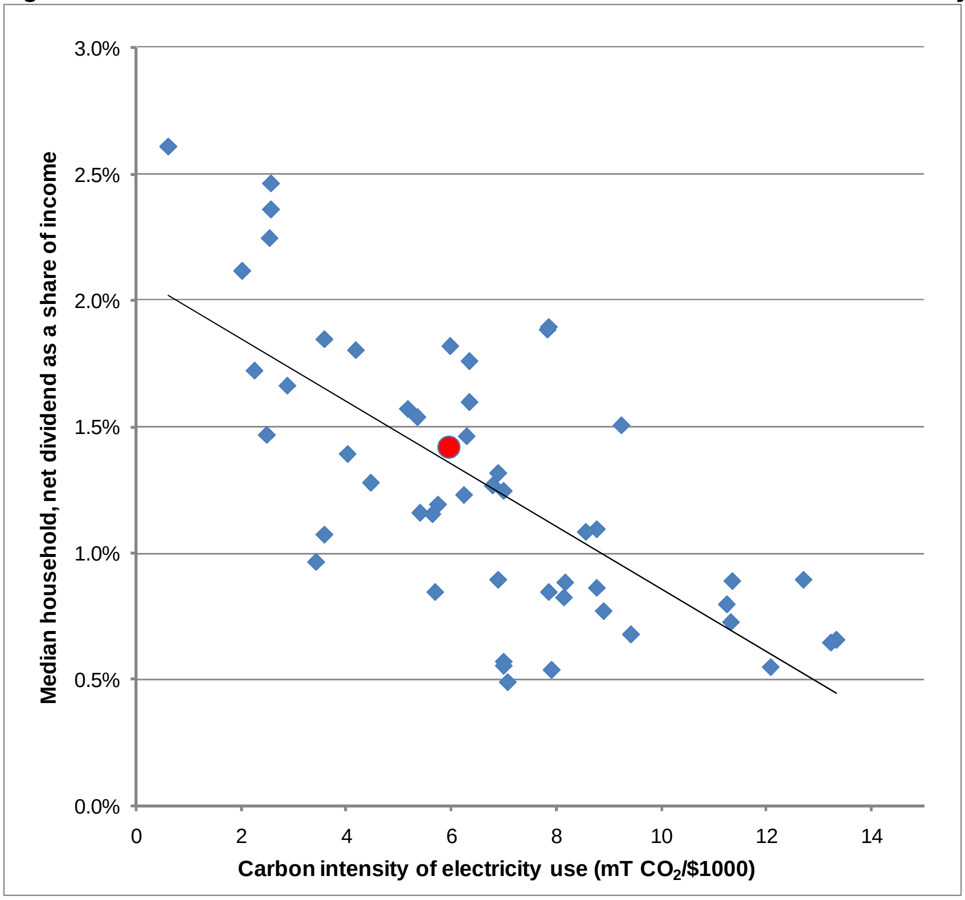
The dominant factor in interstate differences in carbon intensity is the use of coal to generate electricity. This is not the only source of emissions: In round numbers, about 30 percent of U.S. households' carbon emissions are from electricity, 25 percent from gasoline, and 45 percent from everything else. The other categories, however, are more consistent from state to state, so that interstate variation depends most heavily on the carbon intensity of electricity, and specifically on the use of coal.

Transportation emissions per capita in most states fall within a range of 2 to 1; the extreme cases, Wyoming and the District of Columbia, differ by 6 to 1. Emissions from everything else, primarily the indirect emissions from the production of food, other goods, and services, are quite similar across the country, with interstate variation of less than 2 to 1 in per capita emissions. (The small category of home heating varies widely based on climate, but it is not a large part of the total.) Electricity emissions, in contrast, vary by more than 20 to 1 from state to state (after adjusting for interstate electricity trade); Wyoming emits 19.7 mT CO_2 per $1,000 spent on electricity, while

Vermont emits 0.8. Those differences are closely correlated to the share of power consumption that comes from coal: 95.1 percent in Wyoming and 7.8 percent in Vermont.

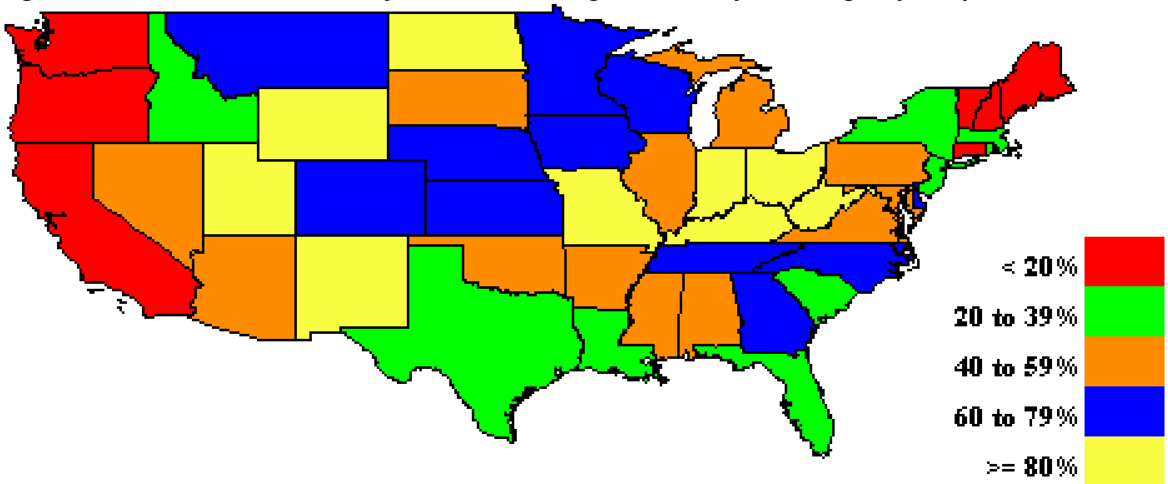
In general, the impacts of a carbon price and dividend on each state are closely related to the carbon intensity of its electricity, which in turn is closely connected to the share of its electricity generated from coal: The lower the carbon intensity and the lower the share of power that comes from coal, the better the state's households will fare. In terms of reducing emissions and prospering under a dividend system, nothing is as important as reducing the use of coal to generate electricity.

Figure ES-2: Net dividends from $75/mT CO2 in 2020 versus carbon intensity of electricity use



Note: The blue squares represent states; the red circle represents the U.S. average.

Figure ES-3: Share of electricity use from coal generation (including imports)

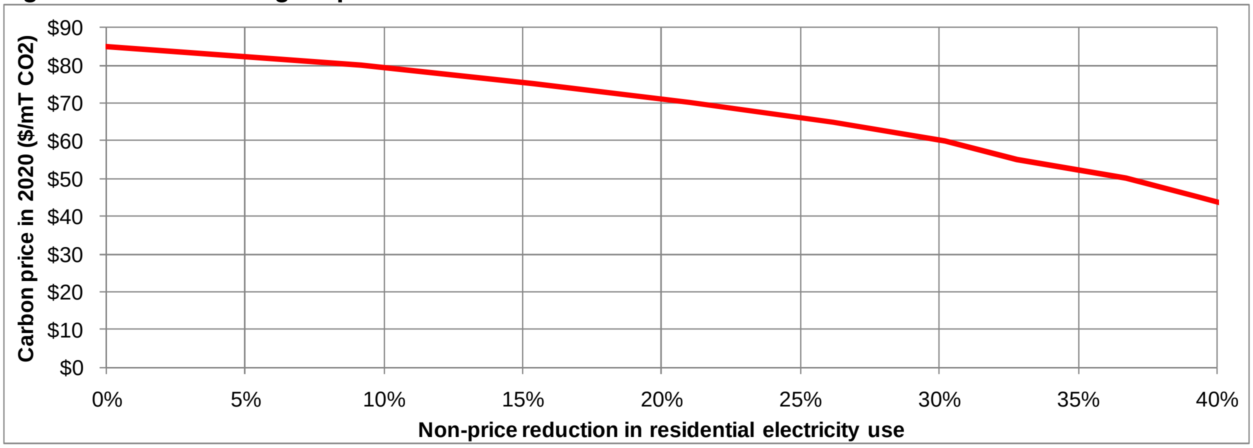


Note: Values rounded to the nearest whole percent. Share of electricity use from coal (including imports) is 9.5 percent for Alaska, 14.8 for Hawaii, and 62.4 for the District of Columbia.

Even if a vigorous program of building low-carbon power plants were to begin tomorrow, most of the electricity used in the United States for the next several years will be produced by plants that exist today. Within the existing plants, there are important differences in carbon intensity: natural gas has about half the emissions of coal per kWh of electricity, while hydropower, nuclear power, and wind have no new emissions per additional kWh (although there are emissions from plant construction for any technology, and from other stages of the nuclear life cycle). Utilities, or power pools, supply the amount of electricity that customers want at any moment, from the plants with the lowest costs; a carbon price makes coal plants slightly more expensive relative to other plants, leading to reduced use of coal plants and a slight decrease in the average carbon intensity of electricity. We have included an estimate of this effect in our model; but this effect, combined with consumer response to carbon prices, is not enough to achieve rapid reduction in emissions.

Therefore, our model includes one additional mechanism beyond price impacts: the adoption of efficiency measures, which are assumed to reduce U.S. average residential electricity consumption by almost 6 percent in 2015, and 15 percent by 2020. There is a tradeoff between efficiency measures and price incentives: Without any efficiency measures, achieving a 17-percent reduction in overall emissions by 2020 would require a carbon price of \$85/mT CO_2, rather than the \$75 in our 2020 scenario. To stay below the price ceilings prescribed in recent legislative proposals, with upper limits at \$32 to \$41/mT CO_2, non-price measures would have to reduce electricity emissions by more than 42 percent – almost triple the amount assumed in our \$75 in 2020 scenario.

Figure ES-4: Achieving 20-percent reduction from 2005 emissions in 2020



Priorities for a Low-Carbon Future

In our model, the states with the biggest losses or smallest gains from climate policy share two qualities: They have made little progress to date in energy efficiency and building alternative transportation networks, and they consume electricity generated almost exclusively from coal. The greater households' price elasticity for electricity, gasoline, and household fuels, the smaller their economic impacts from a carbon price, but households' purchasing decisions can only take them so far. The set of available choices is just as important as the decisions that they make, and public policy has a big role to play in easing households' transition to energy conservation, and in making available alternative transportation and low-carbon-intensity electricity. States that have not yet begun to invest in the green economy have a lot catching up to do, but they may also have a lot of low- and no-cost energy efficiency measures still at their disposal.

Use of electricity generated from coal is, by far, the most important factor determining households' carbon costs. Building lower-carbon-intensity natural gas and renewable-power generation, and retiring coal plants, is essential to reducing impacts for the states with the highest costs from climate policy. (Nuclear power, sometimes touted as the obvious answer, remains quite expensive, in no small part due to the high cost of numerous essential safety precautions. It also requires substantial amounts of cooling water, which will be a scarce resource in a climate-constrained future. And the long-term problem of nuclear waste disposal has not yet been solved.) The employment impacts would be negligible – in 2007, coal miners represented 0.05 percent (i.e., 5/100^{ths} of 1 percent) of the U.S. labor force, and even in Wyoming, with the nation's biggest share of employment in coal mining, they were only 2.2 percent of the workforce. This means providing job retraining or other supports for them would be relatively inexpensive; it can be built into plans for green jobs and energy efficiency projects.

The costs of a climate policy will be unequal across U.S. states; that is inevitable if we are to create effective price incentives and reduce emissions. But the impacts on households can be greatly mitigated through other policy measures, especially by returning carbon policy revenues to households as a per capita dividend or through other mechanisms. In addition, resources must be targeted to states that now depend heavily on coal for electricity and that have a lot of untapped potential for energy efficiency improvements. If we make smart use of carbon policy revenues, we can minimize the impact on household incomes, create new green jobs in every state, and make great strides toward a cutting-edge, low-carbon economy.