INDIANA'S CLIMATE AND ENERGY FUTURE:

A ROADMAP FOR RENEWABLE ENERGY AND NATURAL CLIMATE SOLUTIONS DEPLOYMENT

The Nature Conservancy
Indiana

Acknowledgements

THE NATURE CONSERVANCY TRUSTEE AND CLIMATE COMMITTEE MEMBERS:

Kelly Carmichael
T. J. Kanczuzewski
Jim Carpenter
Christine Woodward Duncan
Nora Hiatt
Bob Shortle
Andrea Terrell
Dave Carter
Jeff Dukes
Ken Inskeep
Christa Adkins

COMPANIES & ORGANIZATIONS HIGHLIGHTED AS CASE STUDIES THROUGHOUT THE REPORT:

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City of Indianapolis
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Cummins
NIPSCO
McCormick Farms

REPORT CREATED BY

Fourth Economy is a national community and economic development consulting firm. Powered by a vision for an economy that serves the people, our approach is centered on principles of competitiveness, equity, and resilience. We partner with communities and organizations, public and private, who are ready for change to equip them with tools and innovative solutions to build better communities and stronger economies.

www.fourtheconomy.com • engage@fourtheconomy.com

On behalf of the Indiana Chapter of The Nature Conservancy, we invite you to read our report that tells a unique story about Indiana. Climate change solutions have a face in Indiana. It is the face of our public colleges and universities, our cities and towns, and the utilities, manufacturers, and agricultural producers that make our economy work. Since 2005, the state of Indiana has reduced carbon emissions by 25 percent while growing the economy by 13 percent. All over the state, investments are being made to tap into the potential of renewable energy, or to use nature and our natural systems to combat climate change, all while improving the bottom line.

This report not only profiles the experiences of some of these organizations, but explores what can be achieved over the course of the next 15 years. This research examines a clean energy future from the perspective of the triple-bottom line of economic, social, and environmental gains that could be achieved. In addition, this report evaluates the potential for nature to be a part of the climate change solution by modeling the impact our farms and forests could have in adapting to a changing climate. The results were eye-opening:

- Adoption of natural climate solutions could sequester up to 2 million metric tons of CO2 annually, and a market-based carbon-credit system could create a new revenue stream that pays farmers for adopting climate-friendly practices.
- Renewable energy installation will add jobs across the energy sector and result in an estimated $51.5 to $110.7 million annually in local tax revenue by 2035.
- Planned closures of coal-fired power plants will provide health benefits to 127,000 of Indiana's most at-risk residents, including to 19,000 infants, 54,000 school-age children, and 54,000 seniors.

These figures are large and impressive, and they could not have been possible without the commitment to sustainability and climate action undertaken by the owners and employees of organizations leading the charge. Their experiences illustrate why clean energy and natural climate solutions matter to the future of Indiana's economy, and The Nature Conservancy in Indiana remains committed to achieving those goals.

Larry Clemens
Indiana State Director

Will Ditzler
Indiana Board of Trustees Chair

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Executive Summary

The Nature Conservancy (TNC) of Indiana issued a Request for Proposals in late 2019 that sought the services of a firm(s) to support two activities: public polling on climate change and clean energy issues in Indiana, and an economic impact assessment and case statement to understand and demonstrate the role of increased investment in clean energy and other climate actions for Indiana's economic future. Through a competitive solicitation process they secured the services of Fourth Economy Consulting and BellWether Research. The following report discusses their analysis and findings.

About the Analysis

Polling

In March 2020, Bellwether Research conducted a telephone survey of 600 Hoosier voters to determine their level of understanding and support for carbon reduction policies and programs in the state of Indiana. The results of the polling helped to inform the development and prioritization of the scenarios that were modeled to ensure that the analysis focused on issues currently supported by Indiana residents.

Economic Impact Assessment

Fourth Economy engaged with TNC staff and a climate advisory committee to review a range of clean energy and climate actions that could be taken. An initial review of the environmental, economic, and social impacts of various actions lead to a decision to focus the analysis on two areas: renewable energy adoption and natural climate solutions implementation. We then looked at two scenarios, informed by TNC strategic planning, and set goals for each action.

Renewable Energy

TNC in Indiana aims to increase renewable energy to grow economies while reducing carbon emissions[1]. This analysis examined two scenarios related to renewable energy. Across both scenarios, planned retirements of existing coal-fired power plants and forecasted increases in electricity demand present an opportunity to add renewable energy capacity.

Scenario 1

100% of all coal replacement capacity to meet projected demand comes from renewables. Under this scenario, renewables would make up 32% of all electricity capacity in 2025, 45% in 2030, and 60% in 2035.

Scenario 2

Replacement of coal-fired power with renewable energy will follow schedules proposed in utility integrated resource plans. This scenario represents plans made by utilities that follow market conditions. Under this scenario, renewables would make up 23% of all electricity capacity in 2025, 34% in 2030, and 40% in 2035.

Natural Climate Solutions

TNC aims to improve carbon sequestration rates through conservation-focused land management practices. This analysis again examined two scenarios. Across both scenarios, the most recent data were used as a starting point: among row crops, cover crop has 9.9% adoption; conservation tillage has 85.1%; and crop rotation, 96%.

Scenario 1

Represents a high scenario with aggressive adoption targets set at 40% cover crop , 100% conservation tillage, and 100% crop rotation. Indiana has 11.9 million acres of row crops. To achieve this scenario, Indiana would need an additional 3.5 million acres of cover crop, 1.7 million additional acres of conservation tillage, and 476,000 additional acres of crop rotation.

Scenario 2

Represents a low scenario that takes into account historical data and trends. In this scenario, each agricultural practice inherited either a forecasted trend value or peak historical value, whichever was greater. To achieve this scenario, Indiana would need an additional 1.2 million acres of cover crop, 378,000 additional acres of conservation tillage, and 97,000 additional acres of crop rotation.

Findings

Build the Economy of the Future

Indiana can build the economy of the future by supporting cleaner energy that provides jobs for Indiana residents. Adding more renewable energy will promote more energy security, where decentralized renewable energy generation makes the state less reliant on a few large generators. Investing in clean energy and natural climate solutions in Indiana will:

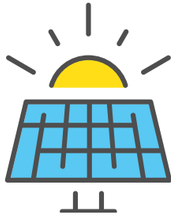
- Accelerate leadership to generate economic benefits
- Retain investment capital and attract out-of-state investors
- Support a triple bottom line.

Accelerate Leadership to Generate Economic Benefits

Trends in renewable energy installation continue to outpace the regulatory environment. Hoosiers that answered polling questions are willing to pay for the benefits.

RENEWABLE ENERGY BENEFITS

Landowners can receive lease payments for developing renewable energy on their property. **Landowner lease payments will equal $23.2 to $49.9 million annually by 2035.**

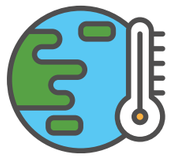


Local tax revenues can be bolstered by wind and solar development. Planned renewable energy additions would result in an estimated **$51.5 to $110.7 million annually in local tax revenue by 2035.**

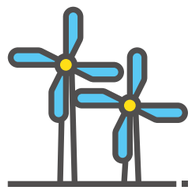
Renewable energy installation would add a net gain of 118 to 402 direct jobs across the energy sector by 2035.

402
DIRECT JOBS

NATURAL CLIMATE SOLUTION BENEFITS



Insurers pay out an estimated $570 million annually for insurance-related costs of flooding and drought in Indiana. If soils could better hold water and lessen surface runoff, **indemnity insurance payments could be lowered by $311 to $357 million annually.**



Nutrient loss through nitrogen leaching costs Indiana farmers $1.9 billion a year. **Farmers could save $950 million annually** if nutrient loss was mitigated through adoption of natural climate solutions.

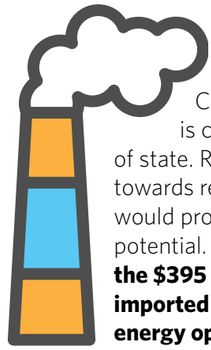
If a voluntary, market-based carbon-credit system were established to pay farmers for adopting climate-friendly practices, **Indiana farmers could earn $333 to $388 million through carbon credits[2]** at a price of $36 per ton of CO_2.

$388m
IN CARBON CREDITS FOR FARMERS

Farmers could save $413 to $541 million annually if cover crops and crop rotations were used to protect against the costs associated with erosion and land degradation.

Retain Investment Capital in Indiana and Attract Out-of-State Investors

Leaders like Ball State University, the City of Indianapolis, Indianapolis International Airport, Northern Indiana Public Service Company, and Cummins are making investments in the low-carbon economy of the future, with many others following suit. With changes to the energy industry and expansion of carbon markets on the horizon, Indiana is well positioned to retain capital investment and attract out-of-state investors.



Coal for electricity generation is currently imported from out of state. Redirecting this expenditure towards renewable energy in Indiana would provide significant upside potential. Indiana utilities could **reinvest the $395 million annually spent on imported coal to promote renewable energy opportunities in Indiana.**

The market for carbon offsets continues to expand, with Silicon Valley companies pledging to go carbon neutral, if not negative, over the next two decades or sooner. **The offset market can provide much-needed capital for Indiana projects.**

Support a Triple Bottom Line

In addition to the economic benefits of renewable energy and natural climate solutions, our analysis identified additional environmental and social benefits.

1 in 5
HOOSIERS LIVE WITHIN 10 MILES OF A COAL PLANT.

Coal-fired power plants are present in 15 of Indiana's 92 counties. **Planned closures will provide health benefits to 127,000 of Indiana's most at-risk residents,** including to 19,000 infants, 54,000 school-age children, and 54,000 seniors.

Agriculture in Indiana releases 18.4 million metric tons of CO_2; the estimated social cost of these GHG emissions is $664 million[3].

Indiana accounts for 5% of all agricultural greenhouse gas (GHG) emissions nationwide. Increased adoption of natural climate solutions within agriculture can help sequester a portion of the state's 18.4 million metric tons of CO_2 emissions. Aggressive measures could **sequester up to 2 million metric tons of CO_2 annually.**

What Hoosiers Told Us

In March 2020, Bellwether Research conducted a telephone survey of 600 Hoosier voters to determine their level of understanding and support for carbon reduction policies and programs in the state of Indiana. Highlights of the results include:

Across all the actions provided, policies that expand renewable energy and increase and incentivize natural climate solutions are widely popular.

$2

64% of Hoosier voters would be willing to pay two dollars more per month for electricity from renewable sources.

81%

of Hoosier voters think Indiana can take steps to **protect the environment without harming the economy.**

2/3

of voters support **requiring that Indiana get 50% of its energy from renewable sources** by 2050.

WHO DO HOOSIERS TRUST?

On issues relating to climate change, Hoosiers tend to trust messengers who are content experts.

Hoosiers place a **'great deal' of trust** in Purdue University Climate Change Research Center (43%), climate scientists (43%), and Indiana Department of Natural Resources (35%).

Hoosiers report placing **'not much' or 'no trust'** in local TV meteorologists (18% not much, 14% not at all) and their community's' leading newspaper (20% not much, 25% not at all).

ACTIONS TO MOVE FORWARD

The following are the most favored actions by Hoosiers.

"Preserve and better manage forests and plant new trees to increase natural carbon capture"

78% STRONGLY FAVOR

"Provide incentives to farmers to adopt agriculture practices which capture carbon in the soil, prevent soil erosion, and improve air quality"

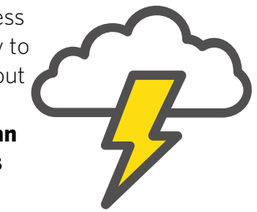
60% STRONGLY FAVOR

"Allow agricultural landowners - not county governments - to decide if they want wind turbines or solar panels on their property"

57% STRONGLY FAVOR

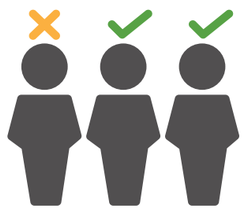
CLIMATE CHANGE CONCERN

While Hoosier voters are less likely than voters nationally to say they are concerned about climate change, **59% say climate change is having an impact in Indiana in terms of more severe or unusual weather events.**



Nearly two-thirds say that reducing the state's carbon dioxide emissions would **help public health and well being**, and 72% say it would **help the environment**.

Hoosiers that identify as Republicans are less likely to **express concern over climate change** compared to Democrats and Independents.



Women – including Republican women – are **more likely to support climate action.**

Focus Areas

By prioritizing issue areas, The Nature Conservancy in Indiana is able to focus on actions for carbon reduction that both match the organization's mission and have a large impact in Indiana.

Based on a review of the data, interviews and discussions with the Climate Committee, and polling results, the focus areas selected for further analysis were the expansion of clean energy and nature-based solutions like carbon capture.

Renewable Energy Modeling

In 2018, renewable energy accounted for 6% of Indiana's electricity production. In 2020, renewable energy made up around 10% of Indiana's electricity capacity. Since 2010, 28 coal-fired plants have retired, and the majority of their electricity generation capacity was replaced by natural gas.[4] There are 8 coal plant retirements scheduled for the next decade in Indiana, and their energy share will need to be replaced by an increase in natural gas or renewable energy.

The majority of Hoosiers (60%) say that Indiana should require a higher renewable energy percentage (and 65% support a 50% renewable energy standard by 2050). 81% of Hoosier voters think Indiana can take steps to protect the environment without harming the economy. In fact, 64% of Hoosier voters would be willing to pay two dollars more per month for electricity from renewable sources.

Renewable electricity generation presents an enormous opportunity to reduce carbon emissions, limit out-of-state spending on coal imports, bring economic benefits like clean energy jobs, and increase local government revenue.

TNC Goals and Scenarios

TNC in Indiana aims to increase renewable energy to grow economies while reducing carbon emissions[5]. This analysis examined two scenarios related to renewable energy. Across both scenarios, planned retirements of existing coal-fired power plants and forecasted increases in electricity demand present an opportunity to add renewable energy capacity.

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Natural Climate Solutions Modeling

Natural climate solutions are "conservation, restoration and improved land management actions that increase carbon storage or avoid greenhouse gas emissions in landscapes[6]." Farming practices such as cover crops, conservation tillage, and crop rotation can reduce carbon emissions, protect against nutrient loss and erosion, and improve water quality. There is an immense opportunity to take use these practices in Indiana, as nearly two-thirds of Indiana's 23 million acres are farmland and Indiana is home to more than 56,000 farms.

Polling conducted in 2020 found that 86% of Hoosier voters support providing incentives to farmers to adopt agricultural practices that capture carbon in the soil, prevent soil erosion, and improve water quality.

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The main difference between the two scenarios is the adoption rate of cover crops, with high and low levels of adoption analyzed.

Renewable Energy Analysis

Background

Indiana is within the top ten coal producers in the United States, and ranks second in coal consumption – surpassed only by Texas[7]. In 2018, coal fueled 69% of Indiana's net electricity generation.

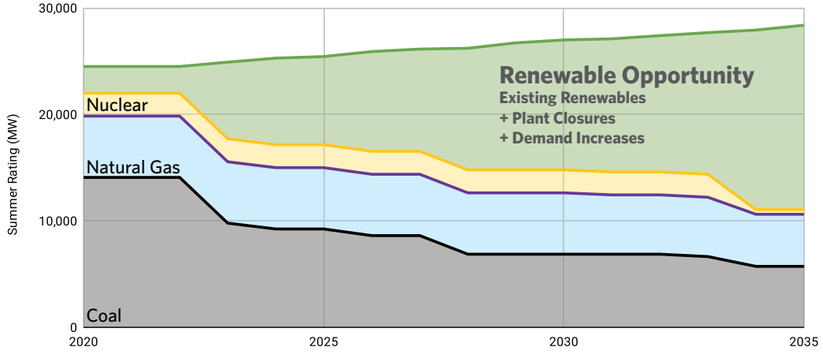
Looking toward the future, coal-fired power plants are aging and becoming more expensive to operate. Meanwhile, energy alternatives like natural gas and renewables are a more viable option than ever before. Increasingly, utilities are retiring coal generation because it is no longer competitive in the energy market given low natural gas prices and declining renewable energy prices. Furthermore, the presence of coal-fired power plants have been linked to adverse health and environmental effects for surrounding communities.

As coal-fired power plants retire, there is an opportunity for additional electricity generation through renewables. Based on utilities' Integrated Resource Plans (IRPs), utilities are already planning investments that will generate 23% of Indiana's electricity from renewable sources by 2025 and 40% by 2035.

Why act?

Indiana is in the middle of a significant transition in its electricity supply. Decisions made today will have ramifications for decades. Because of the increasing cost of operation, Indiana utilities plan to retire 9 coal generation units by 2025, 17 by 2030, and 20 by 2035, representing a respective 18%, 26%, and 32% of forecasted peak electricity demand.

PLANT RETIREMENTS + DEMAND INCREASE = RENEWABLE OPPORTUNITY



Data Source: Data from Indiana Utility Integrated Resource Plans, 2016-2019 and the Indiana Electricity Projections: The 2018 Forecast Update from Purdue University

Predicted higher temperatures will increase demand for electric power while accompanying extreme weather events may affect the reliability of energy delivery, damage infrastructure, and increase electrical blackouts[8]. Increasing renewables in Indiana could:

- **Diversify income** for Indiana farmers. Solar and wind farms can provide additional income support at a time when farmers are vulnerable to market fluctuations.
- **Increase investment** in Indiana. Shifting away from coal power means that Indiana utilities can spend less on importing coal from out of state and instead invest in renewable energy opportunities within Indiana.
- **Improve energy security**. Increasing renewables within the state can lower Indiana's reliance on external energy sources.

Benefit Summary

Additional renewable energy as part of Indiana's electricity mix has economic, environmental, and health and social benefits.

Economic

Increased economic activity in the renewable energy sector will offset losses from coal generation:

- Indiana utilities plan to **more than double the electricity capacity of renewables by 2025, making renewables 23% of the state's overall electricity capacity.**
- There are better employment and wage outcomes if renewables fill 100% of new energy installation in Indiana.
- Planned renewable energy installation would add **1,313 green energy jobs**. These jobs would offset the 1,195 jobs lost through coal plant retirements, for **a net gain of 118 direct jobs across the energy sector by 2035.** If renewables fill 100% of new energy installations in Indiana, the state would **add 1,596 green energy jobs**, offsetting the 1,195 jobs lost through coal plant retirements, for a net gain of 402 direct jobs across the energy sector by 2035. In both scenarios, job losses from reduced coal generation are offset by gains in renewables and natural gas.

The shift to renewables would mean more jobs, but at lower wages. In a worst case scenario:

- The shift from coal will result in a loss of $107 million in total annual wages, given the higher wages paid for coal workers. These **wages would be nearly offset by the jobs and earnings if renewables fill 100% of new energy installation,** as renewable energy jobs would generate $90 million in wages, for a net loss of $17 million. Under current utility planning, the earnings from renewables and coal would only result in $77 million in wages for a net loss of $30 million.
- These wage losses will be mitigated if the transition from coal is managed with the retirements of coal workers. There are approximately 950 workers aged 65 or older in the utilities or mining and gas extraction industries in Indiana[9]. These **personnel retirements would account for 80% of the reductions from coal plant retirements.**

Another 5,500 workers are 55 to 64 years old (25% of the workforce), most if not all of whom will also be retiring before 2035. Furthermore, many utilities are simply shifting these coal workers to new jobs in the utility that would be at an equivalent pay. The lower wages for workers in renewable energy are also a reflection of lower wages for younger workers and new hires. Therefore these wage losses represent the worst case scenario.

Additional benefits include land lease payments to farmers and increased local tax revenues.

- Lease payments can provide an important source of revenue that will stabilize the income of Indiana's farmers and ensure their future. Lease payments will equal $23.2 to $49.9 million annually by 2035. See Landowner Revenues and Tax Revenues for more information (page 20).
- Wind and solar development can bolster local tax revenues. Planned renewable energy additions would result in an estimated $51.5 to $110.7 million annually in local tax revenue by 2035. See Landowner Revenues and Tax Revenues for more information (page 20).

Finally, reduced spending on fossil fuel imports will allow those dollars to remain within the state.

- Utilities could **reinvest the $395 million spent annually on imported coal to promote renewable energy opportunities in Indiana.**

Environmental

Switching to renewable sources leads to decreases in greenhouse gas emissions.

- Planned changes in Indiana's energy mix will reduce a total of 45 million metric tons of carbon dioxide. The social cost of these emissions is $1.6 billion annually. See Carbon Emission Reductions for more information (page 21).

Renewables also create environmental co-benefits like water savings.

- Water is used to cool coal-fired power plants. The total water savings from retiring coal-fired power plants in Indiana would be 158 million gallons (155 million from reduced water withdrawals and 3 million gallons that would not be consumed for cooling), the equivalent of one day of water use for 1.3 million households[10]. See Water Savings for more information (page 21).

Health and Social

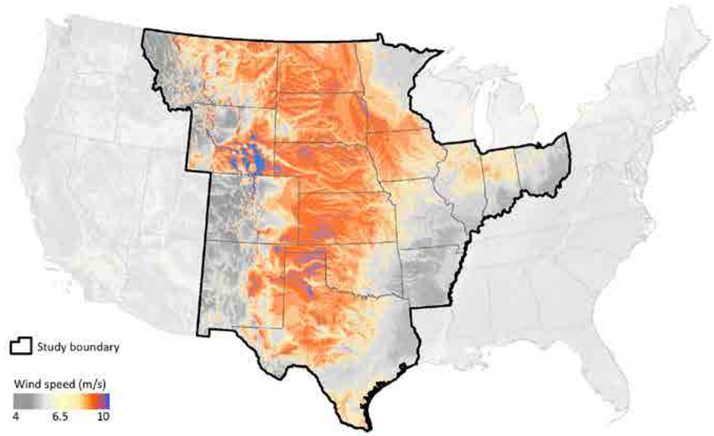
Coal-fired power plants are present in 15 of Indiana's 92 counties, and **one in five Hoosiers live within 10 miles of a coal plant. Planned closures will provide health benefits to 127,000 of Indiana's most at-risk residents**, including to 19,000 infants, 54,000 school-age children, and 54,000 seniors.

Analysis & Modeling

Fourth Economy's analysis considered planned retirements of existing coal-fired power plants, forecasted increases in electricity demand, suitable siting for renewables, ability of the grid to handle renewables, and ability of industry to scale up renewables.

Planned Retirements of Existing Coal-fired Power Plants

Planned closures of coal-fired power plants will total 4.6 gigawatts (GW) in 2025, 7 GW in 2030, and 9 GW in 2035. This was determined by using utilities' Integrated Resource Plans (IRPs). Indiana's largest utilities develop IRPs to ensure there will be adequate resources to meet future obligations, and to satisfy Indiana's requirement of utilities providing safe and reliable services in a cost-effective manner. Utilities use IRPs to evaluate a broad range of feasible and economically viable resource alternatives over a 20-year planning period and select a preferred energy mix. The IRP process requires utilities to anticipate how they will comply with federal environmental regulations, evaluate continued investments in existing plants, and determine the viability of alternative options to meet customer demand.



Site Wind Right
The Nature Conservancy supports the rapid expansion of renewable energy, and America's ample wind resources offer the opportunity to provide clean, low-impact power for people and wildlife. The Site Wind Right map pulls from more than 100 data sets on wind resources, wildlife habitat, current land use and infrastructure to help inform siting decisions. By using Site Wind Right early in the process, developers, utilities, power-purchasers and agencies can help save time and money by highlighting areas with the lowest potential for conflict.

Forecasted Increases in Electricity Demand

The State Utility Forecasting Group at Purdue University produces projections of Indiana's electricity needs. These projections take into account future economic activities, population, and fossil fuel prices, among other factors. Demand is expected to necessitate capacity expansion, from 25 GW in 2020 to 26.4 GW in 2025, 27.9 GW in 2030, and 29.3 GW in 2035[11].

Suitable Siting for Renewables

The Nature Conservancy's Site Wind Right map tracks suitable land for wind development in areas with low conservation impact[12]. The map identifies areas where wind development is unlikely to encounter significant wildlife-related conflict, project delays, and cost overruns. Siting wind generation in areas that are low-impact for wildlife can meet both renewable energy and habitat conservation goals. 4.1 million acres, representing 18% of Indiana, are low-impact areas suitable for development. Up to 50 GW of wind capacity could be added in areas with low conservation impact. This capacity is well beyond Indiana's 25 GW of total electricity generation capacity in 2020 and the forecasted 29 GW of capacity the state is expected to need in 2035. Adding additional renewable energy capacity in Indiana does not need to impact sensitive natural habitats or wildlife species.

Ability of Grid to Handle Renewables

The National Renewable Energy Laboratory (NREL) estimates that "Electricity supply and demand can be balanced in every hour of the year in each region with nearly 50% from variable renewable generation, according to simulations of 2050 power system operations[13]." Midcontinent Independent System Operator (MISO) estimates a 40% limit for renewable generation.[14] If all replacement capacity for planned coal-fired generation closures in Indiana is replaced with renewables, the 50% threshold of renewables would only be reached in 2033.

Ability of Industry to Scale Up Renewables

Renewables make up 10% of the electricity generation capacity in 2020, with 2.3 GW of wind capacity and 428.4 MW of solar capacity. Wind and solar industry groups indicate that as much as 13.5 GW of wind can be added by 2030, and 1.2 GW of solar can be added by 2025[1516]. From 2013 to 2019 Indiana added an average of more than 60 MW of solar generation annually. To meet the projected additional demand, Indiana would have to add four to five times as much solar capacity annually.

Scenarios for Modeling

Fourth Economy modeled two scenarios. Across both scenarios, planned retirements of existing coal-fired power plants and forecasted increases in electricity demand present an opportunity to add renewable energy capacity.

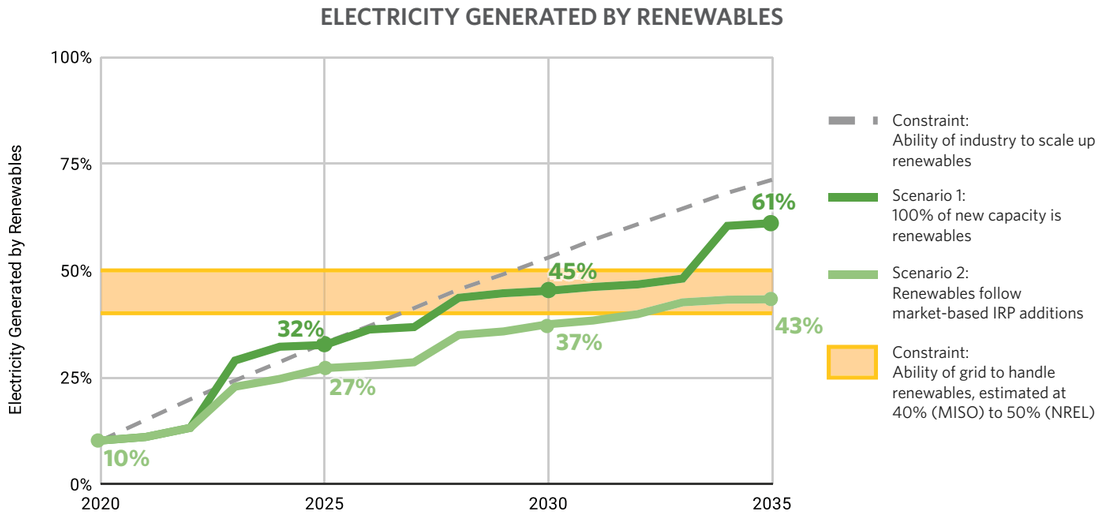
Scenario 1

100% of all replacement capacity to meet projected demand comes from renewables. Under this scenario, renewables would make up 32% of all electricity capacity in 2025, 45% in 2030, and 60% in 2035.

Scenario 2

Replacement of coal-fired power with renewable energy will follow schedules proposed in utility integrated resource plans. This scenario represents plans made by utilities that follow market conditions. Under this scenario, renewables would make up 23% of all electricity capacity in 2025, 34% in 2030, and 40% in 2035.

Under the market conditions found in Scenario 2, the share of renewables within the overall electricity mix more than doubles by 2025, and quadruples by 2035. Replacing all new capacity with renewables (Scenario 1) would require taking additional steps beyond those found in current market conditions. The "gap" electricity generation capacity between the renewable energy adoption in Scenario 1 and Scenario 2 would likely be filled by natural gas. The Midcontinent Independent System Operator (MISO) has estimated a constraint on renewable generation for the electrical grid at up to 40% renewable generation. MISO's analysis shows the integration complexity increases sharply between 30 and 40%. The National Renewable Energy Laboratory (NREL) has estimated a constraint of 50%. As Indiana approaches the 30% threshold, there may be a need for investment to stabilize the grid for additional renewable capacity[17][18].



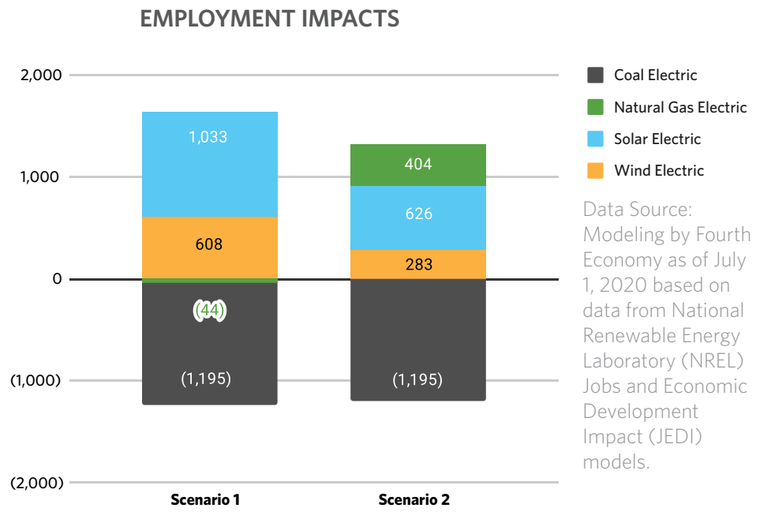
Data Source: Modeling by Fourth Economy as of July 1, 2020 based on data from Indiana Utility Integrated Resource Plans, 2016-2019 and the Indiana Electricity Projections: The 2018 Forecast Update from Purdue University.

Results & Discussion

Employment Impacts

Transitioning to renewable sources based in Indiana will result in the loss of 1,195 coal-generated electricity jobs between 2020 and 2035 in the state of Indiana, although some of these job losses may occur in plants based outside of Indiana that supply the state with electricity. For a conservative estimate we have assumed all of these losses occur in Indiana. The job losses related to this shift from coal have already been happening as utilities invest in natural gas and other generation sources that release fewer emissions.

These job losses will be offset by jobs created in the wind and solar industries, with many of those jobs going to Indiana residents. The number of jobs will depend on how aggressively Indiana moves toward adoption of wind and solar energy. Scenario 2 represents less aggressive adoption, achieving 40% renewables by 2035. This planned renewable energy installation would mean a **net gain of 118 direct jobs by 2035.** This is represented in the chart below for Scenario 2. **The job losses from reduced coal generation are offset by gains in renewables and natural gas.**



Data Source: Modeling by Fourth Economy as of July 1, 2020 based on data from National Renewable Energy Laboratory (NREL) Jobs and Economic Development Impact (JEDI) models.

CASE STUDY

BALL STATE UNIVERSITY

40%

REDUCTION IN ENERGY USE & CARBON EMISSIONS

"Institutions of higher education are in positions to lead efforts in sustainability," says Jim Lowe, Associate Vice President for Facilities Planning and Management at Ball State University.

In 1990, the University developed a Comprehensive Energy Management Program to respond to the growing global concern over climate change. They switched over to geothermal energy in 2014, completely eliminating their dependence on coal. Additional environmental, economic, and social resilience actions pursued by BSU include: obtaining accreditation as an arboretum for their campus with 7,000 trees; installing a public shuttle system that transports over 1 million riders every year who would otherwise be taking individual cars; and maintaining a stormwater management system that collects 700,000 pounds of debris that would otherwise be entering creek beds.

Ball State University's efforts achieved an impressive 40% reduction of their carbon footprint in the past 10 years alone. While their goal is to be carbon neutral by 2050, they're aiming to make it happen as early as 2030.

CASE STUDY

CITY OF INDIANAPOLIS

26%

OF ENERGY SECTOR CARBON EMISSIONS CUT BY 2025

The City of Indianapolis is responding to the needs of their citizens with swift action. Due to the rising social, economic, and infrastructural costs from severe weather, including flooding and temperature events, the City brought together public and private stakeholders and to create a comprehensive climate change and resiliency plan. The plan, called THRIVE Indianapolis, is calling upon the resources and expertise of all Indy residents to guide its development and implementation.

Implementation of the THRIVE plan is being coordinated by the City Office of Sustainability. Some of their actions include: establishing a Building Efficiency Advisory Committee to develop the benchmarking and transparency ordinance for building energy efficiency; informing residents about residential solar generation and connecting them to local installers; and creating a green schools funding and certification program for schools to implement sustainability projects.

These policies and programs are designed to help Indianapolis reach its goal of cutting 26% of energy sector carbon emissions by 2025.

Achieving the more ambitious goals in scenario 1, where renewables fill 100% of the coal replacement and additional demand (for a total of 60% renewable generation), would increase the jobs to a **net gain of 402 direct jobs by 2035**. This is represented in the chart below for scenario 1. The job losses from reduced coal generation are offset by gains in renewables and natural gas related jobs.

In terms of total annual wages, given the higher wages paid to coal workers, the shift from coal will result in a net loss of $17 million in wages ($90 million in wages from renewables in scenario 1 would nearly offset the loss of $107 million in wages for coal employment). In scenario 2 there would be a net loss of $30 million in wages because the wages from renewables and natural gas would only replace $77 million of the $107 million in lost wages from coal generation.

These wage losses will be mitigated if the transition from coal is managed with the retirements of coal workers. There are approximately 950 workers aged 65 or older in the utilities or mining and gas extraction industries in Indiana[19]. **These personnel retirements would account for 80% of the reductions from coal plant retirements.** Another 5,500 workers are 55 to 64 years old (25% of the workforce), most if not all of whom will also be retiring before 2035. Furthermore, many utilities are simply shifting these coal workers to new jobs in the utility that would be at an equivalent pay. The lower wages for workers in renewable energy are also a reflection of lower wages for younger workers and new hires. Therefore these wage losses represent the worst case scenario.

Method to Estimate Employment Impacts

The National Renewable Energy Laboratory (NREL) developed the Jobs and Economic Development Impact (JEDI) models for estimating economic impacts for energy projects. We used the JEDI models for land-based wind, solar, coal, and natural gas generation to estimate the direct job impacts. For each energy source, the JEDI model estimated the number of direct jobs per 1,000 MW. Only the direct jobs were counted, as the indirect and induced jobs may or may not be located within Indiana. Solar provides the most jobs per 1,000 MW (246), followed by coal (143), natural gas (51), and wind (45).

DIRECT JOBS PER 1,000 MW

NREL JEDI MODELS	DIRECT JOBS PER 1,000 MW
Wind Electric	45
Solar Electric	246
Coal Electric	143
Natural Gas	51

Data from National Renewable Energy Laboratory (NREL) Jobs and Economic Development Impact (JEDI) models.

Based on the two scenarios, Fourth Economy modeled the changes in generation for each source. (The reduction in coal capacity is assumed to remain constant in both scenarios.) Scenario 1, with the more aggressive goals for renewable generation, will yield the greater increase in capacity. For scenario 1, natural gas capacity is expected to continue to decline based on some planned closures and the existing IRPs. For scenario 2, the change in natural gas is assumed to equal the gap between the generation from wind plus solar in scenario 1 versus scenario 2.

CHANGE IN CAPACITY FROM PLANT RETIREMENTS

SCENARIO 1	CHANGE IN CAPACITY 2020-2035 (MW)
Wind Electric	13,500
Solar Electric	4,200
Projected at Natural Gas Generation Trend	-868
SCENARIO 2	
Wind Electric	6,280
Solar Electric	2,543
If Natural Gas Fills the Gap between Scenario 1 and 2	8,877
LOSSES IN COAL	
Coal Electric	-8,356

Modeling by Fourth Economy as of July 1, 2020 based on data from Indiana Utility Integrated Resource Plans, 2016-2019 and the Indiana Electricity Projections: The 2018 Forecast Update from Purdue University.

Multiplying the change in generation by the jobs per 1,000 MW provided the following employment impact estimates:

DETAILED RESULTS OF EMPLOYMENT IMPACTS

SCENARIO 1	PROJECTED JOB GROWTH 2020-2035
Wind Electric	608
Solar Electric	1,033
Projected at Natural Gas Generation Trend	-44
Scenario 1 Renewable Gains	**1,596**
SCENARIO 2	
Wind Electric	283
Solar Electric	626
If Natural Gas Fills the Gap between Scenario 1 and 2	453
Scenario 2 Renewable Gains	**1,313**
LOSSES IN COAL (SCENARIOS 1 & 2)	
Coal Electric	-1,195

Modeling by Fourth Economy as of July 1, 2020 based on data from National Renewable Energy Laboratory (NREL) Jobs and Economic Development Impact (JEDI) models.

Landowner Revenues and Tax Revenues

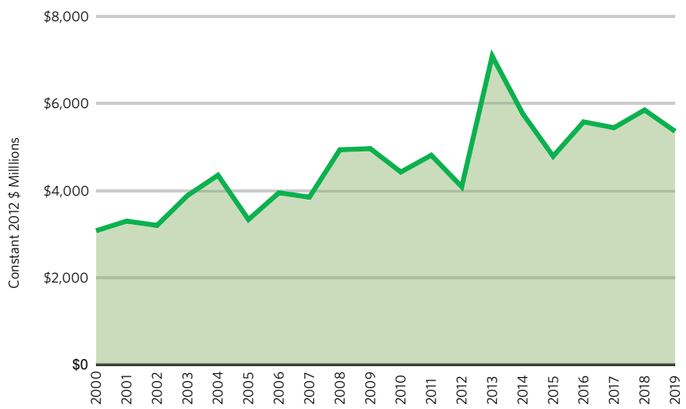
Lease payments can provide an important source of revenue that can stabilize Indiana's farmers and ensure their future. Even in the best of times, farming revenue is subject to natural variations in rainfall as well as swings in supply and demand, but the volatility from global trade and now the disruption of the food supply chain from a global health and economic crisis create more uncertainty. Giving landowners the ability to diversify their revenues can make Indiana's farms more resilient to these shocks, preserving local food supplies and Indiana's agricultural roots. Local authorities will benefit from an increase in property tax revenues, and property values will increase with the additional investment in renewable energy generation.

The economic benefits of adding 6,280 to 13,500 MW of new wind power in Indiana will result in $51 to $110 million in annual property taxes and $23 million to $50 million in annual landowner lease payments.

Method to Estimate Landowner and Tax Impacts

The estimates provided are based on the changes in wind energy from 2020 to 2035 and lease and tax estimates from the National Renewable Energy Laboratory. In 2014, the NREL estimated the impacts from Indiana's first 1,000 MW of wind power. Landowners received $3,700 per MW per year. Wind power also generated $8,200 per MW per year in local property taxes[20].

INDIANA AGRICULTURAL GDP



Source: Bureau of Economic Analysis, 2000-2019.

CHANGES IN WIND ENERGY

WIND	CHANGE IN CAPACITY 2020-2035
Scenario 1	13,500
Scenario 2	6,280

Modeling by Fourth Economy as of July 1, 2020 based on data from Indiana Utility Integrated Resource Plans, 2016-2019 and the Indiana Electricity Projections: The 2018 Forecast Update from Purdue University.

ESTIMATED TOTAL LEASE PAYMENTS AND TAXES

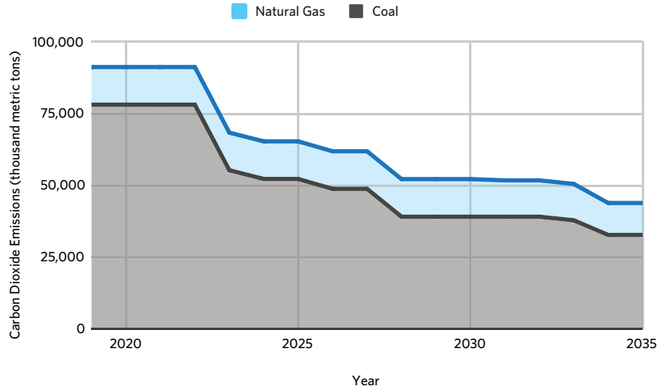
WIND	LEASE PAYMENTS	LOCAL PROPERTY TAXES
Scenario 1	$49,950,000	$110,700,000
Scenario 2	$23,236,000	$51,496,000

Economic Impacts from Indiana's First 1,000 Megawatts of Wind Power. National Renewable Energy Laboratory, 2014.

Carbon Emission Reductions

Reduced coal usage will lower the amount of carbon emissions from electricity generation in Indiana to 45 million metric tons by 2035. The carbon sequestered through natural climate solutions would be approximately 2 million tons in the most aggressive scenario.

CARBON EMISSION REDUCTIONS FROM COAL AND NATURAL GAS



Source: Modeling by Fourth Economy as of July 1, 2020 based on data from Indiana Utility Integrated Resource Plans, 2016-2019 and the Indiana Electricity Projections: The 2018 Forecast Update from Purdue University. Emissions data from Energy Information Administration.

Water Savings

For every megawatt of electricity produced using renewables instead of coal, the water withdrawn from rivers and groundwater drops by 18,600 gallons, the equivalent of more than 150 days of water usage for the typical household. Water consumed for cooling and other plant operations and not returned to the environment drops by 350 gallons for every megawatt switched.[21] The total water savings from retiring coal-fired power plants would be 158 million gallons (155 million from reduced water withdrawals and 3 million gallons that would not be consumed for cooling), the equivalent of one day of water use for 1.3 million households.

CASE STUDY

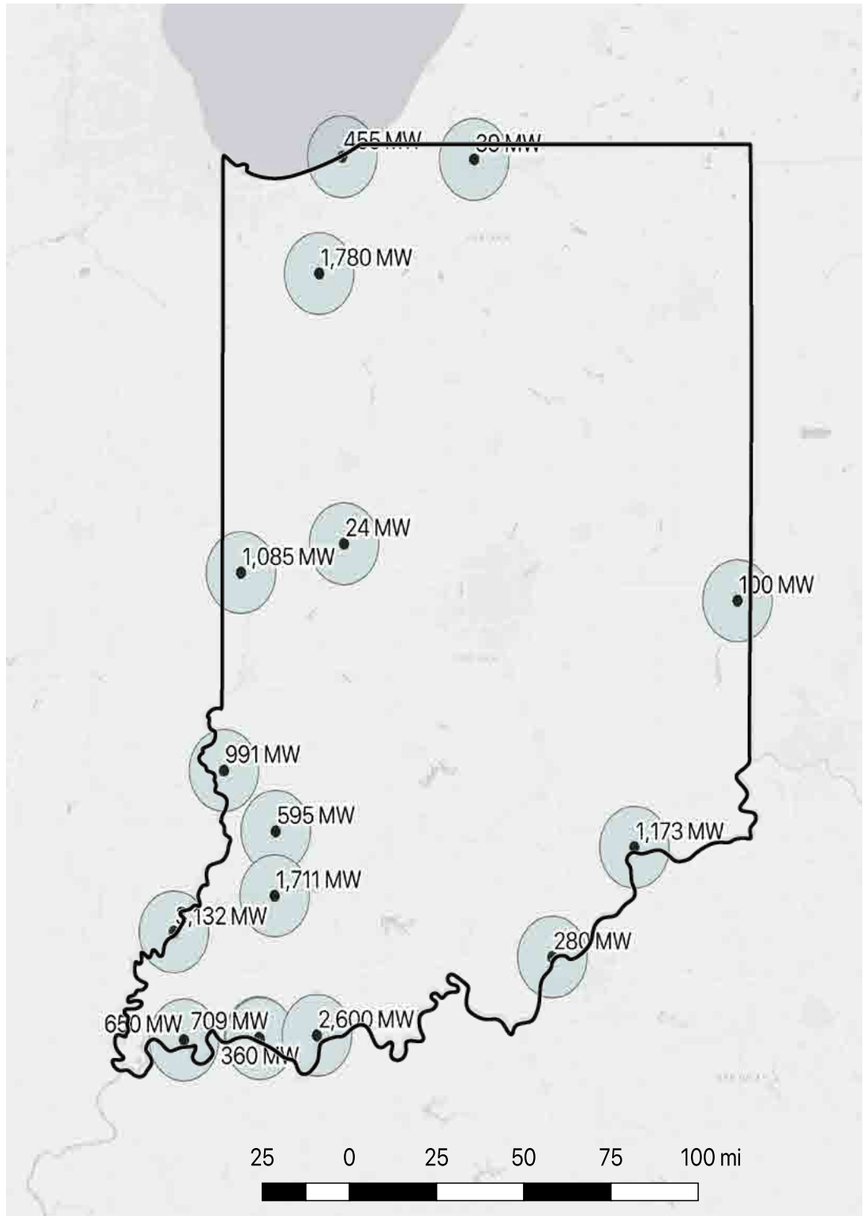
INDIANAPOLIS INTERNATIONAL AIRPORT

END GOAL: CARBON NEUTRALITY

When it comes to modeling leadership in climate resiliency, "show, don't tell" may as well be the unofficial slogan of the Indianapolis International Airport (IND). IND was the first airport in the country to obtain LEED certification for an entire terminal campus, and they have achieved three of the four levels of certification from the international Airport Carbon Accreditation (ACA). The fourth level is the ultimate goal – carbon neutrality – and every year it is closer in sight.

By virtue of being an airport, there exist unique challenges and opportunities in the pursuit of sustainability. IND won awards for its innovative runway de-icing and stormwater treatment systems, and has integrated electric buses into its fleet of service vehicles, but due to the environmental consequences of air travel, only approximately 25% of the airport's carbon emissions can be directly influenced by changes to its operations. The other 75% of carbon emissions must be offset by the creation of public value, or positive externalities. Outside of the initiatives affecting IND's daily operations and the electric shuttle bus fleet, the airport also looks at sustainability as an opportunity to engage with the community and form new partnerships.

COAL-FIRED POWER PLANTS



This map displays the locations and summer megawatt (MW) rating for coal-fired power plants located in Indiana. Also displayed on the map are 10-mile boundaries surrounding each plant.

Health Benefits

Coal-fired power plants are present in 15 of Indiana's 92 counties, and one in five Hoosiers live within 10 miles of a coal plant. Planned closures of 8 plants by 2035 will lead to direct health benefits for 313,000 residents in those counties. Reducing coal emissions enhances public health by reducing incidences of premature death, asthma attacks, and respiratory and heart disease; avoiding related health costs; and reducing the number of missed school and work days due to illnesses.

Households near the poverty line and Black households are disproportionately impacted by pollutants from coal-fired power plants. Black residents account for 14% of those living within 10 miles of a coal-fired power plant in Indiana, compared to 9.3% of the population of the state as a whole. Therefore, Black residents are 1.5 times more likely to be impacted by these pollutants. Households earning less than $25,000 per year in income make up 25% of households within 10 miles of coal-fired plants, compared to 21% for the state overall, with the result that lower income residents are disproportionately impacted. These households may face additional difficulties paying for health costs associated with asthma, respiratory, or heart-related disease.

Children and seniors face increased health risks associated with pollution. There are an estimated 82,000 infants, 216,000 school-age children, and 209,000 seniors that live within 10 miles of a coal-fired power plant in Indiana. Planned closures will provide health benefits to 127,000 of Indiana's most at-risk residents, including to 19,000 infants, 54,000 school-age children, and 54,000 seniors.

These health benefits will help Indiana residents, businesses, and taxpayers avoid costs that are significant but remain largely hidden. These benefits have been estimated at a low of $95 million per year to a high of $379 million by the year 2035[22].

In 2017, the EPA estimated health benefits from

CASE STUDY

CUMMINS

"WE ARE ONLY AS STRONG AS THE COMMUNITIES WHERE WE RESIDE."

"We are only as strong as the communities in where we reside. We need to address the health and safety, social justice, and the environmental challenges in those communities to protect future generations." This is the sentiment of the Cummins leadership, as stated by Brian Mormino, Executive Director of Technical and Environmental Systems, and it is what drives the company to be a leader in sustainability actions, and the creation of their PLANET 2050 strategy. The strategy sets aggressive sustainability targets for the company for the next thirty years, along with eight explicit goals for the next decade, including cutting greenhouse gas emissions in half and water consumption by 30%. Cummins is pursuing a lifecycle approach to their work and products, thinking about both where they are purchasing materials, and how their products will be used.

Their sustainability goals are ambitious and on a tight timeline, but they are not backing down from the challenge. Other companies are following Cummins' leadership and have contacted the company to learn more about PLANET 2050 and the process for creating a strategy of their own.

reduced emissions resulting from the switch to wind and solar power. They expressed these benefits in cents per kilowatt hour (kWh). Using various scenarios and discount rates, wind and solar generate benefits ranging from 2.99 cents per kWh to 8.29 cents per kWh[23]. Based on these estimates, we used 3 cents per kWh for the lower benefit estimate and 8 cents per kWh for the high benefit estimate. The highest benefit results from achieving 60% of electricity from renewable energy (wind and solar) and the estimated benefits of 8 cents per kWh which reflects the higher discount rate of 7%.

CASE STUDY

NIPSCO

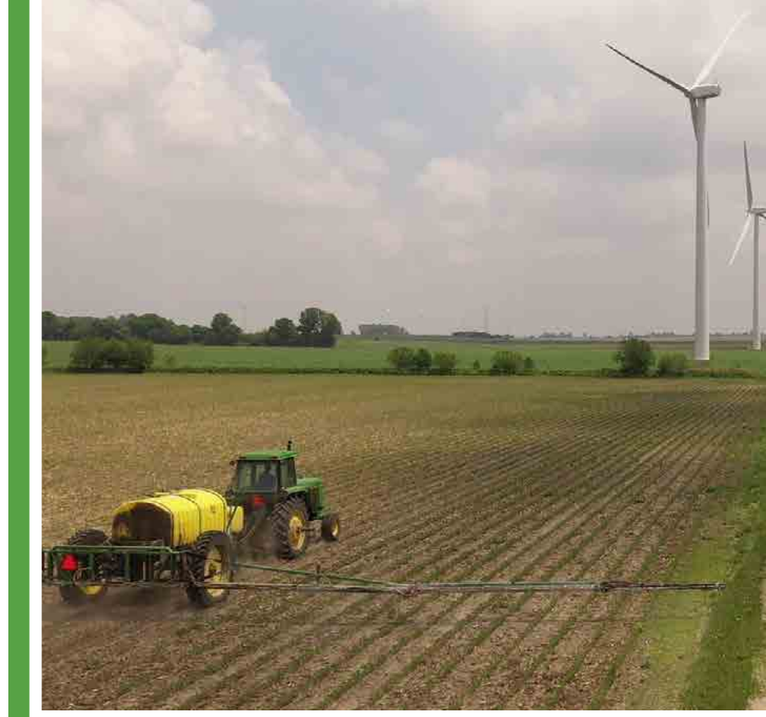
TAKING BOLD ACTION TO SHAPE THE CARBON FUTURE OF INDIANA.

The Northern Indiana Public Service Company (NIPSCO) and its leadership team exemplify how to take bold action to shape the carbon future of Indiana. In 2018, as a result of its integrated resource planning process, NIPSCO announced it would take all of its coal fired power plants offline over the next ten years. As part of that effort, NIPSCO issued a formal Request for Proposals to gain better information on available, real projects at real costs from within the marketplace. All energy technologies were eligible to participate, and NIPSCO screened 90 proposals. Analysis showed that the most viable path for customers involves accelerating the retirement of a majority of NIPSCO's remaining coal-fired generation in the next five years and all coal within the next 10 years. "We determined that maintaining our aging coal fired plants were not the best allocation of capital," says Kelly Carmichael, Vice President of the Environmental team at NIPSCO, adding, "We calculated that over a 30 year period, retiring our remaining coal and transitioning to lower cost, cleaner sources such as wind, solar and battery storage technology, will save customers $4 billion and ultimately result in a cost savings for reducing carbon emissions."

ESTIMATED TOTAL LEASE PAYMENTS AND TAXES

SCENARIO GOALS	SCENARIO 2 40% RENEWABLE GENERATION	SCENARIO 1 60% RENEWABLE GENERATION
Additional Renewables (thousand MWh)	3,156	4,734
ESTIMATED ANNUAL BENEFITS AT FULL ADOPTION (2035)		
Low Estimate of Annual Benefit ($0.03 per kWh)	$94,680,459	$142,020,688
High Estimate of Annual Benefit ($0.08 per kWh)	$252,481,223	$378,721,834

Source: EPA, "Estimating the Health Benefits per-Kilowatt Hour of Energy Efficiency and Renewable Energy." Environmental Protection Agency.



Natural Climate Solutions

We can't tackle climate change without changing our energy systems—but we also can't get there without harnessing the power of natural landscapes, to reduce impacts we're experiencing and turning them from sources of carbon emissions to carbon sinks.

- The Nature Conservancy: Playbook for Climate Action.

Background

Description of Natural Climate Solutions

Natural climate solutions address climate change by capturing and storing additional carbon dioxide from the atmosphere and improving the resilience of ecosystems by decreasing flooding, erosion, soil loss, and leaching.

Farming practices such as cover crops, conservation tillage, and crop rotation can reduce carbon emissions, protect against nutrient loss and erosion, and improve water quality. There is an immense opportunity to use these practices in Indiana, as nearly two-thirds of Indiana's 23 million acres are farmland and Indiana is home to more than 56,000 farms.

In addition to incurring environmental, health, and social benefits, adopting natural climate solutions could carry large economic benefits for Indiana farmers. A voluntary, market-based carbon-credit system could create a new revenue stream that pays farmers for adopting climate-friendly practices.

Helping Indiana farmers adopt natural climate solutions is widely supported. Polling conducted in 2020 found that 86% of Hoosier voters support providing incentives to farmers to adopt agricultural practices that capture carbon in the soil, prevent soil erosion, and improve water quality.

Why Act?

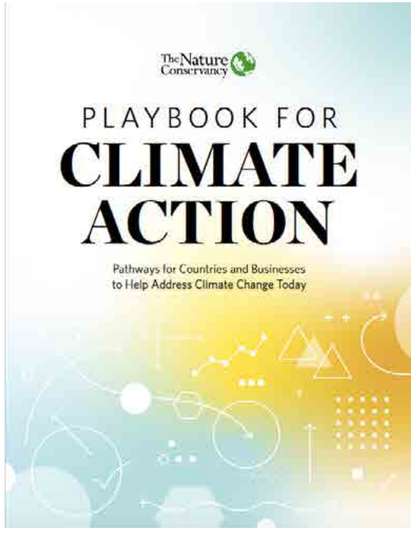
Healthy soil is the cornerstone of life on earth, facilitating ecosystem biodiversity, ample food production, effective water filtration and storage, and carbon sequestration.

Better soil management provides tangible environmental benefits and opportunities for farmers and agricultural producers, too, including substantial profit potential. Improving infiltration and water-holding capacity, for example, can significantly reduce irrigation water needs, lessen dust pollution, and improve nutrient uptake by plants, which can reduce input costs, and reduce plant stress, disease and pest pressure. Over time, these practices reduce the risk of yield loss due to these stressors and can bring about a material increase in crop yields and quality.[24]

- The Nature Conservancy: Playbook for Climate Action

Indiana farmers will not only be impacted by changes in climatic conditions in Indiana, but also changes in prices and technology induced by global climate change. Changes in the growing seasons may result in higher yields, but those gains may be offset by more favorable conditions for pests, insects, and weeds – including new types, which could require increased use of agrochemicals. The increase and variability in precipitation and extreme temperatures could lead to plant diseases, increased risk of flooding, difficulty in the timing of planting, increased demand for irrigation, as well as heat and cold stress on crops and livestock.

Tree species are expected to shift to higher latitudes and elevations for suitable habitat. Tree mortality rates are expected to rise and regeneration is expected to decline. Rising temperatures have increased the frequency and destructiveness of pest outbreaks and introduced new pests into our ecosystem. Changes in growing seasons, temperatures, and rainfall, as well as changes in CO2 and nitrogen levels, will increase growth rates for some species but increase mortality for others, generating a potential shift in the forests of Indiana and the ecosystems and economy they support.



The Nature Conservancy is committed to advancing a comprehensive suite of innovative, science-based solutions for optimizing the policy levers, financial tools, nature-based technologies, and smart development necessary to minimize temperature rise and climate-related impacts to communities. The Playbook for Climate Action outlines opportunities that both the private and the public sectors can employ right now. The five solutions in the playbook are already providing real, tangible benefits for people and nature around the world, and they show that a diversity of ambitious approaches are available to suit different geographies and capacities.

TESTIMONIAL

McCORMICK FARMS

"IT'S NOT JUST ABOUT ECONOMICS. FARMERS DO THIS BECAUSE OF LOVE OF THE LAND AND OF THE LOVE OF THE PLANET."

On his 2,400 acre farm in Vincennes, Indiana, Ray McCormick goes against the mainstream, utilizing never-till farming and land management practices to restore the local ecosystem and sequester carbon. He has built a community around experimentation and pushing the boundaries of traditional agriculture.

Soil health practices, like no-till farming and using cover crops, reinforce the structural integrity and efficiency of soil. Healthy soils can hold an immense amount of atmospheric carbon. "This is the new frontier," Ray says. "We're going to save this planet by what is underground, and we can only save the planet by having other farmers do it. No other greenhouse gas solution has the capability of carbon reduction on such a large scale."

Ray believes the biggest barrier to the growth of the soil revolution is converting other farmers. It requires farmers to adopt a whole new way to approach the land, there are a lot of things to learn, and there is a huge financial risk if things don't go according to plan. "The financials work out," Ray reminds farmers, considering the cost savings that less equipment, labor, and material inputs ensures. "But it's not about economics. Farmers do this because of love of the land and of the love of the planet." Even so, there are major barriers to social and cultural pressures within the farming community, and Ray believes it will take a true commitment to partnership to create programs and incentives and encourage farmers to push the limits of traditional farming practices. "You need all partners working in the same direction."

Benefit Summary

Additional use of agricultural practices like conservation tillage, crop rotation, and cover crops has economic, environmental, and health and social benefits.

Economic

- A voluntary, market-based carbon-credit system could create a new revenue stream that pays farmers for adopting climate-friendly practices. At a price of $36 per ton of CO2, **Indiana farmers are poised to earn $333 to $388 million through carbon credits[25].**
- Nutrient loss through nitrogen leaching costs Indiana farmers $1.9 billion annually. Adoption of natural climate solutions could cut this cost by up to half, **saving Indiana farmers $950 million.**
- Insurers pay out an estimated $570 million annually for insurance-related costs of flooding and drought in Indiana. Indemnity insurance payments could be lowered by $311 to $357 million annually if soils could better hold water and allow for less surface runoff.

Environmental

- Indiana accounts for 5% of all agricultural greenhouse gas emissions nationwide. Increased adoption of natural climate solutions within agriculture can help sequester a portion of the state's 18.4 million metric tons of CO2 emissions. Aggressive measures could **sequester up to 2 million metric tons of CO2 annually.**
- The use of additional **cover crops and crop rotation could save $413 to $541 million annually from costs associated with erosion and land degradation.**

Health and Social

- Agriculture in Indiana releases 18.4 million metric tons of CO2 at an estimated social cost of GHG emissions of $664 million[26].

Analysis & Modeling

Analysis took into consideration the three primary agricultural practices that promote natural climate solutions: conservation tillage, crop rotation, and cover crops.

Conservation Tillage

According to Purdue Extension, conventional tillage "leaves the soil surface bare and loosens soil particles, making them susceptible to the erosive forces of wind and water," whereas conservation tillage "reduces erosion by protecting the soil surface and allowing water to infiltrate instead of running off[27]."

Crop rotation

Crop rotation is the practice of planting different crops sequentially on the same plot of land across seasons. Crop rotation can improve soil health and optimize nutrients in the soil.

Cover crops

Grasses and legumes are planted as cover crops to improve soil structure, moisture, and nutrient content. According to the USDA Natural Resources Conservation Service, "cover crops can provide energy savings both by adding nitrogen to the soil and making more soil nutrients available, thereby reducing the need to apply fertilizer.[28]"

The Operational Tillage Information System (OpTIS), a partnership between Conservation Technology Information Center (CTIC) and The Nature Conservancy, tracks crop rotation, conservation tillage, and cover crop adoption by using remote sensing data[29].

Scenarios

Modeling examined two scenarios. Across both scenarios, the most recent data were used as a starting point: among row crops, cover crop has 9.9% adoption; conservation tillage has 85.1%; and crop rotation, 96%.

By adopting practices like planting winter cover crops and reducing—or eliminating—tillage practices, farmers can significantly improve productivity of their fields, reduce soil erosion, improve water quality and increase carbon storage. In fact, agricultural soils are among the planet's largest reservoirs, or sinks, of carbon. The Operational Tillage Information System (OpTIS) can help increase and accelerate the rate of adoption of soil health practices across US farmlands. OpTIS uses satellites to map and monitor cover crop development and detect plant residue left on cropland to determine the tillage activities.

Scenario 1

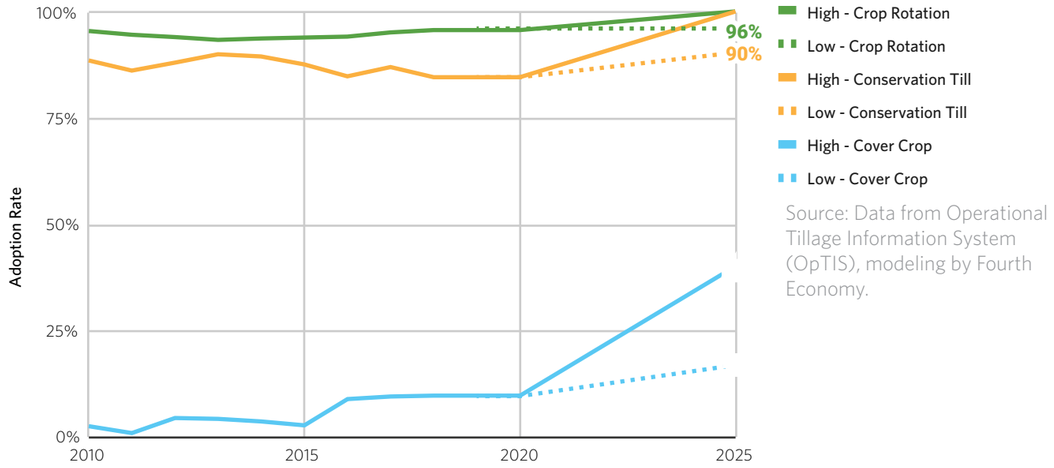
Represents a high scenario with aggressive adoption targets set at 40% for cover crop, conservation tillage, and 100% for crop rotation. Indiana has 11.9 million acres of row crops. To achieve this scenario, Indiana would need an additional 3.5 million acres of cover crop, 1.7 million additional acres of conservation tillage, and 476,000 additional acres of crop rotation.

Scenario 2

Represents a low scenario that takes into account historical data and trends. In this scenario, each agricultural practice inherited either a forecasted trend value or peak historical value, whichever was greater. To achieve this scenario, Indiana would need an additional 1.2 million additional acres of cover crop, 378 million additional acres of conservation tillage, and 97,000 additional acres of crop rotation.

The main difference between the two scenarios is the adoption rate of cover crops.

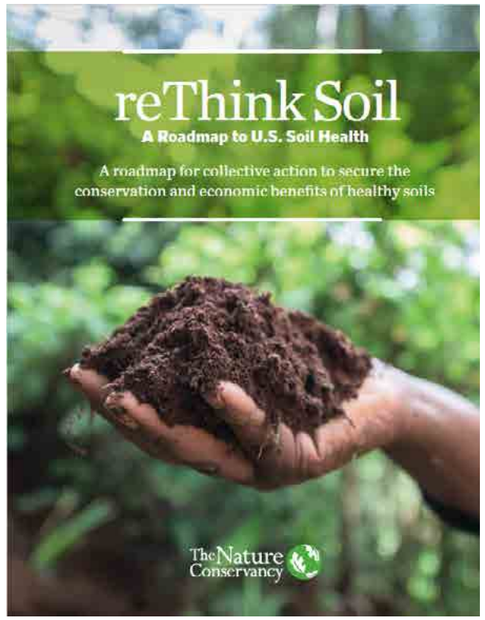
NATURAL CLIMATE SOLUTIONS SCENARIOS



Source: Data from Operational Tillage Information System (OpTIS), modeling by Fourth Economy.

Valuing the Social Cost of Carbon

There are various estimates for the social cost of carbon. Social costs include productivity losses, social services, and indirect losses. Social costs are not paid directly by individuals, businesses, or governments; they are hidden costs that are spread across all residents, but in most cases those who generated the cost are not those who bear it. The Environmental Defense Fund estimates the social cost of carbon at more than $50 per ton, which some experts claim is too low. The EPA estimated a social cost of carbon at $36 per ton at a 3% discount rate for 2015, rising to $55 per ton by 2035. We held the social cost of carbon at the more conservative $36 per ton for these estimates. This falls in the middle range of carbon cost estimates that are provided in various legislative proposals.



The reThink Soil report, developed by an interdisciplinary team of The Nature Conservancy scientists, economists and agriculture experts, makes the case for investing in sustainable soil health practices that can increase agricultural yields, generate more profit for farmers, and reduce negative environmental impacts. In fact, we estimate that adopting soil health practices on all U.S. corn, soy and wheat croplands could deliver nearly $50 billion in social and environmental impacts annually.

Results & Discussion

Greenhouse Gas Emissions and Social Cost of Carbon

The EPA estimated the social cost of CO2 with a comprehensive accounting of related costs, including net agricultural productivity, human health, property damages from increased flood risk, and changes in energy system costs. In the U.S., agriculture is responsible for 345.8M metric tons of CO2 emissions annually at a social cost of $12.4 billion[30]. Based on share of farm land acreage, Indiana accounts for 5.33% of U.S. agricultural emissions, representing 18.4 million metric tons of CO2 emissions annually at a social cost of $664 million.

Carbon Market and Revenue Stream for Farmers

The Growing Climate Solutions Act, introduced by a bipartisan group including U.S. Senator Mike Braun, R-IN, "will break down barriers for farmers and foresters interested in participating in carbon markets so they can be rewarded for climate-smart practices[31]." A voluntary, market-based carbon-credit system could create a new revenue stream that pays farmers for adopting climate-friendly practices. At sequestration rates laid out in research by The Nature Conservancy[32], and with a price of $36 per ton of CO2, Indiana farmers are poised to earn $333 to $388 million through carbon credits.

Watershed Preservation/ Improvement

According to the National Flood Insurance Program, "Flooding is one of the most common natural disasters that occur in the United States, and Indiana experienced 230 flooding or heavy rain events in 2019 alone[33]." Indiana is especially susceptible to flooding, with 24% of the state historically covered by wetlands. As described by the Indiana Geological & Water Survey, "Conditions such as excessive rain, rapid snowmelt, and frozen ground prevent the upper soil surfaces from allowing water to percolate downward as groundwater and increase surface runoff, causing flooding[34]."

A single flood in June 2008 affected more than 25,000 people, isolated the city of Columbus for nearly a full day, and inundated 9% of Indiana's farmland. Damages from this flood were estimated to be more than $1 billion[35]. A more recent flood in March of 2020 claimed eight lives, with at least six in Indiana[36]. With an estimated 16% increase in spring rainfall predicted by Purdue to occur within the next 30 years, flooding will continue to be a persistent problem for Hoosiers[37].

Indiana's Climate Future

Renewable energy and natural climate solutions represent an opportunity for Indiana.

In the next 15 years, investments made in these areas can have triple-bottom line benefits for Hoosiers with economic, social, and environmental gains. In addition to these benefits, renewable energy and natural climate solutions adoption are widely supported by Hoosiers.

Hoosiers overwhelmingly support a transition to a clean energy future, and 81% of Hoosier voters think Indiana can take steps to protect the environment without harming the economy. Analysis indicates that they are right. Renewable energy installation will add jobs across the energy sector and result in an estimated $51.5 to $110.7 million annually in local tax revenue by 2035. Transition to renewable energy will also result in social benefits. Today, 1 in 5 Indiana residents lives within 10 miles of a coal-fired power plant which have been linked to adverse health impacts. Planned closures of coal-fired power plants will provide health benefits to 127,000 of Indiana's most at-risk residents, including to 19,000 infants, 54,000 school-age children, and 54,000 seniors.

Farming practices such as cover crops, conservation tillage, and crop rotation can reduce carbon emissions, protect against nutrient loss and erosion, and improve water quality. There is an immense opportunity to use these practices in Indiana, as nearly two-thirds of Indiana's 23 million acres are farmland and Indiana is home to more than 56,000 farms. Adoption of natural climate solutions could sequester up to 2 million metric tons of CO_2 annually. In addition to these benefits, adopting natural climate solutions could carry large economic benefits for Indiana farmers. A voluntary, market-based carbon-credit system could create a new revenue stream that pays farmers for adopting climate-friendly practices. Helping Indiana farmers adopt natural climate solutions is widely supported as 86% of Hoosier voters support providing incentives to farmers to adopt agricultural practices that capture carbon in the soil, prevent soil erosion, and improve water quality.

These findings illustrate why clean energy and natural climate solutions matter to the future of Indiana's economy. Continued investments in renewable energy and natural climate solutions are supported and will have far reaching benefits for Hoosiers.

Endnotes

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