Is Clean Hydrogen Production a Good Fit for Questa? Final Economic Impact Results

July 2024

Alberto Franco-Solis, Andre F.T. Avelino, Yi Min Zhang, Kevin Topolski, Elaine Hale, and Chrissy Scarpitti

National Renewable Energy Laboratory

Produced for the U.S. Department of Energy by the National Renewable Energy Laboratory (NREL).

DOE/GO-102024-6267 • July 2024

Is Clean Hydrogen Production a Good Fit for Questa? Final Economic Impact Results

July 2024

Alberto Franco Solis, Andre F.T. Avelino, Yi Min Zhang, Kevin Topolski, Elaine Hale, and Chrissy Scarpitti

National Renewable Energy Laboratory

Suggested Citation
Franco-Solis, Alberto, Andre F.T. Avelino, Yi Minh Zhang, Kevin Topolski, Elaine Hale, and Chrissy Scarpitti. 2024. *Is Clean Hydrogen Production a Good Fit for Questa? Final Economic Impact Results*. Golden, CO: National Renewable Energy Laboratory. DOE/GO-102024-6267. https://www.nrel.gov/docs/fy24osti/88932.pdf.

Produced for the U.S. Department of Energy by the National Renewable Energy Laboratory (NREL).

DOE/GO-102024-6267 • July 2024

National Renewable Energy Laboratory
15013 Denver West Parkway
Golden, CO 80401

303-275-3000 • www.nrel.gov

Notice

This work was authored by the National Renewable Energy Laboratory, operated by Alliance for Sustainable Energy, LLC, for the U.S. Department of Energy (DOE) under Contract No. DE-AC36-08GO28308. Funding provided by the DOE's Communities LEAP (Local Energy Action Program) Pilot. The views expressed in the article do not necessarily represent the views of the DOE or the U.S. Government.

Foreword

From 2022 to 2024, a coalition of stakeholders in the Village of Questa, NM partnered with the U.S. Department of Energy's Communities Local Energy Action Program (LEAP) to explore options to develop electrolytic hydrogen production facilities to create jobs, provide clean energy, and utilize former mine resources. In the project's first phase, the National Renewable Energy Laboratory (NREL) provided technical assistance to assess the economic feasibility of constructing solar PV-powered hydrogen facilities at Chevron's former molybdenum mine site and tailing facility, including a grid-tied hydrogen energy storage facility (Topolski et al. 2023). This economic impact assessment report extends the grid-tied energy storage application findings of the original feasibility study to estimate potential impacts on jobs, earnings, and tax revenues. The findings of the previous study and this report are intended to inform the Village of Questa and broader Taos County communities of possible scope, costs, benefits, risks, and next steps of electrolytic hydrogen development, recognizing that the assessment is necessarily incomplete and uncertain given the commercial novelty of clean hydrogen technologies.

This economic impact assessment report relies on the technoeconomic financial analysis conducted in the first phase of the project (Topolski et al. 2023), and on an input-output model applied to the economy of Questa and the surrounding area, the rest of Taos County and the state of New Mexico. Key assumptions used in the first phase financial analysis include estimates of 2027 electrolyzer and fuel cell costs based on global deployment projections; Kit Carson Electric Cooperative (KCEC) service territory projected net load, PV capacity, and storage capacity for 2027; 2021 solar PV generation profiles; a heuristic dispatch strategy for local solar, battery energy storage, and hydrogen energy storage; and ability to claim the full value of Inflation Reduction Act incentives. The economic impact assessment relies on data describing economy-wide linkages and spending patterns in New Mexico regions in 2019 as well as input data sourced from Questa Communities LEAP coalition members and average national workforce characteristics. This study does not address, e.g., a full range of possible costs for early-stage commercial polymer electrolyte membrane (PEM) electrolyzers, PEM fuel cells, and hydrogen storage; implications of multiple weather years for system sizing and operations; quantification of resiliency benefits; a full accounting of water use; water sourcing; project financing and incentives; cost recovery and ratepayer impacts; changes in economic structure post-COVID-19; potential increased demand on public services (safety, roads, water treatment, housing, schools, etc.); environmental impacts; cultural impacts; asset ownership; distribution of benefits; or workforce training needs.

Given the uncertainty of some study inputs, as well as the many aspects of procuring, constructing, and operating a hydrogen energy storage facility not addressed in this study, this report is intended for discussion purposes only and should not be the sole basis of future design or investment decisions. It should not be used to estimate or extrapolate the impact of hydrogen projects of different scales and use cases. The purpose of this report and the overall study is to provide information to the Questa Community Coalition and surrounding community members. The authors, NREL, U.S. Department of Energy, and Communities Local Energy Action Program (LEAP) are not recommending any specific course of action.

Development of any kind comes with tradeoffs that must be considered by community leaders and residents. Choosing a specific economic development path can impact or present tradeoffs between land use, water use, allocation of public services, and the job functions of community members. For the community to determine if hydrogen is a good fit for Questa, they could pursue additional activities such as: assessment of other technology options to provide clean electricity; assessment of other economic development opportunities; hydrogen workforce gap analysis; third-party validation, cost-benefit analysis, and safety design of hydrogen facilities described in this study or otherwise under consideration; ensure leaders are providing continuous, transparent and meaningful outreach and engagement; develop community benefit agreements and workforce development programs.

Acknowledgments

This report could not have been completed without the assistance of numerous individuals during this technical assistance project. The authors would like to extend our most sincere thanks to the Questa Coalition—especially John Ortega (Village of Questa Mayor), Lynn Skall (Questa Economic Development Fund, Executive Director), Luis Reyes (Kit Carson Electric Cooperative [KCEC], CEO), Jacob LaFore (Village of Questa project manager), and Gabriel Herrera (Chevron, Public Affairs Advisor)—for continuous leadership, support, and guidance throughout the project. We also greatly appreciate the help provided by Karen Sharon from the Village of Questa regarding tax and finance information. We appreciate the valuable insights, guidance, and comments provided by Daniel Bilello and Emily Newes of NREL and João Pedro Ferreira of the Weldon Cooper Center for Public Service at the University of Virginia, during the editing and review process. The authors would also like to thank Anthony Teixeira and Liz Gill from the C-LEAP program management team of NREL.

List of Abbreviations

FTE	full-time equivalent
IMPLAN	Economic IMpact Analysis for PLANning
JEDI	Jobs and Economic Development Impact
KCEC	Kit Carson Electric Cooperative
LEAP	Local Energy Action Program
NREL	National Renewable Energy Laboratory
O&M	operation and maintenance
PEM	polymer electrolyte membrane
PV	photovoltaic
SOC	Standard Occupational Classification

Executive Summary

The Village of Questa, New Mexico, is a small village of almost 2,000 people about 25 miles north of the town of Taos. It is located in Taos County, New Mexico, whose largest electricity provider is Kit Carson Electric Cooperative (KCEC). A coalition of stakeholders in the Village of Questa, comprising the Village, KCEC, Questa Economic Development Fund, and Chevron, is exploring options to develop hydrogen facilities as an opportunity to create jobs, provide reliable clean energy, and utilize former mine resources.

Historically, Questa's economy largely consisted of agriculture and income from a molybdenum mine that closed in 2014. About 300 workers were laid off at the time of the closure, when the mine transitioned from active operations into environmental remediation (Logan 2014). Although remediation efforts have been ongoing since 2014 and are expected to continue for at least 16 more years, the number of current on-site jobs, 173 workers (Plant 2022) is much smaller now than it was before the closure, 400 employees and contractors (Parker 2008). Between available workforce, brownfield land, and water rights formerly supporting mine operations, [1] but now in a transition period, there are considerable local resources that could be directed toward clean energy generation.

The electricity KCEC supplies to Questa and other communities in Taos County is already 100% solar during daylight hours. Now, Questa, KCEC, and Chevron are exploring the potential costs and benefits of siting an electrolytic hydrogen energy storage facility and additional solar photovoltaic (PV) capacity in Questa to further advance the region's clean energy economy. A previous report summarized the technoeconomic feasibility of this facility and a second electrolytic hydrogen application for fueling heavy-duty vehicles associated with mine site remediation (Topolski et al. 2023).

In this report, the National Renewable Energy Laboratory (NREL) estimates the potential economic impacts (i.e., jobs, value added, gross output, and tax revenue) of constructing and operating a combined hydrogen (32-MW polymer electrolyte membrane [PEM] electrolyzer + 7.5-MW PEM fuel cell) and solar facility (15 MW) in the Village of Questa. We quantify economic impacts for three geographic regions, Questa and the surrounding area, the rest of Taos County, and the state of New Mexico, using. an input-output model that leverages the Impact Analysis for PLANning model's (IMPLAN's) economic data for the region complemented by construction and operating expenses estimated by NREL and with feedback from the local coalition. We estimate direct, indirect, and induced effects of project construction (transient impacts) and operation (more permanent impacts) under three different scenarios (i.e., Least Local, Mid, and Most Local).

Based on the area's average trade profile, feedback from the coalition, and current market conditions, the hydrogen and solar facilities are expected to support 410 full-time equivalent (FTE) jobs during construction, generating $21 million in income for those workers and $71 million in local economic activity in the state (Figure ES- 1). Of those jobs, 86 are expected to be construction and transportation-related. These investments are also estimated to add $31.2 million to New Mexico's gross state product. In the Village of Questa, we estimate 11 jobs will be supported in the construction and transportation industries, generating $600,000 in earnings. In Taos County, the construction phase is expected to support 235 jobs primarily in construction and professional services, while manufacturing jobs dominate the results for the rest of New Mexico. The Village is also estimated to receive $800,000 in tax revenue from the construction phase alone.

[1] The quantity of mine water rights that might be available for other uses is currently uncertain due to ongoing negotiations between Chevron Mining and the New Mexico Office of the State Engineer (Plant, 2023).

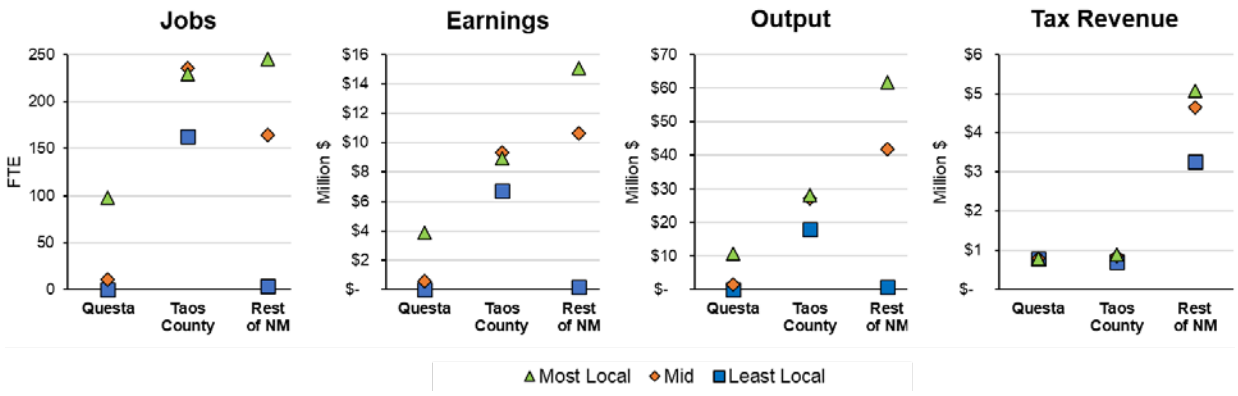

Figure ES- 1. Estimated construction impacts across regions in New Mexico. *Image by author*

Once in operation, the facilities will continue to impact the state, Taos County, and Questa. Around 20 jobs (FTE for each year of operation) are expected to be supported across New Mexico, with approximately 11 directly employed in Questa by both facilities (Figure ES- 2). The total annual within-state economic activity supported by ongoing operations is $6.9 million/yr, generating $1.6 million/yr in additional income. Annual operations are estimated to add $2.5 million to the state's gross state product. The Village is expected to receive around $214,000/yr in tax revenue (gross receipts tax and property taxes).

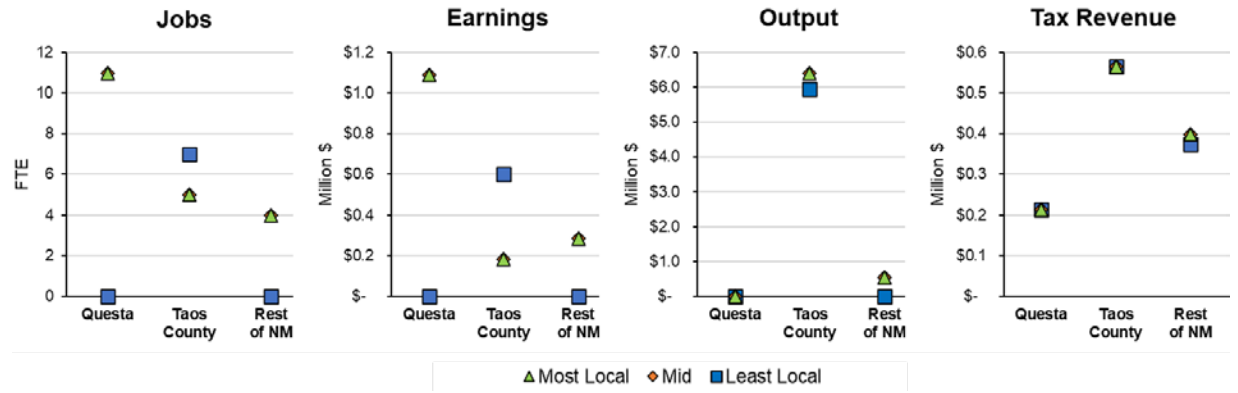

Figure ES- 2. Estimated annual operation impacts across regions in New Mexico. *Image by author*

Impacts vary significantly depending on which businesses are supplying materials, equipment, and services, and where construction workers reside. Figures ES- 1 and ES- 2 provide a range that reflects the case in which most goods and services are supplied by out-of-state businesses (Least Local) and the impacts when all goods and services are supplied by in-state businesses (Most Local). Choosing local suppliers provides the most benefits to Questa and the New Mexico economy, adding up to 400 jobs during construction and 13 long-term jobs. Local and state governments may consider ways to incentivize local businesses to maximize economic benefits.

Table of Contents

List of Figures

List of Tables

1 Introduction

The Village of Questa, New Mexico, is a small village of almost 2,000 people about 25 miles north of the town of Taos. It is located in Taos County, New Mexico, whose largest electricity provider is Kit Carson Electric Cooperative (KCEC). Questa is nearly surrounded by protected federal lands, with the Rio Grande del Norte National Monument to its west and Carson National Forest to its south and east.

Historically, Questa's economy largely consisted of agriculture and income from a now-closed molybdenum mine. The mine opened in 1916, employing 600 workers at its peak (Atencio 2000), and was bought by Chevron Mining in 2005. In 2014, Chevron Mining announced the closure of the mine due to continuing low molybdenum prices and high operating costs. About 300 workers were laid off at the time of the shutdown (Logan 2014). Residents in Questa and surrounding communities lost their jobs when the mine closed and transitioned from active operations into environmental remediation. Although remediation efforts have been ongoing since 2014 and are expected to continue for at least 16 more years, the number of people currently employed on-site (173 workers [Plant 2022]) is much smaller now than it was before the closure (400 employees and contractors [Parker 2008]).

Between available workforce, brownfield land, and water rights that formerly supported mine operations,[2] there are considerable local resources that might be transferable to clean energy projects. Questa, KCEC, and Chevron recognized this possibility in 2021 and applied to the U.S. Department of Energy's Communities Local Energy Action Program (LEAP) for technical assistance. Previous work (Topolski et al. 2023) analyzed the techno-economic feasibility of two possible facilities:

- **Facility A** comprises a 15-MW solar photovoltaic (PV) array and a grid-tied 36-hour hydrogen energy storage facility with 7.5 MW of discharge capacity to complement KCEC's growing clean energy portfolio.
- **Facility B** comprises a 4.2-MW solar PV array, a 4.2-MW electrolyzer, and 16.1 tons of compressed hydrogen storage to supply heavy-duty hydrogen fuel cell vehicles to be used in Chevron mine remediation efforts starting in the early 2030s.

In this report, we estimate the potential economic impacts (i.e., jobs, value added, tax revenue) of constructing and operating Facility A. Temporary effects of the construction phase and more-permanent annual effects during operation were compiled for the Village of Questa, Taos County, and the state of New Mexico.

1.1 Economic Impacts Methodology

To estimate the economic impacts of the solar PV array and hydrogen energy storage components of Facility A, we used an input-output model, one of the most commonly used and straightforward methods (Miller and Blair 2022) for estimating economy-wide impacts due to a change in regional demand (e.g., a new construction project). Input-output models are composed of equations reflecting each sector's production function (i.e., their production "recipes") that together show how these sectors interact in a region. This network structure reflects different sectors buying and selling to one another, local households, government, and external markets. In this way, input-output models can estimate how supply chains respond and how macro-level economic indicators grow, shrink, or shift in response to changes in good and service demands.

[2] The quantity of mine water rights that might be available for other uses is currently uncertain due to ongoing negotiations between Chevron Mining and the New Mexico Office of the State Engineer (Plant 2023).

Input-output models capture "multiplier effects" in the economy that arise from sectoral interaction across different supply chains. A change in demand acts as a drop of water in a still pond that creates waves ("ripples") that are large in the beginning and fade over time. The first wave is the largest: It represents the demand for inputs (e.g., equipment, construction materials, electricity, engineering services) from direct suppliers. To meet this demand for goods and services from the first wave, suppliers of these firms need to purchase inputs as well to manufacture/provide the services demanded, generating a secondary smaller ripple. Then, suppliers of these suppliers also need to purchase additional inputs, and so on, generating a sequence of fading ripples in the economy. The sum of all ripple effects is the total economic impact of that initial change in demand (Figure 1).

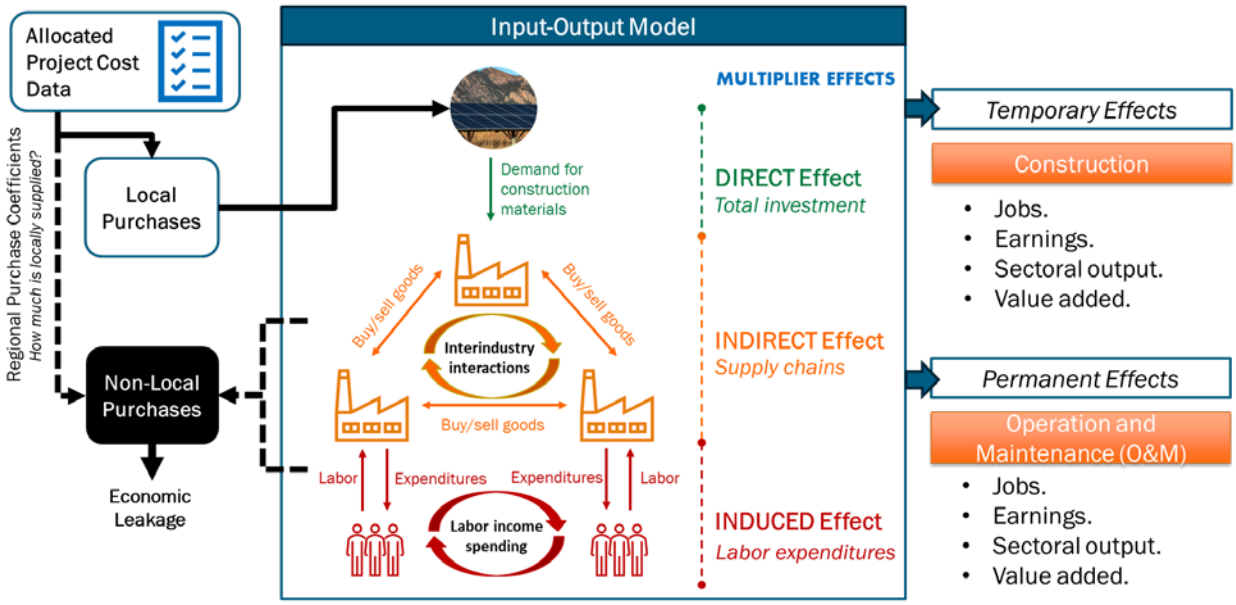

Figure 1. Economic impact analysis overview. *Image by author*

Impacts can be classified as direct, indirect, or induced. "Direct effects" refer to those economic impacts generated by the initial purchase of commodities and services (total investment). To supply those commodities/services, however, commodities/services from the wider economy are required as inputs to production, other commodities/services are required as inputs to these inputs, and so on. The economic impacts generated by these upstream supply-chain linkages are denoted "indirect effects." Finally, in every step of production in each supply chain, labor is required, and remuneration paid. "Induced effects" account for the economic impacts resulting from the spending of such wages/salaries by workers and earnings/profits by proprietors, which creates additional rounds of production in the local economy (Figure 1).

The economy-wide results include total temporary and permanent jobs supported, changes in gross state product (value added), sectoral output, earnings, and taxes:

- Jobs are defined as the sum of full-time equivalent (FTE = 2,080 hr/yr) workers employed at the place of business. All jobs supported by local companies are accounted for, including those of out-of-state commuters (who might spend part of their wages outside the state). Jobs include wage and salaried employees as well as proprietors' jobs (business owners, partners, and tax-exempt cooperative members).
- Output represents the value of production and includes all sales of products/services produced by a sector. It measures the economic activity generated by the project.

- Value added represents the wealth generated by an economic activity and includes compensation of employees (wages and benefits), profit-type income, property income,[3] and taxes on production.
- Earnings are part of the value added that represents pre-tax total compensation of employees (wages and benefits) and proprietor income (income of sole proprietorships, partnerships, and tax-exempt cooperatives).
- Tax revenue represents local, county, and state taxes collected throughout the production process.

1.2 Review of Recent Projects

Local impacts for utility-scale solar projects, especially in small economies like Questa, usually derive from construction and operational phases, while most pre-construction expenses (engineering and professional services, equipment manufacturing, etc.) are provided by businesses outside the region (NREL 2023). Construction tends to bring a large temporary workforce to the region, while operation and maintenance (O&M) supports a small long-term workforce, which can be a subset of the local workers who participated in the construction phase. Overall, most jobs supported by this type of project are construction-related (Figure 2).

Table 1 lists several recently built utility-scale solar facilities across the United States and their reported direct construction jobs and operation jobs supported during the project. On average, we expect 2.2 direct jobs supported during construction per MW installed, and 0.03 annual jobs/MW during operation. The table also shows that larger facilities exhibit economies of scale during construction, that is, they require fewer workers per MW than smaller facilities. For facilities smaller than 100 MW, the ratio of direct construction jobs/MW is around 3.6 versus 1.7 jobs/MW for facilities 100 MW or larger. In terms of O&M jobs, both size facilities have the same average 0.03 annual jobs/MW.

These job ratios are also in line with other estimates of expected direct jobs during solar facility construction: according to the Florida Power & Light Company, two recently built 75.4-MW solar facilities (Saw Palmetto and Cypress Pond) will support around 200 direct jobs each, or 2.6 jobs/MW, during the peak of construction (FPL 2023a; 2023b).

[3] Property income includes capital depreciation, corporate profits (profits not distributed to proprietors), net of business current transfers (transfers between company branches outside the region, government, persons, for which no service is provided), dividends, rents, and royalties.

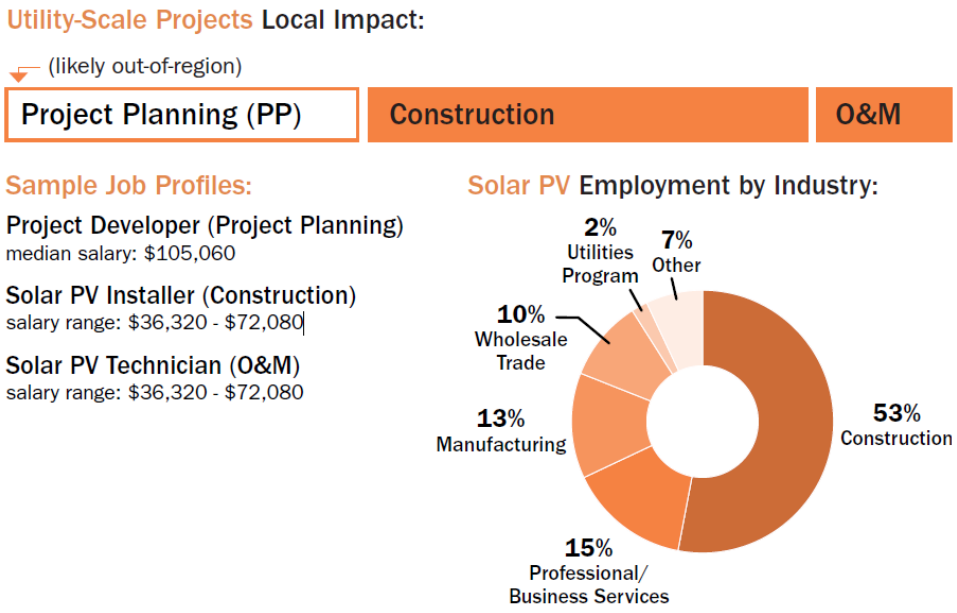

Figure 2. Solar PV employment profile

Adapted from NREL (2023).

The same analysis for direct construction jobs is unavailable for the hydrogen producing facility case. As of the time of this report, there are no commercial hydrogen electrolysis plants in operation in the United States, and hydrogen produced through electrolysis makes up less than 1% of all national generation (Carbon Solutions 2023). A similar facility was recently built in Wessling, Germany—Shell's Rhineland Refinery, a 10-MW hydrogen electrolysis plant—but no employment information for that facility is publicly available.

Table 1. Utility-Scale Solar Facilities and Reported Direct Employment

Facility	Location	Year	Installed Capacity (MWac)	Construction (FTE)	Operation (FTE/yr)
Desert Sunlight	Riverside County, CA	2011	550	550	15
Mesquite 1	Maricopa County, AZ	2013	170	300	12
California Valley Solar Ranch	San Luis Obispo County, CA	2013	250	350	11
Agua Caliente	Yuma County, AZ	2014	290	400	10
Antelope Valley Solar Ranch	Los Angeles County, CA	2014	242	350	20
Lone Valley Solar Park	San Bernadino County, CA	2015	30	170	3
Cameron Solar Park	Calhoun County, SC	2017	20	71	2
Estill Solar Park	Hampton County, SC	2017	20	65	2
Hampton Solar Park	Hampton County, SC	2017	20	64	2
Bingham and Temperance	Clinton and Monroe Counties, MI	2020	40	90	N/A
Two Creeks Solar Park	Manitowoc County, WI	2020	150	200	N/A
Athos I and II	Riverside County, CA	2021/2022	450	600	N/A
Prairie Wolf	Coles County, IL	2021	200	250	N/A
Athos III	Riverside County, CA	2022	224	500	5
Riverstart Solar Park	Randolph County, IN	2022	200	700	5
Townsite Solar Facility	Clark County, NV	2022	232	480	N/A
Yellowbud Solar	Ross and Pickaway Counties, OH	2022	274	550	N/A
Aktina Renewable Power	Wharton County, TX	2022	500	500	N/A

Sources: [1]U.S. Department of Energy (2023d); [2]U.S. Department of Energy (2023e); [3]U.S. Department of Energy (2023c); [4]U.S. Department of Energy (2023a); [5]U.S. Department of Energy (2023b); [6]EDP Renewables (2023a); [7]EDP Renewables (2022a); [8]EDP Renewables (2022b); [9]EDP Renewables (2022c); [10]National Grid Renewables (2023a); [11]Kernan (2021); [12]Rosendin (2023b); [13]National Grid Renewables (2023b); [14]Intersect Power (2023); [15]EDP Renewables (2023b); [16]Rosendin (2023c); [17]National Grid Renewables (2023c); [18]Rosendin (2023a).

2 Data Sources

2.1 Economic Data

The Economic IMpact Analysis for PLANning (IMPLAN)[4] online software was used to quantify the potential economy-wide impacts resulting from the investments in the hydrogen and solar facilities that comprise Facility A, as well as their annual O&M. IMPLAN is a platform for estimating the total impact of structural changes (new industries, sector growth, and demand shocks) in a given region using a demand-driven input-output model. Underlying these analyses is a dataset of social accounting matrices that include sectoral, demographic, and governmental data reflecting how the economy of the region operates in a given year. A social accounting matrix reflects economic flows between sectors, consumers, and institutions at the state, county, and ZIP code levels.

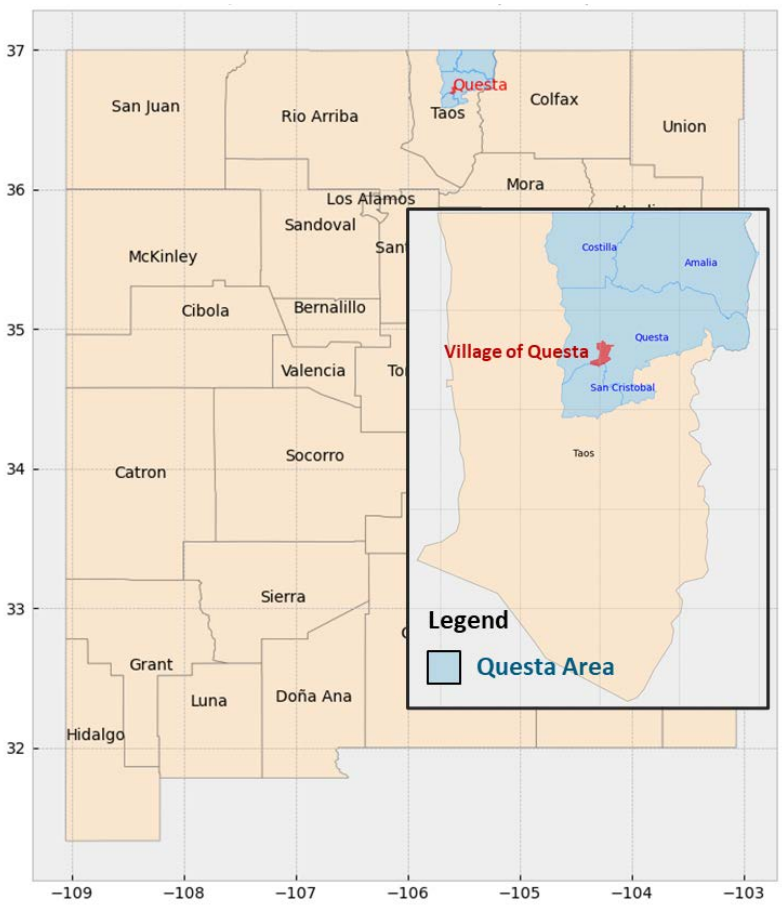

Figure 3. Questa area boundaries (in blue). *Image by Francisco-Solis and Atom. Data from U.S. Census Bureau*

In this study, we divided the New Mexico economy into three regions: Questa Area, rest of Taos County, and rest of New Mexico. The "Questa Area" encompasses adjacent villages and towns that are economically relevant to the Village of Questa, as determined by the Questa Coalition.[5] It is composed of five ZIP codes: 87512, 87519, 87524, 87556, and 87564 (Figure 3). The "Rest of

[4] See https://implan.com/.

[5] The Questa Coalition includes representatives from the Village of Questa (mayor's office, Questa Economic Development Fund), from KCEC, and from Chevron.

Taos" is composed of all other ZIP codes in Taos County, and the "Rest of New Mexico" includes all counties in New Mexico except Taos County. These regions are connected via trade flows according to IMPLAN's data.

IMPLAN' social accounting matrices at the ZIP code-level are not as accurate as those at state or county level due to limited data availability at such granular spatial resolution. Therefore, we adjusted the original social accounting matrices to better reflect current conditions based on feedback from the Questa Coalition.

For this analysis, we used New Mexico's 2019 social accounting matrix from IMPLAN, which reflects the statewide linkages (i.e., sectoral supply chains, population's spending patterns, and transfers between institutions) in that year. Although data up to 2022 is available, we opted to use 2019 data to avoid data anomalies that might be present in 2020–2022 data because of the COVID-19 pandemic and subsequent recovery.

New Mexico does not have sales tax, but instead charges businesses gross receipts taxes. The tax rate is determined by the location where goods or services are delivered, except for "professional services" that are taxed where the work is performed. The 2023 gross receipt tax for the Village of Questa was 8.0625% (New Mexico Taxation and Revenue Department 2023), from which the village keeps 1.5625 percentage points, Taos County retains 1.25 points, and the state gets 5.25 points. Architectural and engineering services are considered professional services and taxed at the Taos Pueblo rate of 7.5%.[6]

Table 2. Mill Levies for State, County, Municipality, and School District, 2023

	Tax Levy	Allocation
State Debt Service	1.360	State
County Operational	11.850	Taos County
Municipal Operational	4.829	Questa Area
School Dist. Operational	0.457	Taos County
School Dist. Debt Service	2.560	Taos County
School Dist. Cap. Improve.	2.000	Taos County
School Dist. Educ. Tech. Debt Service	1.079	Taos County
Taos Soil	1.000	Taos County
Total	**26.135**	

Source: Taos County 2024

Based on current property taxes paid by Chevron in the parcel where the Questa facility will be built, we estimated an updated annual property tax based on the total investment from this project, and the 2023 tax rates for non-residential properties (9 IN NR) in the Village of Questa (Taos County 2024). The tax rates and distribution of taxes between state, county, and village assumed in this study are shown in Table 2.

2.2 Cost Assumptions

The NREL team estimated hydrogen facility construction and operating costs in previous work (Topolski et al. 2023). The facility uses a 32-MW polymer electrolyte membrane (PEM) electrolyzer, 14-ton compressed gas storage, and a 7.5-MW PEM fuel cell. Costs were broken down into producer prices (what is paid to manufacturers), transportation costs, and wholesale margins (most goods are not purchased directly from manufacturers but through a reseller, and these margins account for

[6] The gross receipts tax rate varies throughout the county from 7.0000% to 8.9375%: https://www.taosnm.gov/199/Gross-Receipts-Tax. In this report, the median value is used as the gross receipt tax rate for Taos County.

their added costs) using the margin information from the 2012 Benchmark Input-Output Tables (Bureau of Economic Analysis 2018). Gross receipts taxes were added to the final costs. Construction is assumed to take 1 year. Figure 4 shows the distribution of expenses by major categories.

Construction costs for the solar facility were based on data for a recently installed facility in Mesa, NM, with the same capacity (15 MW) as the Questa project, which were provided by KCEC (L. Reyes, internal communication, July 7, 2023). The cost breakdown for annual operating expenses were estimated using the Jobs and Economic Development Impact (JEDI) Solar PV Model (NREL 2021), assuming total average annual expenses of $91,000 from KCEC. The distributions of expenses for construction and operation are shown in Figure 4. Construction is assumed to take 1 year. Once in operation, assuming a selling price of $0.045/kWh, the facility will generate $5.7 million/yr in revenue and around $460,000/yr in gross receipt tax (L. Reyes, internal communication, December 5, 2023).

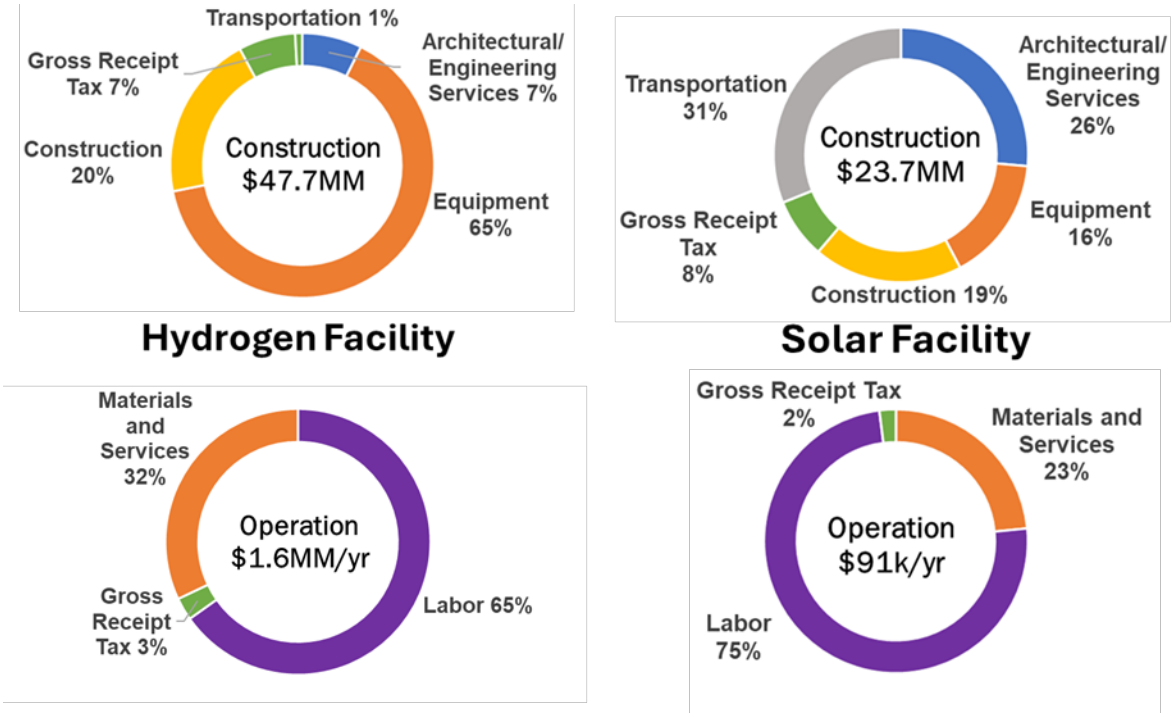

Figure 4. Construction and operation costs breakdown by facility. *Image by author*

2.3 Direct Employment Assumptions (O&M Phase)

We estimated the total number of employees required for the operation of the hydrogen-producing facility based on James et al. (2013) for a central PEM electrolysis plant producing 50,000 kg hydrogen/day. The staff distribution was based on a typical chemical facility operating on a 24/7 schedule. Its occupation breakdown by Standard Occupation Classification (SOC) Code was performed using the 2020 occupation profile of the chemical manufacturing industry (Bureau of Labor Statistics 2023a). Annual salaries were obtained from the 2020 Occupational Employment and Wage Statistics survey, and percentage of benefits was derived from the Bureau of Labor Statistics' Employment Cost Index dataset (BLS 2023b) for the Mountain Census division (Table 3).

Table 3. Direct Employment During O&M, Hydrogen Facility

Staff	SOC	SOC Description	Wages	Positions	Cost/yr
Plant Manager	11-3051	Industrial production managers	$119,710	1	$119,710
Maintenance Supervisor/Safety Supervisor	49-1011	First-line supervisors of mechanics, installers, and repairers	$84,930	1	$84,930
Maintenance Tech	49-9041	Industrial machinery mechanics	$62,010	1	$62,010
Shift Supervisor	51-1011	First-line supervisors of production and operating workers	$73,770	2	$147,540
Shift Operators	51-8091	Chemical plant and system operators	$66,000	4	$264,000
Clerks and Secretaries	43-9061	Office clerks, general	$39,100	1	$39,100
Total Wages				**10**	**$717,290**
Overhead and benefits		Total benefits % =	29.70%		$303,037
Total Compensation					**$1,020,327**

Employment for maintenance of the solar facility was estimated based on the JEDI Solar PV Model (NREL 2021). Occupations were classified in SOC using the 2020 occupation profile of the utilities industry (BLS 2023a). Annual salary was obtained from the 2020 Occupation Employment and Wage Statistics, and percentage of benefits was derived from the Bureau of Labor Statistics' Employment Cost Index dataset (BLS 2023b) for the Mountain Census division (Table 4).

Table 4. Direct Employment During O&M, Solar Facility

Staff	SOC	SOC Description	Wages	Positions	Cost/yr
Technicians	49-2095	Electrical and electronics repairers, powerhouse, substation, and relay	$95,020	0.5	$47,510
Total Wages				**0.5**	**$47,510**
Overhead and benefits		Total benefits % =	29.70%		$20,072
Total Compensation					**$67,582**

2.4 Workforce Characteristics

In addition to estimating total jobs supported by the project across regions, we also report occupation types (classified using SOCs) and their median education, prior work experience, and training requirements for wage and salary jobs.

This workforce profile was estimated in IMPLAN according to its 2019 Occupation Data. This dataset uses state-specific occupation profiles by sector to break down wage and salary jobs into 800+ occupations (detail-level SOC) and their wages and core competencies (IMPLAN 2020). IMPLAN currently does not offer a breakdown of occupations for proprietor jobs, which include business owners, partners, and tax-exempt cooperative members. In the construction and transportation sectors, proprietor jobs include owner-operators and self-employed independent contractors, which can amount to a significant portion of jobs created. According to data from the 2021 American Community Survey, self-employed workers account for an average of 23% of all workers in the construction sector nationwide, and 25% in New Mexico (Siniavskaia 2023).

IMPLAN's dataset was created primarily using O*NET's database (Version 25.1),[7] which provides standardized information about average occupations' characteristics, for example, education requirements, work experience, on-the-job training, and skillsets for workers in the United States. Although these data cover both national and state levels, they are less accurate at the finer regional level for the Village of Questa and, therefore, do not capture local job market conditions.

2.5 Sourcing Scenarios

Construction and operation expenses from the hydrogen and solar facilities were allocated across regions according to assumptions regarding where equipment, materials, services, and labor are sourced from. Goods and services that are provided by companies outside the area (nonlocal purchases) do not generate direct local impacts (Figure 1). The amount of local purchases is then used to introduce a demand shock in the model and to determine the total economic impact, including jobs created in each region, due to these investments.

For this analysis, we created three scenarios (Table 5): (1) a *Least Local scenario* (lower bound), in which all materials and equipment are provided by businesses located outside of New Mexico, while construction is provided by businesses in the rest of Taos and construction workers commute to the site instead of coming from the Village of Questa, so the only impact Questa retains are tax revenues; (2) a *Most Local scenario* (upper bound), in which all goods and services (including solar modules) are supplied by New Mexico businesses[8] and construction is provided by Questa, so Questa and the New Mexico economy retains the most economic benefits from the projects; and (3) a *Mid scenario*, in which supplier information is determined by local shares (regional purchase coefficients) from IMPLAN, data from the coalition, and market information from New Mexico. In the Mid scenario, the electrolyzer and stationary fuel cells are sourced from New Mexico companies located outside Taos County[9] and solar modules are imported from outside the United States.

[7] See https://www.onetcenter.org/dictionary/25.1/excel/.

[8] Maxeon Solar Technologies Ltd. is expected to begin construction in Mesa del Sol in the first quarter of 2024, becoming the first large-scale PV cell and panel manufacturer in New Mexico. Paradise Power Company Inc. (Taos, NM) currently provides solar electric, electric vehicle charging, and energy storage projects, as well as maintenance services to utility-scale solar installations.

[9] Current electrolyzer and fuel cell-related suppliers: Pajarito Powder (Albuquerque, NM) specializes in the manufacturing of advanced catalysts for PEM and alkaline fuel cells and electrolyzers; BayoTech (Albuquerque, NM) specializes in gas and fuel storage and transport; Fuel Cell Technologies (Albuquerque, NM) specializes in fuel cell testing hardware and software. Given these existing suppliers, New Mexico has the potential to attract new hydrogen-related manufacturers to the state.

Table 5. Scenario Specifications

Category	Expense	Least Local Scenario	Mid Scenario	Most Local Scenario
Hydrogen Facility	Electrolyzer	Outside NM	NM	NM
	Stationary fuel cells	Outside NM	NM	NM
Solar Facility	Modules	Outside NM	Outside NM	NM
	Electrical equipment	Outside NM	NM	NM
Services	Construction	Rest of Taos County	Rest of Taos/Questa	Questa area
	Engineering	Outside NM	NM/Rest of Taos	Rest of Taos County
	Transportation	Outside NM	NM/rest of Taos/Questa	Questa area
O&M	Labor	Rest of Taos County	Questa area	Questa area
	Parts/services	Outside NM	NM	NM

Direct labor requirements also change across scenarios: in the Mid and Most Local scenarios, the specification provided in Section 2.3 was used in the analysis. For the Least Local scenario, we modified the direct employment for the hydrogen facility, assuming no administrative staff, one of the supervisors also acting as the plant manager, and reducing the number of operators and shift supervisors. This reduces labor requirements to 5 FTE/yr and labor costs to $501,721/yr. For the solar PV facility, we assume that KCEC will use existing personnel capacity for maintenance, thus eliminating the need to hire or add shifts.

In Table 6 and Figure 5, we show the allocation of direct expenditures by region and scenario. In the Least Local scenario, over three-quarters of all expenses are supplied by businesses outside New Mexico. Construction is the only local impact and is provided by the rest of Taos County, meaning Questa does not benefit from direct expenditures. Conversely, in the Most Local scenario, Questa retains most of the construction and transportation impacts (16% of all expenses), with the rest of Taos providing engineering services (25% of all expenses) and the rest of New Mexico businesses supplying all equipment and materials for construction (59% of all expenditures). In our Mid scenario, due to low regional purchase coefficients from IMPLAN, Questa is impacted with 2.1% of all expenses, while the other three regions supply almost one-third of expenses each.

Table 6. Construction Cost Allocation Across Regions and Scenarios

Category	Region	Least Local Scenario	Mid Scenario	Most Local Scenario
Hydrogen Facility	Questa	0%	0.4%	10.2%
	Rest of Taos County	21.8%	25.2%	19.8%
	Rest of NM	0%	50.4%	70%
	Rest of United States/imported	78.2%	24%	0%
Solar Facility	Questa	0%	5.7%	27.2%
	Rest of Taos County	20.5%	37.4%	35.2%
	Rest of NM	0%	17.9%	37.6%
	Rest of United States/imported	79.5%	39%	0%
All Facilities Combined	Questa	0%	2.1%	15.8%
	Rest of Taos County	21.4%	29.2%	24.9%
	Rest of NM	0%	39.7%	59.3%
	Rest of United States/Imported	78.6%	28.9%	0%

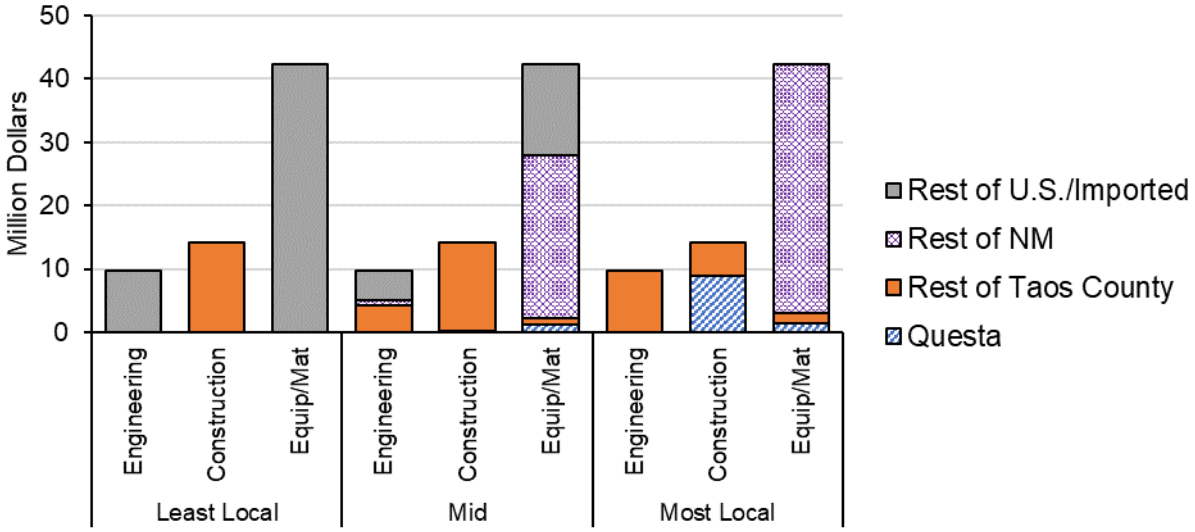

Figure 5. Construction expenses by category, region, and scenario. *Image by author*.

Notes: Construction includes permitting expenses. Equip/Mat category includes transportation costs.

3 Results

The results for the Mid scenario, which are based on current economic conditions (average import shares, coalition feedback, and market data from New Mexico) and the 2019 economic structure for New Mexico, are shown in Table 7. The implementation of these projects has the potential to support 410 full-time equivalent jobs[10], including direct, indirect, and induced effects, during construction across New Mexico, generating $21 million in income for those workers and $71 million in local economic activity. Of those jobs, around 86 are expected to be construction and transportation-related occupations.[11] The project is also estimated to add $31.2 million to New Mexico's gross state product during the year of construction.

Once in operation, the facilities are expected to support approximately 20 jobs (FTE for each year of operation) in the Mid scenario, with approximately 11 workers directly employed by the facilities. The total annual local economic activity supported by ongoing operations is $6.9 million, which includes worker and proprietor earnings of $1.6 million across the state. Annual operations are estimated to add $2.5 million to the state's gross state product.

Table 7. Estimated Economic Impacts, Mid Scenario

Phase	Region	Jobs (FTE)	Earnings (Million $)	Output (Million $)	Tax Revenue (Million $)
Construction	Questa	11	$0.6	$1.5	$0.8
	Taos County	235	$9.3	$27.1	$0.9
	New Mexico	164	$10.7	$42	$4.6
	Total	410	$20.6	$70.6	$6.3
O&M (recurring annual impacts)	Questa	11	$1.1	$0.0	$0.2
	Taos County	5	$0.2	$6.4	$0.6
	New Mexico	4	$0.3	$0.5	$0.4
	Total	20	$1.6	$6.9	$1.2

In terms of tax revenues, the facility is expected to pay $460,000/yr in gross receipts tax, from which $89,000/yr returns to Questa, $300,000/yr goes to the state, and $71,000/yr is distributed to Taos County. Total annual property taxes for the facility are estimated at $632,000/yr, from which $117,000 are distributed to Questa, $33,000/yr to the state, and $482,000 to Taos County. These contributions do not change across scenarios.

During the construction phase, our Mid scenario shows 11 jobs supported in the Village of Questa, mainly from construction and transportation services, 235 jobs supported in the rest of Taos County

[10] Typical of standard demand-driven input-output models (Miller and Blair 2022), input-output results reflect gross impacts and not net impacts. As this model assumes no competition for factors of production (or any other input), a demand shock is accommodated with new labor, capital and resources without causing any displacement impact on labor markets, electricity markets, etc.

[11] The results for the direct jobs for the solar facility are in line with previous projects (see Section 1.3), supporting 2.7 jobs per MW installed during construction and 0.03 jobs/yr per MW installed during operation.

from construction and professional (engineering) services, and 164 jobs supported in the rest of New Mexico, mainly in manufacturing and other sectors (Figure 6).

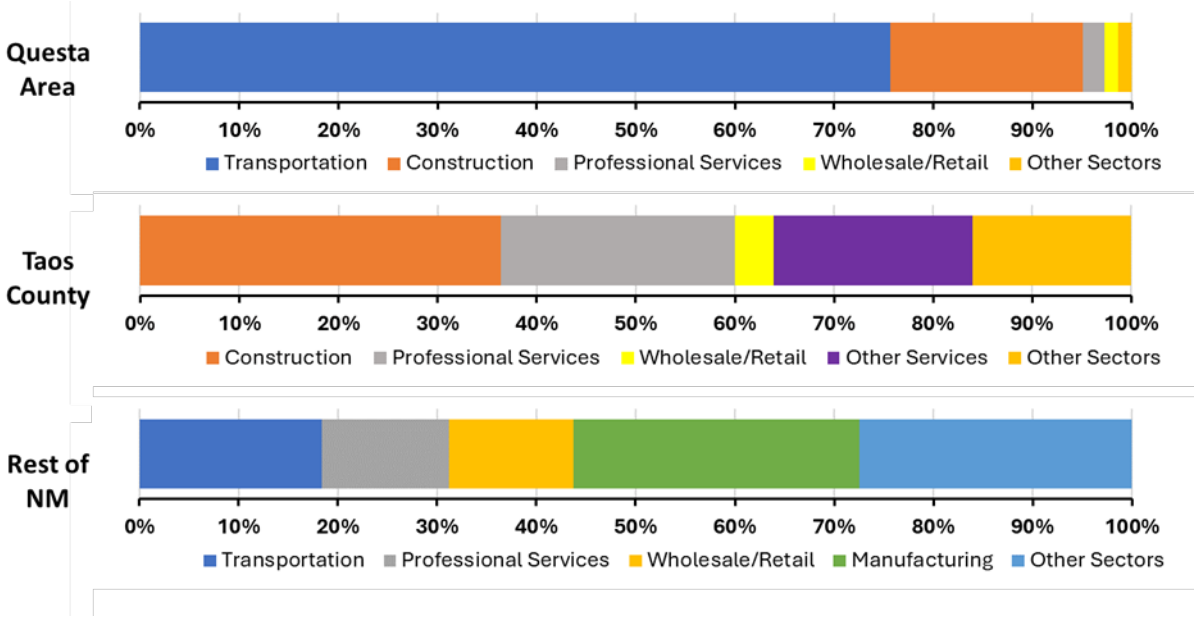

Figure 6. Share of jobs supported by sector during construction, Mid scenario. ***Image by author***

During operation, the hydrogen facility is expected to employ 10 workers, including operators, administrative staff, and managers/supervisors, while the solar facility is expected to support 0.5 FTE jobs, mainly technicians. We expect those workers to reside in the Village of Questa, bringing an additional $1.1 million in earnings to the local economy. However, given the small size of the village's economy and high dependence on the rest of the county for local supplies, a significant portion of induced effects (i.e., the impacts of spending wages) are captured in the rest of Taos County. The latter benefits from these spillover effects by supporting four jobs in addition to one job created from direct expenditures in the region. Finally, in the rest of the state the project is estimated to support four jobs per year. Under this Mid scenario, the Village is expected to collect $800,000 in tax revenues from the construction phase and $214,000/yr from the operation of the facilities.

Occupation profiles for the wage and salary workers supported during construction and operation are shown in Tables 9 and 10. Proprietor jobs (Table 8) are not broken down by occupation in the IMPLAN dataset, but they are primarily composed of owner-operators and self-employed independent contractors in Questa and Taos County, given the level of activity in the construction and transportation sectors.

Table 8. Distribution of Jobs Between Proprietors and Wage and Salary, Mid Scenario

Phase	Job Type	Questa Area	Taos County	New Mexico
Construction	Proprietor	6 (59%)	97 (41%)	32 (20%)
	Wage and salary	5 (41%)	139 (59%)	131 (80%)
Operation	Proprietor	0 (0%)	2 (40%)	2 (50%)
	Wage and salary	11 (100%)	3 (60%)	2 (50%)

Table 9. Distribution of Wage and Salary Jobs by Major Occupation Category and Region Construction Phase, Mid Scenario

SOC	SOC Major Category Description	Questa Area	Taos County	New Mexico
11-0000	Management occupations	4%	6%	6%
13-0000	Business and financial operations occupations	2%	5%	5%
15-0000	Computer and mathematical occupations	1%	2%	3%
17-0000	Architecture and engineering occupations	0%	7%	6%
19-0000	Life, physical, and social science occupations	0%	1%	1%
21-0000	Community and social service occupations	0%	2%	1%
23-0000	Legal occupations	0%	1%	1%
25-0000	Education, training, and library occupations	0%	1%	1%
27-0000	Arts, design, entertainment, sports, media occupations	0%	1%	1%
29-0000	Health care practitioners and technical occupations	0%	2%	3%
31-0000	Health care support occupations	0%	2%	2%
33-0000	Protective service occupations	0%	6%	1%
35-0000	Food preparation and serving-related occupations	0%	5%	6%
37-0000	Building and grounds cleaning and maintenance occupations	0%	2%	2%
39-0000	Personal care and service occupations	0%	2%	1%
41-0000	Sales and related occupations	3%	5%	8%
43-0000	Office and administrative support occupations	11%	13%	13%
45-0000	Farming, fishing, and forestry occupations	0%	0%	0%
47-0000	Construction and extraction occupations	15%	22%	1%
49-0000	Installation, maintenance, and repair occupations	6%	6%	5%
51-0000	Production occupations	0%	2%	17%
53-0000	Transportation and material-moving occupations	57%	6%	18%
Total		**100%**	**100%**	**100%**

Table 10. Distribution of Wage and Salary Jobs by Major Occupation Category and Region, O&M Phase, Mid Scenario

SOC	SOC Major Category Description	Questa Area	Taos County	New Mexico
11-0000	Management occupations	9%	4%	4%
13-0000	Business and financial operations occupations	0%	3%	3%
15-0000	Computer and mathematical occupations	0%	1%	1%
17-0000	Architecture and engineering occupations	0%	0%	0%
19-0000	Life, physical, and social science occupations	0%	0%	0%
21-0000	Community and social service occupations	0%	2%	0%
23-0000	Legal occupations	0%	0%	0%
25-0000	Education, training, and library occupations	0%	2%	0%
27-0000	Arts, design, entertainment, sports, media occupations	0%	1%	0%
29-0000	Health care practitioners and technical occupations	0%	7%	1%
31-0000	Health care support occupations	0%	8%	3%
33-0000	Protective service occupations	0%	0%	0%
35-0000	Food preparation and serving-related occupations	0%	20%	7%
37-0000	Building and grounds cleaning and maintenance occupations	0%	3%	2%
39-0000	Personal care and service occupations	0%	3%	0%
41-0000	Sales and related occupations	0%	14%	10%
43-0000	Office and administrative support occupations	9%	12%	14%
45-0000	Farming, fishing, and forestry occupations	0%	0%	0%
47-0000	Construction and extraction occupations	0%	0%	2%
49-0000	Installation, maintenance, and repair occupations	25%	11%	33%
51-0000	Production occupations	56%	3%	10%
53-0000	Transportation and material-moving occupations	0%	7%	8%
Total		**100%**	**100%**	**100%**

Most occupations supported during construction in Questa are expected to have low education requirements (high school diploma or less) and require less than 1 year of prior work experience (Figure 7). Nevertheless, during operation, education requirements for those jobs supported in Questa would increase and more than 55% will require post-secondary or higher education requirements. At State level, the distribution of education requirements across all jobs supported in during operation in NM is very similar to the construction phase. However, the share of jobs requiring prior work experience during the operation phase is 7 points higher than during construction (Figure 8). Likewise, further education in the form of on-the-job training is required for those workers during operation, with around 40% requiring more than 6 months of training. Moreover, workers supported during operation receive higher average wages than those supported during construction.

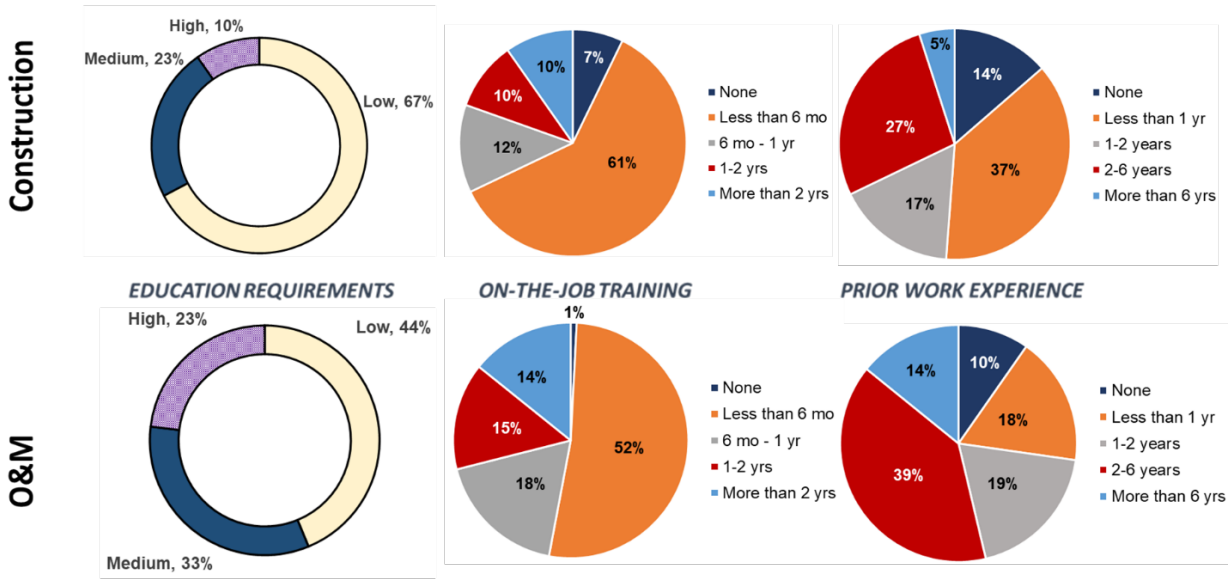

Figure 7. Workforce profile of jobs supported during construction and O&M phases, Mid scenario, Questa. *Image by author*

Note: Low: high school diploma or less; medium: associate's degree or less; high: bachelor's degree or above.

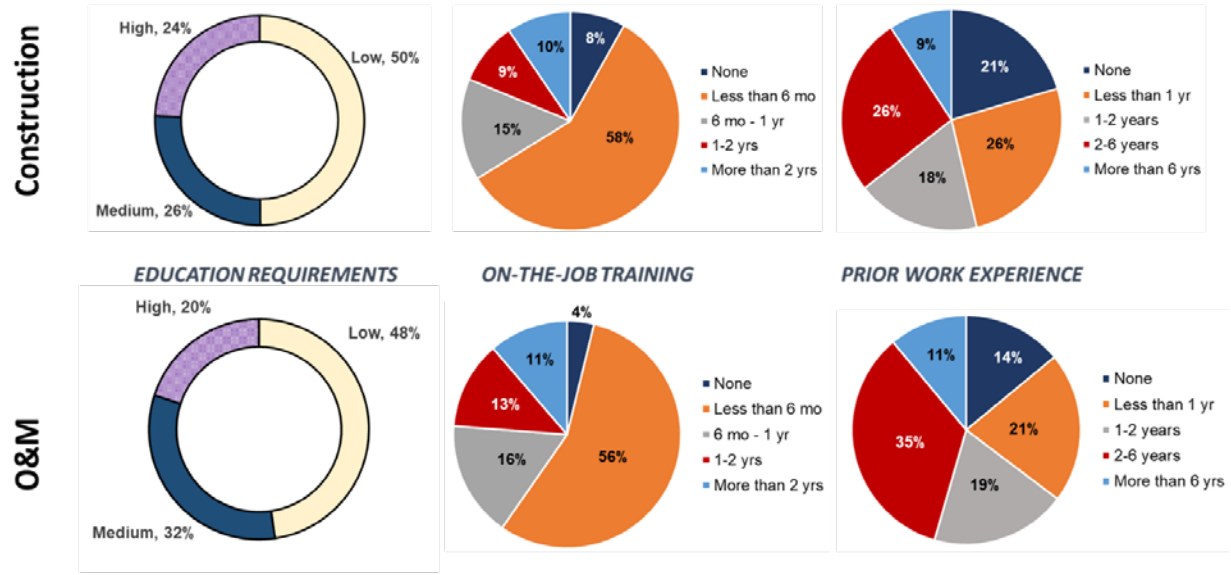

Figure 8. Workforce profile of jobs supported during construction and O&M phases, Mid scenario, all of New Mexico. *Image by author*

Notes: Low: high school diploma or less; medium: associate's degree or less; high: bachelor's degree or above.

The distribution of impacts across regions varies significantly, depending on the location of materials, equipment, and service suppliers. Table 11 and Figure 9 show the results for the Least

and Most Local scenarios. Notice that choosing exclusively local suppliers (Most Local scenario) will provide more benefits to Questa and the New Mexico economy, adding up to 400 jobs during construction and 13 more long-term jobs. Notice that the tax revenue difference between Least Local and Most Local scenarios is small because most of the gross receipts tax comes from the operation of the combined facility, which is the same across scenarios.

Table 11. Estimated Economic Impacts, Least and Most Local Scenarios

Phase	Region	Jobs (FTE)	Earnings (Million $)	Output (Million $)	Tax Revenue (Million $)
Construction	Questa	0–98	$0–$4	$0–$11	$0.8–$0.8
	Taos County	163–229	$7–$9	$18–$28	$0.7–$0.9
	New Mexico	4–245	$0–$15	$1–$62	$3.3–$5.1
	Total	167–572	$7–$28	$19–$100	$4.8–$6.8
O&M (recurring annual impacts)	Questa	0–11	$0.0–$1.1	$0.0–$0.0	$0.2–$0.2
	Taos County*	7–5	$0.6–$0.2	$6.0–$6.4	$0.6–$0.6
	New Mexico	0–4	$0.0–$0.3	$0.0–$0.6	$0.4–$0.4
	Total	7–20	$0.6–$1.6	$6.0–$6.9	$1.1–$1.2

*Note: *Most Local results for Taos County in the operational phase are lower than Least Local results because, in the former, plant operators live in Questa, and Taos supplies some of maintenance/equipment to the plant, whereas in the latter, plant operators live in the rest of the county instead of in Questa.*

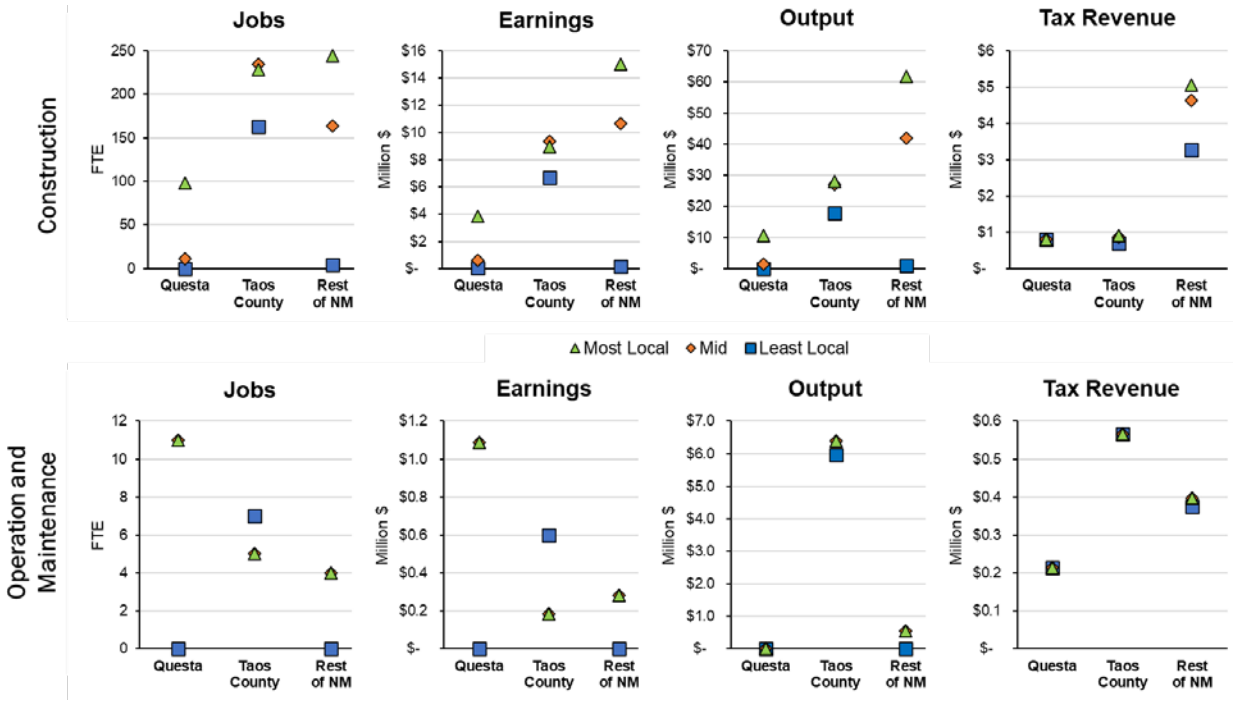

Figure 9. Construction and operation economic impact results by region and scenario. *Image by author*

The breakdown of occupation results for both the Most Local and Least Local scenarios for construction are shown in Table 11 and Table 12. The 0.2 FTE jobs supported in Questa in the Least Local scenario (Table 12) concentrate on transportation- and sales-related occupations because in this scenario construction labor is assumed to commute from adjacent areas (rest of Taos), resulting in only small indirect and induced effects in the village. Therefore, in the rest of Taos, most of the 163 FTE jobs supported are in the construction sector. In the rest of New Mexico, the four FTE jobs supported are in the transportation, sales, and office support sectors, because most materials and services are produced outside the state.

In contrast, in the Most Local scenario (Table 13), most of the 98 FTE jobs supported in Questa are construction- and transportation-related, while the 229 FTE jobs supported in the rest of Taos are distributed across almost all sectors of the economy, most prominently in professional services. In the rest of New Mexico, most of the 245 FTE jobs supported are manufacturing- and transportation-related.

In terms of occupation characteristics across the state, education requirements, on-the-job-training, and prior work experience distribution is similar across the Least and the Most Local scenarios (Figure 10).

Table 12. Distribution of Wage and Salary Jobs by Major Occupation Category and Region, Construction Phase, Least Local Scenario, all of New Mexico

SOC	SOC Major Category Description	Questa Area	Taos County	New Mexico
11-0000	Management occupations	7%	6%	5%
13-0000	Business and financial operations occupations	0%	5%	4%
15-0000	Computer and mathematical occupations	7%	1%	1%
17-0000	Architecture and engineering occupations	0%	2%	0%
19-0000	Life, physical, and social science occupations	0%	1%	0%
21-0000	Community and social service occupations	0%	3%	0%
23-0000	Legal occupations	0%	1%	0%
25-0000	Education, training, and library occupations	0%	1%	1%
27-0000	Arts, design, entertainment, sports, media occupations	0%	1%	0%
29-0000	Health care practitioners and technical occupations	0%	2%	4%
31-0000	Health care support occupations	0%	2%	4%
33-0000	Protective service occupations	0%	8%	3%
35-0000	Food preparation and serving-related occupations	0%	4%	10%
37-0000	Building and grounds cleaning and maintenance occupations	0%	2%	3%
39-0000	Personal care and service occupations	0%	2%	0%
41-0000	Sales and related occupations	33%	5%	13%
43-0000	Office and administrative support occupations	13%	13%	16%
45-0000	Farming, fishing, and forestry occupations	0%	0%	0%
47-0000	Construction and extraction occupations	0%	29%	2%
49-0000	Installation, maintenance, and repair occupations	0%	6%	6%
51-0000	Production occupations	0%	2%	8%
53-0000	Transportation and material-moving occupations	40%	5%	20%
Total		**100%**	**100%**	**100%**

Table 13. Distribution of Wage and Salary Jobs by Major Occupation Category and Region, Construction Phase, Most Local Scenario, all of New Mexico

SOC	SOC Major Category Description	Questa Area	Taos County	New Mexico
11-0000	Management occupations	6%	6%	6%
13-0000	Business and financial operations occupations	4%	6%	5%
15-0000	Computer and mathematical occupations	0%	3%	2%
17-0000	Architecture and engineering occupations	1%	14%	5%
19-0000	Life, physical, and social science occupations	0%	2%	0%
21-0000	Community and social service occupations	0%	2%	1%
23-0000	Legal occupations	0%	1%	0%
25-0000	Education, training, and library occupations	0%	1%	1%
27-0000	Arts, design, entertainment, sports, media occupations	0%	1%	1%
29-0000	Health care practitioners and technical occupations	0%	3%	2%
31-0000	Health care support occupations	0%	2%	2%
33-0000	Protective service occupations	0%	7%	1%
35-0000	Food preparation and serving-related occupations	0%	8%	5%
37-0000	Building and grounds cleaning and maintenance occupations	0%	3%	2%
39-0000	Personal care and service occupations	0%	2%	1%
41-0000	Sales and related occupations	2%	6%	8%
43-0000	Office and administrative support occupations	9%	14%	13%
45-0000	Farming, fishing, and forestry occupations	0%	0%	0%
47-0000	Construction and extraction occupations	57%	3%	2%
49-0000	Installation, maintenance, and repair occupations	8%	4%	5%
51-0000	Production occupations	2%	3%	21%
53-0000	Transportation and material-moving occupations	9%	8%	18%
Total		**100%**	**100%**	**100%**

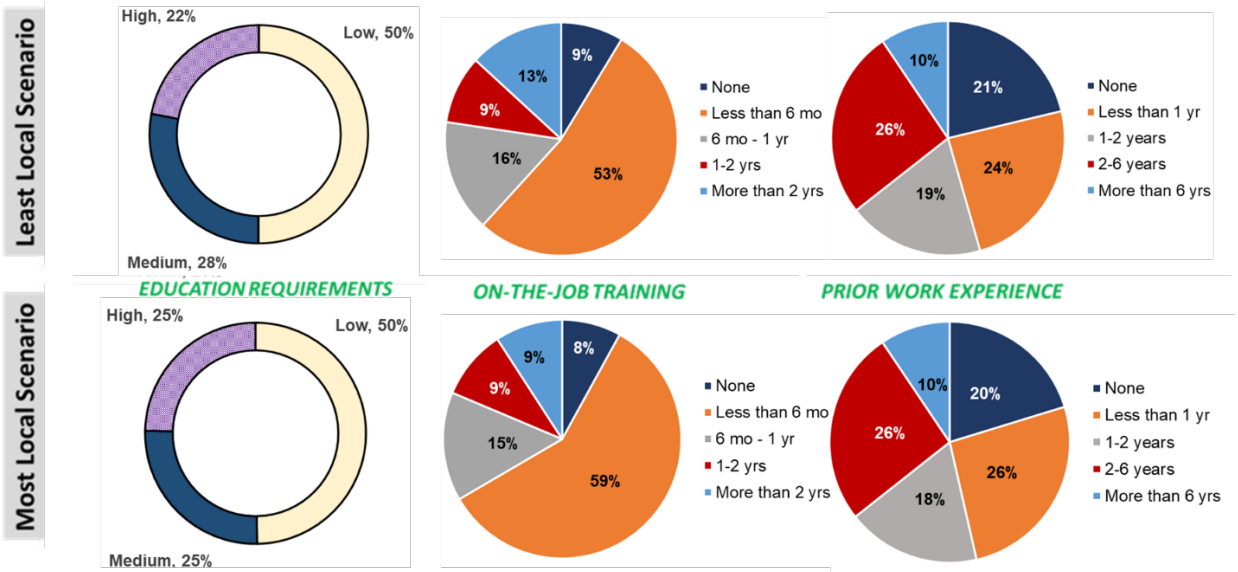

Figure 10. Workforce profile of jobs supported during construction, Least Local vs. Most Local scenarios, all of New Mexico. ***Image by author***

Notes: Low: high school diploma or less; medium: associate's degree or less; high: bachelor's degree or above.

O&M results for the Least Local scenario (Table 14) primarily comprise direct jobs supported by the hydrogen facility (5 FTE) in the rest of Taos County, while Questa and the rest of New Mexico have almost no economic impact. Results for the Most Local scenario (Table 15) are the same as the Mid scenario. In terms of occupation characteristics, education requirements, on-the-job-training, and prior work experience, distribution is similar across the Least and Most Local scenarios (Figure 11).

Table 14. Distribution of Wage and Salary Jobs by Major Occupation Category and Region, O&M Phase, Least Local Scenario, all of New Mexico

SOC	SOC Major Category Description	Questa Area	Taos County	New Mexico
11-0000	Management occupations	0%	1%	0%
13-0000	Business and financial operations occupations	0%	0%	0%
15-0000	Computer and mathematical occupations	0%	0%	0%
17-0000	Architecture and engineering occupations	0%	0%	0%
19-0000	Life, physical, and social science occupations	0%	0%	0%
21-0000	Community and social service occupations	0%	0%	0%
23-0000	Legal occupations	0%	0%	0%
25-0000	Education, training, and library occupations	0%	1%	0%
27-0000	Arts, design, entertainment, sports, media occupations	0%	0%	0%
29-0000	Health care practitioners and technical occupations	0%	1%	0%
31-0000	Health care support occupations	0%	2%	0%
33-0000	Protective service occupations	0%	0%	0%
35-0000	Food preparation and serving-related occupations	0%	5%	0%
37-0000	Building and grounds cleaning and maintenance occupations	0%	1%	0%
39-0000	Personal care and service occupations	0%	1%	0%
41-0000	Sales and related occupations	0%	3%	0%
43-0000	Office and administrative support occupations	0%	2%	0%
45-0000	Farming, fishing, and forestry occupations	0%	0%	0%
47-0000	Construction and extraction occupations	0%	0%	0%
49-0000	Installation, maintenance, and repair occupations	0%	34%	0%
51-0000	Production occupations	0%	50%	0%
53-0000	Transportation and material-moving occupations	0%	1%	0%
Total		**0%**	**100%**	**0%**

Table 15. Distribution of Wage and Salary Jobs by Major Occupation Category and Region, O&M Phase, Most Local Scenario, all of New Mexico

SOC	SOC Major Category Description	Questa Area	Taos County	New Mexico
11-0000	Management occupations	10%	4%	4%
13-0000	Business and financial operations occupations	0%	3%	3%
15-0000	Computer and mathematical occupations	0%	1%	1%
17-0000	Architecture and engineering occupations	0%	0%	0%
19-0000	Life, physical, and social science occupations	0%	0%	0%
21-0000	Community and social service occupations	0%	2%	0%
23-0000	Legal occupations	0%	0%	0%
25-0000	Education, training, and library occupations	0%	2%	0%
27-0000	Arts, design, entertainment, sports, media occupations	0%	1%	0%
29-0000	Health care practitioners and technical occupations	0%	7%	1%
31-0000	Health care support occupations	0%	8%	3%
33-0000	Protective service occupations	0%	0%	0%
35-0000	Food preparation and serving-related occupations	0%	20%	7%
37-0000	Building and grounds cleaning and maintenance occupations	0%	3%	2%
39-0000	Personal care and service occupations	0%	3%	0%
41-0000	Sales and related occupations	0%	14%	10%
43-0000	Office and administrative support occupations	10%	12%	14%
45-0000	Farming, fishing, and forestry occupations	0%	0%	0%
47-0000	Construction and extraction occupations	0%	0%	2%
49-0000	Installation, maintenance, and repair occupations	25%	11%	33%
51-0000	Production occupations	56%	3%	10%
53-0000	Transportation and material-moving occupations	0%	7%	8%
Total		**100%**	**100%**	**100%**

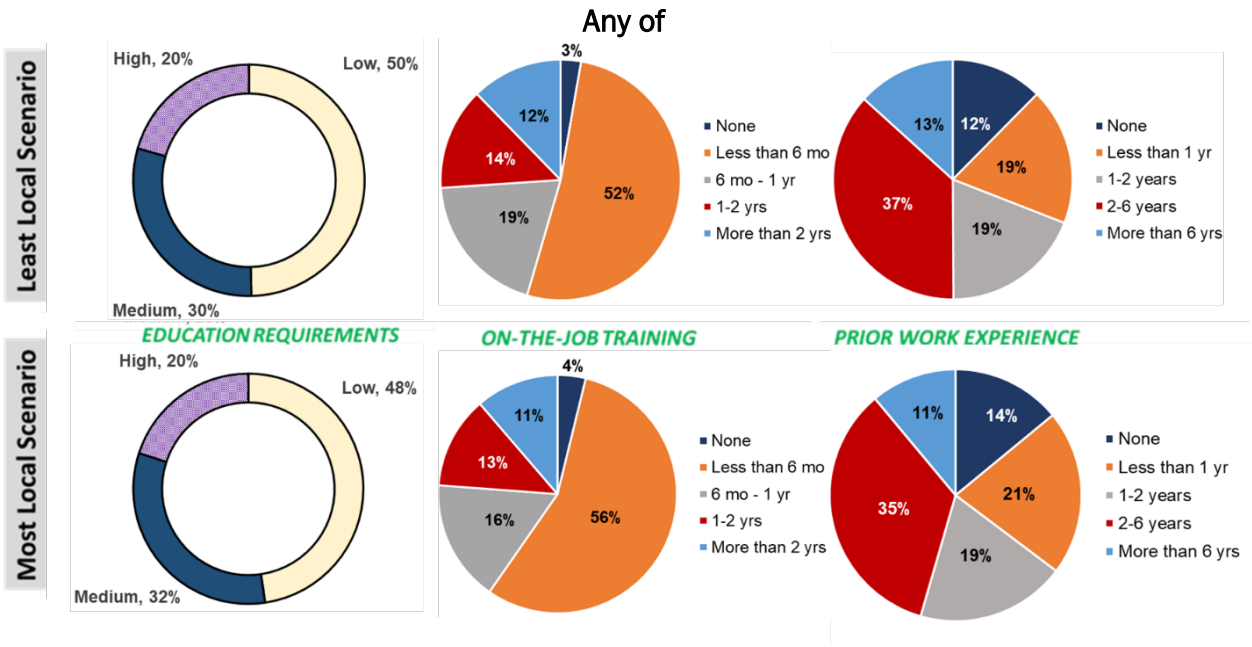

Figure 11. Workforce profile of jobs supported during operation, Least Local vs. Most Local scenarios, all of New Mexico. *Image by author*

Notes: Low: high school diploma or less; medium: associate's degree or less; high: bachelor's degree or above.

4 Limitations

The economic impact estimates in this report should be interpreted within the context of the assumptions employed in the modeling, as well as limitations of the input-output framework. Thus, the results provided are not a precise forecast. Some of the main assumptions in this analysis are:

- We assumed that the whole project is financially viable. We did not evaluate the impact that different financing options and/or incentives and grants may have in the region.

- Typical of standard demand-driven input-output models (Miller and Blair 2022), we assumed unlimited supply of goods, services, and factors of production and existing excess production capacity in the economy, so that the analysis did not consider any interactive price effects. Therefore, the results reflect absolute impacts (i.e., we do not account for the possible displacement impact that constructing and operating the facility has on labor markets, electricity markets, etc.).

- The input-output model employed for this analysis is a static model and represents the economy-wide linkages and spending patterns in New Mexico regions in 2019. The model does not account for dynamic impacts or changes over time. As such, estimates do not account for changes in the economic structure (such as energy systems, population change, or businesses conditions) over time, instead reflecting economic conditions before the COVID-19 pandemic.

- As previously mentioned, results for workforce profiles represent average characteristics of jobs and workers in the United States, and do not account for local labor markets of the economies analyzed. Occupation results only cover wage and salary jobs, not proprietor jobs.

- This study did not assess workforce training needs or how the community could pursue clean hydrogen development equitably.

- Job and occupation results estimate the number of workers supported by the project (demand), but do not account for local labor market conditions (supply).

- This study did not assess potential increased demand on public services (safety, roads, water treatment, housing, schools, etc.), environmental impacts, cultural impacts, potential spin-off business or industry expansion, or ownership and distribution of benefits. It did not assess cost recovery or impact on rate payers.

5 Conclusions

Most economic benefits in the Village of Questa from the proposed hydrogen and solar facilities, especially for tax revenue and jobs, occur during construction. Given current conditions, our Mid scenario estimate is that 11 jobs will be supported in the Village of Questa, mainly from construction and transportation services, with the village expected to collect $800,000 in tax revenues. Temporary jobs supported during construction primarily include truck drivers, material movers, and construction-related (laborers, carpenters, electricians) occupations.

The village will benefit the most in the long term by attracting the new facilities' permanent workers to reside in the area (~11 workers). Across all scenarios, we estimate that annual tax revenues will increase by $214,000, mainly due to property taxes and gross receipts tax from the solar facility operated by KCEC. Permanent jobs supported during operation primarily include plant operators, supervisors, and electrical maintenance workers.

This analysis also highlights that economic impacts vary significantly depending on which businesses are supplying materials, equipment, and services, and where construction workers reside. Choosing local suppliers would provide more benefits to Questa and the New Mexico economy, adding up to 400 jobs during construction and 13 long-term jobs state-wide.

Glossary

Term	Definition
Direct effects	Economic impacts generated due to the purchase of goods and services directly required for a project during construction or O&M.
Indirect effects	Economic impacts generated by production in upstream supply chains required to supply the direct goods and services required for the project.
Induced effects	Economic impacts resulting from the spending of wages/salaries by workers involved in the production of direct goods and services or in their required inputs in upstream supply chains. Expenditures from workers create additional rounds of production in the local economy.

References

Atencio, E. 2000. "The mine that turned the Red River blue." *High Country News*. August 8, 2000. https://www.hcn.org/issues/184/5962.

BLS (Bureau of Labor Statistics). 2023a. *2020 Quarterly Census of Employment and Wages*. https://www.bls.gov/cew/downloadable-data-files.htm.

BLS. 2023b. "Employment Cost Index." https://www.bls.gov/eci/data.htm.

Bureau of Economic Analysis. 2018. "2012 Benchmark Input-Output Tables." https://www.bea.gov/industry/input-output-accounts-data.

Carbon Solutions. 2023. *The Landscape of Clean Hydrogen: An Outlook for Industrial Hubs in the United States*. https://industrialinnovation.org/wp-content/uploads/2024/01/The-Landscape-of-Clean-Hydrogen.pdf.

EDP Renewables. 2022a. "Cameron Solar Park, Calhoun County, South Carolina." https://www.edpr.com/north-america/sites/edprna/files/2023-02/SC%20Cameron%20Solar%20Fact%20Sheet%202022.pdf.

EDP Renewables. 2022b. "Estill Solar Park, Hampton County, South Carolina." https://www.edpr.com/north-america/sites/edprna/files/2023-02/SC%20Estill%20Solar%20Fact%20Sheet%202022.pdf.

EDP Renewables. 2022c. "Hampton Solar Park, Hampton County, South Carolina." https://www.edpr.com/north-america/sites/edprna/files/2023-02/SC%20Hampton%20Solar%20Fact%20Sheet%202022.pdf.

EDP Renewables. 2023a. "Lone Valley Solar Park, San Bernardino County, California." https://www.edpr.com/north-america/sites/edprna/files/2023-01/CA%20Lone%20Valley%20Fact%20Sheet_0.pdf.

EDP Renewables. 2023b. "Riverstart Solar Park, Randolph County, Indiana." https://www.edpr.com/north-america/sites/edprna/files/2023-02/IN%20Riverstart%20Fact%20Sheet.pdf.

FPL (Florida Power & Light Company). 2023a. "Cypress Pond Solar Energy Center." https://www.fpl.com/project/cypress-pond.html.

FPL. 2023b. "Saw Palmetto Solar Energy Center." https://www.fpl.com/project/saw-palmetto.html

IMPLAN. 2020. "Occupation and Core Competency Data." https://support.implan.com/hc/en-us/articles/360051197853-Occupation-and-Core-Competency-Data.

Intersect Power. 2023. "Intersect Power Reaches Commercial Operation of 310 MWp Athos III Solar + Storage Project in California." *Cision PR Newswire*. January 11, 2023. https://www.prnewswire.com/news-releases/intersect-power-reaches-commercial-operation-of-310-mwp-athos-iii-solar--storage-project-in-california-301719488.html.

James, B., W. Colella, and J. Moton. 2013. *PEM Electrolysis H2A Production Case Study Documentation*. Arlington, VA: Strategic Analysis Inc. https://www.nrel.gov/hydrogen/assets/pdfs/h2a-pem-electrolysis-case-study-documentation.pdf.

Kernan, M. 2021. "Wisconsin's newest large-scale solar energy project in Manitowoc County." *ABC2*. September 23, 2021. https://www.wbay.com/2021/09/23/wisconsins-newest-large-scale-solar-energy-project-manitowoc-county/.

Logan, J.R. 2014. "Questa mine permanently closed, 300 laid off." *Taos News*. June 2, 2014. https://www.taosnews.com/news/questa-mine-permanently-closed-300-laid-off/article_8d3f41f9-9067-596d-930d-6f8f22b81b63.html.

Miller, R. E., and P.D. Blair. 2022. *Input-output analysis: Foundations and extensions* (3rd ed). Cambridge University Press. https://doi.org/10.1017/CBO9780511626982

National Grid Renewables. 2023a. "MiSolar Portfolio (40 MW)." https://nationalgridrenewables.com/projects/misolar/.

National Grid Renewables. 2023b. "Prairie Wolf Solar Project (200 MW)." https://nationalgridrenewables.com/projects/prairie-wolf/.

National Grid Renewables. 2023c. "Yellowbud Solar Project (274 MW)." https://nationalgridrenewables.com/projects/yellowbud/.

New Mexico Taxation and Revenue Department. 2023. "Gross Receipts Location Code and Tax Rate Map." Accessed September 4, 2023. https://www.tax.newmexico.gov/governments/gross-receipts-location-code-and-tax-rate-map/.

NREL. 2021. "Jobs and Economic Development Impacts (JEDI) Solar Photovoltaics Model rel. PV05.20.21." https://www.nrel.gov/analysis/jedi/pv.html.

NREL. 2023. "Clean Energy Employment Impacts." DOE/GO-102023-5941. Golden, CO: NREL. https://www.nrel.gov/docs/fy23osti/86712.pdf.

Parker, S. 2008. "Questa Mine." *Taos News*. August 28, 2008. https://www.taosnews.com/news/business/questa-mine/article_2e167912-780a-5e61-8bfe-aae31db64e4f.html.

Plant, G. 2022. "Remediation project ramps up at Questa Mine." *Taos News*. April 13, 2022. https://www.taosnews.com/news/environment/remediation-project-ramps-up-at-questa-mine/article_e694f27b-cf1f-5c9b-8691-aad56c2bec46.html.

Plant, G. 2023. "Chevron in talks with state over water dispute." *Taos News*. November 21, 2023. https://www.taosnews.com/news/environment/chevron-in-talks-with-state-over-water-dispute/article_c8586b93-94f5-537d-a013-26e539067ede.html.

Rosendin. 2023a. "Aktina Renewable Power Project, Wharton County, TX." https://www.rosendin.com/project/aktina-renewable-power-project/.

Rosendin. 2023b. "Athos I & II, Riverside County, CA." https://www.rosendin.com/project/athos-i-ii/.

Rosendin. 2023c. “Townsite Solar Facility, Boulder City, NV.” https://www.rosendin.com/project/townsite-solar-facility/.

Siniavskaia, N. 2023. “Construction Self-Employment Rises Post Pandemic.” *National Association of Home Builders*. March 30, 2023. https://eyeonhousing.org/2023/03/construction-self-employment-rises-post-pandemic/#:~:text=According%20to%20the%202021%20American,in%20construction%20are%20self%2Demployed.

Taos County. 2024. “2023 Taos County Property Tax Rates.” https://www.taoscounty.org/DocumentCenter/View/2573/2023-Taos-County-Property-Tax-Rates.

Topolski, K., E. Hale, C. Scarpitti, H. Niaz, A.F.T. Avelino, and A. Franco-Solis. 2023. “Is clean hydrogen production a good fit for Questa? Intermediate feasibility study results.” Presented August 17, 2023. https://www.nrel.gov/docs/fy23osti/86665.pdf.

U.S. Department of Energy. 2023a. “Agua Caliente - Loan Programs Office.” https://www.energy.gov/lpo/agua-caliente.

U.S. Department of Energy. 2023b. “Antelope Valley Solar Ranch - Loan Programs Office.” https://www.energy.gov/lpo/antelope-valley-solar-ranch.

U.S. Department of Energy. 2023c. “California Valley Solar Ranch - Loan Programs Office.” https://www.energy.gov/lpo/california-valley-solar-ranch.

U.S. Department of Energy. 2023d. “Desert Sunlight - Loan Programs Office.” https://www.energy.gov/lpo/desert-sunlight.

U.S. Department of Energy. 2023e. “Mesquite 1 - Loan Programs Office.” https://www.energy.gov/lpo/mesquite-1

For more information about Communities LEAP, visit:
energy.gov/communitiesLEAP

Produced for the U.S. Department of Energy by the National Renewable Energy Laboratory (NREL).

DOE/GO-102024-6267 • July 2024