SEEDS OF OPPORTUNITY

How Rural America Is Reaping Economic Development Benefits from the Growth of Renewables

BY KATIE SIEGNER, KEVIN BREHM, MARK DYSON

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ABOUT US

ABOUT ROCKY MOUNTAIN INSTITUTE

Rocky Mountain Institute (RMI)—an independent nonprofit founded in 1982—transforms global energy use to create a clean, prosperous, and secure low-carbon future. It engages businesses, communities, institutions, and entrepreneurs to accelerate the adoption of market-based solutions that cost-effectively shift from fossil fuels to efficiency and renewables. RMI has offices in Basalt and Boulder, Colorado; New York City; Oakland, California; Washington, D.C.; and Beijing.

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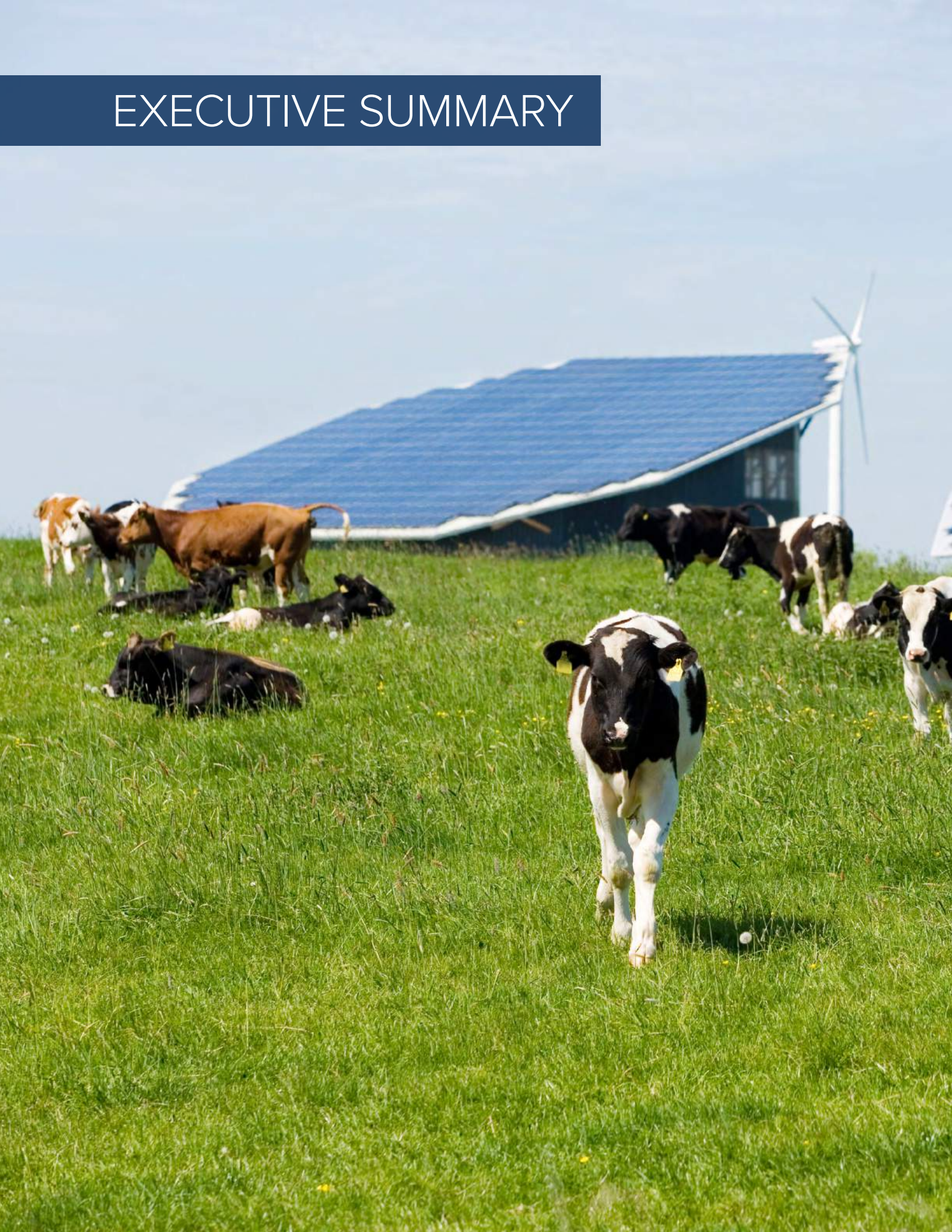


EXECUTIVE SUMMARY

WIND AND SOLAR ARE THE NEW CASH CROPS

Despite a turbulent start to the 2020s, an important and positive message for rural America is emerging in the decade ahead: rural communities have a significant opportunity to strengthen and diversify their local economies by embracing and actively engaging in the ongoing renewable energy transition.

By 2030, renewable energy capacity in the United States will at least double, and potentially grow by a factor of seven or higher if new policies are enacted to capitalize on continuing cost declines in wind and solar. [1] This study uses forecasts of wind and solar growth from a report released in 2020 by UC-Berkeley and GridLab that assessed the potential for the US grid to be reliably powered by 90% carbon-free energy in 2035.[2] The *2035 Report* 90% clean scenario projects an average of 29 GW of utility-scale solar and 32 GW of onshore wind installed annually through 2035.[3]

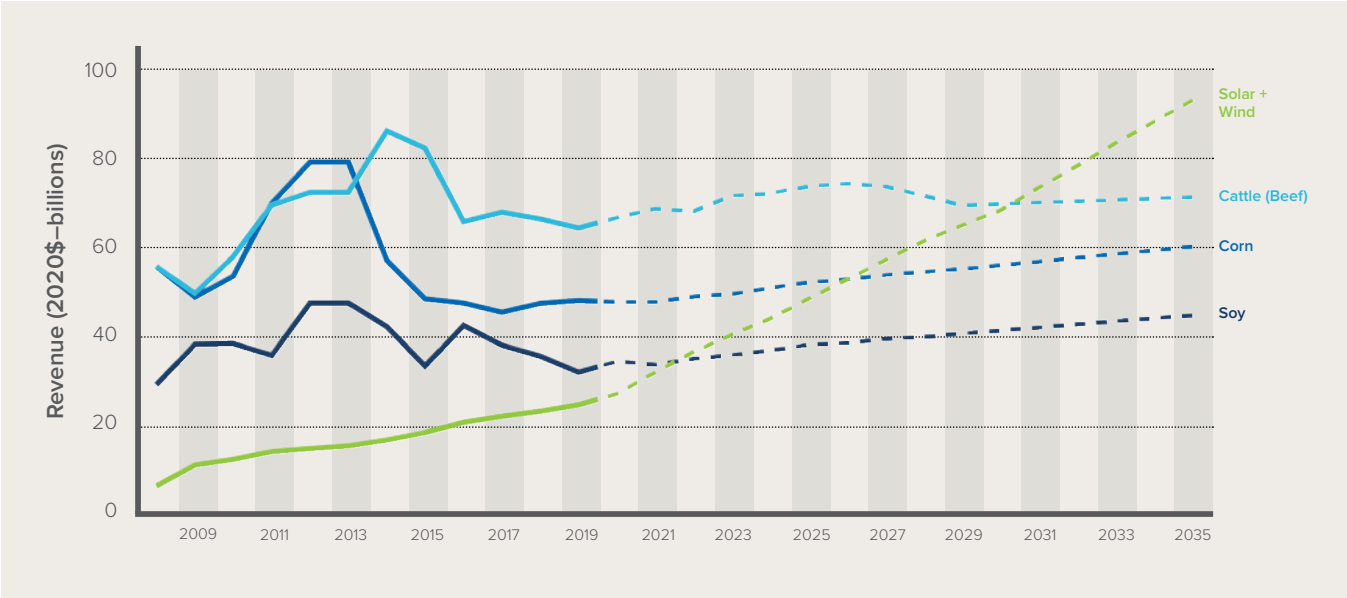
Even as this dramatic growth reshapes the US electric grid, the rise of wind and solar is delivering significant opportunities for the communities that are home to these projects. For 99% of onshore wind capacity in the United States as well as a growing share of utility-scale solar capacity, those communities are predominantly in rural counties.[4]

Rural communities stand to receive a sizeable boost to their local economy as the scale of wind and solar investment increases. Annual revenues from wind and solar projects could exceed $60 billion dollars by 2030[5] —a sizable complement to expected revenues from the top three US agricultural commodities (corn—$58 billion, soy—$44 billion, and beef production—$70 billion).[6]

However, whereas wind and solar growth forecasts look robust, a 2019 USDA report found US corn and soybean production could decline as much as 80% over the next 60 years due to increased heat and drought fueled by climate change.[7] At their core, wind and solar power are rural commodities that can be harvested and sold like any other crop. And importantly, for forward-thinking rural communities, they are climate solutions rather than potential future climate casualties.

EXHIBIT ES1

Onshore Wind and Utility-Scale Solar Revenue Compared with the Top Three Agricultural Commodities Revenues



THE ECONOMIC DEVELOPMENT OPPORTUNITY OF A GENERATION

The rural economic development generated by onshore wind and utility-scale solar projects flows from project owners' direct payments to local governments, businesses, and individuals. These payments are primarily tax revenues, land lease payments, and employee wages. The direct impacts are significant in and of themselves, but they also generate indirect and induced impacts that create a profound economic ripple effect in local communities.[8]

By 2030, in a US grid on track to be 90% carbon-free by 2035, the ~750 GW of installed onshore wind and utility-scale solar capacity could deliver nearly $11 billion per year in direct benefits to the rural communities where these projects are located. Over their project lifetimes, the ~600 GW of new systems installed between 2020 and 2030 would generate $220 billion in benefits across rural America. These direct impacts break down into four primary categories:

- **Tax payments:** Annual local taxes from wind and solar projects could total $2.7 billion in 2030, allowing town and county governments to invest more in public services and school districts.

- **Land lease payments:** Annual payments to rural landowners leasing portions of their property for wind and solar projects could total $2.2 billion in 2030.

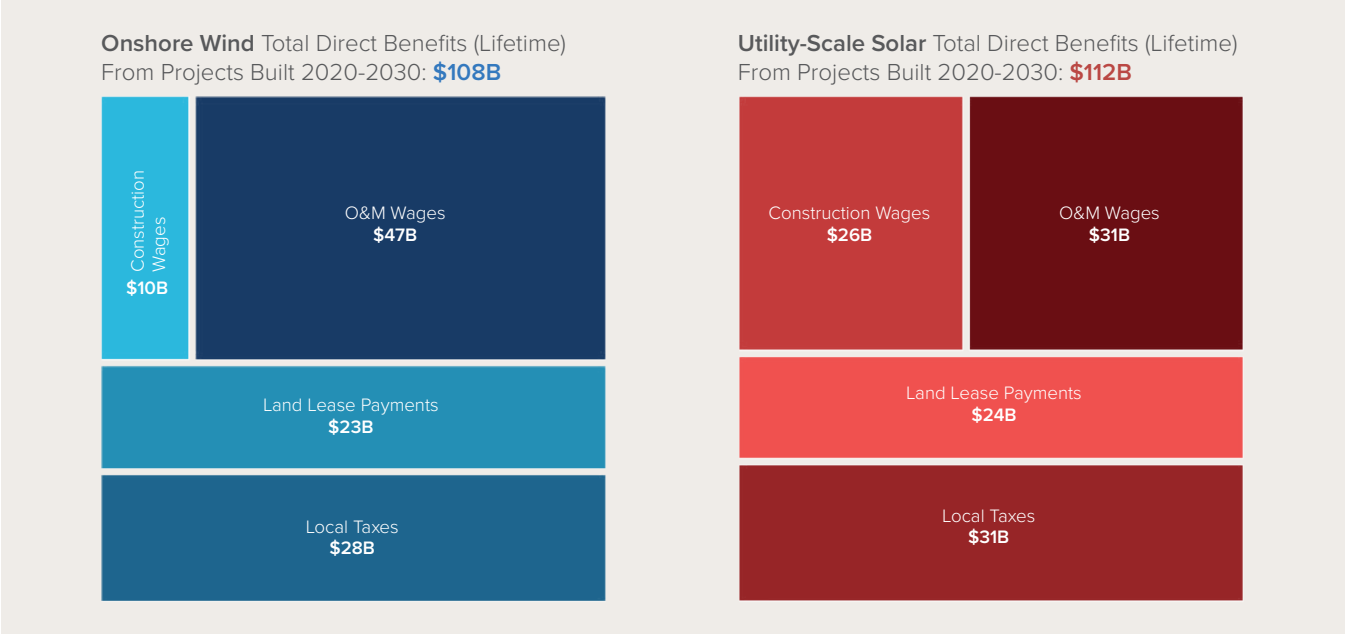
- **Construction wages:** The 54 GW of wind and solar projects slated to come online in 2030 will employ roughly 40,000 workers (FTE)[i] during the construction phase, delivering $2.3 billion in annual wages.

- **Operations and maintenance wages:** An operations and maintenance (O&M) workforce of 38,000 will be needed to support new and existing wind and solar capacity in 2030, delivering $3.7 billion in annual wages.

[i] FTE = full-time equivalent, or one person working full-time for a year (also called a "job-year").

EXHIBIT ES2

Direct Rural Economic Development Impacts from Wind and Solar Projects Built between 2020 and 2030, Lifetime Values



Along with the direct impacts described above, renewables deployment offers additional indirect and induced economic development potential that rural communities can capture:

- **Indirect economic impacts** stem from the inputs purchased for a project; in this case, the wind turbines, solar panels, and associated materials that make up wind and solar generation facilities. Thus, indirect impacts are closely connected to **wind and solar manufacturing.** The magnitude of the impact depends on the share of inputs that are locally sourced. Capturing a share of the wind or solar supply chain locally can greatly enhance the economic development implications—particularly the jobs calculus—of renewables in rural areas. To date, over 500 facilities across the US manufacture renewable energy components,[9] and that number is likely to grow along with wind and solar installed capacity over the next decade.
- **Induced economic impacts** accrue as the local revenues and wages associated with project development circulate in the local economy. The hundreds of workers that come to town during the wind and solar project construction phase typically boost business for local bars and restaurants, hardware stores, and hospitality businesses. During the project operations phase, the induced impact results from O&M employee spending and landowners with additional lease revenues investing more in their property.

To truly grasp the significance of the opportunity, it is important to consider not only the narrow scope of economic development, but also the broader, place-based community development that these projects can support. The three case studies that follow illustrate how wind and solar projects, as well as wind manufacturing, are contributing positively to the local economies where they are sited.

CASE STUDY: WIND FARMS ARE FLOURISHING ON COLORADO'S EASTERN PLAINS

Wind energy development is generating significant local revenues and employment for the towns and counties of Colorado's Eastern Plains. With strong wind speeds and expanding transmission access to Denver and other Front Range cities, the Eastern Plains are home to all 4,500 MW (4.5 GW) of installed wind capacity in Colorado, and more projects are on the way. This development activity has enabled a sizable boost to county tax revenues, additional income streams for rural ranchers and landowners, and a modest but meaningful number of well-paying job opportunities for local residents.

Primary economic development impacts of Eastern Colorado wind generation

- Stable and significant contributions to **local tax revenues,** which have allowed communities to increase spending on schools, infrastructure, and other social services: More than 40% of Lincoln County's tax revenues now come from the wind industry,[10] and the 600 MW Rush Creek project is expected to generate $62.5 million in local tax revenue over its 25-year lifetime.[11]

- **Land lease payments** to rural landowners, which provide dependable revenues that complement farmers' unpredictable income streams and generate economic ripple effects in the community: Elbert County landowners hosting 30 Rush Creek project turbines on their 10,000 acre ranch will receive an estimated $270,000 per year in land lease payments.[12]

- An influx of **dollars spent on the local service economy** during the project construction period: This prompted some local businesses, such as the Limon RV park, to expand in order to meet the increased demand for short-term housing.

> **"When you bring a new industry out here, that should make life better for the residents of Lincoln County. What I like about renewables is they're not subject to the feast and famine cycles of the oil and gas industry."**
>
> **– Troy McCue, Lincoln County Economic Development Corporation Director**

- The creation of **well-paying, permanent O&M jobs** for rural residents: These jobs, bolstered by the presence of the Northeastern Junior College wind technician program in nearby Sterling, have allowed eastern Colorado residents the opportunity to train for and secure jobs close to home. The wind industry currently employs 45–50 people in Lincoln County,[13] which had a population of 5,610 in 2018.

Factors that enabled successful development outcomes

- **Proactive planning on the part of local leaders:** For example, during the Rush Creek project development, the Limon Workforce Center compiled a list of construction subcontractors in the 10-county region to maximize local hiring in the construction phase.

- **Facilitating dialogue between the developer and community members:** The Lincoln County Economic Development Corporation has served in many communications and liaison roles during wind project development, helping to find common ground and solutions to issues like right of way negotiations and project development impacts on the local community.

- **Highlighting and maximizing the economic benefits that wind projects can generate for the community:** Ultimately, local leaders interviewed for this article stressed that wind development provided a needed boost to their local economy, and that positive impact outweighed any downsides.

CASE STUDY: SEEDS OF A SOLAR BOOM GROW IN WEST TEXAS

Solar energy development is taking off in Texas, where installed capacity is set to grow nearly eight-fold in the next several years as projects in the planning and development phase are constructed and come online. If all solar projects with signed interconnection agreements are built, solar will likely become the third-largest generation source in Texas—behind gas and wind—by 2022.[14]

The continued strong growth of renewables in the state is good news for rural counties and residents, which stand to receive an additional $3.4–$4.3 billion in lifetime tax revenues and $3.2–$5.8 billion in lifetime land lease payments from the new wind and solar projects in the development pipeline.[15] They will also receive indirect benefits from an influx of workers and earnings in the local economy during the construction phase and the stable contributions of the operations phase.

The story behind the state's largest solar project, Enel Green Power's 497 MW Roadrunner Solar, demonstrates how local communities are realizing the economic development potential of utility-scale solar projects.

Primary economic development impacts of Roadrunner Solar

- Roadrunner Solar's construction phase, with hundreds of workers earning $20 million in aggregate wages,[16] **boosted the local economy** in McCamey, Texas, at a critical time, supporting local businesses in weathering the COVID-19 pandemic and economic downturn.

Image courtesy of Enel Green Power

- The $60 million in lifetime **tax payments** and payments in lieu of taxes (PILOTs) that Enel Green Power will be providing to Upton County over the lifetime of the project will primarily support the McCamey Independent School District and McCamey County Hospital District.[17]

- Enel Green Power is committed to local hiring for as much of the employment associated with Roadrunner Solar as possible, and to establishing a strong community connection. The company is retrofitting the old post office building on McCamey's main street to serve as its long-term **O&M facility,** expected to employ six FTE workers.

- Roadrunner Solar will provide **land lease payments** over the course of its lifetime. Across Enel Green Power's approximately 1,000 MW Texas solar portfolio, the company averages $3,500/MW in annual land lease payments.[18] Similar to construction worker earnings, these payments create economic multiplier effects when spent locally on improvements to the land or property hosting the project.

"The greatest thing the Roadrunner project has done for McCamey is support its local businesses."

– Judge Dusty Kilgore, Upton County, TX

Factors that enabled successful development outcomes

- **Negotiating a mutually beneficial tax abatement agreement:** Upton County has granted a handful of tax abatements to renewable energy projects, which benefit the county by bringing in new development and revenue streams that ripple throughout the local economy. For their part, tax abatements allow developers to build financeable projects and offer competitive power prices, enabling the realization of a project in a particular location.

- **Preparing housing and local businesses to meet the construction demand spike:** The McCamey community had a hard time keeping up with housing demand during Roadrunner's construction, but ultimately developed new apartment complexes and houses that are still in use today. Local businesses, for their part, saw an uptick in revenues even despite the economic lull created by the COVID-19 pandemic.

- **Maintaining a strong long-term relationship with the project owner:** Now that the Roadrunner project is fully operational, Enel Green Power remains in regular contact with Upton County and McCamey leaders about opportunities for community investment. The company is maintaining a presence in McCamey, setting aside funding for local sustainability initiatives, and exploring educational partnership opportunities in the region.

CASE STUDY: WIND MANUFACTURING RE-ENERGIZES A CENTRAL IOWA COMPANY TOWN

Wind turbine manufacturing played a central role in the ability of Newton, Iowa, to rebound economically after its primary employer, Maytag, was acquired by Whirlpool and left the community in 2007. Within a year of Maytag's departure, two component manufacturers associated with the wind industry had established operations in Newton: blade manufacturer TPI Composites, and tower manufacturer Arcosa Towers.

Both companies have flourished since arriving in Newton in 2008, now employing 1,250 people and helping cut unemployment in Jasper County from a high of nearly 10% in 2009 to 2% today.[19] Furthermore, they have demonstrated a commitment to community investment and the potential to attract additional businesses to the area—harbingers of a stable economic future for the community.

"TPI Composites and Arcosa have been lifesavers for the community. Their jobs are the highest paying in the community right now. They're very competitive, with great benefits, and are attracting workers from many surrounding communities that now come to Newton for work."

– Frank Liebl, Newton Development Corporation Executive Director

Primary economic development impacts of central Iowa wind manufacturing

- Wind manufacturing has created substantial new **job opportunities** for area residents, which pay above the county average and are attracting workers from 68 communities across central Iowa to work in Newton. TPI Composites, for example, pays out over $50 million in annual wages to their employees.[20]

- TPI Composites is increasingly involved in **community investment** initiatives, supporting local community service days as well as civic and philanthropic institutions such as the Salvation Army.

- The presence of wind component manufacturers is helping attract **additional new businesses** to the community, most recently demonstrated by the interest of several wind turbine recycling companies that are considering opening Newton-based facilities.

Factors that enabled successful recruitment and retention of wind manufacturers

- **Local, county, and state-level collaboration on new business incentive packages:** The Newton Economic Development Corporation (EDC) worked closely with county and state-level counterparts to develop a tailored, criteria-based incentive package for TPI Composites. Arcosa also received a package similar to TPI's in the form of grants, loans, and tax breaks, as well as assistance for a rail spur and a storage yard for the towers.

- **Effective marketing of the community's strengths:** Newton highlighted its educated and experienced manufacturing workforce as well as its large available building space to bring new companies to town following Maytag's departure. TPI Composites affirmed that the high-quality workforce was a motivating factor in the company's decision to site a plant in Newton.

- **A proactive approach to recruiting new businesses:** Newton EDC and community leaders cast a wide net in searching for Maytag replacements, keeping an open mind and seeking diversification for the local economy. To date, 15 new companies have established facilities in Jasper County, both in old Maytag buildings and in new plants built to their specifications.

Image courtesy of Frank Liebl, Newton EDC

IMPLICATIONS AND RECOMMENDATIONS

Lessons learned from community and industry experience to date can help capture the immense value on the table for rural communities in the coming decade, and enable the transition to a cost-effective, low-carbon power system that benefits all Americans. We offer recommendations for local, state, and federal leaders to unlock this opportunity.

Recommendations for local leaders

- **Review land use planning and local ordinances to prepare for renewables development.** Before the first projects are developed, local leaders can:
  - Consider options for land-use policies and ordinances that are conducive to wind and solar development;
  - Engage in regional planning to proactively identify target areas for wind and solar development as well as any needed grid interconnections; and
  - Establish a dialogue with potential developers to gain an understanding of their priorities, processes, and potential value-add to the community.
- **Understand and develop tax policy for renewables.** Property tax assessment approaches may impede renewable development, prevent the community from fully capturing the tax benefits of projects, or both. Local leaders can:
  - Consider specific tax treatment for renewable energy projects, such as tax abatements or other structures;
  - Align tax policies with local priorities to ensure the new revenues can be spent where most needed and support future growth; and
  - Harmonize their tax treatment of renewables with neighboring counties and jurisdictions, to streamline the payments from project owners.
- **Support landowners and local officials.** Local leaders can support landowners and local officials in engaging with developers by providing educational resources, training, and collaboration opportunities to build local expertise on renewables.
- **Capture value from the construction boom.** Local businesses stand to gain an economic boost during project construction. Local leaders can:
  - Inform local contractors and business owners early about planned wind or solar projects so they have time to prepare for the demand and potentially connect with the developer about serving as a local vendor; and
  - Work with hotels, RV parks, and local housing authorities to ensure sufficient short-term housing for construction workers while avoiding over-building.

- **Build a local O&M workforce.** To enable their communities to capture the long-term job opportunities associated with new projects, local leaders can:
  - Establish or support training opportunities for local residents to participate in the wind and solar O&M workforce; and
  - Advocate for the use of regional and local labor on nearby projects (e.g., during negotiations with a developer).
- **Support community development.** The revenues and jobs that wind and solar development provides can help rural communities maintain their economic vibrancy and their cultural character. To maximize that potential, local leaders can:
  - Explore opportunities with the project developer to support tangible community revitalization initiatives; and
  - Encourage dual use projects that can deliver other local economic and environmental services, such as solar plus grazing and pollinator-friendly solar.

Recommendations for state and federal leaders

- **Define a state-level policy framework for renewables.** In some instances, states have established approaches to renewable energy taxation or siting that guide local treatment of projects. State leaders can:
  - Consider creating a standard tax assessment methodology and/or siting policy that applies to all local jurisdictions.
- **Prepare new workers and transition the existing rural workforce.** Rural communities have the potential to play a bigger role in building the wind and solar projects they host. To support this outcome, state and federal leaders can:
  - Support the expansion of wind and solar workforce training programs, particularly in low-income, historically disadvantaged, and fossil fuel-dependent communities; and
  - Carefully weigh the implications for rural workers of any workforce requirements imposed on wind and solar development.
- **Encourage domestic manufacturing.** Increasing the share of wind and solar components manufactured in the United States offers a promising avenue for fostering economic growth and new jobs in predominately rural regions. State and federal leaders can:
  - Incentivize long-term public and private investments in American renewable energy manufacturing through financing tools like loan guarantees or tax credits; and
  - Work with the Department of Commerce as well as local economic development professionals to foster the development of renewable energy manufacturing and supply chain hubs.
- **Support rural asset ownership opportunities and community wealth-building.** Some communities, tribes, and rural stakeholders are interested in more opportunities to generate wealth locally by owning wind and solar. To support local investment opportunities, state and federal leaders can:
  - Propose tax and incentive reforms that would make it easier for rural electric co-ops and other rural interests to own or invest in renewables projects.
- **Create long-term demand certainty for wind and solar development.** Long-term regional demand for clean energy will send a strong signal to developers, businesses, and communities to invest in the needed training and infrastructure. State and federal leaders can:
  - Create regional renewable development zones supported by sufficient transmission infrastructure; and
  - Establish durable energy policies that provide clear direction for the state or country's energy future.

Renewable energy projects are operational in many rural communities across the United States today, and the explosive growth projected for wind and solar generation will bring these projects to many more by the end of the decade. Based on the economic data and experiences yielded by the industry to date, that growth represents an investment in rural America that will total in the hundreds of billions of dollars, helping communities maintain and strengthen their economic viability for the long term. The renewables transition is already well underway, employing half a million Americans and providing new income to rural communities across the nation.[21] How communities engage with these new power generators will determine the extent to which the benefits help build and sustain a thriving rural America.

INTRODUCTION: WIND AND SOLAR ARE THE NEW CASH CROPS

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2020 has become a tipping point year in many respects. Like so many industries, the energy sector faced unprecedented upheaval as a result of the COVID-19 pandemic, as travel restrictions, work from home policies, and social distancing abruptly shifted energy demand and consumption patterns. At the same time, a surge in climate-related disasters—from hurricanes in the East and South to wildfires across the West—placed climate and energy concerns in the national spotlight more than ever before.

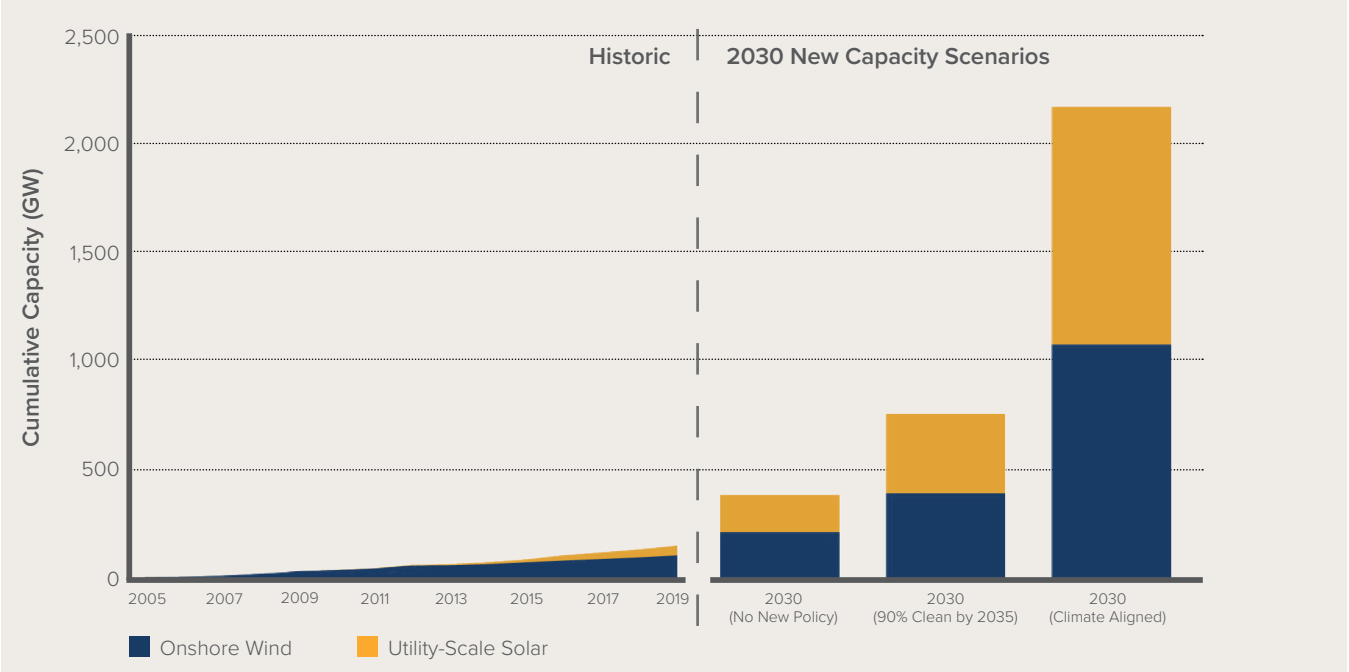
THE EXPLOSIVE GROWTH OF THE RENEWABLE ENERGY INDUSTRY

Amid this period of substantive and disruptive change, however, the long-term trend of the energy transition and the growth of renewables endures. Wind and solar projects are already up and running in many parts of the country, and in retrospect, 2020 may well be seen as an inflection point after which the United States and the world embark on a dramatic acceleration of clean energy technology deployment. Over the course of this decade, renewable energy installed capacity is expected to grow at minimum by a factor of two, and potentially by a factor of up to seven as new policies are enacted and costs continue to fall.

In this study, we highlight what the near-term growth in renewable energy means for rural America, using forecasts of future wind and solar capacity additions from a report released in 2020 by UC-Berkeley and GridLab. The *2035 Report* assessed the potential for the US grid to be reliably powered by 90% carbon-free energy in 2035,[22] and projects annual capacity additions averaging 29 GW of utility-scale solar, 32 GW of onshore wind, and 9 GW of battery storage in such a scenario.[23] Exhibit 1 illustrates the expected growth of the industry in a business-as-usual scenario, also modeled in the report, and the explosive potential if policy and market fundamentals continue to support clean energy deployment.

EXHIBIT 1

US Onshore Wind and Utility-Scale Solar: Historical Capacity and 2030 Capacity Expansion Scenarios



A Note on Scenarios

The graph above profiles three scenarios for renewable energy buildout:

i. No New Policy scenario: The business-as-usual scenario from the 2035 Report.

ii. The 90% Clean scenario: This scenario (also from the 2035 Report) models how the US power system can achieve 90% carbon-free electricity by 2035 while decreasing costs 10% compared with 2020.

iii. Climate-Aligned scenario: This scenario is based on the Rewiring America Mobilizing for a Zero Carbon America report released in July 2020. It involves both deep decarbonization of electric power supply and rapid electrification of mobility, industry, and buildings, consistent with a pathway to limiting warming to 1.5°C–2°C.

The remainder of the report is built on the central scenario—the 90% Clean case from the *2035 Report*.

A Note on Use of the *2035 Report*

This study does not go into depth on the modeling assumptions or technical, regulatory, and financial changes that might need to occur in the context of realizing the projected new capacity additions outlined in the 2035 Report. Below, we summarize relevant elements of that study's approach:

- **Cost projections** were based on NREL's Annual Technology Baseline (ATB) and included sensitivity analysis around low-, mid-, and high-cost projections.
- **Projected wind and solar capacities** and associated transmission buildout were calculated using NREL's Regional Energy Deployment System (ReEDS) capacity-expansion model.
- **System reliability** was assessed using Energy Exemplar's PLEXOS model to ensure the operational viability of a 90% clean grid.

Even without new policy, the shift to renewables is being driven fundamentally by innovation and the growing scale of the renewables industry. Wind and solar, even without federal tax subsidies, are now the cheapest form of new generation in the United States,[24] and are beginning to undercut just the operating costs of many existing fossil fuel power plants.[25] Given the remarkable and ongoing drop in clean energy technology costs, the *2035 Report* found that a shift to a 90% carbon-free grid could lower wholesale electricity costs by 10% from today's levels, while maintaining grid reliability.

A NEW RURAL COMMODITY TO HARVEST

The rise of wind and solar as major energy generation sources has important implications for the communities located near these projects. Almost all onshore wind capacity in the United States (99%)—and a growing share of utility-scale solar capacity—is located in rural areas.[26] Thus, rural communities stand to receive a sizeable boost to their local economies as the scale of wind and solar investment increases.

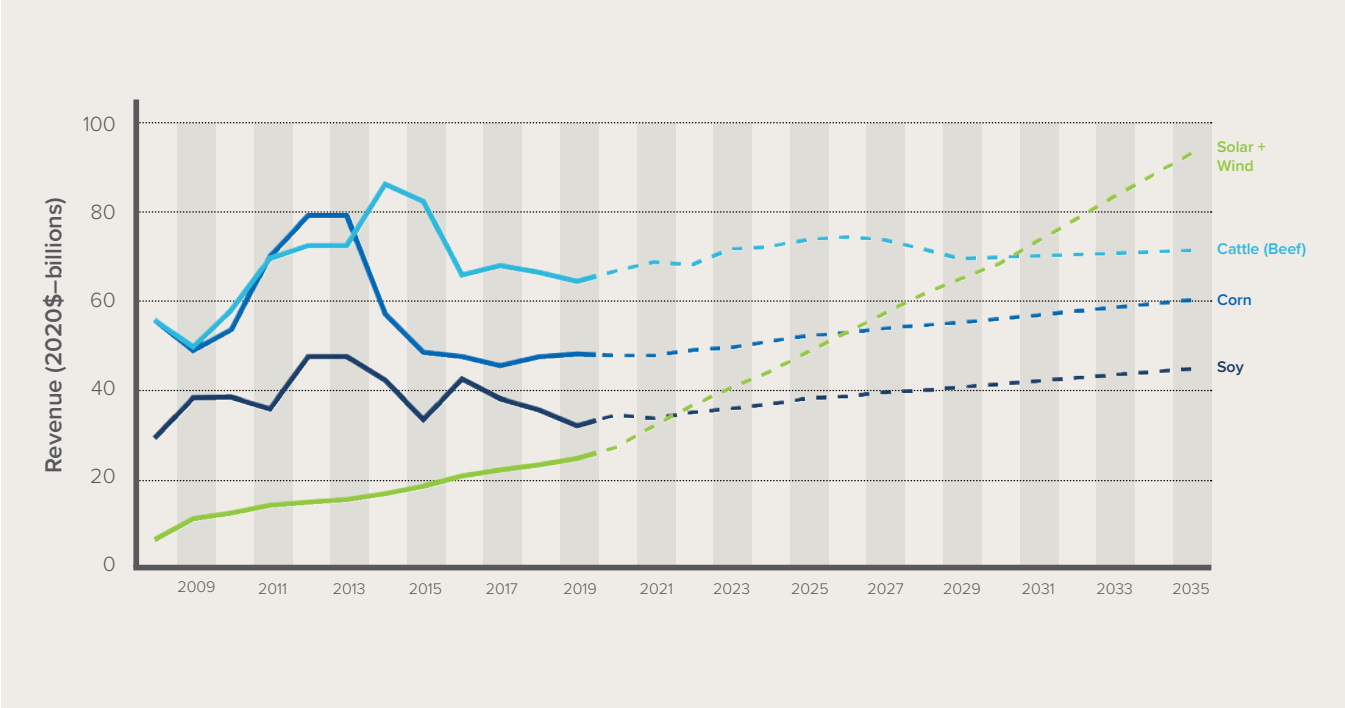
If all of the wind and solar in the *2035 Report* 90% Clean Scenario is built, annual revenues from wind and solar projects could exceed $60 billion dollars per year by 2030.[ii] For comparison, revenues from US corn and soy harvests are projected to total $58 billion and $44 billion, respectively, in 2030.[27] Revenue from US beef production is projected to be $70 billion in 2030.[iii] As these numbers indicate, renewable energy represents a significant new rural commodity to harvest, with a total economic output on par with other major rural industries.

While both agriculture and renewable energy development represent large opportunities for economic activity in rural America, there are key differences between these activities that can enable them to complement each other:

- Agriculture and renewables development benefit rural economies in different ways. Agriculture provides more long-term jobs in rural communities, while renewable energy will contribute significantly to local taxes and landowner revenues.

EXHIBIT 2

Onshore Wind and Utility-Scale Solar Revenue Compared with the Top Three Agricultural Commodities Revenues



Sources: 2035 Report, NREL ATB, LBL Utility-Scale Solar Report; LBL Utility-Scale Wind Report; USDA Economic Research Service; USDA Agricultural Projections; see Appendix A for additional details on methodology.

[ii] Throughout the report, all dollar figures are listed in real 2020 dollars.

[iii] According to the USDA, beef cattle represent the largest US agricultural commodity. Most beef production involves a two-step supply chain starting with grazing at cow-calf operations (i.e., ranching) and ending at feedlots, **https://www.ers.usda.gov/topics/animal-products/cattle-beef/sector-at-a-glance/.**

- For landowners, agriculture and renewable energy have very different risk profiles. Wind and solar land leases generally provide a low- or no-risk revenue stream, since they are secured through long-term contracts. On the other hand, agricultural commodities are subject to weather-related yield and price volatility, likely exacerbated by ongoing climate change.[iv]

- Wind and solar projects do not necessarily preclude other land uses including continued farming or ranching. Wind turbines have small land use footprints, making it common for farming and ranching to continue throughout a wind project site. Solar installations have a larger footprint,[v] but land use needs remain modest compared to other rural land uses, and a growing number of solar projects are pioneering dual use opportunities that can deliver important economic and environmental services locally.

  For example, solar-plus-grazing projects are putting sheep to work as lawnmowers and creating win-win opportunities for developers and farmers; pollinator-friendly solar projects are supporting native plants and pollinators that provide valuable ecosystem services; and agrivoltaics projects are experimenting with growing crops around panels on a solar site.[28] Additionally, utility-scale solar projects can be developed on uncultivated or marginal land, alleviating concerns about land trade-offs.

[iv] A 2019 USDA report found that US corn and soybean production could decline by as much as 80% over the next 60 years due to increased heat and drought fueled by climate change, **https://www.ers.usda.gov/webdocs/publications/93547/err266_summary.pdf?v=9932.1.**

[v] The roughly 450 GW of utility-scale solar projected to be developed by 2030 would require around 3 million acres of land. While sizable, that footprint is just a small fraction of US land, and far less than the 36 million acres dedicated to corn grown for ethanol production.

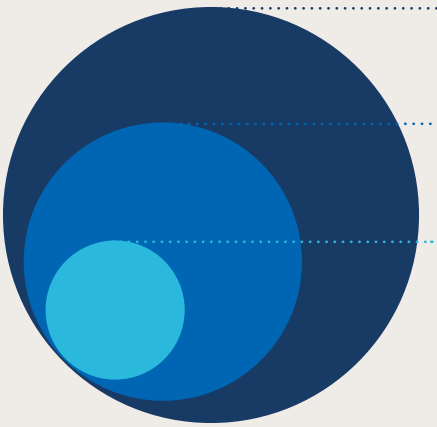
THE ECONOMIC DEVELOPMENT OPPORTUNITY OF A GENERATION

The rural economic development generated by utility-scale wind and solar energy projects flows from project owners' direct payments to local governments, businesses, and individuals.[vi] These payments are primarily tax revenues, land lease payments, and employee wages. The direct impacts are significant in and of themselves, but they also generate indirect and induced impacts that create a profound economic ripple effect in the host community. Economists can model and quantify those ripple effects, known as multipliers, by understanding local or regional economic relationships and using input-output models to estimate the effect of a new project on the broader economy,[29] demonstrated conceptually in Exhibit 3.

This study quantifies the scale of the economic development opportunity from the growth of onshore wind and utility-scale solar projects in rural areas. Existing projects are already benefitting local economies across the country, and the large development pipeline is an auspicious sign of the economic development to come. The economic implications of the clean energy transition writ large are even more significant.[vii] In total, our analysis suggests that the approximately 600 GW of new wind and solar projects projected to be built between 2020 and 2030 would generate $220 billion in lifetime value across rural America.[viii]

EXHIBIT 3

Schematic of New Projects' Economic Development Impacts—Direct, Indirect, and Induced



Direct

$ and jobs tied to project:

- Tax revenues
- Land lease payments
- On-site construction jobs
- O&M jobs

Indirect

$ and jobs from project supply chain:

- Revenues to local construction vendors
- Economic output of component manufacturers
- Manufacturing jobs

Induced

$ and jobs from project's economic ripple effect:

- Revenues to local stores from construction worker spending
- Extra hand hired by landowner receiving lease payments
- Employees hired by local businesses to meet increased demand

[vi] For the remainder of this report, given the rural focus of the analysis, "wind and solar" projects refer specifically to onshore wind and utility-scale solar, which comprise the majority of the projected capacity additions and will to a large degree be sited in rural areas. Offshore wind and distributed-scale solar are excluded from analysis.

[vii] The energy transition will provide additional economic development opportunities for the United States, in both rural and urban areas. Transmission and battery storage (mostly as part of hybrid renewables plus storage projects) will support more jobs and rural investment. Distributed energy resources (e.g., rooftop solar) and energy efficiency will require a significant workforce and decrease household energy spending. Electrification of buildings and mobility will further expand the market. Though important, these impacts are out of scope for this report.

[viii] Based on an expected 30-year lifespan, the average project life derived from LBNL wind and solar benchmarking.

METHOD AND ANALYSIS

METHOD AND ANALYSIS

To quantify the economic development potential that wind and solar represent for rural America, the analysis approach in this study builds on both real-world data from the renewables sector and forecasts of future project development. Beginning with a literature review, heavily informed by the National Renewable Energy Laboratory's (NREL's) Jobs and Economic Development (JEDI) modeling suite, we determine current $/MW or FTE/MW values for the direct economic impacts associated with wind and solar projects.[ix] Those impacts are split into two primary timeframes: the construction phase (typically 12–18 months), and the operations phase (average project lifetimes are 25–30 years).

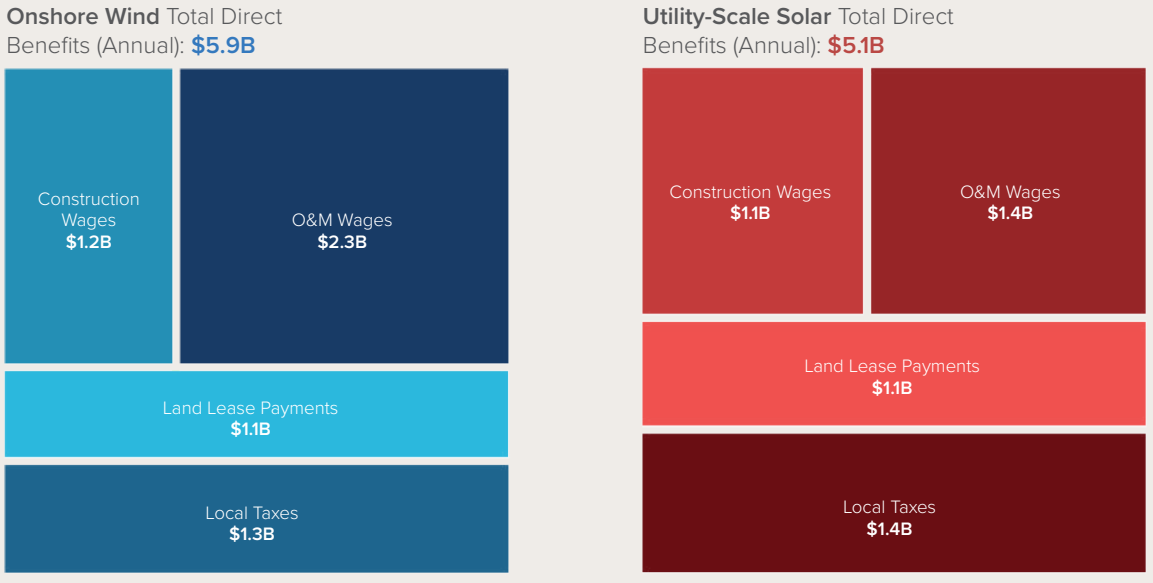
We then use the *2035 Report* to estimate capacity additions by technology and year. As wind and solar construction and operations costs are expected to continue to decline, we use data from NREL's ATB model to estimate $/MW and FTE/MW declines throughout the study period. The result is national estimates for direct economic development impacts from the wind and solar projected to be built this decade.[X]

THE DIRECT ECONOMIC BENEFITS OF THE COMING DECADE'S WIND AND SOLAR DEVELOPMENT

In 2030, the projected ~750 GW of installed onshore wind and utility-scale solar capacity could deliver nearly $11 billion per year to rural communities.[xi] This annual value is derived from four primary categories, illustrated in Exhibit 4 and described below:

EXHIBIT 4

Direct Rural Economic Development Impacts from Wind and Solar Projects in 2030, Annual Values



[ix] FTE refers to a "full-time equivalent" position, or one person working full-time for a year (also called a job-year).

[x] See Appendix A for additional details on the methodology behind this approach.

[xi] 2030 value (not discounted), represented in 2020 dollars.

- **Tax payments: Annual local taxes from wind and solar projects could total $2.7 billion in 2030, allowing town and county governments to invest more in public services and school districts.**

  The scale and nature of tax payments can vary widely among states and counties across the country, depending on the assessment of renewable energy projects. In some places, wind and solar projects are eligible for tax abatements, and commonly negotiate a "payments in lieu of taxes" (PILOT) with the host community, while in other areas projects are taxed at pre-determined rates. In many cases, however, taxing entities make accommodations for renewable energy projects to allow the tax schedule to fit with wind and solar project finance realities.

  Since agricultural or undeveloped land is generally taxed at very low rates, the tax benefit of wind and solar is almost entirely additive. Communities often use these additional proceeds to pay for upgraded public services such as improvements to police and fire stations, and to provide increased funding for school districts. Whatever form they take, the tax payments from renewables projects represent community-wide benefits.

- **Land lease payments: Annual payments to rural landowners leasing their land for wind and solar projects could total $2.2 billion in 2030.**
  Land lease payments are privately negotiated, but pricing is based on several common factors. Solar lease payments, for example, are closely linked to land values and generally calculated on a $/acre basis. Utility-scale solar projects typically require approximately seven acres per megawatt of project capacity and the land lease payments are higher than prevailing land rents due to the greater expected returns. Wind land lease payments are also partially dependent on land values but can also be based on turbine output and are more commonly referenced on a $/MW or $/turbine basis.

  Solar and wind land leases provide a stabilizing hedge for rural landowners facing uncertain agricultural commodity prices, as those payments flow annually throughout the project lifetime of 25–30 years. Landowners with wind turbines on their property have been found to invest twice as much in their farm as their neighbors without turbines.[30]

- **Construction wages: The 54 GW of wind and solar projects slated to come online in 2030 will employ roughly 40,000 workers during the construction phase, delivering $2.3 billion in annual wages.**
  Construction of a utility-scale wind or solar project can last between several months to several years, depending on the size of the project. During that time, the project will employ a variety of workers completing tasks ranging from road construction and land-grading to installation and electrical work. The total workers will vary by project throughout the construction cycle, but on average approximately 70 FTE are needed to build a 100 MW wind project and 178 FTE are needed to build a 100 MW solar project. Salaries average $64,000 for wind construction and $50,000 for solar projects.

  Some workers are likely to be local, particularly individuals and firms doing land and site work (e.g., landscaping, grading, fencing) as well as employees of local vendors contracted for the project. However, workers often come from outside the host community as well, since the required volume or specialization of labor might not be locally available. The construction phase generates a large induced impact locally, as workers spend their wages in local businesses.

- **Operations and maintenance (O&M) wages: An O&M workforce of 38,000 will be needed to support new and existing wind and solar capacity in 2030, delivering $3.7 billion in annual wages.**
  Wind projects require on average one full-time worker for every seven turbines, or roughly 10 per 100 MW,[31] and positions include a mix of plant management,

oversight, and IT responsibilities as well as technician roles that involve monitoring, standard and periodic maintenance, and facility administration. Solar projects have fewer maintenance needs, averaging around 4 FTE per 100 MW, and O&M roles include periodic electrical work as well as facility landscaping to minimize panel shading.

Though fewer workers are needed for long-term O&M than for the construction phase, O&M jobs endure for the life of the project, making their economic impact more significant in the long term. Wind and solar O&M workers commonly live in the region or state where projects are based, and when they live nearby, their stable, well-paying jobs contribute to local communities' economic vitality.

Over the course of wind and solar project lifetimes, the impact becomes even more significant and sustainable. A core component of renewables' economic development impact stems from the stability of the revenues they provide to rural communities. Local governments and rural landowners can count on the tax payments and land lease payments every year the project is operational, which can be a boon for counties or landowners that have been historically reliant on rural industries with more variable revenue streams, such as oil and gas extraction or farming.

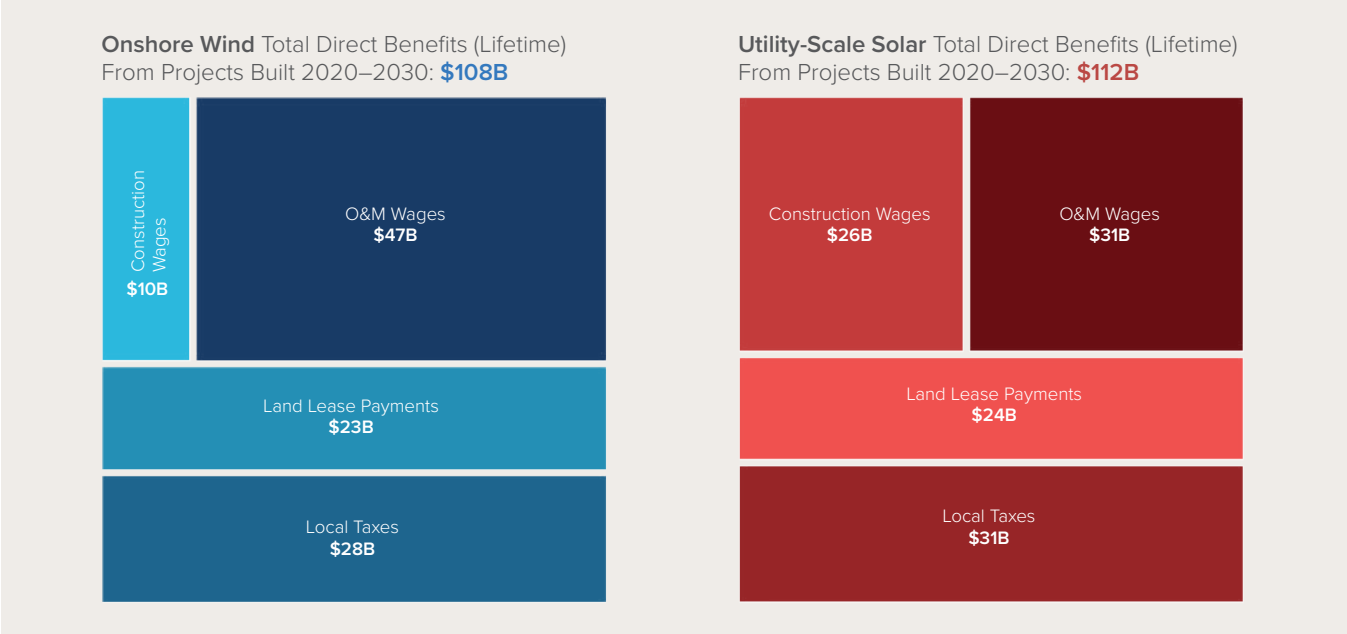
Additionally, while the number of O&M jobs is modest compared to short-term construction jobs, the permanent nature of the positions adds up to a sizable amount of O&M wages in the 25–30 year project lifespan—which, as Exhibit 5 demonstrates, exceeds construction wages in the long run.

In total, our analysis suggests that the approximately 600 GW of new wind and solar projects projected to be built between 2020 and 2030 would generate $220 billion in lifetime value across rural America.[xii]

[xii] Based on an expected 30-year lifespan, the average project life derived from LBNL wind and solar benchmarking studies.

EXHIBIT 5

Direct Rural Economic Development Impacts from Wind and Solar Projects Built Between 2020 and 2030, Lifetime Values



ACCOUNTING FOR THE ECONOMIC RIPPLE EFFECT OF RENEWABLES PROJECTS

Along with the direct impacts described and quantified above, renewables deployment offers additional indirect and induced economic development potential that rural communities can capture.

Wind and solar component manufacturing: The economic benefits of renewable energy manufacturing are **indirect**, or supply chain, **economic impacts** and their magnitude depends on the share of inputs that are locally sourced. Over 500 facilities in the United States manufacture wind and solar components,[32] and facility locations—particularly on the wind side, which comprises the majority of renewables manufacturing—are partially driven by local project development potential.[xiii]

Capturing a share of the wind or solar supply chain locally can greatly enhance the jobs and economic output of renewables in rural areas: for instance, the presence of in-state manufacturing was found to increase the economic development potential of Iowa's wind industry by 24%–70%, depending on the share of domestic manufacturing.[33] Renewable energy advocates are pushing for enhanced domestic manufacturing capability, which could result in even greater indirect impacts from the coming wind and solar buildout.[34]

[xiii] The high transportation costs for turbine components can sometimes offset the benefits of cheaper labor in other countries, creating a case for local manufacturing in places with a large project development pipeline (Ted James and Alan Goodrich, Supply Chain and Blade Manufacturing Considerations in the Global Wind Industry, NREL, 2013).

Increased spending in the community: The local revenues and wages paid out by wind and solar projects create **induced economic impacts** as the dollars circulate in the local economy. The hundreds of workers that come to town during the project construction phase, for example, typically boost business for local bars and restaurants, hardware stores, and hospitality businesses. During the project operations phase, the induced impact results from O&M employee spending and landowners with additional lease revenues investing more in their property.

Rural wealth-building opportunities: While not the norm today, there is potential for greater local investment and project ownership that could drive more wealth generation to rural communities. Given the existing tax credit and project finance structures, most wind and solar investors are companies or investment firms with large tax appetites. Similarly, due to the capital-intensive nature of development, most renewable energy project owners are developers, utilities, or investor groups with a national or even international scope.

However, some wind and solar projects have been developed with greater local ownership. For example, the Crow Lake Wind project developed by a Basin Electric Co-op subsidiary included a seven-turbine carveout owned by a group of local investors,[35] and community solar projects like those being developed by a growing number of rural electric co-ops offer more opportunity for member investment as well as shared savings.[36] These opportunities, which might help increase local buy-in for projects, could expand as costs continue to decline and policies evolve.

FROM PROJECTIONS TO REALITY: NAVIGATING DIVERSE COMMUNITY PERSPECTIVES

Rural community members sometimes have conflicting views of potential or planned renewable energy development, which can stall or block projects from being built in a particular area. Concerns can be based on real or perceived project impacts (e.g., noise or viewshed impacts, environmental impacts, property value impacts), or a preference for different, possibly competing local priorities. Research on operating projects has helped alleviate some concerns (for example, sound from wind turbines is typically mitigated by setbacks from nearby housing and has no direct health impacts)[37] and debunk misinformation. Additionally, rural residents' growing experience with wind and solar is shifting opinions in some cases.

Research conducted in Colorado and New Mexico found that rural residents' perspectives on renewable energy have become more favorable in the past five years, and survey respondents cited experience with operating wind and solar projects as a contributing factor.[38] Local practices that engage and account for different points of view in the decision-making process are important for establishing broad support.

Recognizing that wind and solar projects are highly localized developments with impacts specific to the rural communities around them, this study uses a set of case studies to help illustrate the economic development outcomes quantified at a national scale. The narratives that follow tell the story of how operating wind and solar projects, as well as wind manufacturing, contribute to the local economies where they are sited.

CASE STUDY: WIND FARMS ARE FLOURISHING ON COLORADO'S EASTERN PLAINS

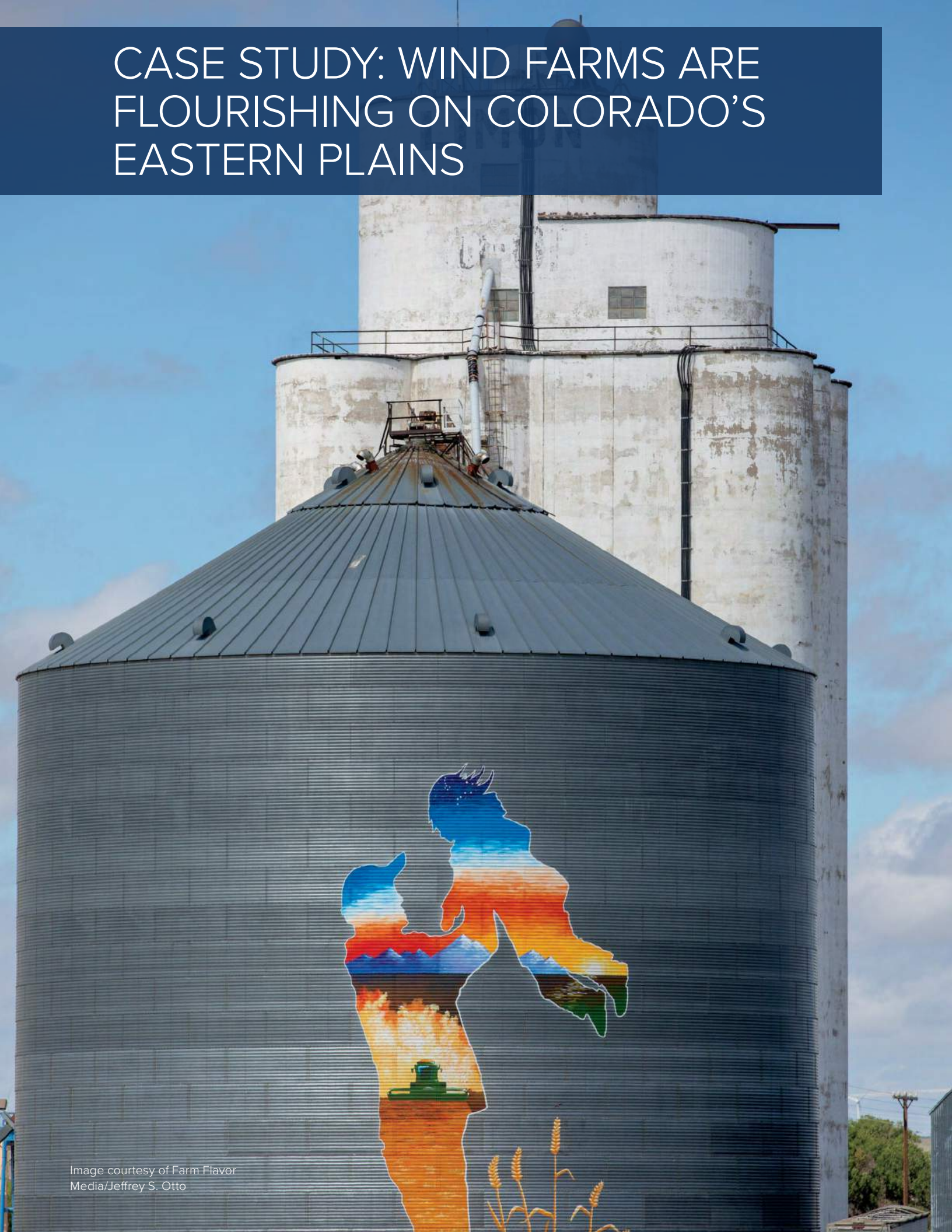


Image courtesy of Farm Flavor Media/Jeffrey S. Otto

CASE STUDY: WIND FARMS ARE FLOURISHING ON COLORADO'S EASTERN PLAINS

Projects like Xcel Energy's 600 MW Rush Creek Wind Farm provide a stabilizing economic impact to rural counties

Limon, Colorado—the "Hub City" of the Eastern Plains—is the largest town in Lincoln County, known for its wheat farming, ranching, and expansive vistas. Sitting at the intersection of I-70 and several state highways, Limon is one of the first places drivers can catch a glimpse of the Rocky Mountains coming from the east. Local leaders are working hard to bring people and new businesses off the interstate and into the community.

The 60-foot tall "Heart of Harvest" mural painted by three local women artists on a grain silo is a prominent manifestation of those efforts; the growing fleet of 440-foot tall wind turbines in the area is another. Thanks to a strong wind resource, "Hub City" and its surroundings have become a hub for the wind industry in recent years, to the benefit of the local economy and town and county coffers.

The Eastern Plains of Colorado are home to all of the state's 4,500 MW (4.5 GW) of installed wind capacity. In addition to energy, the turbines are generating billions of dollars' worth of economic output and thousands of jobs for the state. A new report from the conservative environmental stewardship organization The Western Way estimates that the wind industry will deliver $2.4 billion in construction phase investments to Colorado between 2000 and 2024 (accounting for planned projects underway), and $214 million in economic benefits from the ongoing operations phase by 2024.[39] Importantly, Colorado is home to several wind turbine manufacturing facilities in addition to the wind projects themselves, increasing the share of economic output captured by the state from wind project development.

A large portion of Colorado's wind development is centered on the four-county region that includes Lincoln, Elbert, Kit Carson, and Cheyenne counties. The rural, semi-arid region of small farming communities benefits from its proximity to Denver, which is served by Xcel Energy—a utility with an 80% carbon reduction target by 2030—as well as an expanding network of transmission lines that is supporting the development of additional wind projects.

The five operating wind projects in the four-county region add over 2,000 MW of generating capacity to the Colorado grid, and millions of dollars to county tax rolls. For Lincoln County, home to portions of all five projects, annual wind revenues now comprise 42% of the total assessed tax base, providing $1.8 million of the $4.3 million total. In Kit Carson County, turbines support roughly half the general fund revenues[40]—and more projects are on the way, as shown in Exhibit 6.

"There's been a major shift in electrical generation out to the Great Plains," noted Lincoln County Economic Development Corporation Executive Director Troy McCue. "The increase in tax revenues coupled with payments to landowners is a significant addition to our local economy. Wind generation really is keeping many farming and ranching families solvent, and in business long term. That's the distinct advantage of wind: you can continue to farm and ranch around the base of the turbines, so the agricultural character of our community remains intact."[41]

THE DEVELOPMENT OF RUSH CREEK I AND II

The development, construction, and operation of the Rush Creek wind farm from 2016 to 2019, analyzed in a comprehensive NREL report released last fall,[42] highlight the multiple ways in which the wind industry has contributed to the economic development of the region. Developed by Invenergy, Rush Creek I and II encompass 95,000 acres of land across Lincoln, Elbert, Kit Carson, and Cheyenne Counties. Mortenson Construction fulfilled the EPC services, and Vestas' Colorado manufacturing facilities supplied the 300

EXHIBIT 6

Operating and Planned Wind Projects in the Four-County Region of Colorado's Eastern Plains

	Size	Commercial Operation Date	Location	Developer	Total Investment
Operating					
Cedar Point	250 MW	2011	Lincoln, Elbert, and Arapahoe counties	RES Americas	$535 million
Limon I, II and III	600 MW	2012–2014	Lincoln, Elbert, and Arapahoe counties	NextEra	$1.05 billion
Rush Creek I and II	600 MW	2018	Lincoln, Elbert, Kit Carson, and Cheyenne counties	Invenergy	$1 billion
Cheyenne Ridge	500 MW	2020	Cheyenne and Kit Carson counties	TradeWind Energy (acquired by Enel Green Power)	$743 million
Bronco Plains	300 MW	2020	Kit Carson County	NextEra Energy Resources	$540 million
Planned					
Crossing Trails	104 MW	2021	Cheyenne and Kit Carson counties	EDP Renewables North America	$187 million
Arriba	150 MW	2021	Lincoln County	NGC Partners, Guzman Energy	$360 million

2-MW turbines. Xcel Energy now owns and operates the 600 MW project: the largest in the state at the time of its completion in late 2018.

Due to the presence of in-state manufacturing, the statewide economic impact of the project is sizable, contributing $280 million to Colorado's GDP in the construction phase and $20 million annually during the 25-year operational lifetime, based on NREL's Jobs and Economic Development Impacts (JEDI) model.[43] Inclusive of indirect and induced economic impacts, Rush Creek supported nearly 3,000 jobs during the construction phase and will support 180 jobs for its ongoing operations.

LOCAL ECONOMIC DEVELOPMENT IMPACTS

The four-county region where the turbines are sited has seen its share of tangible benefits as well. These are primarily in the form of tax revenues, land lease payments, the influx of jobs and spending during the construction phase, and the additional full-time job opportunities of the operating phase. Exhibit 7 and the accompanying graph in Exhibit 8 present the aggregate local economic development contributions supported by the Rush Creek project.

The stories behind the statistics above shed light on what these kinds of impacts mean for rural communities.

Tax revenues

Significant and stable income streams for local governments

The Rush Creek project will provide Lincoln County $390,000 in annual tax revenues for the next 25 years. The counties receiving tax revenues from Rush Creek and other projects can use those revenues to best support their community needs. For example, Lincoln and Elbert counties have channeled some of their wind revenues into contingency funds to help buffer the effects of economic downturns, such as the pandemic-induced recession currently confronting the country.[44] Revenues are also commonly spent on schools, social services, public safety, and infrastructure upgrades such as roads and bridges. Rush Creek is contributing just under $1 million a year to the school districts in the four counties that host its turbines.[45]

Funding for specific local initiatives

Lincoln County's Economic Development Corporation is using some of the funds to support community revitalization initiatives and amenities like an indoor rec center, outdoor pool, and trails system, in the hopes of attracting new residents to the region—including the growing wind O&M workforce.

"We're out here in an arid area, with small towns and scarce water resources, so when you build out other industry sectors, like clean energy, that brings much more stability and diversification to our local economy. When you bring a new industry out here, that should make life better for the residents of Lincoln County. What I like about renewables is they're not subject to the feast and famine cycles of the oil and gas industry," said McCue.[46]

Land lease payments

Keeping the ranch in the family

Wind project land lease payments typically range between $3,000 and $7,000 per megawatt annually.[47] For ranchers or farmers, who can continue to graze and grow crops around the turbines, these payments are a valuable additional source of income that can help them weather the ups and downs of the volatile agricultural economy—not to mention the vagaries of weather itself.

Jan and Virgil Kochis host 30 Rush Creek turbines on their 10,000-acre ranch in eastern Elbert County, equating to annual land lease payments on the order of $270,000 based on the range cited above. They reported to NREL researchers that they are still ranching and dryland farming on the property, and that the additional revenue provides stability for the years when rain is scarce or crop yields are low.[48] Anecdotes from other landowners reveal a similar story: wind turbine lease payments can help keep a farm in the family, and serve as a hedge or form of crop insurance for lean years.

"Whether you grow crops or raise livestock, you are always at the mercy of the weather," said landowner Mark Hillman, who has leased a portion of his land to the recently completed Cheyenne Ridge project. "The wind towers provide some financial stability in the years when the wind just blows hot and dry, which is kind of what it's done this year."[49]

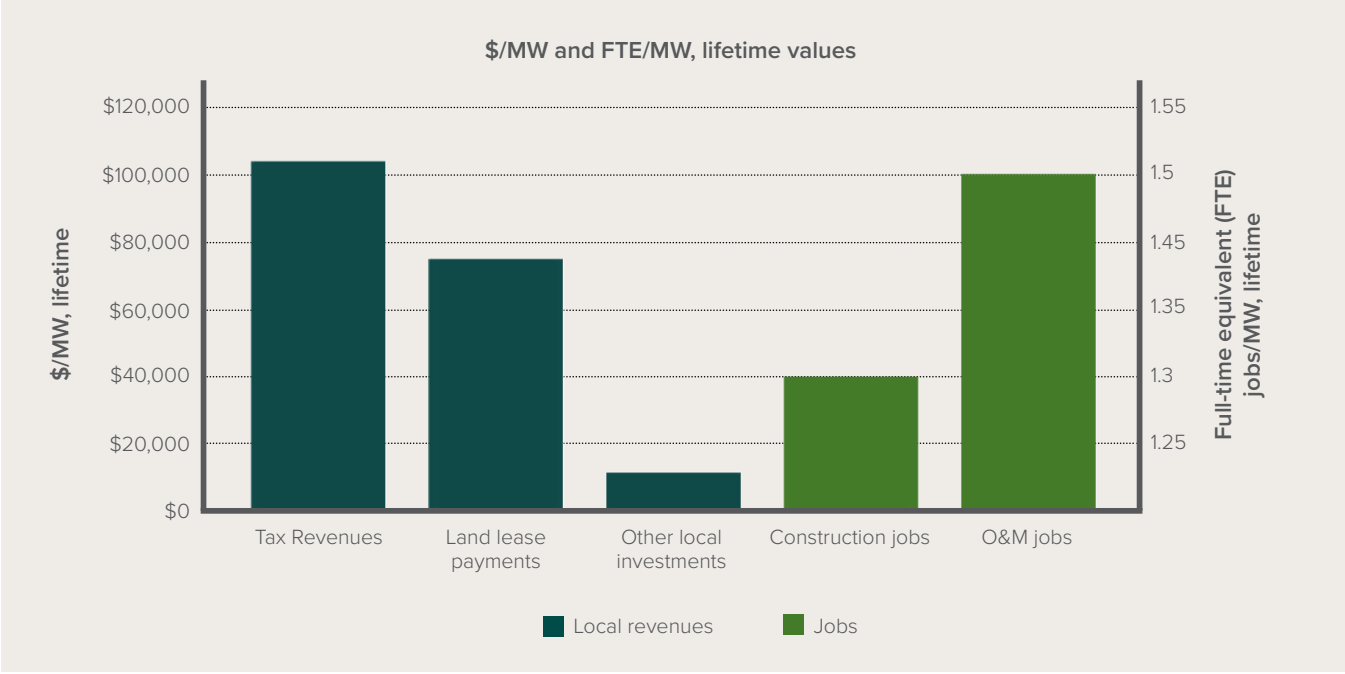
EXHIBIT 7

Local Economic Development Impacts from the Rush Creek Wind Farm in Eastern Colorado

Economic Development Benefit	Contribution (Total over 25-year lifetime)[50]
Tax revenues	$62.5 million
Land lease payments	$45 million
Other local investments	$7 million
Direct construction jobs (FTEs)	290
Direct O&M jobs (FTEs)	12

EXHIBIT 8

Direct Economic Development Impacts from the Rush Creek Wind Farm, Lifetime Values per Megawatt



Rural landowners spend more money locally

The added revenue for rural landowners also has an economic multiplier effect that ripples through the rest of the community. "For those who do have a tower, there is a great benefit for them and the community through the trickledown effect," said Audrey Sayles, one of the local artists behind the mural-painting campaign. "They have extra money, so they are putting up new infrastructure on their farms, buying machinery, hiring an extra hand etc."[51]

Supporting research from a University of Michigan landowner study bears that out. A 2014 survey of rural landowners across 14 Michigan townships found that those with wind turbines on their property had invested twice as much money in their farms—in home improvements, outbuildings, farm equipment, and drainage/irrigation—over the past five years compared with their neighbors and landowners in townships without wind farms.[52]

Construction phase impacts

Increased demand for local services

The construction of Rush Creek took place over an 18-month period in 2018 and into 2019. The arrival of the regional and out-of-state workforce generated significant induced economic impacts, increasing demand for housing and services that translated into more revenues and employment opportunities for local businesses and residents.

"The construction phase and the hundreds of workers it employed in 2018 spiked demand for services, retail sales, hotel rooms, rentals, and RV parks," stated McCue. "Two new RV parks were created to serve the demand, and they have continued operations beyond the completion of Rush Creek." The Trailing Edge RV Park in Limon is now home to a mural painted on a wind turbine blade (shown at right) created by a trio of local artists—a tribute to the economic growth the wind industry has brought to Limon.

Logan County EDC Director Trae Miller had similarly positive things to say about the construction phase impacts of a project currently under development. "This will fuel our local economy at a time we really need it," he said—particularly the service industry businesses that have been hard hit by the COVID-19 pandemic and social distancing requirements.[53]

Creating opportunities for local vendors to support construction

Community leaders such as McCue and Melody Bolton, the director of the Limon Workforce Center, proactively planned for the Rush Creek construction phase in order to ensure their rural communities were ready and able to reap the benefits and to avoid strain on their limited resources.

Image courtesy of Some Girls and a Mural

McCue communicated to local hospitality businesses and landlords before construction started to help them repurpose housing and hotel units into longer-term apartments to meet the expected demand. Bolton, recognizing that the construction workforce demand exceeded what Limon could provide, created the Rush Creek Partnership with nearby counties to help local job seekers and businesses gain contracts with the developer. They developed a list for Mortenson and Xcel of construction sub-contractors in the 10 surrounding counties, helping to maximize the companies' local hiring—a legal requirement of development in Colorado.

O&M phase impacts

A small but stable new employment opportunity

Projects like Rush Creek require a smaller long-term workforce to attend to the operations and maintenance (O&M) of the turbines, and that workforce becomes all the more stable when additional wind projects are sited nearby. Lincoln County currently counts between 45 and 50 full-time jobs in the wind industry, according to McCue. That's a big deal for an area with a population density of two people per square mile. More jobs are expected as the Arriba project and others are built in the region.

"These small, incremental job additions help change the complexion of the community, as families move in and stay," said McCue who estimated that every 100 turbines created an additional 8–10 full-time jobs.

The induced impacts of the O&M workforce

Findings from a recently published NREL report on the wind O&M workforce show how these stable jobs support local economies.[54] The study analyzed commuting and spending patterns of surveyed employees and contractors in the wind O&M workforce, helping rural communities to better understand the economic ripple effects that wind projects create over their lifetimes. Survey responses indicated that wind plant employees tended to spend money in the local area around the plant, although were not as likely to live locally.

Efforts by organizations like McCue's to attract these longer-term employees to live in the community could help rural towns see an even greater impact from renewables O&M. Already, there are signs of the real estate sector seeking to build and market housing for O&M workers in places like Limon, where an investment memorandum for the new Smoky Trail apartment complex notes, "The booming renewable energy sector continues to spur high income job growth, fueling further demand for quality housing."[55]

Miller of Logan County also emphasized the relatively high salaries that wind jobs provide, commenting that the handful of good-paying jobs was "not a ton, but we don't have many high wage jobs out here, so the impact is still big for our community."[56]

Community investments from project owners

In addition to the workforce impacts, project owners often provide community investments or "good neighbor agreements" during the operations phase, contributing to sports team sponsorships, charitable donations, or workforce development programs for the community. Miller referenced the Northeastern Junior College's wind technician program as an example of a regional workforce development effort that is helping Eastern Colorado retain more wind jobs in-state. His brother-in-law graduated from the program and was hired on by a local project, allowing him to continue living nearby. Wind developers have supported the program by donating equipment, including a fully functioning nacelle, and meeting with the college regularly to ensure training remains up to date.

ENABLING FACTORS

The Rush Creek Wind Farm and the additional wind development in the region have delivered substantial benefit to Lincoln County and its neighbors. County commissioners as well as leaders of community institutions like economic development corporations (EDCs) play an important role in enabling those benefits, starting with whether or not they grant the local approvals necessary for the project to move forward. Based on

the experiences from the wind buildout on Colorado's Eastern Plains, successfully realizing the economic development opportunities associated with wind projects comes down to **proactive planning, facilitating dialogue** between the developer and community stakeholders, and **highlighting the economic upside** of the projects to the community.

- **Proactive planning**

  Even before a developer or potential project is on the horizon, there is a good deal that rural community leaders can do to position themselves well to host future projects, beginning by articulating and aligning on an economic development strategy. For example, communities can come together before talking to the developer and ask, "what do we need from them as a community?"

  "Getting together and aligning on asks is smart," said Suzanne Tegen of the Center for the New Energy Economy (CNEE) at Colorado State University.[57] Additionally, once a community knows a project is under development, preparing local housing and service businesses for the construction boom can help maximize the economic benefit of the industry's presence in the area and mitigate any potential challenges associated with housing shortages or rising rents. Considering strategic investments to fulfill industry and workforce needs can also help ensure that more of the investment and job opportunities are captured locally.

- **Facilitating dialogue between stakeholders**

  Local leaders are often at the center of brokering the engagements between the developer and community members. They can help create streamlined, equitable processes for land lease negotiations, short-term housing creation, local employment contracts, etc. In the absence of such processes, "it can feel almost like a lottery hit the local agriculture community," said local resident Staci Ravenkamp, who noted that there can be tensions between those who host turbines and their neighbors who do not. Ravenkamp also shared that the contracts can be complex and challenging for landowners to parse without support. Support and educational resources for landowners to facilitate smooth leasing processes can help allay such concerns.

  For his part, McCue served in many communications and liaison roles during Rush Creek's development, helping the developer secure access to a county right of way and finding mutually agreeable solutions to smooth the RV park expansion process, for example. Similarly, Bolton served as an organizer and conduit for local companies and construction sub-contractors to fulfill the services required by the wind farm's construction company. Now that Rush Creek has been built, the network she assembled is pursuing highway construction opportunities and other infrastructure projects in the region.

- **Highlighting and maximizing the economic benefits**

  The Lincoln County EDC communicated extensively with area residents about the project, to ensure people knew it was coming and understood the financial benefits that wind could bring to the community. "This is something that we as a community financially need. That seemed to trump any other concerns people might have about the project," said McCue. "My perspective is, let's move forward towards the future, because if you're not growing a little bit, you're likely dying. We need ways to keep young people coming back, keep our locales vital and viable for the future."

  McCue sees renewable energy as part of the solution to achieving the economic vitality that ensures places like Limon can retain their culture and community character well into the future. The track record of wind development on the Eastern Plains to date indicates it is certainly a help, and McCue encourages other counties to follow their lead. "Keep an open mind," he encouraged his counterparts, "and reach out to other counties like ours so we can share our story."

CASE STUDY: SEEDS OF A SOLAR BOOM GROW IN WEST TEXAS

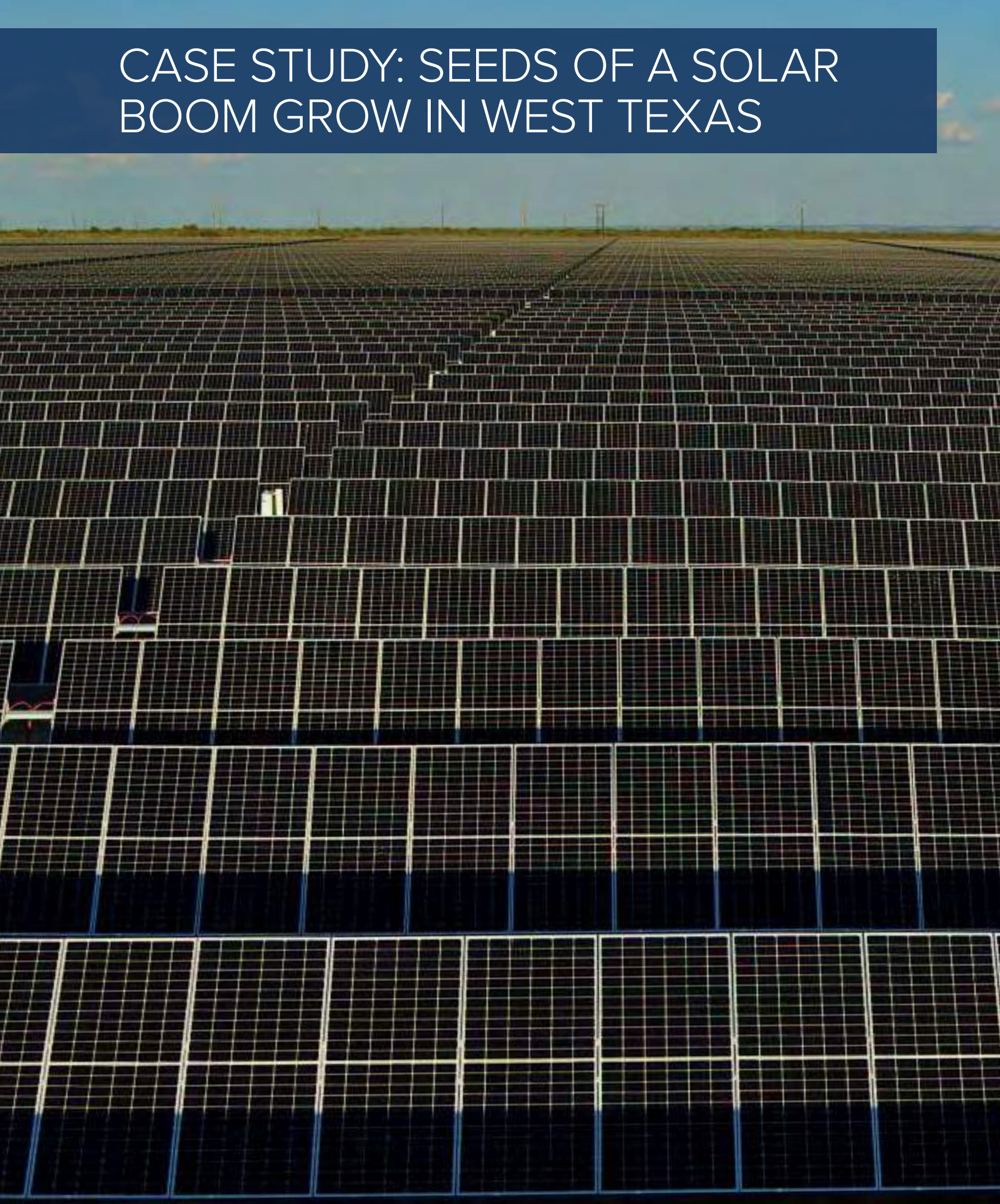


Image courtesy of Enel Green Power

CASE STUDY: SEEDS OF A SOLAR BOOM GROW IN WEST TEXAS

Enel Green Power's 497 MW Roadrunner solar project is diversifying and bolstering Upton County's local economy

McCamey, Texas, is named after an oil wildcatter whose 1925 discovery of oil sparked a boom in the region, leading to the establishment of a tent city that was incorporated as a town the following year. By the turn of the next century, the town was declared the "Wind Energy Capital of Texas" by the state legislature, following the proliferation of wind turbines across the mesas surrounding McCamey.

Today, the community within Upton County is witnessing another energy generation boom: the 497 MWdc Roadrunner Solar project and its 1.2 million bifacial solar panels became the largest solar installation in the state when it began operations earlier this year. Owned and operated by Enel Green Power North America (Enel), Roadrunner Solar offers McCamey and Upton County an opportunity to further diversify their economic base. Furthermore, the project demonstrates how solar developers can create shared value locally and establish a durable presence in the community.

Roadrunner may not keep the title of largest solar project in Texas for long. The Upton County installation is coming online at the vanguard of a rapidly expanding set of solar projects in development across the state. Texas counted just under 4,000 MW of solar online as of August 2020, and a staggering 27,000 MW of projects in the planning or construction stage.[58]

Given the low prices that solar projects are offering power purchasers,[59] that significant growth is good news for energy consumers as well as rural communities in Texas, which stand to benefit from the influx of dependable tax revenues, land lease payments, and jobs generated along with the energy from these projects. A report released in summer 2020 estimated that a county in Texas could expect to receive between $9.4 million and $13.1 million in lifetime taxes for a 100 MW solar project located in its boundaries, and a Texas landowner could expect between $5.2 and $27.7 million in lifetime land lease payments (depending on land values, which vary across different geographies in the state).[60]

THE DEVELOPMENT OF ROADRUNNER SOLAR

Construction of Enel's Roadrunner Solar project began in February 2019, the first phase of the project was completed by the end of the year, and the second phase began operations in early September 2020. The 497 MW project spans 2,770 acres in Upton County, and employed 400 people during the peak of the construction phase. Its size is notable in several respects: Roadrunner is the largest solar project in Texas, the largest solar installation in Enel's US portfolio, and one of the largest projects to date to use bifacial solar technology, which increases the project's production potential by capturing sunlight reflected off the ground.

Construction practices adhered to Enel's sustainable construction standard, which included a focus on local hiring and spending, construction waste management and beneficial reuse, and a commitment to solar panel recycling: Enel worked with the Texas-based panel recycler Eco Environmental to recycle broken or damaged panels. The project has secured two corporate power purchase agreements (PPAs) with Mondelez International and The Clorox Company, for 65 MW and 75 MW of output, respectively, and will sell portions of the remaining energy on Texas' wholesale electricity market (ERCOT).

Upton County and McCamey leaders are pleased to see solar joining the ranks of energy developers in the area, emphasizing the project's contributions to local businesses as well as the value it will add to county revenues through the payments in lieu of taxes (PILOTs) the company will be paying. Texas law allows local governments to offer tax abatements to attract new development, governed by Chapter 313 of

the tax code.[61] Upton County granted Roadrunner an abatement for the first 10 years of project operations based on the premise that the project's lifetime economic development contributions would provide a net benefit to the community. In aggregate, Enel estimates it will pay in excess of $115 million to the local area over the project's useful life.

"Roadrunner has been great," said McCamey Economic Development Corporation director Chelsea Barrandey. "We have a whole lot of sunshine in West Texas, and are happy to support Texas with that resource. And Enel has been a wonderful partner and team player with McCamey EDC and the community—we're fortunate to see wind and solar now coexisting with oil and gas here in this area."[62]

LOCAL ECONOMIC DEVELOPMENT IMPACTS

For Upton County and McCamey, the project's contributions (Exhibits 9 and 10) are supporting local businesses, community improvement projects, and workforce development opportunities.

EXHIBIT 9

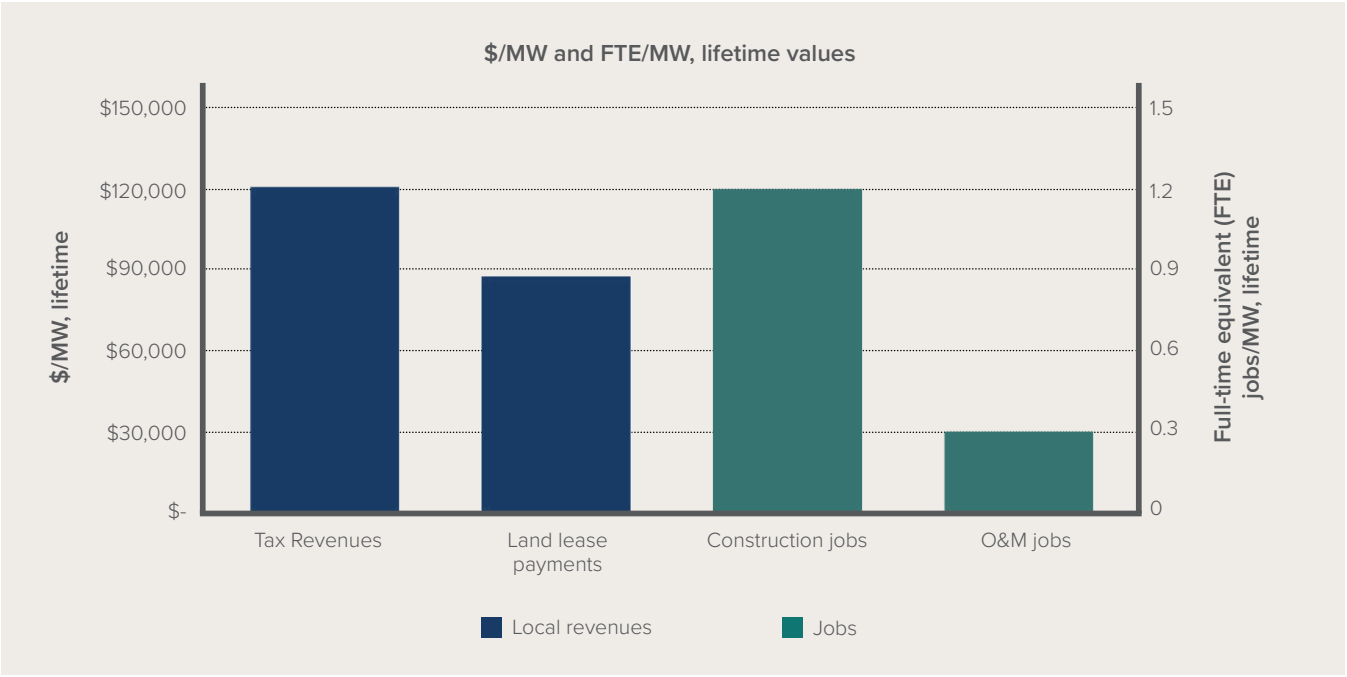
Local Economic Development Impacts from the Roadrunner Solar Project in Upton County, TX

Economic Development Benefit	Contribution (Total over 25-year lifetime)
Tax revenues	$60 million
Land lease payments	$43 million*
Construction and O&M wages	$35 million
Community benefit investments	$700,000
Direct construction jobs (FTEs)	400
Direct O&M jobs (FTEs)	6

**Estimate based on the average land lease payment per megawatt across Enel's TX portfolio*

EXHIBIT 10

Direct Economic Development Impacts from Roadrunner Solar, Lifetime Values per Megawatt



Construction phase impacts

Filling local restaurants and stores

Roadrunner's construction phase spanned 19 months and had a large impact on the McCamey economy at a time local business needed it most—during the COVID-19 pandemic and the economic downturn that followed. At 5:30 p.m. on a weekday in McCamey, restaurants and grocery stores are full, observed Judge Kilgore, adding that "the greatest thing the Roadrunner project has done for McCamey is support its local businesses."[63]

With a population of roughly 1,800 people, McCamey doesn't have many restaurants or shops, but it has seen an uptick in business revenues during construction, as well as the arrival of a new Family Dollar franchise. Enel estimates that at least $8 million of the $20 million the project paid out in wages during the construction phase was then recirculated in the local economy. [64]

The workforce housing challenge

Accommodating the influx of workers was not without its challenges, however. In such a small town, residents aren't used to seeing strangers around; "that's one thing that startled people in our small community," said McCamey EDC director Chelsea Barrandey.[65] The town didn't have much extra housing to spare, so it established a set of travel trailer camps to house construction workers and built three new apartment complexes as well as five new houses. Nevertheless, during construction, there was no housing available in town. Barrandey would like to see additional apartment complexes created to alleviate housing pressures.

Developer contributions to community initiatives

While the economic impacts of project construction are largely short term, Enel's contributions to the community during the construction phase point to the company's long-term commitment to creating shared value locally. Enel supported Upton County's

Image courtesy of Enel Green Power

COVID-19 emergency relief efforts, donating money directly to the hospital and local schools, and has contributed $25,000 toward a new pavilion in McCamey that Barrandey envisions serving as a community gathering hub and farmers market. "We listened to local leaders and understood from McCamey EDC that the pavilion was one of their highest-priority local initiatives," said Marcus Krembs, head of sustainability for Enel North America, noting that the town's vision to build local food systems in the area aligned well with Enel's commitment to creating shared value for all stakeholders.[66]

Tax revenues

Tax abatement requirements

Enel is paying Upton County and the local school district 10 years of PILOT payments, followed by typical property taxes for the lifetime of the project. The regulations governing tax abatements, enumerated in the Texas Economic Development Act or Chapter 313 of the state tax code, require state comptroller certification that the project will generate more tax revenue for the state over its lifetime than the amount of the abatement.[67] Therefore, tax abatement approval is a good indication of a project's anticipated net economic benefit.

Many abatement agreements, including the agreement with Enel, also have provisions for the benefitting company to make supplemental payments or PILOTs. Judge Kilgore of Upton County added that in his own assessment of whether or not to grant an abatement for the Roadrunner project, he looked at how the solar installation would impact private businesses and create local jobs. "We want to make sure we're benefitting private individuals, landowners, and businesses," he said of the decision on the Roadrunner project tax abatement.[68]

Revenues for schools and hospitals

Between the PILOTs and tax payments Enel will make over Roadrunner's estimated 25-year life, Enel projects it will contribute $60 million to local government,[69] which will primarily flow to the McCamey Independent School District and McCamey County Hospital District. These payments provide a big benefit to schools looking to issue or repay bonds for capital improvements. Additionally, depending on the scale of the project and the make-up of the local tax base, renewable energy tax revenues can help counties lower tax rates for local residents, as Bee County in southern Texas has done thanks to its renewables investments.[70]

O&M phase impacts

Establishing a base of operations locally

Enel estimates that Roadrunner will require six full-time employees during project operations, which would create 180 job-years (one employee working full-time for a year, in economic development parlance) over the 25-year lifetime. Based on the terms of the tax abatement negotiated with Upton County, Enel has local hiring requirements it must meet during the project's operating life. As a starting point for delivering on that commitment, Enel purchased and is retrofitting a former post office building in McCamey to serve as its permanent local O&M facility.

"For every large project, we typically construct an office or warehouse," said Krembs. "Recently, we've been looking more toward existing real estate to meet that need, as that requires less materials, makes these buildings more sustainable, and places our people in the heart of the community."[71]

Educational partnerships

Additionally, Enel is planning to implement renewable energy-based educational partnerships with local school districts as well as scholarships for students to pursue career pathways in renewables. "Providing resources for classroom-to-career STEM programs with local institutions is a key focus area within Enel's community investment strategy," added Krembs. With its strong solar and wind resources, the area around McCamey is likely to see additional development from Enel and others.

"It would be great to see kids around here graduate, go to trade school, then come home and have good-paying jobs available to them," said Judge Kilgore.[72]

Land lease payments

Solar land lease payments are largely driven by local land values and opportunity costs, as the land is less commonly used for other purposes. However, the rise of dual-use projects that incorporate sheep grazing, pollinator habitat, and even crop growing throughout the project footprint may result in more solar projects that realize multiple land uses and value streams.[73] The prevailing norm for projects today is for payments to be calculated on a dollar per acre basis, with solar land leases typically higher than the default land rents.

In the case of the Roadrunner Solar project, the land lease payments are covered under confidentiality terms of the contract. However, Enel estimates it pays an average of $3,500/MW on solar land leases throughout its Texas portfolio.[74] These land lease payments are meaningful additions to personal income for rural landowners. "We really try to encourage developers to build on private citizens' land," said Judge Kilgore.

ENABLING FACTORS

The Roadrunner Solar project has delivered substantial benefit to Upton County and its local businesses. County and town leaders, as well as the developer's commitment to supporting the community, played an important role in enabling those benefits, starting with granting the local approvals necessary for the project to move forward. Based on the experiences from the construction and early operations of Texas' largest solar project, successfully realizing the economic development opportunities associated with solar development comes down to **preparing housing and local businesses** for the spike in demand during the construction phase, **negotiating mutually beneficial tax agreements**, and **maintaining a strong relationship** with the project owner over the course of its operations.

- **Preparing housing and local businesses to meet the construction demand spike**

  When asked what advice she would offer fellow local leaders facing potential wind or solar projects in their community, McCamey EDC's Barrandey said the first priority was ensuring the community has housing available for the construction workers coming to town. She suggested creating a mix of temporary and permanent housing options, as the demand spike during construction could help the community meet

pre-existing housing needs. "You want the projects to happen in your town," Barrandey said, "but if you don't have the housing available it can be tricky to accommodate all those workers."[75]

Housing had been an economic challenge in McCamey, so with Roadrunner construction on the horizon, the McCamey EDC budgeted $200,000 to put toward building new homes in town, with five built to date and more potentially on the way. The new apartment complexes built during construction remain occupied today.

- **Negotiating a tax abatement agreement that worked for the developer and the community**
  Texas' Chapter 313 tax abatements are local economic development tools that counties can use to attract a wide variety of investments beyond just wind and solar development. Given the state's high property tax rates,[76] the ability to grant abatements can help rural regions of Texas remain competitive in their bids to bring in new business to their area. Abatements are approved at county leaders' discretion; they would not do so if they did not expect the new investment to generate local returns. With respect to capital-intensive renewable energy projects, these abatements help developers realize financeable projects that are able to offer local value to the community as well as low power prices to Texas consumers.

  Judge Kilgore has negotiated a handful of abatements with renewable energy projects, and says he has come to an agreement on all of them. "Wind and solar companies have been easy to work with," he said. "They are picking their project sites for a particular reason, so we're able to come up with agreements that make sense for both parties."[77] A successfully negotiated abatement can be the linchpin in locking in a wind or solar project locally, and can also include specific provisions that support community needs, whether that be school funding or local job creation.

- **Continued discussions with Enel on opportunities to create shared value in the community**
  Now that Roadrunner has begun operations, Enel and community leaders are in close contact about ongoing opportunities for Enel to engage locally. The company has an annual budget for sustainability initiatives and other community investments, and has been exploring various public health and educational initiatives it could support. Community leaders like Barrandey and Judge Kilgore are in regular contact with Enel, which is looking to take its cues from local officials on where to direct its investments.

  The strong partnerships that exist between McCamey, Upton County, and Enel are promising signs that the revenues generated during the life of the Roadrunner Solar project will create a beneficial impact locally. For their part, Judge Kilgore and Barrandey are happy to see the project in their community. "Upton County is blessed with abundant sun and wind," noted Judge Kilgore,[78] who has seen the county becoming more dependent on wind and solar as economic drivers in recent years. "The sun is a reliable energy source and we should be tapping into it," affirmed Barrandey.[79]

Image courtesy of Enel Green Power

CASE STUDY: WIND MANUFACTURING RE-ENERGIZES A CENTRAL IOWA COMPANY TOWN

CASE STUDY: WIND MANUFACTURING RE-ENERGIZES A CENTRAL IOWA COMPANY TOWN

The arrival of TPI Composites and Arcosa Inc. in Newton helped retain the local manufacturing economy

At the dawn of the 20th century, Newton, Iowa, was the washing machine capital of the world. As the headquarters of the Maytag Corporation, Newton owed much of its economic stability and local identity to the manufacturing jobs created by Maytag. During its prime, the company employed over 4,000 people in the town of roughly 15,000, and contributed to numerous community institutions including a park, pool, and concert bowl that bear its name.

Then in 2006, Whirlpool bought Maytag, and by the following year the company—as well as the jobs it supported—had left Newton. Searching for a new, more diversified set of industries to fill the void, the town attracted two wind turbine manufacturers to Jasper County, and to date has successfully maintained a manufacturing presence in the local economy.

Iowa is home to over 10,000 MW of wind capacity, which generates a nation-leading 42% of the state's electricity.[80] The state counts 66 large-scale projects and nearly 6,000 turbines within its borders, and several neighboring states are developing wind projects at a growing clip as well. For wind turbine original equipment manufacturers (OEMs), proximity to projects informs factory siting decisions, as turbine blades and towers are large, heavy, and expensive to transport. This home-state advantage of a booming wind industry, combined with the vacated Maytag buildings and the experienced manufacturing workforce, made Newton a prime location for a wind manufacturing company.

Not long after Maytag closed its doors, the town caught the eye of two wind manufacturers, and by 2008 Newton had added a pair of major new employers to its economy: Arizona-based TPI Composites, which manufactures wind turbine blades, and Texas-based Trinity Structural Towers (now Arcosa Towers), which manufactures wind towers.

THE ARRIVAL OF TPI COMPOSITES AND ARCOSA TO NEWTON

TPI Composites has been crafting composite wind blades since 2001, and sells its blades to OEMs including Siemens Gamesa, Vestas, and General Electric (GE).[81] According to Iowa General Manager Josh Syhlman, the company's production facility siting decisions are largely driven by the needs of its customer, which in the case of the Newton facility is GE. When TPI began looking to expand in the Midwest, it had just one other operating factory, in China. To make the decision about establishing operations in Newton, the company conducted an economic feasibility study as well as extensive conversations with local, county, and state decision makers.[82]

EXHIBIT 11

Wind Projects and Wind Manufacturing Facilities in Iowa

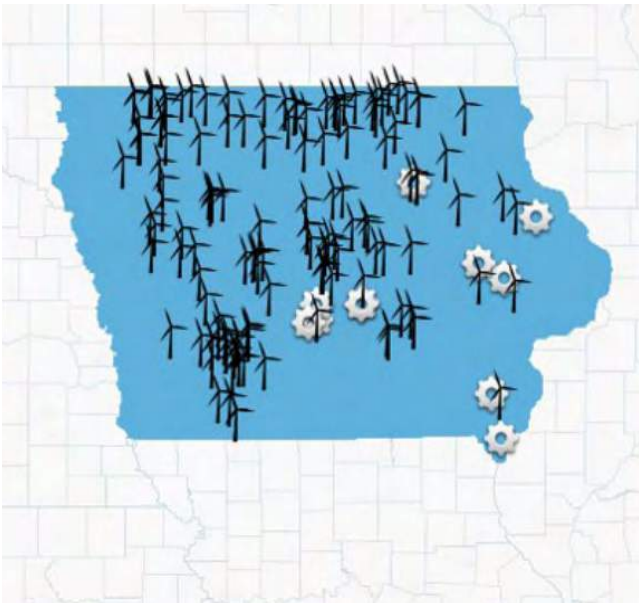


Image courtesy of AWEA

Supported by the Iowa Economic Development Authority, Newton was able to offer TPI a package of state and local incentives to offset the initial location expenses.[83] After numerous meetings to iron out the details of siting logistics and incentive terms, TPI Composites established operations just north of Newton in a new 330,000 square-foot blade manufacturing plant.

Hard on their heels was another GE turbine supplier, Arcosa, which had entered the wind manufacturing industry in 2000 through its subsidiary, Arcosa Towers.[84] By fall of 2008, Arcosa had joined TPI Composites in Newton, manufacturing wind towers in a portion of the old Maytag plant building. The two companies collectively employed 500 workers at the outset and have now grown to supporting a workforce of 1,250.

This growth is in part fueled by the rapidly improving technology and declining costs characterizing the wind industry today. Syhlman of TPI Composites noted that the company has produced seven different turbine blades to date, as blade length continues to increase with upgrades in materials and design.[85] Given the enhanced generation potential of longer blades, many wind project owners have found it in their economic interest to upgrade the blades of existing turbines before the end of their useful lives, driving increased demand alongside the growing number of new wind projects nationwide.

Photo courtesy of Frank Liebl

LOCAL ECONOMIC DEVELOPMENT IMPACTS

For the past decade, Frank Liebl has been the executive director of the Newton Development Corporation (NDC), responsible for recruiting new companies to the community as well as working with existing companies. Knowing it would be hard to fill the void of a company as integral to the community as Maytag, NDC embarked on a strategy of diversification that ultimately attracted 15 new businesses to the community over the past decade.[86] Twelve of the companies lease space in the former Maytag facility, which had 1.8 million square feet to fill. The wind manufacturers, profiled in Exhibit 12, were the two most important new additions according to Liebl.

"They have been a lifesaver for the community," Liebl said of TPI Composites and Arcosa. "Their jobs are the highest-paying in the community right now. They're very competitive, with great benefits, and are attracting workers from many surrounding communities that now come to Newton for work."[87]

In addition to alleviating the high unemployment in the wake of Maytag's departure, the two wind manufacturing companies provide meaningful community investments as well as new business prospects that give the town hope for enduring economic revitalization.

EXHIBIT 12

Financial Profiles of Newton's Two Wind Manufacturing Companies: TPI Composites and Arcosa, Inc.

Financials	TPI Composites	Arcosa, Inc.*
Market capitalization	$1.1B	$2.2B
Production facilities (global)	13	5
Production facilities (United States)	2	3
Employees—Newton facility	1,000	250
Annual salaries—Newton facility	$50M	$8.9M

*Includes the company's other segments, construction and transportation products.

Wind manufacturing employment

Rebounding from the post-Maytag unemployment spike

TPI and Arcosa's growing Newton facilities have contributed toward lowering the unemployment rate from a high of nearly 10% in 2009 to 2% today, according to Liebl. Exhibit 13 illustrates the drop in manufacturing jobs immediately following Maytag's departure, and the gradual rebound that wind manufacturing supported. Today, TPI Composites is the largest employer in Jasper County, a point of pride for Syhlman as the general manager. A Newton native himself, Syhlman has worked in manufacturing his whole career, and was recruited by TPI Composites while working at Anderson Windows in Des Moines.

"The role was an exciting opportunity for me to come back home and be a part of something bigger," said Syhlman of his decision to return to Newton and work for TPI. "This is an amazing industry; three and a half years in, I plan to work in renewables the rest of my career."[88]

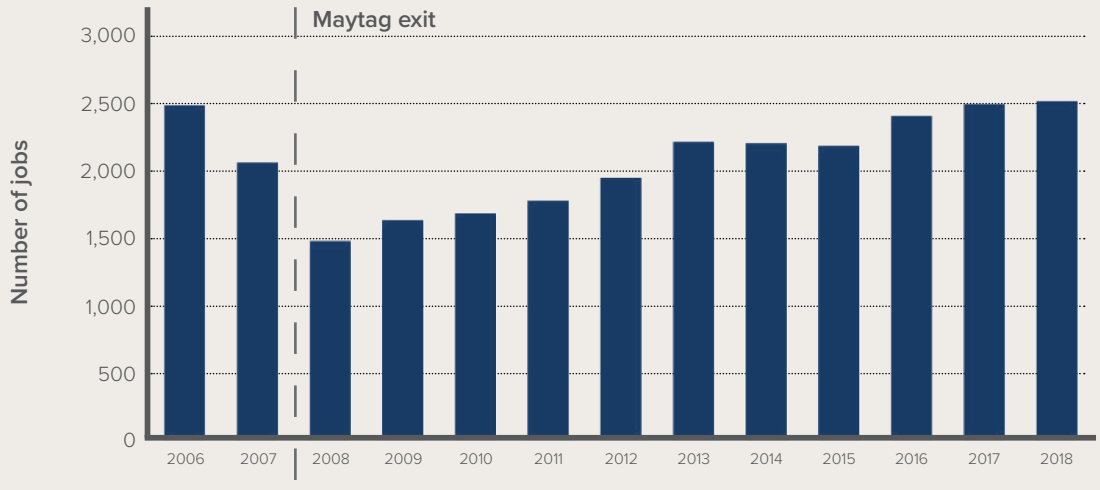
Wind manufacturing job characteristics

Manufacturing components for wind turbines is a labor-intensive industry, involving workers across a range of occupations in the manufacturing sector, from assemblers and welders to computer-controlled machine tool operators. Of the roughly 1,000 employees at TPI Composite's Newton plant, 650 are direct labor jobs responsible for producing the blades. Syhlman describes them as craftsman positions more than assembly-line style manufacturing. Another 200 positions are professional roles including engineers, quality control and safety staff, program managers, and the leadership team. The remaining portion are warehouse and support staff.[89] Tower manufacturing requires different processes—most of the Arcosa positions are welding jobs.

As Liebl noted, TPI's wages are above the county average, and the quality earnings on top of the scale of the workforce add up to a sizable financial benefit to the community. According to Syhlman, TPI Composites pays in excess of $50 million a year in salaries.[90]

EXHIBIT 13

Manufacturing Jobs in Jasper County, Iowa, Before and After Maytag's Departure



Community investment

Support for local institutions

In Liebl's estimation, wind turbine manufacturers make for good corporate citizens. Syhlman noted that once TPI Composites had established a successful track record at its Iowa production site, the company increased its focus on community engagement through local sponsorships and community service days.[91] For example, TPI Composites supports the local Salvation Army and participated in a community clean-up day this past summer after a destructive wind storm blew through the town.

Leading COVID response and recovery

More immediately, TPI Composites played a large role in helping Newton weather the COVID-19 pandemic and associated economic downturn that have shaken up social and economic stability around the world. In Liebl's view, TPI Composites was very proactive in addressing COVID-19 in the early days of the crisis, shutting down for nearly two weeks and talking with their counterparts in China to inform the appropriate safety measures to implement going forward. TPI held seminars on social distancing and distributed masks to employees and family members. As a result, the company, and the community, didn't stay shut down for long.[92]

New business prospects

Attracting companies with clean energy goals

A state with abundant renewable energy generation is an attractive prospect for sustainability-minded companies looking for cheap, clean sources of energy to power their operations. Liebl believes that Iowa's wind industry has helped draw big companies to the state, which is now home to numerous data centers including facilities owned by Facebook and Google.[93]

That ability to attract additional business is key to Newton's economic recovery strategy. By Liebl's estimates, approximately 80% of new companies come to a community through channels established by existing companies, such as supply chain companies that the buyer would like to have closer to its own operations.[94] And Newton is looking to grow out from under the shadow of Maytag by diversifying the businesses it hosts. In addition to wind manufacturing and a number of small manufacturing companies with established roots in the community, the town now counts a paper supplier, tire company, commercial printing, and call centers among its area businesses.

Opportunities for supply chain businesses

Today, Newton has another new and potentially significant corporate prospect in its sights from a sub-sector directly related to wind manufacturing. As the US wind industry starts to see early projects reach the end of their useful lives, and as turbine technology advancements fuel upgrades to existing projects, the industry is beginning to reckon with how to dispose of old turbine components. Newton continues to work with a couple of companies that say they have the technology to shred wind turbines into pellets that can be used in other products. "We are anxious to see what develops," said Liebl.

ENABLING FACTORS

The successful establishment of TPI Composites and Arcosa Towers in Newton has delivered substantial benefit and much-needed stability to Jasper County after the upheaval of Maytag's departure. The two companies went a long way toward filling the employment vacuum left by Maytag, and all indications point toward a long-term future in the community. Syhlman believes that the TPI plant will remain in Newton for the foreseeable future.

Local and state-level economic development efforts played an important role in enabling those benefits to flow to Newton, from successful recruitment of the two manufacturing companies to developing positive ongoing relations with each businesses' leadership teams. Based on the Newton experience, factors that enabled the community to become a hub for wind turbine manufacturing included collaboration

between state and local leaders to offer **aggressive, criteria-based incentives**; savvy **marketing of the community's strengths**; and a **proactive, open-minded approach to recruiting new businesses to the town.**

- **City, county, and state collaboration on incentives package**

  The state took a big lead in attracting TPI and Arcosa (then Trinity) to Newton, according to Liebl.[95] Along with local counterparts, he worked hand in hand with the Iowa Economic Development Authority to put together a tailored package of state and local incentives as well as criteria that the companies would have to meet to be eligible. For example, the state's High Quality Jobs (HQJ) program offers qualifying businesses tax credits and/or direct financial assistance to offset some of the costs of locating or expanding in Iowa; to qualify, businesses must meet wage threshold and minimum benefits requirements.[96]

  State and local economic development officials then met with company representatives to negotiate an arrangement that would work for both parties. Together, the city, county, and state of Iowa gave TPI Composites $8 million in loans, grants, and tax breaks to support its new production facility in Newton.[97] Twelve years in, that investment appears to be offering strong returns in the form of 1,000 high-paying jobs. Arcosa subsequently received a similar package as well as tailored support for tower transport logistics.

- **Marketing the community's strengths**

  While Maytag's departure was a sizeable loss for the community, Newton retained valuable assets that positioned the town well to attract new businesses. The former Maytag buildings offered a substantial amount of available real estate for lease, and the workforce retained strong manufacturing credentials that potential new companies viewed as a draw.

  "The large, educated workforce in Jasper County was a huge factor in TPI's decision to locate there," noted Syhlman.

  Community leaders marketed Newton to prospective businesses with a simple pitch: we're ready to work—and it worked. In addition, the Newton Development Corporation and local officials launched broader community marketing efforts like "Get to Know Newton" to showcase the community's small-town charm.[98] These efforts helped earn Newton national recognition, including a 2012 visit from President Obama in which he highlighted the town as an example of the clean energy industry's role in supporting job creation and post-recession revitalization.

- **A proactive approach to recruiting new business**

  Newton economic development professionals and community leaders wasted little time developing and implementing a strategy to secure the town's post-Maytag future. The Newton Transformation Council secured a federal Regional Innovation Grant in 2008 to develop a revitalization plan, and promptly set to work recruiting new companies to town. Local leaders recognized and embraced the opportunity to diversify.

  "When we had Maytag, manufacturing was all we did," said Liebl. "Now we have wind manufacturers, paper suppliers, a tire company—so many things that really helped Newton stabilize its economy. We don't turn down anything unless it doesn't fit in our community. Our approach is to be proactive, answer inquiries, and see where things go from there." Liebl and others see things going in a very positive direction for the wind industry, and by extension, Newton, for years to come.

IMPLICATIONS AND RECOMMENDATIONS

IMPLICATIONS AND RECOMMENDATIONS

Lessons learned from community and industry experience to date can help capture the immense value on the table for rural communities in the coming decade, and enable the transition to a cost-effective, low-carbon power system that can benefit all Americans. We offer recommendations for local, state, and federal leaders to unlock this opportunity.

RECOMMENDATIONS FOR LOCAL LEADERS

At the local level, elected officials, economic development corporation (EDC) directors, and other leaders have agency to prepare their communities to maximize the economic benefits of wind and solar development in their area. Building on the insights of the case studies presented here, these emerging best practices can help rural decision makers incorporate wind and solar projects into their jurisdictions.

- **Review land use planning and local ordinances to prepare for renewable development:** Before the first projects are developed, rural elected officials and planners have an opportunity to proactively assess how wind and solar projects could fit in their jurisdictions. Local leaders can:
  - Revisit local planning and land-use ordinances with wind and solar development in mind. In Adams County, Colorado, for example, local officials seeking to promote solar development undertook a review of all zoning codes to identify those that might impede projects.[99]
  - Implement land-use policies and ordinances that are conducive to wind and solar development. NREL has developed a set of best practices for solar zoning,[100] and the DOE's WINDExchange platform provides a database of local wind ordinances.[101]
  - Engage in regional planning to proactively identify target areas for wind and solar development. Several counties in Western Colorado, for example, have formed a regional clean energy network to collaborate on efforts to bring more renewables to the area.[102]
  - Establish a dialogue with potential developers to gain an understanding of their priorities, processes, and potential value-add to the community.

- **Understand and develop tax policy for renewables:** Property tax assessment approaches for wind and solar projects vary widely, and if a local policy is not well-considered in light of wind and solar project characteristics, it may impede development or prevent the community from fully capturing the tax benefits of projects. Local leaders can:
  - Carefully consider specific tax treatment for renewable energy projects, such as tax abatements or other structures, with an eye toward establishing assessment approaches that are workable for local governments and developers.
  - Align tax policies with local priorities to ensure the new revenues are not restricted from use where they might be most needed.
  - Identify ways to capitalize on the stable inflow of payments, which could help counties bolster their creditworthiness and lower their cost of capital, for example.
  - Harmonize the tax treatment of renewables with neighboring jurisdictions to streamline taxation for projects that could straddle multiple counties.

- **Provide resources to support landowners and local officials:** While landowners and local governments can benefit considerably from wind and solar projects in their area, the development process can be daunting and confusing to those with no prior renewables experience. Local leaders can:
  - Educate and coordinate landowners to establish accurate expectations and encourage comparable payments across properties. For example, the Minnesota Farmers Union created a Farmers'

Guide to Solar and Wind Energy in 2019 to help prepare rural landowners to evaluate solar and wind leasing opportunities.[103]
- Offer training to local officials tasked with managing the permitting, financial contributions, and community engagement associated with wind and solar projects.

- **Capture value from the construction boom:** The construction phase can be a busy time for a host community, and while not without its challenges, it can provide a large economic opportunity for local businesses. Many developers would like to work with local vendors to procure the products or services that are commonly available locally, such as gravel, concrete, water, and various construction tools. Some have established local vendor programs to identify those that exist near their projects.[104] Local leaders can:

  - Inform local contractors and business owners early about planned wind or solar projects, so they have time to prepare for the demand. Melody Bolton's Rush Creek Partnership is one example of how local leaders can maximize opportunities for local hires and contracts.
  - Work with hotels, RV parks, and local housing authorities to ensure sufficient short-term housing for construction workers. Importantly, too, communities should avoid overbuilding, as new investments will need to be sustained after the construction phase.

- **Build a local O&M workforce:** The project operations phase can be an important source of long-term job opportunities for a rural community, especially when local workers are equipped with the skills to fill those positions. Local leaders can:

  - Establish or expand training opportunities for local residents to participate in the wind and solar O&M workforce. Wind and solar training programs are being developed in community colleges and

trade organizations across the country and are filling an important need for a rapidly growing field. The Interstate Renewable Energy Council has compiled a list of exemplary solar training programs,[105] and the Department of Energy's WindExchange platform includes a map of wind energy education and training programs across the country.[106]
- Advocate for the use of regional and local labor on nearby projects, for example during negotiations with a developer.

- **Support community development:** The revenues and jobs that wind and solar development provides can help rural communities maintain their economic vibrancy and their cultural character. To maximize that potential, local leaders can:

  - Explore opportunities with the project developer to support tangible community revitalization initiatives based on local priorities, whether that's new fire trucks, expanded emergency services, or bleachers for the school athletic fields.
  - Encourage dual use projects that can support other local economic and environmental services, such as solar plus grazing and pollinator-friendly solar.

RECOMMENDATIONS FOR STATE AND FEDERAL LEADERS

There is a strong role for state and federal leaders to enact and support renewable energy policies that drive community and economic development in rural America. These policies should be based on a robust understanding of on-the-ground realities in rural communities, in order to complement and not counteract local efforts.

- **Define a state-level policy framework for renewables:** In some instances, states have established approaches to renewable energy taxation or siting that guide local treatment of projects. State and federal leaders can:

  - Link tax assessment with production. Illinois, for example, assesses wind turbines at a standard rate per megawatt-hour of generating capacity and includes a steep depreciation schedule that is set at the state level. The value of the land occupied by the turbines is still determined locally. The state's approach has won accolades for being one of the clearest models in the country.[107]
  - Create a standard tax assessment methodology and/or siting policy (addressing issues like setback requirements, among other considerations) that applies to all local jurisdictions. The Texas tax abatement policy described in the Roadrunner Solar case study is an example of that approach.

- **Prepare new workers and transition the existing rural workforce:** Rural communities have the potential to play a bigger role in building the wind and solar projects they host. State and federal leaders can:

  - Fund wind and solar workforce training programs, particularly in low-income, historically disadvantaged, and fossil fuel-dependent communities. For example, looking ahead to the 2023 retirement of its coal-fired Merom Generating Station, Hoosier Energy Rural Electric Cooperative recently created an online certificate program in partnership with Indiana State University to retrain workers for careers in distributed generation and communications.[108]
  - Assess the implications for rural workers of any workforce requirements imposed on wind and solar development.

- **Encourage domestic manufacturing:** Wind and solar manufacturing facilities add significantly to the jobs and economic development tally of the renewables transition, and public policy can play a role in supporting more companies to establish or expand US operations. Increasing the share of wind and solar components manufactured in the United States offers a promising avenue for economic prosperity

at all scales, as manufacturing has the highest jobs multiplier effect of any sector of the US economy.[109] State and federal leaders can:

- Incentivize long-term public and private investments in American renewable energy manufacturing through financing tools like loan guarantees or tax credits.
- Work with the Department of Commerce as well as local economic development professionals to foster the development of renewable energy manufacturing hubs.

- **Support rural asset ownership opportunities and community wealth-building:** Some communities, tribes, and rural stakeholders are interested in more opportunities to generate wealth locally by owning wind and solar. For example, the Standing Rock Sioux Tribe recently formed a new public power authority and is crowdfunding an effort to build a 235 MW wind farm. Similarly, a coalition of six Sioux tribes formed the Oceti Sakowin Power Authority in 2015, with ambitious goals of developing a 2 GW network of wind turbines in the Dakotas.[110] State and federal leaders can:

  - Propose tax and incentive reforms that would make it easier for rural electric co-ops and other rural interests to own or invest in renewable energy projects. Several co-ops and policy advocates in the renewables sector support reinstating a "direct pay" or cash grant option for the two primary wind and solar tax credits, the Investment Tax Credit (ITC) and the Production Tax Credit (PTC). This option was temporarily added in the wake of the 2008 recession to fuel additional clean energy investments.

- **Create long-term demand certainty for wind and solar development:** Long-term regional demand for clean energy will send a strong signal to developers, businesses, and communities to invest in the needed training and infrastructure. The state of New Mexico, for instance, is seeing a surge of wind and solar development in the wake of the 2019 Energy Transition Act's passage, which set a zero-carbon electricity standard by 2050.[111] State and federal leaders can:

  - Create regional renewable development zones supported by sufficient transmission infrastructure. The Texas Competitive Renewable Energy Zones,[112] which built out transmission into wind-rich areas of west Texas, are widely credited with spurring gigawatts of renewable energy development in the region.
  - Establish durable energy policies that provide clear direction for the state or country's energy future.

CONCLUSION

CONCLUSION

Renewable energy projects are operational in many rural communities across the United States today, and the expected growth of wind and solar generation will bring these projects to many more by the end of the decade. Based on the economic data and experiences yielded by the industry to date, that growth represents an investment in rural America that will total in the hundreds of billions of dollars, helping communities maintain and strengthen their economic viability for the long term.

Fundamentally, wind and solar projects are infrastructure additions to the rural landscape that provide stable revenue streams to local governments and co-exist well with other local industries. Rural leaders play an important role in siting and approving wind and solar projects locally, and have an opportunity to consider the economic development impacts that could be generated along with the renewable power in their communities. State and federal leaders also have a part to play in supporting renewable energy development that benefits rural communities locally as well as American energy consumers more broadly.

The renewable energy revolution is upon us; how communities engage with these new power generators will determine the extent to which the benefits help build and sustain a thriving rural America.

APPENDICES

APPENDICES

APPENDIX A: QUANTITATIVE ANALYSIS METHODOLOGY

Rural Commodities Comparison

Methodology

Exhibit A1 compares past and projected future revenue from utility-scale solar and onshore wind to revenues from sales of major US agricultural products.

For past agricultural commodity revenue, we used data from the United States Department of Agriculture (USDA) Economic Research Service.[113] Future revenues are based on USDA Agricultural Projections through 2029.[114] Trends from 2020 to 2029 were extrapolated to project revenue from 2030 through 2035.

For onshore wind and utility-scale solar revenue, we first assumed annual capacity installations consistent with the *2035 Report* 90% Clean Scenario. We then assumed that for the entirety of a project's operating life it will generate revenue identical to the levelized cost of energy (LCOE) for solar or wind in the year the project was built. We used Lazard's Levelized Cost of Energy[115] for historic LCOEs. Future LCOEs were drawn from NREL's 2020 Annual Technology Baseline (ATB).[116] For wind we used the moderate cost-decline class 5 wind scenario. For solar we used the moderate cost decline scenario and City solar resource scenario. NREL's ATB was used to estimate annual production of solar and wind.

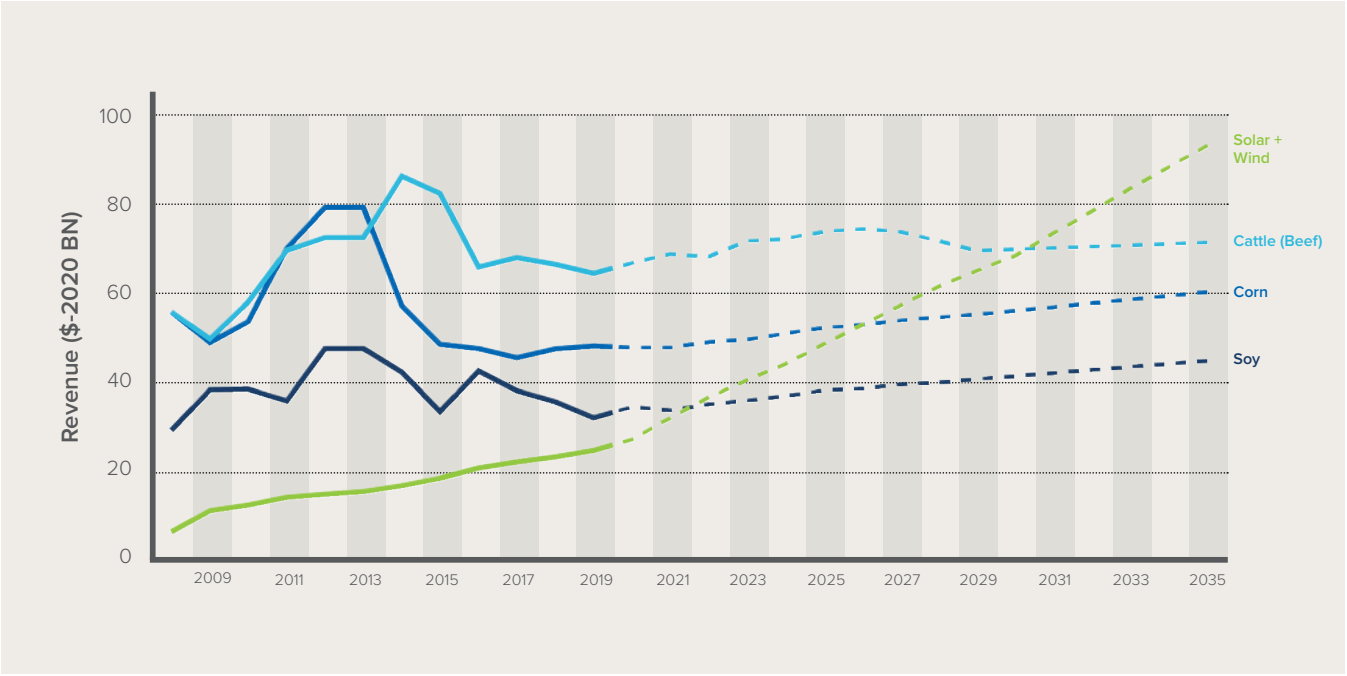
We assumed that revenue per unit energy produced ($/MWh) will remain constant throughout a solar or wind asset's life. This ignores the fact that tax benefits will accrue toward the start of the assets' life.

Discussion

Exhibit A1 shows total economic revenues from wind and solar. This total revenue will pay for direct

EXHIBIT A1

Onshore Wind and Utility-Scale Solar Revenue Compared with the Top Three Agricultural Commodity Revenues



local costs (land lease payments, property taxes, construction wages, O&M wages) as well as the cost of hardware and returns to investors.

Exhibit A1 is not intended to suggest that rural residents will see more revenue from wind and solar than from agricultural commodities; it is developed to demonstrate the scale of this rurally focused industry in comparison with other rural commodities. Additional comparisons, such as the $/acre value of cropland, ranchland, and renewables land leases, are beyond the scope of this chart. For reference, according to the USDA,[117] net revenue from corn and soy production is currently a little less than $300/acre. Solar rents range widely and can be anywhere from $250 to $2,000 per acre.

Direct Rural Economic Development Impacts from Wind and Solar Projects in 2030

Methodology

Inputs: This analysis uses the *2035 Report* 90% Clean scenario to project annual onshore wind and utility-scale solar capacity additions from 2020 to 2030. From there, we quantify four direct economic impacts associated with these wind and solar projects that would primarily flow to rural areas:

- Property tax revenues
- Land lease payments
- Construction wages
- O&M wages

While the direct impact of wind and solar will vary considerably by project and location, a thorough literature review informed estimates for average national values associated with a typical wind and solar project. A common tool across many of the analyses was the Jobs and Economic Development Impacts (JEDI) model developed by NREL, which informs several of the estimates we produced.

This analysis focused on quantifying direct impacts specifically, as those are the most tangible and concrete impacts of wind and solar development. While indirect and induced impacts would add to these values, they are harder to predict so they are excluded from this approach.

We derived national averages for $/MW and FTE/MW values from wind and solar projects as follows:

- **Property tax:** Using NREL's 2020 study of the wind O&M workforce, we assumed average wind property tax revenues per megawatt were $3,545/MW/year. For solar, we used state-specific analyses from diverse geographies to estimate average property tax revenues of $3,940/MW/year.

- **Land lease payments:** Based on an AWEA publication,[118] we assumed wind land lease payments averaged $2,987/MW/year nationally. For solar, we estimated (based on interviews) that solar lease payments were typically 3X the lease payment a landowner would receive for renting cropland. Using USDA data on cropland rents in each state,[119] and a weighted average based on states' projected 2030 installed solar capacity, we calculated an average national solar lease price of $438/acre/year or $3,067/MW/year.

- **Construction Labor:** Using the NREL JEDI model, we assumed the equivalent of 70 workers would need to work for a full year to build 100 MW of wind, and those workers would be paid an average of $64,000 per year. Using data from an IRENA UNESCO presentation we assumed 178 full-time workers would need to work for one year to build 100 MW solar,[120] and using NREL data we assumed those workers would be paid an average of $50,000 per year.[121] We assumed that the number of workers needed to build a project would decline over time proportional to projected declines in install costs (based on NREL ATB).

- **O&M Labor:** Using the NREL wind O&M workforce study, we assumed 11 full time workers are needed to perform O&M on 100 MW of wind and that the average salary would be $63,000 for those workers. Using data from Sandia National Labs,[122] we assumed three workers are needed to provide O&M for a 100 MW solar project and those workers would be paid an average $75,000 per year. We assumed that for each new project year, the O&M workers required would decline proportional to LCOE decreases.

The chart below shows the direct economic impact values on a per-MW basis that informed this analysis. In all cases, we aired toward conservative values to mitigate for the considerable geographic variation and fast-changing nature of the industry:

EXHIBIT A2

Direct Economic Impact Values

	Assumption/Calculation*	Value	Unit	Source/Calculation	Source Publication Year
A	Wind/solar project lifetime	30	years	LBL wind & solar benchmarking studies; NREL ReDS	2019
B	Onshore wind installed capacity, 2020	119.1	GW	*2035 Report*	2020
	Onshore wind installed capacity, 2030	366.2	GW	*2035 Report* projection	2020
C	Utility-scale solar installed capacity, 2020	61.5	GW	*2035 Report*	2020
D	Utility-scale solar installed capacity, 2030	392.8	GW	*2035 Report* projection	2020
E	Tax revenues - wind	3,545	$/MW-y	Averaged value from NREL wind O&M report	2020
F	Tax revenues - solar	3,940	$/MW-y	Averaged value from 6 state-based studies	2019-2020
G	Land lease payments - wind	2,987	$/MW-y	AWEA report (national average)	2017
H	Land lease payments - solar	3,067	$/MW-y	RMI calculation based on USDA cropland rent data and EIA solar data	2020
I	Construction jobs - wind	0.70	FTE/MW	NREL JEDI assessment report	2013
J	Construction jobs - solar	1.78	FTE/MW	IRENA	2016
K	Construction jobs earnings - wind	64,286	$/year	NREL 2018 Cost of Wind Review	2018
L	Construction jobs earnings - solar	50,518	$/year	Averaged value from NREL Solar PV Cost Benchmarks, 2018	2018
M	O&M jobs - wind	0.11	FTE/MW	NREL wind O&M report	2020
N	O&M jobs - solar	0.05	FTE/MW	Sandia National Lab solar O&M report	2015
O	O&M job earnings - wind	63,250	$/year	Averaged value from NREL wind O&M report	2020
P	O&M job earnings - solar	74,880	$/year	Sandia National Lab solar O&M report	2015

Quantifying total direct impacts (annual and lifetime values):

- An estimated annual value for each direct economic impact flowing from wind and solar projects was calculated by multiplying the per-MW value by the total installed capacity in 2030.

- An estimated lifetime value for each direct economic impact flowing from wind and solar projects was calculated by multiplying the per-megawatt value by the total new installed capacity between 2020 and 2030, and then by 30, the average project lifetime. (Note: since construction workers are short term, the construction wage lifetime value was not multiplied by 30; we assumed construction work supported by the new installed capacity would last roughly one year so wages were simply multiplied by new capacity additions.)

- These total direct impacts are represented in treemaps in the study to show their values in relation to each other, and how they differ between solar and wind projects.

APPENDIX B - LITERATURE REVIEW

In this section we provide a list of the primary reports and resources that informed the research and analysis for this study. Along with the literature review, our research was informed by extensive interviews with renewable energy developers, economic development professionals, and rural community leaders.

UC-Berkeley, GridLab (2020): *2035 Report*

The *2035 Report* uses the latest renewable energy and battery cost data to demonstrate the technical and economic feasibility of achieving 90% clean (carbon-free) electricity in the United States by 2035. Two central cases are simulated using state-of-the-art capacity expansion and production-cost models: The No New Policy case assumes continuation of current state and federal policies; and the 90% Clean case requires that a 90% clean electricity share is reached by 2035. These scenarios are depicted graphically in the Introduction section of this report, and the remainder of this report is grounded around the new installed capacity projections of the 90% Clean case.

Rewiring America (2020): *Mobilizing for a Zero-Carbon America*

This report, based on an extensive industrial and engineering analysis of what total decarbonization of the US energy system would entail, demonstrates that aggressive decarbonization would create, rather than destroy, many millions of well-paying American jobs.

Development Research Partners, prepared for The Western Way, Pro 15, Action 22 (2020): *The Economic Benefits of Colorado's Eastern Plains Renewable Energy Industry*

This report profiles the renewable energy industry in Colorado's eastern plains and measures the economic benefits wind and solar projects provide in terms of construction, investment, employment, and business activity.

IdeaSmiths LLC - Josh Rhodes (2020): *The Economic Impact of Renewable Energy in Rural Texas*

This analysis sought to assess the local taxes and landowner payments associated with utility-scale renewable energy projects, as well as local sentiment toward these projects, in rural Texas counties.

Mangum Economics, prepared for MDV SEIA (2020): *The Economic Contribution of Utility-Scale Solar Development to Virginia*

This report provides an analysis of the development of utility-scale solar energy in Virginia, the factors driving that development, and what it means for host localities within the state.

NREL (2019): *Economic Impacts of Wind Energy in Colorado Case Study: Rush Creek Wind Farm*

This report is a quantitative and qualitative analysis of a single wind development: the 600 MW Rush Creek Wind Farm, based on the Jobs and Economic Development Impacts (JEDI) model and qualitative research and interviews. The results highlight the jobs and economic activity supported during wind construction, manufacturing, and operation and maintenance activities.

NREL (2020): *Workforce and Economic Development Considerations from the Operations and Maintenance of Wind Power Plants*

This report assesses the qualitative and quantitative impacts of O&M workers who may reside in communities near utility-scale, land-based wind plants. This report also updates existing economic impact research, expanding the current wind energy economic analysis portfolio with detailed project-based information about the land-based wind O&M workforce.

NREL (2014): ***Economic Impacts from Indiana's First 1,000 Megawatts of Wind Power***
This study uses the Jobs and Economic Development Impacts (JEDI) model to estimate the economic impacts of the first 1,000 MW of wind energy in Indiana during construction and operation phases.

Purdue University (2020): ***An Examination of the Community Level Dynamics Related to the Introduction of Wind Energy in Indiana***
This report examines the wind energy sector in Indiana and selected counties and includes information gathered via two different approaches: rigorous secondary data analysis and primary data collection using an online survey and online listening sessions.

Ohio University (2020): ***Measuring the Economic Impacts of Utility-Scale Solar in Ohio***
This report details a comprehensive economic impact study for utility-scale solar energy projects in Ohio, based on three deployment scenarios: a "low" scenario (2.5 GW), a "moderate" scenario (5 GW), and an "aggressive" scenario (7.5 GW). The economic impact study includes a workforce analysis, a review of potential tax revenues, and production calculations for each deployment scenario.

Sandia National Lab (2015): ***Budgeting for Solar PV Plant Operations & Maintenance: Practices and Pricing***
This paper presents an overview of the utility-scale PV O&M budgeting process along with guiding rationales, before detailing perspectives on current plant upkeep activities and price points, largely in the United States.

University of Illinois (2015): ***The Economic Impact of a New Solar Power Plant in Arizona: Comparing the Input-Output Results Generated by JEDI vs. IMPLAN***
This paper calculates the impact on job, income and output creation of a new solar power plant in an input-output framework. The analysis compares the multipliers generated by the construction and operation/maintenance of a plant located in California with those it would have generated had it been built in Arizona. It also compares results obtained with IMPLAN software with the solar photovoltaic model of JEDI.

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ENDNOTES

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