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FACT SHEET

HOW MISSOURI CAN MEET ITS CLEAN POWER PLAN TARGETS

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WHAT DOES THE CLEAN POWER PLAN MEAN FOR MISSOURI?

In August 2015, the U.S. Environmental Protection Agency (EPA) finalized the Clean Power Plan (CPP), the first-ever carbon pollution standards for existing power plants (Box 1). The CPP builds on progress already under way to move the country toward a cleaner electricity system, including rapidly falling prices of renewables and increased deployment of money-saving energy efficiency measures. The plan enables states to use a wide range of options to meet their standards, such as existing clean energy policies and power plants (the focus of this analysis), other tools to cut electricity use and increase the use of renewables, and broader initiatives such as participation in a cap-and-trade program or use of a carbon tax (Box 2).

Missouri has put policies in place to promote renewable development and improve energy efficiency, but power sector emissions will increase if the goals in these policies aren't met. By building on and expanding these policies to take greater advantage of clean energy resources, the state can reduce its emissions and put itself in a strong position to comply with the CPP. In this fact sheet, we show how Missouri can meet, and even exceed, its CPP standards through clean energy policies and better use of existing power plants while minimizing compliance costs, ensuring reliability, and harnessing economic opportunities in clean energy.

Disclaimer: *This Fact Sheet contains preliminary research, analysis, findings, and recommendations. It is intended to stimulate timely discussion and critical feedback and to influence ongoing debate on emerging issues. Its contents may eventually be revised and published in another form.*

WHAT DOES THE CLEAN POWER PLAN REQUIRE FOR MISSOURI'S POWER PLANTS?

Each state has the flexibility to use one of three targets provided in the Clean Power Plan: (1) an emission rate target for existing power plants, which measures the carbon intensity of the state's existing fossil electricity generation; (2) a mass-based target for existing power plants, which measures the absolute level of CO_2 emissions allowed by the state's affected power plants; or (3) a mass-based target for new and existing power plants (i.e., new source complement).

Missouri has the option to choose one of the following three targets:

- **Emission rate target for existing sources:** 1,272 pounds per megawatt-hour (lbs./MWh) by 2030, a reduction of 37 percent below its 2012 emission rate of 2,008 lbs./MWh.
- **Mass-based target for existing sources:** 55 million short tons of CO_2 in 2030, which is about 29 percent lower than the state's CO_2 emissions from fossil electricity generation in 2012.
- **Mass-based target for new and existing sources:** 56 million short tons of CO_2 in 2030, which is about 28 percent lower than the state's CO_2 emissions from fossil electricity generation in 2012.

The percent reductions above are calculated using EPA's 'adjusted' 2012 baseline, which includes the CO_2 emissions and generation from fossil plants that are affected by the Clean Power Plan, consistent with EPA's methodology.

HOW MISSOURI CAN MEET—OR EXCEED—THE CLEAN POWER PLAN REQUIREMENTS

Missouri can put itself in a strong position to meet or exceed its targets by building on the clean energy policies it already has in place and encouraging more use of renewable energy and energy efficiency. Carbon dioxide (CO_2) emissions from the state's power plants fell 6 percent between 2005 and 2012 due to reduced generation, increased use of natural gas, and other market factors. However, this trend is not expected to continue. According to our business-as-usual projections, based in part on the U.S. Energy Information Administration's *Annual Energy Outlook 2015* (AEO2015), existing power plant emissions in the state are expected to rise 15 percent between 2012 and 2030, as both coal and natural gas generation increase to meet rising demand.[1]

Our business-as-usual (BAU) projections do not reflect coal plant retirements that were announced after the publication of AEO2015, including a number of aging coal units that will likely retire or be converted to natural gas within the next several years. Ameren Missouri—the state's largest electric utility, accounting for about 46 percent of the state's generation—plans to retire its 834 MW Meramec coal plant by 2022 and indicated in its 2014 Integrated Resource Plan that it may not need to replace the lost capacity.[2] KCP&L—which accounts for about 20 percent of the state's generation—also plans to stop burning coal at six of its units by 2021, either by retiring them or converting them to burn natural gas.[3] Retiring these and other aging, uneconomic coal plants can help Missouri lower its emissions and comply with the CPP while creating new economic opportunities in clean energy.[4] To illustrate the impact of these retirements, our BAU projections would be 4–7 percent lower in 2030 if Meramec was retired (and the lost capacity was not replaced) and all six KCP&L units were either converted to natural gas or retired and not replaced.[5]

CO_2 REDUCTIONS FROM EXISTING CLEAN ENERGY POLICIES AND EXISTING POWER PLANTS

Missouri's renewable energy standard and voluntary energy efficiency goals can reduce emissions by offsetting rising electricity demand and promoting use of renewable energy.[6] By meeting the targets in these clean energy policies and making better use of existing power plants, Missouri can achieve about 90 percent of the reductions

required to meet its mass-based target. By taking the measures listed below, Missouri can reduce existing power plant emissions 26 percent below 2012 levels by 2030 (Figure 1). These actions are consistent with Missouri's Comprehensive State Energy Plan, released in October 2015, which emphasizes the importance of diversifying Missouri's energy portfolio and increasing efforts to help homes and businesses save energy.[7]

If Missouri were to choose to use the rate-based target, these actions would reduce the average emission rate of Missouri's existing fossil fleet by 27 percent below its 2012 emission rate—to 1,459 lbs. per MWh—in 2030, achieving 75 percent of the reductions needed to meet the state's rate-based target of 1,272 lbs. per MWh.[8]

- **Meeting voluntary energy efficiency goals.** Missouri's Energy Efficiency Investment Act (MEEIA) sets voluntary energy efficiency savings goals that reach 1.9 percent of sales in 2020 (and subsequent years) for cumulative savings of nearly 10 percent of electricity sales by 2020. By meeting these goals, Missouri could achieve about 50 percent of the reductions required to meet its mass-based target.[9]
- **Meeting renewable energy targets.** Missouri's Renewable Energy Standard requires 15 percent of the electricity sold by its investor-owned utilities to come from renewable sources by 2021. By meeting this standard through in-state generation in addition to its voluntary efficiency goals, Missouri can achieve 63 percent of the reductions required to meet its mass-based target.[10,11]
- **Increasing the use of existing natural gas plants.** Missouri's most efficient natural gas plants—combined cycle (NGCC) units—generated less than one-fourth of the electricity they were capable of producing in 2012. By running existing NGCC plants at 75 percent in addition to the measures above, Missouri can achieve 79 percent of the reductions required to meet its mass-based target.[12]
- **Increasing coal plant efficiency.** Low- and no-cost operational improvements and best practices can improve the efficiency of existing coal plants. By increasing the average efficiency of the remaining coal fleet by 4.3 percent in addition to the measures above, Missouri can achieve 90 percent of the reductions required to meet its mass-based target.[13]

Details on the modeling assumptions for this analysis are provided in the appendix.

CO_2 REDUCTION OPPORTUNITIES USING EXPANDED CLEAN ENERGY POLICIES

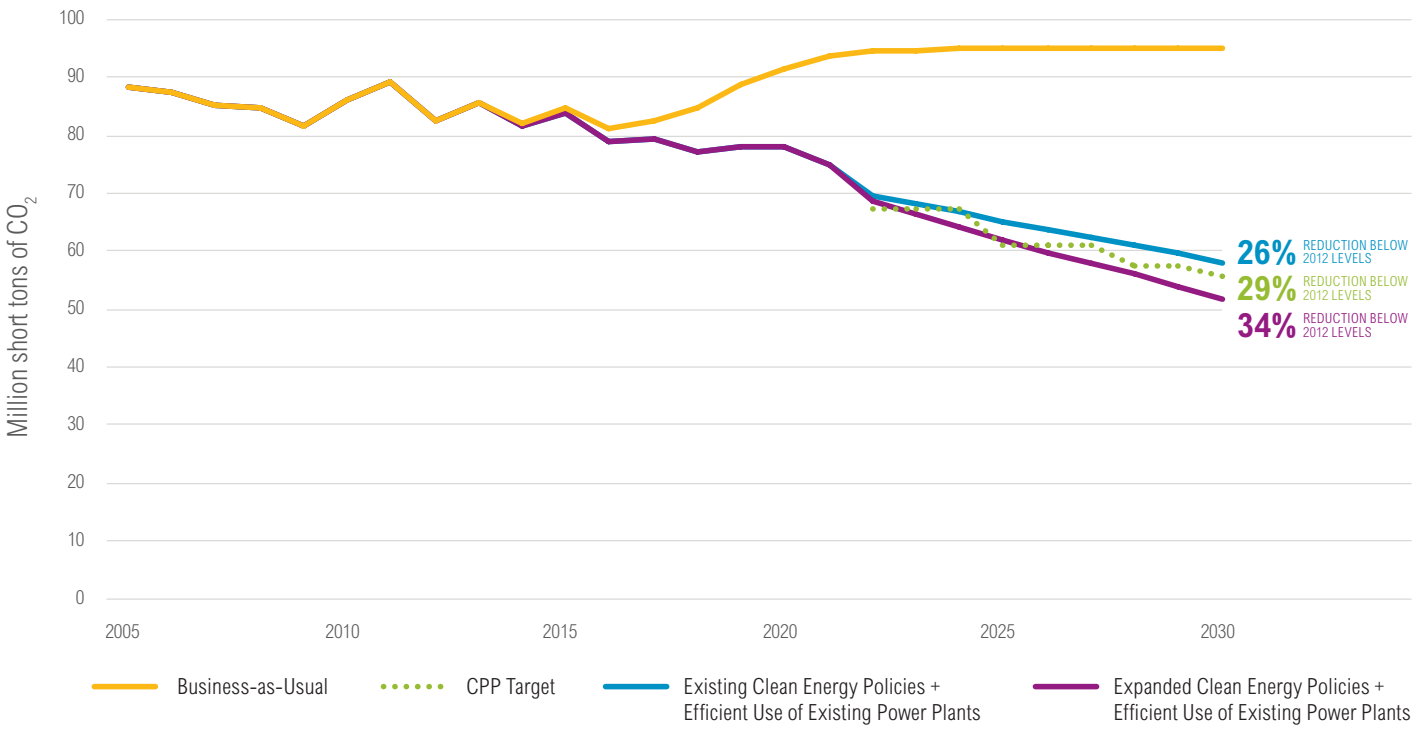
Missouri could make up the gap that remains by increasing renewable generation after the renewable energy standard is reached in 2021. For example, if renewable energy grew from 15 percent of investor-owned utility sales in 2021 to 20 percent of all state sales by 2030, Missouri would more than make up the remaining gap, exceeding the reductions required to meet its mass-based target by 17 percent. This would reduce the emission rate of its existing fossil fleet to 1,391 lbs. per MWh, achieving 84 percent of the reductions needed to meet its target if it opted for a rate-based approach.

The state could generate revenue if it exceeded the required reductions because the CPP makes it easy for states to trade carbon allowances or emission rate credits across state lines. Missouri could also generate extra credits by taking advantage of EPA's Clean Energy Incentive Program, which rewards early action in renewable energy and energy efficiency in low-income communities.

On the other hand, Missouri's pathway to compliance is less certain if utilities don't meet the voluntary efficiency goals described above. Without increased efficiency, in-state generation and power plant emissions are projected to grow through 2030. As a result, if Missouri met the mandatory renewable standard and took advantage of the power plant opportunities listed above, but did not meet the voluntary efficiency goals, emissions would increase between 2012 and 2030. This would leave the state's existing plants with a shortfall of 24 million short tons of CO_2, which they would have to make up using other measures or by sending money out of state to purchase credits.[14]

Missouri could emit more CO_2 emissions than our estimates, which include only existing power plants, if it builds new natural gas plants in the future and decides to comply with EPA's existing source-only standard. EPA is requiring any states that adopt the existing source-only standard to address increased emissions from new plants (i.e., leakage) through allowance allocation rules, allowance set-asides, or other mechanisms. An alternate approach would be to adopt the new source complement standard that also covers new power plants, rather than the existing source standard. The use of the new source complement would further incentivize zero-carbon generation sources, and ensure that future CO_2 emissions from Missouri's power sector do not increase.

Figure 1 | **Existing Power Plant Emission Pathways for Missouri**



Note: This figure depicts the Clean Power Plan's interim and 2030 mass-based targets for Missouri's existing power plants (CPP Target for Existing Plants). The Existing Clean Energy Policies + Efficient Use of Existing Power Plants pathway shows emissions from affected plants after meeting the state's clean renewable energy standard and voluntary efficiency goal and making better use of the state's existing power plants (increasing generation of the existing combined cycle natural gas fleet and improving efficiency of existing coal plants). The Expanded Clean Energy Policies + Efficient Use of Existing Power Plants pathway shows emissions after expanding clean energy policies and making better use of existing power plants. These pathways do not account for potential credits that Missouri could generate by taking early action under the Clean Energy Incentive Program. The percent reductions shown on the figure are calculated using EPA's 'adjusted' 2012 baseline, which includes the CO_2 emissions and generation from fossil plants that are affected by the Clean Power Plan.

HOW MISSOURI CAN MAXIMIZE THE ECONOMIC BENEFITS OF THE CLEAN POWER PLAN

As we have shown, Missouri could achieve 90 percent of the reductions needed to meet its CPP target by meeting its renewable energy standard and voluntary efficiency goals and making better use of existing power plants. Missouri can develop an implementation plan that maximizes the economic benefits to the state and achieves emission reductions cost-effectively.

Such a plan could include:

- **Adopting a market-based carbon pricing program:** A carbon pricing program—in the form of either a cap-and-trade program or a carbon fee—has major economic advantages over alternative implementation approaches:

1. A carbon price encourages the most cost-effective emission reductions without favoring any particular technology. A study of air pollution regulations found that market-based approaches have ranged from 1.1 times to 22 times more cost-effective than nonmarket approaches to regulation.[15]

2. Revenues from allowance auctions or a carbon fee can be used to accomplish other policy objectives, such as reducing the tax burden on Missouri's residents and businesses or making productive public investments. A carbon price of $10 per short ton on the power plant emissions allowed under Missouri's mass-based target for existing plants would provide average annual revenues of roughly $550 million.[16] This revenue could be used to provide assistance to those who may be adversely affected by the carbon price—such as low-income households and any displaced utility-sector workers—to make strategic investments in renewable energy

Box 1 | Overview of EPA's Final Clean Power Plan

The power sector is the leading source of carbon dioxide (CO_2) emissions in the United States, but also offers some of the most cost-effective opportunities to reduce those emissions. Power sector emissions at the national level decreased by 16 percent between 2005 and 2012 due to the recession, increased penetration of renewable energy, increased energy efficiency, and the low price of natural gas. Without new policies like the CPP, current projections show that emissions will slowly rise or hold steady through 2030 to reach 10–17 percent below 2005 levels.*

On August 3, 2015, EPA finalized standards for existing power plants that will help drive additional CO_2 emission reductions by 2030. States have the option to comply with either rate-based (lbs. CO_2 per megawatt-hour) targets for existing fossil plants or mass-based (short tons of CO_2) targets for either the existing fossil fleet or for new and existing fossil plants. EPA developed these state-specific standards by taking into account the composition of each state's existing fossil fleet along with an estimate of the potential to increase the existing coal fleet's efficiency, ramping down coal generation by increasing the utilization of the existing natural gas combined cycle fleet, and developing more renewable energy resources.

The Clean Power Plan makes use of the flexibility allowed by the Clean Air Act so that states can take advantage of several different measures to lower the carbon intensity of its power generation mix—such as fuel switching, dispatch of existing low-carbon power plants, increased generation by renewable sources, and energy efficiency. EPA also is providing states with several implementation plan options, including the option to get credit for early action, which we discuss in more detail in Box 2. States have until September 6, 2016 to submit either a final implementation plan or an initial submission with an extension request. All state plans should be completed by 2018 and compliance will begin in 2022. EPA will issue a federal implementation plan for states that do not submit their own plans. EPA is currently taking comments on the federal plan it proposed in August 2015, and is expected to finalize the plan in the summer of 2016.

Notes: * While CO_2 emissions from the power sector have already fallen 16 percent since 2005 (relative to 2012 levels), the U.S. Energy Information Administration's *Annual Energy Outlook 2015* projects that power sector emissions will slowly increase between 2012 and 2030 so that CO_2 emissions reach approximately 10 percent below 2005 levels (note, this only takes into account policies that were on the books as of the end of October 2014). On the other hand, EPA's baseline projections for its modeling of the Clean Power Plan, which includes lower cost estimates for renewable technologies, estimate that power sector emissions will reach 17 percent below 2005 levels by 2030. Specifically, EPA's projections estimate less coal-fired generation and more natural gas and renewable generation in 2030 than EIA's projections.

and energy efficiency or to offset other taxes. The Regional Greenhouse Gas Initiative (RGGI) illustrates how investment of auction revenue can benefit the local economy. During the period from 2009 to 2014, investments of nearly $2 billion in auction proceeds into bill assistance, energy efficiency, renewable energy, and other uses generated nearly $3 billion in economic value-added across the nine participating states, according to a study by Analysis Group.[17]

3. The CPP encourages states to take advantage of interstate trading opportunities without needing to formally join a regional program. Taking advantage of interstate trading would enable Missouri to sell surplus allowances and generate revenue from out-of-state sources if it surpasses its CPP targets. Assuming an allowance price of $10 per short ton, over $20 million in revenues could flow into the state per year on average between 2022–30 by expanding its clean energy policies and using available infrastructure and selling the credits on interstate markets. (This does not include consideration of any credits that might be generated through the Clean Energy Incentive Program prior to 2022.)

4. Carbon pricing provides financial incentives for regulated entities to reduce their emissions beyond the target, which encourages the adoption and diffusion of low-carbon energy technologies. Such technological advancements can lower overall compliance costs and boost economic growth.

- **Investing in energy efficiency.** By reducing electricity demand, improvements in energy efficiency reduce the need for investments in electricity supply, which frees up capital to invest in other productive ways across the economy. If the energy efficiency programs are less expensive than electricity generation—as the empirical evidence indicates many of them are[18]—electricity prices should fall in the long run, leaving Missouri's residents with more income to spend, save, or invest. In 2013, Ameren Missouri's efficiency programs returned over $3 in benefits for

Box 2 | Clean Power Plan Compliance Options

The Clean Power Plan offers states significant flexibility. As states develop their implementation plans, they will need to make a number of decisions that will affect how they comply. Key considerations include:

- **TYPE OF TARGET**
  States can choose either a rate-based target (in lbs. CO_2/MWh) or a mass-based target (in short tons of CO_2). States using a rate-based target can adopt separate standards for coal and combined cycle natural gas units, a weighted average for all affected units, or equivalent standards that apply to individual units or groups of units. States using a mass-based target can use EPA's standard for existing units only, or for existing and new units collectively (known as a new source complement).

  Since mass-based plans will rely on reported power plant emissions, complementary actions to improve energy efficiency and increase renewable generation do not need to be quantified in the state plans. Rate-based plans require an explicit accounting of actions used to adjust the emission rate from affected units, including evaluation, measurement, and verification of those actions.

- **TYPE OF STATE PLAN**
  The CPP allows two types of state plans. Under an "emission standards" plan, states place mass- or rate-based emission requirements directly on affected units, which are then required to reduce their emissions or rate directly or by using credits generated by fuel-switching, renewable energy, energy efficiency, or other approved measures. States that adopt a mass-based target can opt for a "state measures" plan. With this type of plan, states can use a portfolio of state-enforced measures, which can apply both to affected units and other entities (for example, demand-side efficiency, renewable portfolio standards, cap-and-trade programs). Under this approach, states could also implement a carbon tax for compliance. This approach must include emission standards for affected power plants in case the portfolio approach does not achieve the required reductions.*

- **INDIVIDUAL OR MULTISTATE COMPLIANCE**
  States can choose to comply individually or as part of a multistate plan with an aggregated target. States also can coordinate with other states while retaining an individual state goal. Joining a regional cap-and-trade program—or just allowing trading with other states that adopt the same compliance approach— may be the most cost-effective option for some states, lowering compliance costs while ensuring reliability.[a] Studies in the Southwest Power Pool, PJM, and MISO regions have found that regional compliance would be the most cost-effective option.[b]

  The Regional Greenhouse Gas Initiative illustrates how a multistate trading approach can help reduce emissions while driving investments in renewable energy and energy efficiency and saving money for electricity customers. Over the first six years of the program, investments from auction proceeds have generated nearly $3 billion in economic value-added to the region and created over 28,000 job-years of employment.[c]

- **TRADING**
  States don't need to join a cap-and-trade program or formally coordinate with other states to trade. EPA allows states to trade emission rate credits (rate-based target) or emission allowances (mass-based) regardless of their implementation plan type as long as states meet "trading ready" criteria provided in the rule.** However, mass-based states may only trade with other mass-based states and rate-based states may only trade with other rate-based states. Once trading-ready state plans are approved, states can begin trading right away without additional requirements or approval from EPA.

- **EARLY ACTION**
  EPA is offering a Clean Energy Incentive Program to reward early investments in energy efficiency projects that benefit low-income communities and in renewable energy. States can earn additional credits from EPA by implementing eligible projects in 2020 and 2021.

Notes:

* According to the final rule, a state measures plan "must also include a contingent backstop of federally enforceable emission standards for affected EGUs that fully meet the emission guidelines and that would be triggered if the plan failed to achieve the required emission reductions on schedule."

** These criteria include use of an EPA-approved (or EPA-administered) emission and allowance tracking system (mass-based) and provisions for issuing, tracking, and submitting emission rate credits (rate-based). Section VIII of the final rule provides more guidance (http://www.epa.gov/airquality/cpp/cpp-final-rule.pdf).

Sources:

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every dollar invested.[19] The Analysis Group found that the reinvestment of auction proceeds made by RGGI states in energy efficiency and renewable energy during the period from 2012 to 2014 led to net electricity savings of $341 million for households, businesses, and industry.[20]

The investments needed to move toward a low-carbon future will strengthen Missouri's economy over the long term. While these investments are likely to involve short-run economic costs—including somewhat higher electricity rates and fewer investment dollars available for alternative opportunities in the electricity sector or across the economy—they will pay off over time. Missouri's residents will spend less of their income on electricity thanks to improvements in efficiency and the low operating costs of renewable energy.[21] And less reliance on coal will enable more in-state investment—Missouri pays an average $1.3 billion per year to other states to import coal.[22]

In a transition to a low-carbon power sector, jobs will be gained in the clean energy industry and will decline in high-carbon industries, like coal, accelerating trends already under way. The clean energy industry creates jobs in manufacturing, construction, home maintenance, and other sectors—in 2014, the renewable and efficiency sectors employed over 28,000 people in Missouri.[23] State and federal governments should help manage the transition to a lower-carbon economy by offering job training or other programs to ensure that opportunities are available for all workers.

Climate change could lead to increasingly costly future impacts to Missouri, including crop losses, flooding, and other weather-related disasters.[24,25,26] Strong implementation of the CPP is a critical component of U.S. efforts to combat climate change and prevent the worst of these impacts. Lowering the carbon-intensity of the power sector also will lead to reductions in harmful local air pollutants like particulate matter, nitrogen oxides, and sulfur dioxide, which can contribute to respiratory issues or heart and lung diseases.[27]

By meeting its renewable standard and efficiency goals, Missouri's existing power plants could decrease their emissions with or without the Clean Power Plan. Missouri can now use this rule as an opportunity to maximize economic benefits from curbing emissions and thus meeting or exceeding its Clean Power Plan targets.

THE CLEAN POWER PLAN WILL MAINTAIN ELECTRIC GRID RELIABILITY

The Clean Power Plan provides flexibility aimed at ensuring the continued reliability of the nation's power grid.[28] Under the final CPP, states can choose from a wide variety of compliance options that are best suited to that state's existing resources and policies. While EPA is offering states incentives to invest in renewable energy and energy efficiency early, they also have given states additional time to complete and implement their plans by changing the compliance start date from 2020 to 2022. In addition, the Clean Power Plan is requiring each state to consider reliability issues as it develops its implementation plan, while also providing a mechanism for states to revise their plans if significant unplanned reliability issues arise. EPA also created a reliability safety valve that allows a power plant to temporarily exceed its targets during unexpected events or emergencies that raise reliability concerns. EPA consulted closely with the Department of Energy and the Federal Energy Regulatory Commission in developing the CPP's reliability provisions. These agencies will continue to work together to monitor CPP implementation and help resolve any reliability concerns that arise.

The U.S. power sector also has shown it has the ability to reliably deliver electricity to homes and businesses despite changes in electricity mix and demand. EPA's environmental regulations under the Clean Air Act, such as the Acid Rain Program or Mercury and Air Toxics Standards, have never caused blackouts. This is because EPA granted flexibility to power plants in the past—just like it is doing under the Clean Power Plan—and because state regulators have standard reliability practices that have been used for decades to address reliability issues if and when they arise.[29] Analyses of the proposed Clean Power Plan have shown that compliance is unlikely to affect reliability because of these standard practices and the flexibility inherent in the rule.[30] In addition, several studies have found that the flexibility of the current grid would allow for renewable penetration levels exceeding those required by current state targets. These studies have shown that proven technologies and practices can reduce the cost of operating generation portfolios with high variable renewable energy levels and enable reliable grid operation with more than 50 percent renewable penetration.[31]

OPPORTUNITIES IN DETAIL

Below, we describe Missouri's opportunities to comply with the Clean Power Plan in more detail, including: (1) increasing energy efficiency, (2) increasing renewable energy, (3) increasing use of natural gas,(4) improving coal plant efficiency, and (5) other compliance options.

1. INCREASING ENERGY EFFICIENCY

Missouri's Energy Efficiency Investment Act (MEEIA) sets a voluntary goal for the state's utilities to capture all cost-effective energy efficiency opportunities. The Public Service Commission (PSC) established the following voluntary energy efficiency savings goals as a benchmark for cost-effective efficiency potential: 0.3 percent of sales in 2012, ramping up to 1.9 percent in 2020 and subsequent years, for cumulative savings of nearly 10 percent of electricity sales by 2020.[32]

Most utilities now offer energy-saving programs to their customers, including technical assistance, energy audits, rebates, and other financial incentives. Ameren Missouri, the state's largest utility, estimated that its 2013 portfolio of efficiency programs returned over $3 for every $1 invested.[33] KCP&L projects that its investments in energy efficiency and wind power will save its customers $1 billion over the next 20 years.[34] According to a survey by Environmental Entrepreneurs and Missouri Energy Initiative, the efficiency sector employed over 32,000 people in the state in 2014.[35]

Achieving electricity savings in line with the PSC's benchmarks—a level of savings that has already been achieved or will be required by several other states—could play a critical role in helping Missouri meet its CPP targets while saving money for homes and businesses. As discussed in Missouri's State Energy Plan, a number of additional strategies could help the state capture greater efficiency and achieve this level of savings, including passing new legislation to implement a binding efficiency standard, adopting and enforcing up-to-date building energy codes, increasing access to financing for energy efficiency, and decoupling utility revenue from sales.[36,37] The American Council for an Energy-Efficient Economy estimated that implementing a suite of new efficiency initiatives, including utility programs and building codes, could reduce electricity consumption in the state by 17 percent below projected levels in 2025. Together, these measures would save Missouri's consumers $6.1 billion in lower energy bills and have the potential to create 8,500 new jobs.[38]

However, if utilities achieve less efficiency than outlined in the goals—for instance, Ameren's 2014 Integrated Resource Plan indicated it could only achieve 7 percent cumulative electricity savings below projected levels by 2025[39]—it will be more difficult and expensive to comply with the CPP.

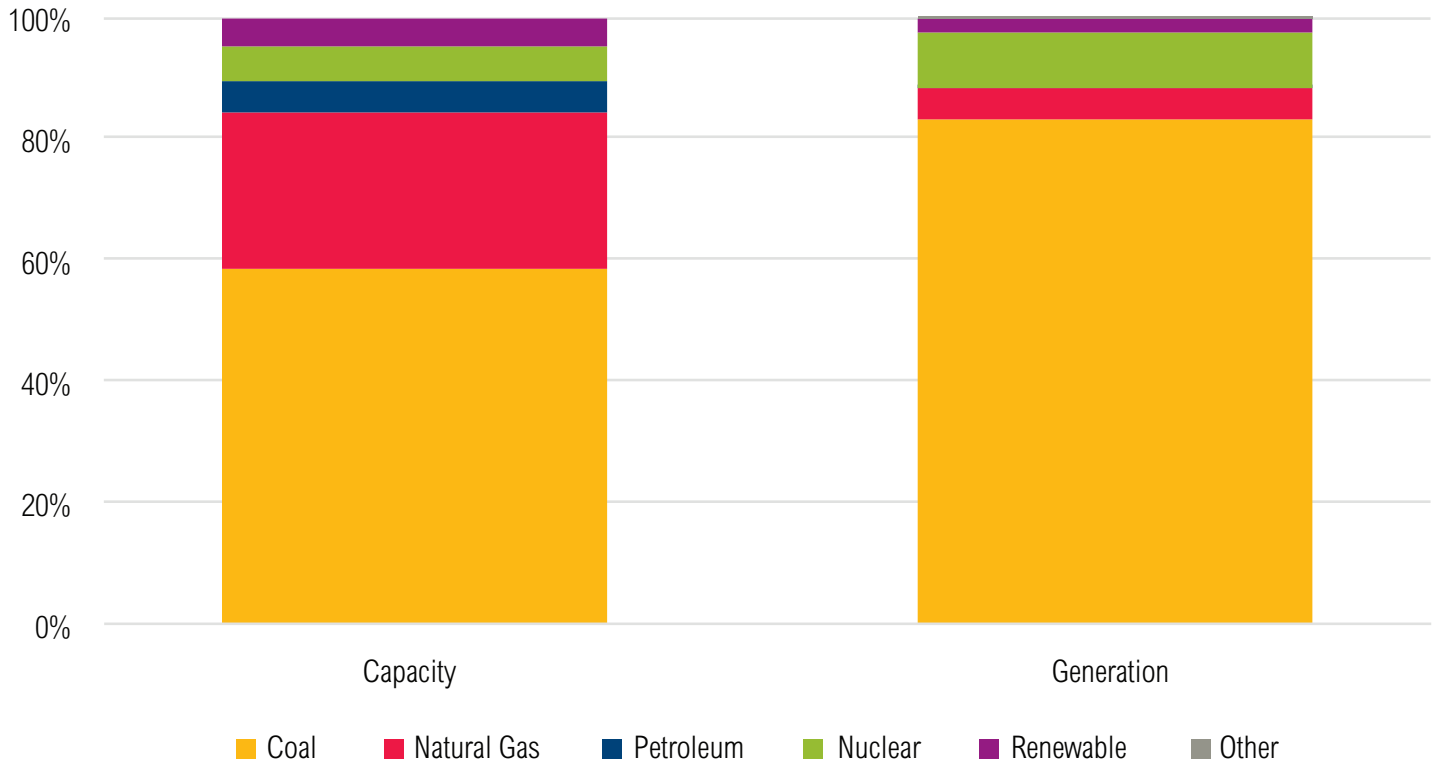
2. INCREASING RENEWABLE GENERATION

Missouri's Renewable Energy Standard requires 15 percent of the electricity sold by its investor-owned utilities to come from renewable sources by 2021.[40,41] While renewable energy in Missouri only comprised 3 percent of total generation in 2013, the state's wind capacity has been on the rise in recent years, nearly doubling between 2008 and 2013. The American Wind Energy Association estimated that as of 2014, Missouri's wind industry generated $1.4 million in annual land lease payments and nearly $1 billion in total capital investment in the state.[42] The renewable energy industry employed over 6,000 workers in the state in 2014.[43] And a study by the University of Missouri, St Louis estimated that the state's renewable standard could create up to 30,000 jobs by 2021, providing over $1 billion in new income to state residents if the renewable power required to meet the standard is built and produced in Missouri.[44]

Missouri can harness economic development opportunities by capturing its significant potential for wind and solar energy. Large corporations are increasingly interested in buying renewable energy, including those with a presence in Missouri, such as Ikea, Walmart, GM, General Mills, and others. According to analysis by Advanced Energy Economy, Missouri could gain $220 million in investment by meeting just 1 percent of the energy needs of the state's large corporate renewable buyers with new wind and solar resources.[45]

Scaling up renewable development can also help keep more of Missouri's spending on power production in state. Because Missouri produces very little coal, it must import nearly all of its coal resources from other states, sending an average $1.3 billion out of state each year from 2008–13. And the price the state's utilities pay to import coal is on the rise, growing 20 percent between 2010 and 2013.[46] Continuing to increase renewable generation after the standard is reached to 20 percent by 2030 could help the state meet, or even exceed, its CPP targets.

Figure 2 | **Missouri Generation and Generating Capacity, 2013**



3. INCREASING USE OF EXISTING NATURAL GAS PLANTS

According to data from the U.S. Energy Information Administration, the capacity factor of Missouri's existing combined cycle natural gas fleet was only 24 percent in 2013—meaning that these plants generated less than one-fourth of the electricity they are capable of producing. As a result, natural gas comprised only 5 percent of total generation in 2013 even though it comprised nearly 26 percent of total generating capacity in the state (Figure 2).[47] Increasing the capacity factor of these existing units to 75 percent—together with Missouri's existing clean energy policies—could help the state cut power sector emissions.[48,49]

4. INCREASING COAL PLANT EFFICIENCY

Existing coal plants can increase their efficiency through refurbishment and improved operation and maintenance practices.[50,51] In developing the final CPP, EPA found that coal plants could significantly increase their efficiency by improving operations to return to the best performance they have achieved in the past. By comparing average coal plant heat rates in 2012 to their best demonstrated performance between 2002 and 2012, EPA estimated that the coal fleet could achieve average efficiency improvements of 2.1–4.3 percent across interconnection regions, or about 4 percent nationwide.[52]

EPA expects that these improvements can largely be achieved through application of no- or low-cost best practices—for example, operations and maintenance improvements, replacing worn seals and valves, and cleaning equipment—and will not require equipment upgrades. However, upgrades can be used to comply with the rule. While there are high up-front costs associated with refurbishing existing coal units, the resulting increase in unit efficiency will lead to annual fuel savings.[53] Some plants could also decrease their emission intensity by co-firing with natural gas, using the igniters that are already built into many existing pulverized coal boilers.[54]

Increasing the efficiency of Missouri's existing coal fleet by an average 4.3 percent starting in 2022, the potential improvement rate that EPA identified for the eastern interconnection, could help Missouri cut its power sector emissions.

5. OTHER COMPLIANCE OPTIONS

The compliance options we modeled in our analysis are illustrative of the reductions that the state could achieve using its clean energy policies and existing power plants. Missouri could take advantage of other opportunities to help meet its target—including use of combined heat and power at industrial and commercial facilities or setting state appliance standards for appliances not covered by federal standards—among other measures that improve efficiency or increase use of renewables. In addition to using individual policies, states also can take broader approaches to reduce emissions, including joining a cap-and-trade program or implementing a carbon tax. As previously discussed, market-based approaches can help reduce compliance costs while generating revenue for the state.

OUTLOOK FOR MISSOURI

Missouri can put itself in a strong position to comply with the Clean Power Plan while taking advantage of economic opportunities and maintaining grid reliability. The state has already put policies in place to increase renewable generation and encourage more energy efficiency, but power plant emissions are projected to increase if the state doesn't follow through on these policies. Failing to meet its renewable energy standard and voluntary efficiency goals will make CPP compliance more difficult and expensive. But by meeting its voluntary efficiency goals and expanding its renewable energy standard, Missouri could put itself in a strong position to meet, or even exceed, its targets. Adopting EPA's new source complement standard would further incentivize zero-carbon generation sources and ensure that CO_2 emissions from the state's power sector do not increase in the future.

Box 3 | **About the Series**

In *Delivering on the U.S. Climate Commitment*, WRI identified ten key actions the Obama administration must take in the absence of congressional action in order to meet the U.S. commitment to reducing greenhouse gas (GHG) emissions by 26–28 percent below 2005 levels by 2025. These actions include setting performance standards for existing power plants, reducing consumption of hydrofluorocarbons, reducing fugitive methane emissions from natural gas systems, and increasing energy efficiency. Of these ten actions, the greatest opportunity for reductions comes from the power sector. In his Climate Action Plan, President Obama directed EPA to work expeditiously to finalize carbon dioxide (CO_2) emission standards for new power plants and adopt standards for existing power plants. As states prepare to comply with these standards, it will be necessary to understand available opportunities for reducing CO_2 emissions from the power sector. This series of fact sheets aims to shed light on these opportunities by illustrating the potential for CO_2 emission reduction in a variety of states. We show how these emissions savings stack up against the reductions required under the Clean Power Plan. This series is based on WRI analysis conducted using publicly available data. See the appendix for additional information on our methodology and modeling assumptions.[a]

Notes:
a. World Resources Institute. 2015. *How States Can Meet Their Clean Power Plan Targets. Appendix A: Detailed Overview of Methods.* Washington, DC: World Resources Institute.

POLICY FRAMEWORK AND INTERACTION

This analysis assumes the existing policies and other reduction opportunities discussed in the text are fully implemented. Depending on the combination of measures actually implemented by Missouri, each will have different impacts on the generation mix and resulting emissions. For example, increasing the use of existing combined cycle natural gas plants results in fewer emission reductions in this analysis than would be the case if it were considered in isolation, because implementation of the renewable standard decreases the amount of coal-fired generation that would otherwise be available to shift to natural gas. The emission reductions presented in the text are a result of each policy applied in the following sequence: (1) energy efficiency improvements applied to business-as-usual generation; (2) increased renewable generation applied to the resulting adjusted generation; (3) increased use of existing combined cycle natural gas units; and (4) increased efficiency of any remaining coal units. For consistency with EPA's approach, we include only the existing fossil fleet as part of our business-as-usual projections, and only new renewable generation and energy efficiency measures put into place after 2012.

ENDNOTES

1. Because AEO2015 does not include state-level projections, we relied on regional projections of annual electricity generation growth rates by fuel for Missouri's electricity projections. Because neighboring states have varying policies that will affect future in-state generation differently, these regional projections may not fully capture all the relevant trends that are expected to occur within the state's power sector.

2. Ameren Missouri. 2014. "2014 Integrated Resource Plan, Chapter 4." Accessible at: <https://q9u5x5a2.ssl.hwcdn.net/-/Media/Missouri-Site/Files/environment/renewables/irp/irp-chapter4.pdf?la=en>.

3. KCP&L. January 20, 2015. "KCP&L Announces Plans to Cease Burning Coal at Three Power Plants." Accessible at: <http://www.kcpl.com/about-kcpl/media-center/2015/january/kcpl-announces-plans-to-cease-burning-coal-at-three-plants>.

4. In 2013, the Union of Concerned Scientists identified nearly 1,000 MW of additional coal capacity that was no longer economically competitive with existing combined cycle natural gas plants. For more information, see: <http://www.ucsusa.org/clean_energy/smart-energy-solutions/decrease-coal/economic-analysis-us-coal-plants.html#.VgQIastVhBc>.

5. Calculated by subtracting 2013 coal generation from these units from total BAU coal generation in 2021–30, and adding the equivalent amount of natural gas generation from the KCP&L units in the same years.

6. While the AEO2015 does not explicitly model state efficiency standards, its projections do capture some of the effects of efficiency programs through regional demand trends. We estimate the amount of efficiency embedded in our BAU projections using a methodology developed by EPA and Synapse (<http://epa.gov/statelocalclimate/documents/pdf/EPA%20background%20and%20methodology%20EE_RE_02122014.pdf>; <http://www.synapse-energy.com/project/state-energy-efficiency-embedded-annual-energy-outlook-forecasts>). See appendix for details. The emission reductions listed here reflect the efficiency from meeting Missouri's efficiency goal that is additional to the efficiency embedded in the BAU projections. Renewable energy standards are explicitly modeled in AEO2015; however, for purposes of our analysis we assume that the standards are met through in-state generation and adjust renewable projections accordingly. This results in 1–4 TWh of additional renewable generation per year beyond business-as-usual projections between 2018 and 2030.

7. Department of Economic Development, Division of Energy. October 2015. "Missouri Comprehensive State Energy Plan." Accessible at: <https://energy.mo.gov/energy/docs/MCSEP.pdf>.

8. States can choose to develop an implementation plan based on either the mass- or rate-based target. Missouri would not need to meet the rate-based target if it chooses to use a mass-based target.

9. Our analysis also finds that meeting its energy efficiency goals without taking other actions to reduce emissions can get Missouri 50 percent of the reductions required to meet its rate-based emissions standard.

10. Our analysis also finds that meeting its renewable energy standard in addition to its efficiency standard can get Missouri 59 percent of the reductions required to meet its rate-based emissions standard.

11. For modeling purposes, we assume that new renewables development occurs in-state to help comply with new standards, and utilities do not purchase out-of-state renewable energy certificates or make alternative compliance payments for compliance purposes. Under the Clean Power Plan, utilities could procure emission reduction credits from out-of-state renewable sources if permitted by the state, and renewable power providers have registered credits in the state. Credits from renewable projects can only be listed in a single registry to avoid double-counting of credits.

12. Our analysis also finds that increasing the use of its existing natural gas plants in addition to its clean energy policies can get Missouri 66 percent of the reductions required to meet its rate-based emissions standard.

13. Our analysis also finds that improving coal plant efficiency together with all other measures can get Missouri 75 percent of the reductions required to meet its rate-based emissions standard.

14. This figure was calculated assuming no additional efficiency savings are realized beyond those already embedded in business-as-usual projections from existing efficiency measures.

15. For more information, see: <http://yosemite1.epa.gov/EE/epa/eed.nsf/6058a0895486355785252766200639df3/f9c8c8a37d6aab6f8525774200597f42!OpenDocument>.

16. This estimate of annual revenue from a $10 carbon price uses Missouri's interim and final mass-based targets between 2022 (67 million short tons of CO_2) and 2030 (55 million short tons of CO_2). Revenue in any given year will be higher or lower, depending on the response to the carbon price.

17. Analysis Group. 2011. "The Economic Impacts of the Regional Greenhouse Gas Initiative on Ten Northeast and Mid-Atlantic States." Accessible at: <http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/economic_impact_rggi_report.pdf>; Analysis Group.2015. "The Economic Impacts of the Regional Greenhouse Gas Initiative on Nine Northeast and Mid-Atlantic States." Accessible at: <http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/analysis_group_rggi_report_july_2015.pdf>

18. For more information see: <http://emp.lbl.gov/sites/all/files/total-cost-of-saved-energy.pdf>.

19. Ameren Missouri. 2015. "Energy Efficiency Programs." Accessible at: <https://www.ameren.com/missouri/uefficiency/energy-efficiency-programs>; York, D. 2014. "Expanding Opportunities, Gaining Experience with Energy Efficiency in Missouri." Missouri Energy Initiative. Accessible at: <http://moenergy.org/aceejune2014>.

20. Analysis Group. 2015. "The Economic Impacts of the Regional Greenhouse Gas Initiative on Nine Northeast and Mid-Atlantic States." Accessible at: <http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/analysis_group_rggi_report_july_2015.pdf>.

21. EPA modeling of the CPP estimated that electricity bills for the average American will be 7–7.7 percent lower in 2030 due to changes in the average electricity price and demand.

22. Calculated using EIA data on the quantity and cost of coal shipments to electric utilities by state for 2008 through 2013 (http://www.eia.gov/coal/data.cfm).

23. Environmental Entrepreneurs and Missouri Energy Initiative. 2015. "Clean Jobs Missouri: Sizing Up Missouri's Clean Jobs Base and Its Potential." Accessible at: <https://www.e2.org/ext/doc/FINAL.LR.MissouriJobsReport_15014.pdf>.

24. Risky Business Project. 2015. "Heat in the Heartland: Climate Change and Economic Risk in the Midwest." Accessible at: <http://riskybusiness.org/uploads/files/RBP-Midwest-Report-WEB-1-26-15.pdf>.

25. White House. 2015. "The Threat of Carbon Pollution: Missouri." Accessible at: <https://www.whitehouse.gov/sites/default/files/docs/state-reports/climate/Missouri%20Fact%20Sheet.pdf>.

26. National Climate Assessment. 2014. Accessible at: <http://nca2014.globalchange.gov/report/regions/midwest#intro-section-2>.

27. For more information, see:< http://www.epa.gov/airquality/urbanair/>.

28. U.S. Environmental Protection Agency. 2015. "Keeping Energy Affordable and Reliable." Accessible at: <http://www.epa.gov/airquality/cpp/fs-cpp-reliability.pdf>.

29. Susan F. Tierney. 2015. "How to Examine the U.S. Energy Information Administration's Report: Analysis of the Impacts of EPA's Clean Power Plan." Testimony Before the U.S. House of Representatives Committee on Science, Space and Technology, Subcommittee on the Environment and Subcommittee on Energy. Accessible at: <http://www.analysisgroup.com/uploadedfiles/content/news_and_events/news/tierney_testimony_house_science_and_technology_committee_6-22-2015.pdf>. Analysis Group. 2015. "Electric System Reliability and EPA's Clean Power Plan: Tools and Practices." Accessible at: http://www.analysisgroup.com/uploadedFiles/Content/Insights/Publishing/Electric_System_Reliability_and_EPAs_Clean_Power_Plan_Tools_and_Practices.pdf>.

30. For example, see: Brattle Group. 2015. "EPA's Clean Power Plan and Reliability Assessing NERC's Initial Reliability Review." Accessible at: <http://info.aee.net/hs-fs/hub/211732/file-2486162659-pdf/PDF/EPAs-Clean-Power-Plan--Reliability-Brattle.pdf?t=1438552731095>. Analysis Group. 2015. "Electric System Reliability and EPA's Clean Power Plan: Tools and Practices." Accessible at: <http://www.analysisgroup.com/uploadedFiles/Content/Insights/Publishing/Electric_System_Reliability_and_EPAs_Clean_Power_Plan_Tools_and_Practices.pdf>. Analysis Group. 2015. "Electric System Reliability and EPA's Clean Power Plan: The Case of MISO." Accessible at: <http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/analysis_group_clean_power_plan_miso_reliability.pdf>.

31. C. Linvill, J. Migden-Ostrander, and M. Hogan. 2014. "Clean Energy Keeps the Lights On." Accessible at: <http://www.raponline.org/press-release/clean-energy-keeps-the-lights-on>.

32. Senate Bill No. 376. 2009. Accessible at: <http://www.senate.mo.gov/09info/pdf-bill/tat/sb376.pdf>.

33. Ameren Missouri. "Energy Efficiency Benefits." Accessible at: <https://www.ameren.com/missouri/uefficiency/energy-efficiency-programs>; York, D. 2014. "Expanding Opportunities, Gaining Experience with Energy Efficiency in Missouri." Missouri Energy Initiative. Accessible at: <http://moenergy.org/aceejune2014>.

34. Sierra Club. 2014. "Clean Power Plan for Missouri." Accessible at: <http://content.sierraclub.org/creative-archive/sites/content.sierraclub.org.creative-archive/files/pdfs/0817-Missouri-CPP-Report_04_web.pdf>.

35. Environmental Entrepreneurs and Missouri Energy Initiative. 2015. "Clean Jobs Missouri: Sizing Up Missouri's Clean Jobs Base and Its Potential." Accessible at: <https://www.e2.org/ext/doc/FINAL.LR.MissouriJobsReport_15014.pdf>.

36. Market barriers can limit the deployment of energy efficient technologies and best practices, so policies are needed to harness all cost-effective opportunities. According to research by the American Council for an Energy-Efficient Economy, states with efficiency standards in place have achieved much greater annual electricity savings than states without them. See: <http://aceee.org/sites/default/files/publications/researchreports/u1403.pdf>.

37. Department of Economic Development, Division of Energy. October 2015. "Missouri Comprehensive State Energy Plan." Accessible at: <https://energy.mo.gov/energy/docs/MCSEP.pdf>.

38. American Council for an Energy-Efficient Economy. 2011. *Missouri's Energy Efficiency Potential: Opportunities for Economic Growth and Energy Sustainability*. Accessible at: <http://ded.mo.gov/energy/docs/aceestudy.pdf>.

39. https://q9u5x5a2.ssl.hwcdn.net/-/Media/Missouri-Site/Files/environment/renewables/irp/irp-chapter8.pdf?la=en

40. We count each kilowatt-hour of renewable energy generated in Missouri as 1.25 kilowatt-hours for RES compliance purposes, as specified in Missouri's RES legislation.

41. Amendment to Chapter 393 of the Revised Statutes of Missouri, Relating to Renewable Energy, version 4, 2008-031. Accessible at: <http://www.sos.mo.gov/elections/2008petitions/2008-031.asp>.

42. American Wind Energy Association. 2014. "Missouri Wind Energy Fact Sheet." Accessible at: <http://awea.files.cms-plus.com/FileDownloads/pdfs/Missouri.pdf>.

43. Environmental Entrepreneurs and Missouri Energy Initiative. 2015. "Clean Jobs Missouri: Sizing Up Missouri's Clean Jobs Base and Its Potential." Accessible at: <https://www.e2.org/ext/doc/FINAL.LR.MissouriJobsReport_15014.pdf>.

44. University of Missouri, St Louis. 2008. *Clean Jobs, New Prosperity: Economic Impact Study of Proposition C.* The Missouri Clean Energy Initiative. Accessible at: <http://pprc.umsl.edu/pprc.umsl.edu/data/PropCEconomicImpactFullReport.pdf>.

45. Advanced Energy Economy. November 2015. "Policy Brief: Expanding Missouri's Corporate Renewable Energy Market." Accessible at: <http://info.aee.net/hubfs/State_Policy/policy-brief-expanding-missouri-corporate-renewable-energy-market.pdf?t=1446822766895>.

46. Calculated using EIA data on the quantity and cost of coal shipments to electric utilities by state (<http://www.eia.gov/coal/data.cfm>).

47. WRI estimates based on data from U.S. Energy Information Administration. *EIA-923 Generation and Fuel Data.* Accessible at: <http://www.eia.gov/electricity/data/eia923/>; and *EIA-860 Annual Electric Generator Data.* Accessible at: <http://www.eia.gov/electricity/data/eia860/>.

48. Our estimate of potential generation from NGCC units includes all existing units listed in the EIA-860 database. NGCC units are designed to be operated up to 85 percent capacity (see http://mitei.mit.edu/system/files/NaturalGas_Chapter4_Electricity.pdf), but actual maximum capacity factors may differ among units. We assume a conservative maximum capacity factor of 75 percent.

49. We did not account for the increases in methane associated with the increased production of natural gas due to a higher demand for the fuel. Going forward, industry should work with EPA to reduce methane leakage rates from natural gas systems. For additional information, see: <http://www.wri.org/publication/clearing-the-air> and <http://www.wri.org/publication/reducing-methane-emissions-natural-gas-development-strategies-state-level-policymakers>.

50. Phil DiPetro and Katrina Krulla. 2010. "Improving the Efficiency of Coal-Fired Power Plants for Near Term Greenhouse Gas Emissions Reductions." National Energy Technology Laboratory, Office of Systems, Analyses and Planning. DOE/NETL-2010/1411. Accessible at: <http://www.netl.doe.gov/energy-analyses/pubs/ImpCFPPGHGRdctns_0410.pdf>.

51. "Regulating Greenhouse Gas Emissions Under the Clean Air Act." 73 *Register* §147(2008). Accessible at: <http://www.gpo.gov/fdsys/pkg/FR-2008-07-30/pdf/E8-16432.pdf>.

52. EPA calculated potential heat rate improvement for each region using three different analytical approaches and used the most conservative value for each region when setting the final targets. For more details, see the Clean Power Plan GHG Mitigation Measures Technical Support Document, accessible at: <http://epa.gov/airquality/cpp/tsd-cpp-ghg-mitigation-measures.pdf>.

53. For example, the National Energy Technology Laboratory found a payback period of less than four years for a refurbishment technology that achieves a 2 percent heat rate improvement. For more information, see: National Energy Technology Laboratory. *Benefits of the Big Bend Power Station Project.* Accessible at: <http://www.netl.doe.gov/technologies/coalpower/cctc/ccpi/pubs/tampa.pdf>; and "Analyses Show Benefits of Improving Unit Heat Rate as Part of a Carbon Mitigation Strategy." *Lehigh Energy Update* 28 (1), February 2010. Accessible at: <http://www.lehigh.edu/~inenr/leu/leu_65.pdf>.

54. Personal communication with Tomas Carbonell, Environmental Defense Fund, July 12, 2013.

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ABOUT WRI

World Resources Institute is a global research organization that turns big ideas into action at the nexus of environment, economic opportunity and human well-being.

Our Challenge
Natural resources are at the foundation of economic opportunity and human well-being. But today, we are depleting Earth's resources at rates that are not sustainable, endangering economies and people's lives. People depend on clean water, fertile land, healthy forests, and a stable climate. Livable cities and clean energy are essential for a sustainable planet. We must address these urgent, global challenges this decade.

Our Vision
We envision an equitable and prosperous planet driven by the wise management of natural resources. We aspire to create a world where the actions of government, business, and communities combine to eliminate poverty and sustain the natural environment for all people.

Our Approach
COUNT IT
We start with data. We conduct independent research and draw on the latest technology to develop new insights and recommendations. Our rigorous analysis identifies risks, unveils opportunities, and informs smart strategies. We focus our efforts on influential and emerging economies where the future of sustainability will be determined.

CHANGE IT
We use our research to influence government policies, business strategies, and civil society action. We test projects with communities, companies, and government agencies to build a strong evidence base. Then, we work with partners to deliver change on the ground that alleviates poverty and strengthens society. We hold ourselves accountable to ensure our outcomes will be bold and enduring.

SCALE IT
We don't think small. Once tested, we work with partners to adopt and expand our efforts regionally and globally. We engage with decision-makers to carry out our ideas and elevate our impact. We measure success through government and business actions that improve people's lives and sustain a healthy environment.