

# Communities Local Energy Action Program Study

Colorado, Montana, and Utah Nuclear and Data  
Center Feasibility Study and Business Case

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## Colorado, Montana, and Utah Nuclear and Data Center Feasibility Study and Business Case

**Revision 0 - Revision 1 will be issued following the release of Revision 0 and will include Appendices B and C.**

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## EXECUTIVE SUMMARY

Electrical power demand across the United States (U.S.) is growing, and data centers are playing a major role in the demand trajectory as well as the growing need for grid stabilizing reliable power. The growth of power demand, paired with aging power generation infrastructure, presents both an investment opportunity and a capacity supply challenge. Advanced nuclear technologies are candidates for meeting this growing demand. Energy communities with power generation assets and operating experience via existing coal plants are uniquely positioned to be home to future nuclear and/or data center deployments. To meet growing electricity demands and leverage the existing coal plant workforce, there is a window of opportunity for coal plants to partner with data centers while a nuclear power plant is being deployed to provide reliable power. The data center could be powered by a nuclear generating source when the coal plant shuts down and/or when the nuclear power plant is operational.

The Gateway for Accelerated Innovation in Nuclear (GAIN) partnered with communities in Colorado (CO), Utah (UT), and Montana (MT) through the U.S. Department of Energy's (DOE) Communities Local Energy Action Program (C-LEAP) to assess the feasibility of leveraging data centers to support and enable nuclear deployment. The selected communities for the Colorado, Montana, and Utah Nuclear and Data Center Feasibility Study and Business Case effort were Moffat and Routt Counties in Colorado, Rosebud and Treasure Counties in Montana, and Carbon and Emery Counties in Utah. Each community has operating coal power generation assets and residents that support coal plant operations.

The objective of GAIN's work was to inform the path forward for communities in Colorado, Montana, and Utah by providing information needed to make decisions regarding nuclear and/or data center deployment and facilitate conversations with potential partners. The Colorado, Montana, and Utah Nuclear and Data Center Feasibility Study and Business Case effort consisted of four distinct studies (i.e., Site Feasibility Study, Power Source Study, Economic Impact Assessment, and Financial Instrument Investigation) that were leveraged to inform community-specific business cases.

The site feasibility study, conducted by Oak Ridge National Laboratory (ORNL), evaluated the suitability of various locations within the selected communities, and the states of Colorado, Montana, and Utah overall for nuclear and data center deployment projects. While the formal siting process for a nuclear reactor requires significant time, effort, and detail, the siting assessment evaluated high level feasibility in the region. These regions were screened for factors that could preclude nuclear or have potential to increase cost and/or risk associated with nuclear deployment.

The power source study evaluated the potential of selected communities in Colorado, Montana, and Utah to secure near-term power for data center development and evaluated the outlook, strategies, and timelines for developing and sustaining long term power. The availability of existing power plant and transmission capacity for use by a large (i.e., 100 megawatt (MW)) data center were evaluated through analysis of locational marginal pricing (LMP), existing coal plant capacity factors, and limited input from coal plant utilities. The feasibility of data centers to secure power via power purchase agreements (PPAs) in the relevant energy markets as well as the states' interest in accelerating these deals were also considered. Finally, generic deployment timelines were provided, beginning from initial feasibility studies and finishing with the start of operations. Together, each of these elements shape the picture of power source feasibility and informed recommendations specific to each community.

The economic impact assessment, conducted by energy economists at Idaho National Laboratory (INL), quantifies how data center and nuclear power plant construction and operation affect the regional economies of the selected communities according to direct facility employment opportunities, supporting supply chain activities, and induced community spending. The assessment measures employment/job creation, increased labor income impacts, and overall value-added within the selected communities. This assessment draws on industry insights from past projects and literature published by technology developers to enhance the accuracy of modeling results. Additionally, actions that the communities can implement to increase the financial incentive for developers to build locally were examined.

The financial and regulatory instrument investigation, prepared by INL and MPR Associates, Inc. (MPR), provides the C-LEAP communities with strategies that could be leveraged to attract nuclear and/or data center development. These strategies include targeting and mitigating specific development hurdles or providing financial support through fundraising programs. This study provides insight into different financial and regulatory strategies and highlights examples of their deployment in communities across the U.S.

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## ACRONYMS

AEP	American Electric Power
AGNC	Associated Governments of Northwest Colorado
AI	Artificial Intelligence
AWS	Amazon Web Services
BTM	Behind the Meter
CAISO	California Independent System Operator
CCS	Carbon Capture and Storage
CFR	Code of Federal Regulations
C-LEAP	Communities – Local Energy Action Program
CO	Colorado
CPUC	Colorado Public Utilities Commission
DC	Data Center
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
EIA	Energy Information Administration
EPRI	Electric Power Research Institute
EPZ	Emergency Planning Zone
ESP	Early Site Permit
ERP	Electric Resource Plan
FERC	Federal Energy Regulatory Commission
FTM	Front of the Meter
GAIN	Gateway for Accelerated Innovation in Nuclear
GIS	Geographic Information System
GPM	Gallons Per Minute
GW	Gigawatt
HB	House Bill
HJR	House Joint Resolution
IMPLAN	Impact Analysis for Planning
INL	Idaho National Laboratory
IRP	Integrated Resource Plan
ISA	Interconnection Security Agreement

ISO	Independent System Operator
IT	Information Technology
JTS	Just Transition Solicitation
LBNL	Lawrence Berkeley National Laboratory
LLWR	Large Light Water Reactor
LMP	Locational Marginal Pricing
LWR	Light Water Reactor
MISO	Midcontinent Independent System Operator
MPR	MPR Associates, Inc.
MSR	Molten Salt Cooled Reactor
MT	Montana
MW	Megawatt
MWh	Megawatt Hour
MWe	Megawatt Electric
NEPA	National Environmental Policy Act
NRC	U.S. Nuclear Regulatory Commission
NREL	National Renewable Energy Laboratory
NWE	NorthWestern Energy
OCC	Overnight Capital Cost
ORNL	Oak Ridge National Laboratory
OR-SAGE	Oak Ridge – Siting Analysis for power Generation Expansion
PGA	Peak Ground Acceleration
PPA	Power Purchase Agreement
PPSM	People Per Square Mile
PUCO	Public Utilities Commission of Ohio
RG	Regulatory Guide
RTO	Regional Transmission Organization
SB	Senate Bill
SEUALG	Southeastern Utah Association of Local Governments
SME	Subject Matter Expert
SMR	Small Modular Reactor
SPP	Southwest Power Pool
TIF	Tax Increment Financing

U.S.	United States
USGS	U.S. Geological Survey
UT	Utah
WEIM	Western Energy Imbalance Market

## INTRODUCTION AND PURPOSE

The Gateway for Accelerated Innovation in Nuclear (GAIN) partnered with communities in Colorado (CO), Montana (MT), and Utah (UT) through the U.S. Department of Energy's (DOE) Communities Local Energy Action Program (C-LEAP) to assess the feasibility of leveraging data centers to support and enable nuclear deployment.

The selected communities for the Colorado, Montana, and Utah Nuclear and Data Center Feasibility Study and Business Case effort were Moffat and Routt Counties in Colorado, Rosebud and Treasure Counties in Montana, and Carbon and Emery Counties in Utah. Each community has operating coal generating assets and residents that support coal plant operations. To meet growing electricity demands and leverage the existing coal plant workforce, there is the opportunity for coal plants to partner with data centers to provide reliable power. Meanwhile, a nuclear power plant can be deployed with the commitment to power the data center when the coal plant shuts down and/or when the nuclear power plant is operational.

The objective of GAIN's work was to inform the path forward for communities in Colorado, Montana, and Utah by providing information needed to make decisions regarding nuclear and/or data center deployment and facilitate conversations with potential partners.

This report documents the methodology and findings of the Colorado, Montana, and Utah Nuclear and Data Center Feasibility Study and Business Case effort. The approach employed by GAIN is intended to be applicable and repeatable for other communities considering data center and/or nuclear power plant deployment. The findings documented in Appendices A, B, and C are intended to support next steps specific to the communities of interest in Colorado, Montana, and Utah, respectively.

## COMMUNITIES LOCAL ENERGY ACTION PROGRAM (C-LEAP)

DOE's C-LEAP provides technical assistance to low-income, energy-burdened communities that are facing economic impacts from fossil fuel-related closures, such as coal plant retirements and mine closures. The program supports competitively selected communities in developing community-driven strategies for energy-related economic development (Reference 1).

Communities participating in the program are encouraged to explore a range of energy pathways, individually or in combination, to maximize local benefits. These pathways include:

- Deployment of advanced nuclear technologies and support for existing reactors
- Carbon capture and storage (CCS)
- Energy planning and infrastructure development

- Community resilience microgrids
- Assessment of critical minerals from energy waste and by-products
- Energy-efficient building upgrades and beneficial electrification
- New or expanded manufacturing

## **COLORADO, MONTANA, and UTAH COMMUNITIES**

Moffat and Routt Counties in CO (References 2, 3), Rosebud and Treasure Counties in Montana (References 4, 5), and Carbon and Emery Counties in Utah (References 6, 7) are all C-LEAP communities that are exploring opportunities for advanced nuclear and/or data center deployment and are interested in potential benefits of co-location. Selected communities through the C-LEAP program have operating coal plants, which provide economic stability through jobs and a significant tax base to the surrounding community. To take an active role in shaping the economic future of their region, these communities are developing community action plans that include strategies for energy-related economic development. These communities recognize that they are uniquely positioned to be a part of the expansion of power generation in the United States (U.S.) necessary to meet future capacity demands. However, even existing coal plants without announced retirement dates will eventually cease operations, as no generating facility has an indefinite operational lifespan. Community action plans that anticipate potential changes to existing generation are important to ensure communities are prepared to capitalize on opportunities with new power generation projects. New power generation may also be supported by new energy consumer industries such as data centers.

Additional information on the context and motivation for each of these communities is included in the subsequent sections below. Figure 1 shows the locations of the current coal plants that support the C-LEAP communities discussed in this report. Table 1 includes additional information (i.e., capacity, power market, balancing authority, and retirement dates) for each of the coal plants shown in Figure 1.

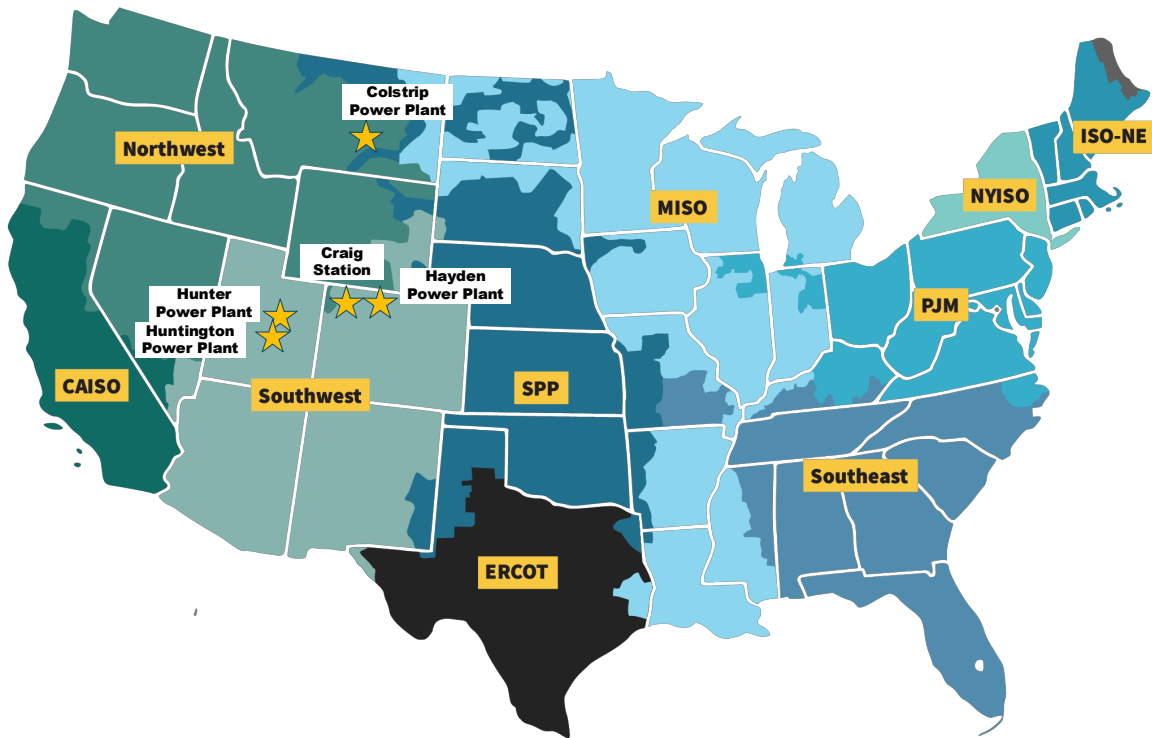


Figure 1. C-LEAP Applicant Communities Coal Plant Locations

Table 1. C-LEAP Applicant Communities Coal Plants

County	Current Coal Power Plant(s)	Net Capacity (Megawatts (MW)) <sup>1</sup>	U.S. Power Market <sup>2</sup>	Owner/Partial Owner <sup>3</sup>	Expected Retirement Date (If Applicable)
Moffat County, CO	Craig Station	1285	Southwest Power Pool (SPP) Western Energy Imbalance Service Market	Tri-State Generation	All Units Retired by 2028
Routt County, CO	Hayden Station	441		Public Service Company of Colorado (Xcel)	
Rosebud County, MT	Colstrip Power Plant (2 Operational Units)	1480	California Independent System Operator (CAISO) Western Energy Imbalance Market (WEIM)	NorthWestern Energy (NWE)	Not Planned

**Table 1. C-LEAP Applicant Communities Coal Plants**

County	Current Coal Power Plant(s)	Net Capacity (Megawatts (MW)) <sup>1</sup>	U.S. Power Market <sup>2</sup>	Owner/Partial Owner <sup>3</sup>	Expected Retirement Date (If Applicable)
Emery County, UT	Hunter Power Plant (3 Units)	1363	CAISO WEIM	PacifiCorp East	Not Planned
	Huntington Power Plant (2 Units)	909			Not Planned

Notes:

1. According to Energy Information Administration (EIA) data for net summer/winter capacity (Reference 9).
2. Utah, Colorado, and Montana have regulated electricity markets (Reference 8).
3. For all coal plants except for the Craig Station, the plant owner is the same entity as the balancing authority of the region who is responsible for processing interconnection applications. The balancing authority for the Craig Station is the Western Area Power Administration – Rocky Mountain Region (Reference 9).

## Colorado

The Associated Governments of Northwest Colorado (AGNC) is a council of local governments with the mission to advocate, inform, and represent the needs of various counties in Northwest Colorado. The AGNC applied for a C-LEAP grant to explore economic opportunities for new energy resources in the fossil-fuel dependent Moffat and Routt Counties. Several state regulations have led to the accelerated planned closure of Colorado’s coal plants in these communities (Reference 14), which have historically been reliant on the coal industry as a significant portion of the tax base and supply of local jobs. Moffat County is home to Craig Station, which is operated and majority-owned by the wholesale power supplier Tri-State Generation & Transmission Association (Reference 11) and is dispatched according to the Western Area Power Administration – Rocky Mountain Region balancing authority (Reference 9). Routt County is home to Hayden Station, which is operated and majority owned by the Public Service Company of Colorado (which is a subsidiary of Xcel Energy) (Reference 13), who is also the balancing authority (Reference 9).

The owners of both Craig and Hayden Stations announced plans to retire all power generation units by the end of 2028, in accordance with the Colorado state-level push to decarbonize and retire coal units (Reference 12). As a result, community members are looking to pursue alternate energy resources to replace the jobs and tax revenue historically provided by the coal plants. AGNC’s goal for the C-LEAP study is to leverage the insights to attract new investment from advanced energy developers and large-scale projects, educate and retain the local workforce for emerging industries, and promote local economic development.

## Montana

Rosebud and Treasure Counties in Southeast Montana applied for a C-LEAP grant to further explore ways to strengthen their economy with expanded power generation and new industries. There is one operating coal plant in this region: the Colstrip Power Plant, which will be majority owned by NWE, the utility and balancing authority for Southeast Montana (NWE ownership will increase to 55% effective January 2026). The owners of Colstrip do not currently have planned retirement dates for the operating Units 3 and 4 and will continue to supply power to the majority of Montana for years to come. NWE is continuing to look for ways to continue to diversify their portfolio, including options such as nuclear, natural gas, and wind and solar.

The communities' goals for the C-LEAP study are to leverage insights to make informed decisions and plans regarding the introduction of modern power sources, the promotion of local business growth, and the attraction of investment through large-scale projects in the area. Southeast Montana also wants to continue to develop the local workforce and help prepare the local talent for the potential emerging industries in the community.

## Utah

The Southeastern Utah Association of Local Governments (SEUALG) is a regional planning organization representing the needs of Southeastern Utah's "Coal Country", Carbon and Emery Counties. SEUALG applied for C-LEAP technical assistance to support their mission of expanding power generation and business opportunities and to strengthen their economies. There are two operating coal plants in this region, the Hunter Power Plant and the Huntington Power Plant. Utah's biggest power utility and balancing authority is PacifiCorp, which owns and operates the two plants. Rocky Mountain Power is the division within PacifiCorp that operates in Emery and Carbon, Utah.

Utah originally anticipated the shutdown of Hunter and Huntington to be in 2031 and 2032 (as stated in the Utah C-LEAP Application) but the plant owner, PacifiCorp, has since revised their integrated resource plan (IRP) to extend the life of the plants indefinitely (Reference 27). PacifiCorp plans for these coal plants to operate at lower capacities as existing and future renewable sources provide lower-cost power (Reference 26).

SEUALG applied for C-LEAP grant and technical assistance due to Carbon and Emery Counties experiencing a shift in the local economy when the decommissioning of the two plants was announced (Reference 6). While the retirement dates have since been rescinded, easing the immediacy of an economic shift, the community is interested in long-term solutions for sustaining jobs and spurring economic growth. SEUALG's goals for the C-LEAP study are to identify generation technologies that have the potential to contribute to job creation, educate and retain the local workforce for emerging industries focused on maintaining quality jobs and

competitive wages, and inform local stakeholders empowered to meaningfully shape the region's energy future.

## **GATEWAY FOR ACCELERATED INNOVATION IN NUCLEAR (GAIN)**

GAIN is an initiative established by the DOE and operates out of Idaho National Laboratory (INL). GAIN functions as a public-private partnership designed to provide access to technical expertise, regulatory guidance, and financial resources to advance the commercialization of nuclear technologies (Reference 15). As nuclear technologies progressed toward deployment, GAIN's role expanded to include support for stakeholders—such as states, utilities, and communities—that are newly exploring nuclear energy.

Under the C-LEAP initiative, GAIN is providing technical assistance to conduct nuclear and data center feasibility studies and develop community specific business cases. MPR Associates, Inc. (MPR), INL, and Oak Ridge National Laboratory (ORNL) supported the effort to develop the Colorado, Montana, and Utah Nuclear and Data Center Feasibility Study and Business Case effort, as part of the greater GAIN team.

## **NUCLEAR OVERVIEW**

Nuclear power has an essential role in modernization of the grid and the power sources that are needed to meet ever growing electricity demands. Today's commercial nuclear power fleet provides ~20% of US electricity generation. Nuclear power plants supply highly reliable power that provides stability to the grid, with an average capacity factor of 93% (Reference 23).

There are many different types and sizes of nuclear reactor designs. Modern advanced nuclear reactor designs include two generations of reactors, termed Gen III+ and Gen IV reactors. Gen III+ reactor designs include innovations informed by the design of the current U.S.'s operating large light water fleet and still use water as a coolant, low enriched uranium as fuel, and have passive safety systems. Gen IV reactors use non-water coolants and fuels that are not currently used by the current U.S. operating fleet, have passive safety systems, and are designed to expand applications to higher temperature industrial applications (Reference 23). General nuclear reactor sizes and output ranges are summarized in Table 2.

**Table 2. General Nuclear Reactor Sizes**

<b>Nuclear Reactor Size<sup>(1)</sup></b>	<b>Output Range<sup>(1)</sup> (MW)</b>
Micro	≤ 50
Small <sup>(2)</sup>	50 ≤ 300
Medium <sup>(2)</sup>	300 ≤ 600
Large	> 600

Notes:

1. Power output range and nomenclature described in GAIN Taxonomic guidance on Advanced Reactors (Reference 16)
2. Small and medium advanced reactors may be grouped into the Small Modular Reactor (SMR) category.

Reactors that use water as a coolant are the most prevalent reactors in use today. Advanced water-cooled technologies are based on previous water-cooled reactor designs. Water is used in these reactors as both: 1) a moderator to slow down the speed of neutrons emitted during fission to increase the probability of fission events, and 2) as a coolant to carry away heat created by fission. New Gen III+ water-cooled advanced reactor designs feature inherent safety characteristics that can maintain the safety of the reactor without operator intervention. One such characteristic is using natural circulation to cool the reactor core instead of active circulation driven by pumps. Designing advanced reactors to include such inherent safety characteristics is beneficial to strengthen overall nuclear safety.

Gas cooled reactors, a variety of Gen IV reactors, produce high temperature heat and typically use helium as the heat transfer medium, although some designs use carbon dioxide. The coolant gas at the reactor core output temperature can exceed 900°C in some designs (Reference 17). In most designs, the gas coolant is compressed and used to transfer heat to a secondary loop, which can be another heat transfer medium, such as water. Generated heat can be used to produce electricity or used in non-electric applications, such as desalination or industrial heating. Gas cooled reactors also include inherent safety characteristics, such as the use of inert coolants and high-heat capacity moderators which can limit rapid temperature excursions during operation.

Molten salt cooled reactors (MSR) and liquid metal cooled reactors are two types of non-water-cooled reactors that share similar characteristics. Molten salt and liquid metal do not expand as much as water when heated, which allows these reactors to be operated at higher temperatures and lower pressures (e.g., atmospheric or near atmospheric conditions). The lower pressure design can enable advantages in both safety and capital cost, as vessels and piping do not need to be designed to withstand high-pressure. Additionally, higher temperatures enable higher electricity generation efficiency as well as a broader range of potential industrial applications (Reference 18). Molten salt and liquid metal reactor technologies are of lower maturity in the

U.S. compared to other designs. Liquid metal reactors have been demonstrated in the past, but there are few commercial deployments, which are all in Russia (Reference 19). Similarly, MSRs have had few demonstrations, which have been limited in scale with no commercial deployments to date. MSRs and liquid metal reactor designs also have inherent safety characteristics, including the use of natural circulation to remove heat without additional power input to the plant.

Owner-operators looking to add nuclear to their portfolio have challenging decisions to make regarding the selection of viable designs to meet their use-case (Reference 24). Advanced nuclear technologies and their supply chains are still maturing and only a few designs are commercially available. A few advanced nuclear technologies are discussed in this study, including the Xe-100 and the Natrium reactor, to provide a representative perspective on feasibility of development. These technologies are picked with illustrative objectives in mind but are not intended provide technology selection recommendations. Owners/operators should systematically review the available reactor technologies to identify the designs that best fit an owner-operator's goals.

Siting a nuclear reactor requires a complex screening process to ensure exclusionary, avoidance, and suitability criteria are considered. In the siting study contained herein, advanced reactor siting criteria are varied by technology size and cooling requirements for initial screening. While there are many advanced reactor design possibilities, preliminary feasibility studies for a few generalized designs provide important insight into advanced reactor siting feasibility in the regions of interest.

## **DATA CENTER OVERVIEW**

While central to the digital age, data centers have historically operated behind the scenes. Data centers are a necessary byproduct of the internet, electronic commerce, and other electronic transactions necessitated by and in facilitation of digital transformation. Storage, computation, artificial intelligence (AI), quantum computing, and other important data operations take place in data centers. The physical make-up of data centers is composed of the computing and support infrastructure that Information Technology (IT) systems require, such as servers, data storage drives, network equipment, auxiliary equipment for power supplies, cooling, and building security. The online/digital access that enables data centers to transmit, process, and store data is provided by fiber optic cables that connect to the internet. This infrastructure is all stored within large facilities that can be singular buildings or collections of buildings, referred to as campuses. An example data center campus is shown below in Figure 2.



**Figure 2.** Data Center Campus (Reference 10)

There are several types of data centers, distinguished by their functions and power requirements. The most typical data center types are (i) enterprise, (ii) co-location/tenet, (iii) cloud, (iv) hyperscale, and more recently, (v) AI factories. Enterprise data centers are wholly owned and operated by a single company who uses the storage and compute capabilities to support their own business operations (e.g., banks, government organizations, retail chains). Co-location/tenet data centers are owned and operated by a third-party company who provides the necessary infrastructure and leases server space to customers. Cloud data centers are owned and operated by a single company who offers virtual services to customers (e.g., Amazon Web Services (AWS), Microsoft Azure, Google Cloud). Hyperscale is less of a type of data center and more so a distinction based on the size and power requirements of any of the previous data center types mentioned. Hyperscale data centers are typically considered to be facilities that house at least 5,000 servers, occupy at least 10,000 square feet, and can require 100 or more MWs of power (Reference 20). AI factories are specialized data centers that are optimized to handle high-performance computing for machine learning training, deep learning inference, and large-scale data processing. These data centers are increasingly growing in size and will soon be demanding gigawatts (GW) of power.

Power consumption and operational profiles may vary across the different data center types. Cloud and hyperscale data centers that host globally distributed workloads or provide 24/7 cloud services traditionally have minor fluctuations in IT loads. However, recent efforts by cloud service providers have focused on timing certain workloads to match peak renewable generation and future initiatives are focused on actually shifting moveable compute tasks to data centers in regions with available renewable energy (Reference 10). Additionally, traditional enterprise or

smaller privately owned data centers may have more predictable load variability, with the potential for load reduction during non-business hours when computational demands decrease. Across all data center types, auxiliary loads, such as cooling systems, may introduce additional variability into the overall power profile. Cooling systems respond dynamically to both IT load requirements and environmental conditions, with power consumption increasing during periods of elevated ambient temperatures or computational demands. Despite the daily load fluctuations of all data center types, the grid operator must still maintain the capacity to meet the contractually agreed upon power supply at any moment. This requirement ensures that data centers have the flexibility to scale their operational capacity without having to consider their typical utilization patterns or the current demand on the grid.

In terms of feasibility, data centers do not have stringent siting requirements and mostly follow the requirements of standard building codes for industrial facilities. However, data centers are strategically sited according to the availability of land, power, connectivity, water, and skilled workers. As the demand for data center capacity grows, the size, power, and cooling requirements of data centers scale accordingly. Smaller data centers require tens of acres to accommodate the server buildings, power infrastructure, cooling systems, and security, whereas larger data centers (i.e., hyperscalers) can require hundreds of acres of land for the same systems. The large power requirements typically demand a direct connection into the transmission system and therefore locations that reduce the amount of new power infrastructure (i.e., construction of new high voltage power lines) are more favorable to data center developers. While building out a fiber optic connection is not as cost prohibitive as building new power infrastructure, locations that have direct connectivity access are also generally preferred. For cooling, data center water usage parallels energy usage with larger data centers consuming up to several million gallons of water per day. This water can come from various sources including surface water, groundwater, municipal water, and recycled or non-potable water (Reference 21).

The data center market has seen substantial growth since the turn of the century, and the surging demand for AI workloads indicates this growth will be accelerating to an exponential pace through the end of this decade. Electricity demand projections are predicting that data centers will be the single largest contributor to U.S. electricity load growth through 2029, adding as much as 65 GW of load to the grid (Reference 22). With the increasing demand for and deployment of data centers, the competition for securing power between data center developers will only continue to increase. The appetite of data center developers to secure firm, reliable power is something that can be leveraged to incentivize data centers to locate in these communities of interest. Data center deployments in these communities would increase tax revenue, provide local jobs, and would provide additional incentive to nuclear developers to locate future nuclear projects in the historically coal-reliant communities.

## DATA CENTER AND POWER PARTNERSHIP BACKGROUND

The history of data center partnerships with their primary power generator at emphasized benefit of both the energy provider and the data center developer is short and rapidly evolving. Because data centers consume so much power, securing a relationship with the power provider can be critical to deployment. Partnerships between data centers and electricity providers are commonly formed through power purchase agreements (PPAs). PPAs are for the long-term procurement of output from a power generation source to cover energy consumer capacity required for operation. As part of the arrangement between the data center developer and the energy provider, these facilities may also be physically co-located.

Co-located data centers and power generation sources are those that are built adjacent to one another. Co-location arrangements are characterized by two factors: whether the data center is connected to the power grid, and whether the power generator is connected to the power grid. Co-located projects may operate entirely independent from the grid, such that they are only connected to each other, or they can have additional connection to the grid for supplemental power and stability (Reference 44).

Not all PPA types require co-location of the consumer to its particular power generation source. The three main types of PPAs are onsite, physical off-site, and virtual off-site. A key distinction between PPA types is whether the data center is co-located to its source of power. Onsite PPAs are more typical for small solar generation. Off-site physical PPAs facilitate the purchase of power from a particular power generation source, while virtual off-site PPAs facilitate the purchase of energy from an energy provider's portfolio not attributed directly to specific projects (Reference 45).

More recently, data center developers and energy providers have attempted to form agreements to directly transfer power "behind the meter" (BTM), as a form of interconnection. When power is transferred from a power source directly to the customer, the two facilities are co-located to bypass the need for connection to the utility grid. Most power sources, especially large capacity ones, distribute their power in "front of the meter" (FTM). FTM power sources transfer power directly to the public grid, where off-takers can purchase it. BTM interconnection agreements go beyond a typical PPA to extract benefits from co-location. For example, BTM connections aim to reduce or eliminate interconnection costs that FTM connections require. However, FTM co-located connections still could benefit from reduced interconnection costs due to the shorter distances the power would need to travel to the customer.

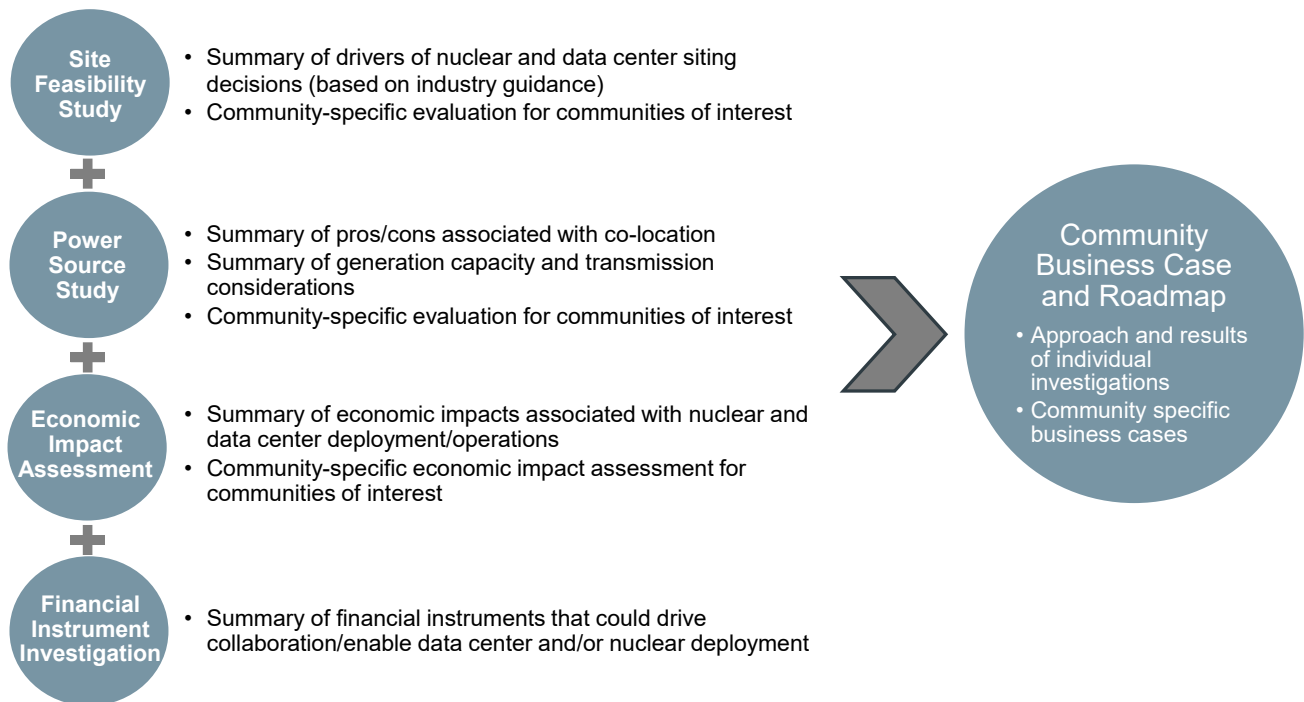
Partnerships between data center developers and the source of the power needed to operate take all forms and sizes. The ability to secure power through these agreements can be a significant driver for development.

## APPROACH AND REPORT CONTENTS

GAIN developed and implemented a structured methodology to evaluate the feasibility of nuclear and data center deployment in the communities of interest and prepare community specific business cases. The Colorado, Montana, and Utah Nuclear and Data Center Feasibility Study and Business Case effort consisted of four distinct studies (i.e., Site Feasibility Study, Power Source Study, Economic Impact Assessment, and Financial Instrument Investigation) that were leveraged to inform community-specific business cases.

The body of the report contains industry guidance and common insights. The community specific business cases, located in Appendices A, B, and C, are intended to focus future C-LEAP communities' efforts on feasible opportunities to bring investment and boost economic growth and sustainment.

Figure 3 provides a breakdown of the sub-studies that informed the community-specific business cases. Additional details regarding the four sub-studies and community business case development are provided below.



*Figure 3. Study Description*

## SITE FEASIBILITY STUDY

The purpose of the site feasibility study, conducted by ORNL, was to assess the feasibility of siting data centers and nuclear reactors in the selected C-LEAP communities and consider the potential for co-location. Data sets characterizing screening criteria by geographic location are processed in the Oak Ridge Siting Analysis for power Generation Expansion (OR-SAGE) tool, developed by ORNL to map criteria requiring more investigation for screening sites. The developed criteria were selected to serve as an initial screen based on industry input. The results are intended to provide insight to the suitability of siting each individual technology in the regions studied. Ultimately, each technology was studied independently, and then overlaid to illustrate where both a nuclear reactor and a data center may be favorably cited. Regions with identified flags may still be suitable for siting these technologies; flagged criteria are intended only to indicate challenges to siting.

Three nuclear reactor technology configurations were considered: a large water-cooled light water reactor (LWR), a water-cooled SMR, and an air-cooled SMR. For data centers, criteria were developed to reflect the feasibility of a hyperscale sized data center. These configurations are not intended to recommend specific designs but to provide the landscape of sites available for various designs. Some sites may be more favorable for one technology, and not for another.

## POWER SOURCE STUDY

The purpose of the power source study, performed by MPR, was to assess viability of deploying nuclear reactors and/or data centers in the selected C-LEAP communities based on factors beyond siting. The power source study was divided into three parts, explained below.

1. Assessment of local generation and transmission – Considered if nuclear reactors and/or data centers can be supported from a power/transmission perspective. Determined viability of supporting a data center via the existing coal plants using the capacity factor and locational marginal pricing (LMP). Capacity factor provides insight into the additional power the coal plants could produce if demand required it, while LMP data can be used to infer the available capacity of the local transmission network to carry more power.
2. Data center and nuclear partnerships – Explored potential partnerships between nuclear and data center developers. Described pathways nuclear reactors and data centers could leverage with mutual benefits (e.g., co-locating a data center with a generation source, a BTM grid interconnection, and a PPA). Highlighted benefits of these strategies and status of on-going projects.
3. Deployment timelines – Considered duration of key data center deployment milestones (e.g., site feasibility, permitting, design and engineering, and construction) and the major risks that

could delay achievement of each milestone. Considered options for ensuring continuity of power generation following retirement of the coal plants (e.g., natural gas, nuclear, etc.).

## ECONOMIC IMPACT ASSESSMENT

The purpose of the economic impact assessment, performed by energy economists from INL, was to evaluate regional economic impacts associated with nuclear and data center development in selected C-LEAP communities. This was done by analyzing the economic impact associated with deploying a new nuclear power generating asset and/or a data center.

Regional economic impacts (e.g., jobs and income) associated with deployment and operation of power generating assets and data centers depend on several factors, including the population of the local community, and the capacity and technology associated with the asset(s) of interest. The results of this assessment are not intended to be used for financial forecasting or to replace accounting practices but should be used to compare socio-economic impacts of various generation options.

## FINANCIAL AND REGULATORY INSTRUMENT INVESTIGATION

The purpose of the financial and regulatory instrument investigation, prepared by INL and MPR, was to provide the C-LEAP communities with strategies that could be leveraged to attract nuclear and/or data center development. These strategies include targeting and mitigating specific development hurdles or providing financial support through fundraising programs. This study provides insight into different financial and regulatory strategies and highlights examples of their deployment in communities across the U.S. The findings are not community specific and can be applied broadly.

## COMMUNITY SPECIFIC BUSINESS CASE DEVELOPMENT

The results of the 4 sub-studies are integrated into community specific business cases (Appendices A, B, and C) to provide results and insights tailored to each community of interest. The community-specific business cases are intended to inform communities on valuable next steps they could take to advocate for potential futures that appear feasible and are specific to their circumstances.

The results of the four individual studies above can be distilled into seven unique feasibility drivers for developing the nuclear and/or data center business case and roadmap for each community. Those unique drivers and their relevance are described below:

1. **Available Capacity of Existing Coal Plants:** Excess coal plant capacity could be leveraged to power data centers prior to nuclear deployment.

2. **Available Capacity of Existing Transmission System for New Large Loads:** Insight into available transmission capacity in the communities of interest could inform site selection and deployment timing for data centers and/or nuclear reactors.
3. **Retirement Date Compatibility with Deployment:** Strategic deployment of large load customers and generating assets could allow the communities to optimize their available resources and improve future preparedness.
4. **Utility Position on Large Load Off-takers (e.g., Data Centers):** Awareness of the utilities' policies related to large load off-takers will enable informed discussions with developers and potentially streamline interconnection.
5. **State and Local Energy Regulations:** State and local legislation could present favorable conditions for data center and/or nuclear developers to locate in the communities of interest.
6. **Site Suitability and Co-location Feasibility:** Insight into a community's ability to host a data center and/or nuclear reactor and awareness of potential siting advantages and/or barriers could focus next steps.
7. **Financial and Regulatory Instruments:** Local and state policies that reduce regulatory barriers and/or provide financial incentives could make communities more attractive to data center and nuclear developers.

While not directly tied to one of the noted feasibility drivers, the economic impact assessment is crucial for evaluating the inherent benefit of building up the nuclear power and data center industries and supporting community planning. The drivers mentioned above primarily focus on determining if it is technically possible to add a data center and/or nuclear reactor to each community, while the economic impact assessment informs on the economic incentive to do so according to each communities' needs. Therefore, it is important that the results of the economic impact assessment are considered as part of deployment planning.

## **SITE FEASIBILITY STUDY**

The site feasibility study, performed by ORNL, investigated the feasibility of siting nuclear reactors and/or data centers in the selected C-LEAP communities and considered potential for co-location. ORNL applied the internally developed OR-SAGE tool to conduct this analysis. While the formal siting processes for data centers and nuclear reactors require a significant amount of time, effort, and detail, this site feasibility study provides an initial assessment of whether these regions have characteristics that could be barriers to siting. This site feasibility study leverages publicly available information, industry-recognized siting guidance, and insights from industry experts including members of the greater GAIN team.

## SITE FEASIBILITY TOOL

The OR-SAGE tool is designed to use industry-accepted practices for screening sites and then employ the proper array of data sources through the considerable computational capabilities of geographic informational system (GIS) technology available at ORNL. The tool was developed to screen the potential for nuclear reactor siting on a national and regional basis. However, because of the tool granularity, it is often focused specifically on the immediate area around user sites of interest.

More than 60 data sets have been collected and processed by ORNL to develop exclusionary, avoidance, and suitability criteria for screening sites. Available site evaluation parameters include population density, slope, seismic activity, proximity to cooling-water sources, proximity to hazard facilities, avoidance of protected lands and floodplains, susceptibility to landslide hazards, and many others.

The OR-SAGE is a visual, relational database. The database partitions the contiguous U.S., a total of 720 million hectares (~1.8 billion acres), into 100-m by 100-m (1 hectare or ~2.5 acre) cells. The database traces just under 700 million individual land cells. Successive suitability criterion is applied to each cell in the database. User-specified thresholds can be applied to each siting parameter data layer. In this manner, a variety of scenarios can be quickly and thoroughly evaluated. Data can be added and/or revised within OR-SAGE to address user interests.

## METHODOLOGY

ORNL developed screening criteria for both nuclear reactor and data center siting based on industry-recognized guidance and insights from industry experts. All siting parameters should be considered as “flags” to inform siting decisions and should not be used to rule in or rule out any site. It should be noted that it is not the role of a DOE National Lab to select sites for nuclear reactors or data centers. The goal of this study was to apply the OR-SAGE tool to allow customers to make informed decisions regarding data center siting or data center siting supported by a co-located nuclear reactor.

### Siting Parameters

This section details the selected screening criteria applied in the OR-SAGE tool and their basis for both nuclear reactor and data center technologies.

#### *Advanced Reactor*

Nuclear reactor siting in the U.S. is based on limiting dose to individuals on the site exclusion area boundary and on the boundary of a low-population zone as defined in Title 10 to the Code of Federal Regulations (CFR), Part 100. Other criteria are well-defined U.S. Nuclear Regulatory

Commission (NRC) guidance for siting a nuclear reactor in the U.S. in NRC Regulatory Guide (RG) 4.7, “General Site Suitability Criteria for Nuclear Power Stations,” (Reference 32). Furthermore, the Electric Power Research Institute (EPRI) Siting Guide (Reference 33) for Nuclear Energy Generation Facilities provides siting criteria for consideration that is updated periodically. Approximately 50 potential site selection evaluation parameters are identified in the various sources related to public health and safety, environment, socioeconomic, and engineering factors. Selected advanced non-light-water reactor siting factors for a nominal small nuclear reactor provide a high level of discrimination and readily available data.

The values for population density, safe shutdown earthquake, and streamflow are all dependent on the nuclear reactor technology selected. The OR-SAGE model uses publicly available water projections for various advanced reactor technologies which can be added to the average data center cooling water requirement. Table 3 contains the Advanced Reactor Parameters applied for the analysis in OR-SAGE.

**Table 3. OR-SAGE Advanced Reactor Parameters**

<b>OR-SAGE Screening Criteria for Reactor Technologies</b>	<b>Advanced Reactors (Large Light Water Reactor (LLWR), SMR)</b>
Safe shutdown earthquake (ground acceleration)	>0.3, >0.5
Wetlands/Open waters	Flagged
Protected Lands	Flagged
Slope	>12% grade, >18% grade
Landslide hazard (moderate or high)	Flagged
100-year floodplains	Flagged
Streamflow – cooling water makeup (flagged if water required for cooling is greater than 10% of resource)	<130,000 gpm, <36,000 gpm (resource requirements)
Proximity to hazards (buffer distance)	Flagged 1-10 miles
Proximity to fault lines (buffer distance)	Depends on length of fault
Population density (people per square mile [ppsm])	Flagged varying distances (1-20 miles) from >500 ppsm depending on technology type

### **Data Centers**

Numerous sources provided insight on parameters considered for data center siting. The standard advanced reactor siting parameters applied within the OR-SAGE model were used for the data center for population density, safe shutdown earthquake ground acceleration, wetlands/open waters, protected lands, slope, landslide hazard, 100-year floodplain, proximity to hazards, and

proximity to fault lines. The values for streamflow are dependent on the size of the data center under consideration, a value of zero indicates that the data center relies on potable water for cooling as opposed to natural streamflow. The compiled siting parameters for data centers are summarized in Table 4.

Fiber-optic infrastructure is also a factor in siting a data center but was not included as screening criteria (Reference 28). Maps of publicly available data for major fiber-optic infrastructure are provided for each state (Colorado, Montana, and Utah) to show how they interconnect and route to major cities.

**Table 4. OR-SAGE Data Center Parameters**

<b>OR-SAGE Screening Criteria for Reactor Technologies</b>	<b>Large Hyperscale (100 MW)</b>
Safe shutdown earthquake (ground acceleration)	>0.75
Wetlands/Open waters	Flagged
Protected Lands	Flagged
Slope	>30% grade
Landslide hazard (moderate or high)	Flagged
100-year floodplains	Flagged
Streamflow – cooling water makeup (flagged if water required for cooling is greater than 10% of resource)	Not modeled – Water usage assumed to be low enough to be supplied by city/town infrastructure

### ***Colocation of Advanced Reactors and Data Centers***

In this analysis, the feasibility of reactor siting and co-location for new development of data centers and nuclear reactors is measured for three reactor technology configurations: a LLWR, a fresh-water-cooled SMR, and a city-water-cooled/air-cooled SMR. The OR-SAGE screening criteria for each of these technologies can be seen in Table 5. Table 5 also contains the compiled criteria for siting a hyperscale data center, which is the technology of interest for the co-location analysis.

User-specified thresholds were applied to each siting parameter data layer to evaluate a variety of scenarios. The variety of advanced reactors modeled should not be taken as specific design recommendations; they serve to bound possible developments. Owner-operators looking to add nuclear to their portfolio have challenging decisions to make regarding the selection of viable designs to meet their use-case (Reference 24).

**Table 5. Advanced Reactor and Data Center Siting Parameters**

OR-SAGE Screening Criteria for Reactor Technologies	Discussion/Rationale	Large LWR	Wet Cooled SMR	Dry Cooled SMR	Data Center: Large/Hyperscale
Safe shutdown earthquake (ground acceleration)	<p>All reactor technology designs will be designed to withstand some seismic load and can vary from technology to technology. Technology agnostic parameters for LLWRs and SMRs suggest tolerances up to 0.3g's and 0.5g's, respectively (Reference 33), but depend on seismic tolerances specific to reactor technology. Because of this, a range of seismic tolerance is used for the wet cooled and dry cooled SMR case.</p> <p>For data centers and their importance to national infrastructure, design tolerances are typically higher. The American Society of Civil Engineers recommends peak ground acceleration (PGA) tolerances depending on regional seismicity and can range from 0-1.25g. A midpoint of 0.75g is used (Reference 34).</p> <p>Generally, design costs and operational risk increase with the seismic activity at a site.</p>	>0.3g	>0.3g	>0.5g	>0.75g
Wetlands/Open waters	Wetlands are protected in Section 404 of the Clean Water Act due to their ecological importance, and require additional permits to dredge, fill, and/or build on top of them (Reference 33). They should therefore be avoided and are flagged in this study. Additionally, open waters, while not necessarily federally protected, are also flagged as areas to avoid.	Flagged	Flagged	Flagged	Flagged
Protected Lands	Protected lands (i.e., national parks, national forests, scenic rivers, tribal lands, etc.) should be flagged, as impacts from construction and operation of facilities requiring a National Environmental Policy Act (NEPA) review (nuclear reactors and potentially data centers) may cause significant delays in obtaining needed permits.	Flagged	Flagged	Flagged	Flagged

**Table 5. Advanced Reactor and Data Center Siting Parameters**

<b>OR-SAGE Screening Criteria for Reactor Technologies</b>	<b>Discussion/Rationale</b>	<b>Large LWR</b>	<b>Wet Cooled SMR</b>	<b>Dry Cooled SMR</b>	<b>Data Center: Large/Hyperscale</b>
Slope	<p>Site grading (i.e., cut and fill) can be costly. Typical industry guidance suggests avoiding land with greater than 12% grade for LLWRs 18% for SMRs (Reference 29), and 30% for Data Centers (Reference 30).</p> <p>This evaluation will flag areas where slope grading exceeds these thresholds for each scenario.</p>	>12% grade	>18% grade	>18% grade	>30% grade
Landslide hazard (moderate or high)	<p>Potential landslides can threaten structural integrity of both nuclear and data centers, and may require significant engineering mitigation strategies, and greatly increase costs. Therefore, areas with high landslide risk should be avoided. Areas of high landslide risk will be flagged in this evaluation.</p>	Flagged	Flagged	Flagged	Flagged
100-year floodplains	<p>Sites prone to flooding may require additional civil works to mitigate flood risks, and significantly increase site development costs. Properties prone to flooding should be avoided and should be a consideration during land acquisition.</p>	Flagged	Flagged	Flagged	Flagged
Streamflow – cooling water makeup (flagged if water required for cooling is greater than 10% of resource)	<p>For wet cooling options, surface water withdrawal permits often require an environmental assessment to ensure impacts to aquatic ecosystems are minimized.</p> <p>Because of the variability in streamflow and to simplify the analysis, water availability for wet cooled options, areas are flagged if they are more than 20 miles away from a flowing water source with an average low-flow rate less than 10x the reactor type’s withdrawal rate.</p>	<130,000 gpm (resource requirement)	<36,000 gpm (resource requirement)	Not modeled – Water usage assumed to be low enough to be supplied by city/town infrastructure	Not modeled – Water usage assumed to be low enough to be supplied by city/town infrastructure (~500 gpm makeup demand)

**Table 5. Advanced Reactor and Data Center Siting Parameters**

OR-SAGE Screening Criteria for Reactor Technologies	Discussion/Rationale	Large LWR	Wet Cooled SMR	Dry Cooled SMR	Data Center: Large/Hyperscale
Proximity to hazards (buffer distance)	<p>Avoid siting where nearby activities could affect plant design and/or operation.</p> <p>Siting near U.S. Department of Defense (DOD) reserved land and near major airports will introduce additional stakeholders to the project and may cause additional site-specific design and/or plant operations requirements.</p> <p>Legacy contamination could become the liability for the new nuclear owner and operator and influence plant operations.</p> <p>For the above potential hazards, the following items were considered "Hazards" for all reactor and data center types and associated buffer radii:</p> <p>Commercial Airport (5 mi for small and 10 mi for large)</p> <p>Military bases (1 mi)</p> <p>Refineries (1 mi)</p>	Flagged	Flagged	Flagged	Not currently applicable
Proximity to fault lines (buffer distance)	<p>The NRC provides extensive guidance regarding fault lines and how they should be characterized to inform seismic design. "Capable Faults" are ones that could significantly impact site design. 10 CFR Part 100 Appendix A requires that any fault greater than 1000 ft long within 5 miles of the site must be assessed to determine if they are capable.</p> <p>Because of this, a 5-mile buffer area is added to all identified U.S. faults, per the U.S. Geological Survey (USGS).</p>	Flagged Depends on length of fault	Flagged Depends on length of fault	Flagged Depends on length of fault	Not currently applicable

**Table 5. Advanced Reactor and Data Center Siting Parameters**

<b>OR-SAGE Screening Criteria for Reactor Technologies</b>	<b>Discussion/Rationale</b>	<b>Large LWR</b>	<b>Wet Cooled SMR</b>	<b>Dry Cooled SMR</b>	<b>Data Center: Large/Hyperscale</b>
<p>Population density (people per square mile)</p>	<p>Proximity to a densely populated area could increase deployment complexity and development costs (e.g., additional emergency planning procedures). Some advanced reactors are expected to be able to be sited closer to population-dense areas than existing LLWRs. Generally, areas with population densities greater than 500 ppsm should be avoided (Reference 33). If an advanced nuclear technology vendor demonstrates the ability for a reactor to be sited closer to population-dense areas, this criterion could be less stringent.</p>	<p>Flagged areas within 20 miles of greater than 500 ppsm</p>	<p>Flagged areas within 1 mile of greater than 500 ppsm</p>	<p>Flagged areas within 4 miles of greater than 500 ppsm</p>	<p>Not currently applicable</p>

## Typical Water Usage

Both data centers and nuclear power plants require cooling to operate. Cooling requirements depend on the designs selected and proposed size of the project. Cooling options include water-cooled, air-cooled, or hybrid methods. Water-cooled solutions are common and require proximity to water resources abundant with sufficient flow to cool the facility. More temperate climates may be preferred because they enhance cooling capacity and reduce the cooling water requirements. Environments that require greater mechanical cooling are less desirable because of the costs associated with keeping cooling equipment running (References 35, 36).

In regions where water is scarce, air-cooled or hybrid cooling options may be deployed, such that cooling water makeup availability is not exclusionary to development. Long distance routing of water sources has also been used in the west to enable cooling water supply, as was done for Colstrip Power Plant's water supply.

Data centers require cooling to keep servers and equipment cool but cooling capacity requirements depend on the proposed size of the project. A 2024 Lawrence Berkeley National Laboratory (LBNL) study projected direct data center cooling requirements at 0.48 L/kWh (Reference 42). This translates to 0.0021 gallons per minute (gpm) for each kW of demand. Under this consideration, a large 100 MW data center would require 210 gpm of purified freshwater cooling. If this were limited to no more than 10% of the available water source, then a source providing at least 2,100 gpm would be necessary. Reports from 2016 put the data center makeup water at 12.8 gpm/MW (Reference 43). A 100 MW data center at this value would require 1,280 gpm in cooling with the local water source capable of providing at least 12,800 gpm. New data centers certainly trend toward the lower water demand. As such, a reasonable bound on new data center makeup water is 5 gpm/MW. Therefore, a 100 MW facility would need a 500 gpm makeup water, which could be supplied by a 5,000 gpm local water source. Alternatively, data center water demand is low enough that it may be supplied by city/town infrastructure. In this study data center proximity to water sources with sufficient streamflow was not flagged, it was assumed that local city/town infrastructure could supply.

For water cooled nuclear reactors, the cooling water supply required for operation is expected to be approximately 13,000 gpm for large, and 3,600 gpm for small based on vendor feedback. Using the same limitation to consume no more than 10% of the available water source, proximity to a water source providing at least 130,000 gpm and 36,000 gpm for large and small reactors, respectively is included as flagged screening criteria.

## Typical Technology Footprints

Nuclear power plants can be used to support a variety of different needs and, depending on the size of the plant, require a variable amount of space for housing the plant and maintaining the

necessary safety boundary. There are also variable requirements for security and the amount of additional infrastructure (i.e., cooling systems) needed for the chosen design. Based on industry research, a LLWR typically requires approximately 500 acres of land, while a small/medium sized reactor typically requires 50 acres (References 37, 38).

Hyperscale data centers support extremely large data service providers. Companies with such needs include Amazon, Apple, ByteDance, Google, Meta, and Microsoft. Hyperscale data centers represent a significant capability increase above middle-sized data centers. These data centers have a much larger footprint, exist on their own campus, and generally fit within an upper bound of 200 acres including all support buildings (Reference 40). Beyond individual hyperscale data centers, developers are envisioning GW scale campuses housing multiple hyperscale facilities.

Footprint was not used as a screening criterion. Typical footprints can be used with the site feasibility study results to envision where data centers and/or nuclear power plants could be sited within counties of interest.

## COMMON INSIGHTS

Many elements of the siting feasibility study apply to all considered C-LEAP communities. The flags: water availability, topographical sloping, and protected lands identified for regions within Colorado, Montana, and Utah are anticipated to be applicable to many other western states.

More generally, the results of the evaluation may apply to sites with similar water availability. Given the scarcity of water in these western regions of The U.S., special consideration should be given to different cooling options. (e.g., wet-cooled, air-cooled, hybrid cooling).

Additionally, this study found that if a site is suitable for a nuclear reactor, that site is very likely also suitable for a hyperscale data center, given enough acreage to build. Ultimately, more detailed feasibility studies will have to be conducted in any potential siting areas to confirm suitability.

GAIN's siting evaluation approach is also fully transferrable; utilities and other stakeholders can follow the steps laid out in this assessment for different regions with ORNL's OR-SAGE or other similar GIS database tools. The criteria are listed in Table 5 and can be applied or customized for a technology of interest to screen regions for optimal characteristics and identify potential flags that must be overcome to develop in a particular area.

## **POWER SOURCE STUDY**

The power source study investigated (1) how existing plant operating and transmission system conditions can inform the ability to secure near-term power for the development of a dependent data center and influence the strategic siting of a nuclear reactor for long-term power security, (2) how partnerships between data centers and nuclear reactors can mutually benefit each other, while recognizing the barriers that these partnerships would have to overcome, and (3) how communities could leverage their existing resources to efficiently deploy a data center and/or nuclear reactor while continuing to supply power according to market conditions.

## **LOCAL GENERATION AND TRANSMISSION ASSESSMENT**

The ability to deploy a data center near-term is largely driven by the ability to secure near-term power. Existing generation capacity, if available, of the coal plants in the communities of interest could be leveraged as a primary source of power to incentivize data center developers to locate in the Montana, Utah, and Colorado communities. While available generation capacity may be an initial driver to encourage data center developers to deploy in the communities of interest, the capacity of the local transmission network is a secondary consideration that data center and new nuclear developers will have to account for when determining their preferred method for power delivery. Transmission capacity refers to the maximum amount of power a transmission system can reliably carry to serve loads or accept new generation according to voltage, stability, and thermal limits of the transmission lines (Reference 40). Both data center and new nuclear developers will have to weigh their plans for future expansion against the capabilities of the existing infrastructure at the coal plant sites and surrounding areas.

Assessing the generation and transmission capacity available in an area using publicly available information is not an exact science. There are nuances and uncertainties in the available data provided by generators, utilities, and balancing authorities. However, each data source that is investigated adds another layer of confidence to the overall assessment. This study leverages multiple resources to help build a complete picture about the available generation and transmission capacity in each community.

### **Generation Capacity**

Generation capacity refers to the maximum electrical power a plant can generate under ideal operating conditions. The actual maximum power output is often lower for expensive and aging assets, particularly during periods of peak environmental conditions or high performance from cheaper generation (i.e., renewables). Capacity factor is a performance metric that is used to evaluate how often a plant operates at its maximum capacity. The capacity factor is simply the total electrical output of a plant for a given period divided by the theoretical maximum electrical

output of that plant if it had operated at its nameplate capacity for the duration of that period. This metric is one source that can be used to investigate the available capacity of the coal plants that could be used to power a data center in the communities of interest.

While the capacity factor can be useful in some applications, it is only a quantitative measurement of actual generation compared to maximum generation. Capacity factor alone does not provide any insight into why a plant may be operating below its generation capacity. Drivers that may cause a coal plant to derate (reduce generation) or go off-line could include:

- Planned outages
- Forced or unplanned outages
- High dispatch price (i.e., priced out of competitive wholesale electricity markets)
- Maintenance derating due to degraded equipment performance
- Periods of fluctuating demand (i.e., coal plants are generally not considered to be flexible generators so they may be operated at partial load to allow for more flexible sources to respond to changes in demand)
- Emissions limits
- Transmission constraints forcing curtailment of expensive generators

These factors can equally contribute to a reduced capacity factor yet tell different stories about the available generation capacity of the coal plant. Frequent forced outages or maintenance-required derates would indicate degraded reliability, which data center developers would view negatively. However, reduced output due to forced curtailment or high dispatch prices (i.e., poor price competitiveness) may present a good opportunity for a long-term partnership that would benefit both the coal plant owner and data center developer.

In addition to the lack of transparency regarding the drivers of reduced output, capacity factor can be interpreted in different ways. For example, a 50% capacity factor can refer to both 100% electrical output for 50% of the time and 50% electrical output for 100% of the time.

Capacity factor provides a historical measure of a generation facility's output and therefore serves as a useful initial indicator of a plant's available capacity. When combined with other sources of information, it can offer clearer context for understanding why a plant is operating at a given level. The next section examines LMP, an additional metric that can shed light on the underlying drivers of reduced output, particularly whether curtailment is demand- or cost-driven. Furthermore, engaging directly with power plant owners and utilities can provide valuable insight into performance-driven curtailments.

While the actual driving force(s) behind reduced power output can only be confirmed through discussions with the generation asset owner, for the purposes of this study, any decreasing trends in power output are assumed to be cost- or demand-driven curtailments. The coal plants are assumed to be capable of ramping up to full power output and therefore any identified available generation capacity could be leveraged by a data center. This approach enables drawing conclusions about the availability of power for data center operations without requiring assumptions about the local grid's capabilities to support large load customers.

### **Transmission Capacity**

One metric to evaluate the value of electric energy at a specific location is LMP. LMP is an aggregated total price of electrical energy accounting for the load, generation output, and physical limits of the transmission system in a particular location. There are thousands of unique nodes across all Independent System Operator (ISO)/Regional Transmission Organization (RTO)<sup>1</sup> territories that represent generation sources, large loads, and locations of energy redistribution (i.e., substations and switchyards).

LMP values are calculated considering three factors: marginal cost of energy, marginal cost of losses, and marginal cost of congestion. The marginal cost of energy is simply the base cost of generating electricity across the entire system and reflects the cost of the most economical resource available to meet demand. This cost is uniform for all nodes in the same electricity market (i.e., ISO/RTO or otherwise coordinated electric market like the WEIM in which the Utah and Montana coal plants participate). The marginal cost of losses reflects the cost of energy lost due to resistance across transmission lines. This value varies depending on the distance and efficiency of the transmission path. Finally, the marginal cost of congestion reflects the price differentials caused by constraints on the transmission system due to limited transmission capacity. This component is the most relevant aspect of LMP pricing for this investigation into the feasibility of deploying a nuclear power plant and/or data center within each of the communities of interest.

Congestion prices can indicate how the capacity and efficiency of local transmission systems within a larger electric system differ. If a system were unconstrained and efficient enough to have no losses, the LMP values for all nodes within the system would be the same. Therefore, the variation in congestion pricing at the nodes corresponding with the Montana, Utah, and

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<sup>1</sup> ISOs and RTOs are federally regulated entities that are responsible for the management and control of the electric transmission grid in a state or region with deregulated wholesale power markets. ISOs/RTOs operate a region's electric transmission grid, administer the wholesale power markets, and ensure the safety and reliability of the electric system in a region. ISOs/RTOs can exist within a single state or encompass multiple states. Some examples include the SPP, Midcontinent Independent System Operator (MISO), and the CAISO.

Colorado coal plants can be used to draw informed conclusions about the capacity of the local transmission lines. While the marginal cost of losses also contributes to the variation in LMPs across nodes, this analysis will focus specifically on congestion pricing.

In an ideal system with no transmission constraints, the congestion component of LMP would be \$0/MWh (megawatt hour), indicating unconstrained flow to and from a particular node. Any deviation from \$0/MWh indicates congestion on the grid, and the sign of that deviation depends on which side of the congestion bottleneck a node is on. Negative congestion pricing occurs when a node is on the export-constrained side of the bottleneck – where transmission lines are struggling to export excess generation from this side. This lowers the LMP, incentivizing expensive generation sources to go off-line. Conversely, positive congestion pricing occurs when a node is on the import-constrained side of the bottleneck – where transmission lines are struggling to meet demand using imported cheap generation. This increases local LMPs, incentivizing expensive generation sources to come on-line relieve congestion. The historical congestion pricing of the nodes corresponding with the Montana, Utah, and Colorado coal plants can be used to draw conclusions about the how the local systems would respond to the addition of large loads and/or generators.

Tailored deployment recommendations for each community can be crafted according to whether the transmission systems in these communities are better equipped to support a data center and/or generator in the present day using these insights. While these results are indicative of present-day transmission congestion/constraint, this approach provides a defensible methodology for replicating future transmission congestion/constraint investigations as local transmission system conditions change according to newly added generation sources and system upgrades.

## **NUCLEAR AND DATA CENTER PARTNERSHIPS AND CO-LOCATION**

The feasibility of partnerships for the co-location of nuclear power generation and data center development was further investigated to identify benefits and challenges. The presence of existing available power generation may attract the new development of a data center, and the development of a data center may in turn attract nuclear power development. Strategic partnerships between power generation and data centers could de-risk both projects. These partnerships often include PPAs prior to development and in some cases, co-location of the facilities. The benefits of co-locating a data center adjacent to its primary power generation source and feasibility of common partnerships to enable development are addressed in this section. The feasibility of realizing these benefits can also be location specific, such that the context of the project location and parameters can help or create challenges to the overall business-case.

## Co-location

Co-location, data center development adjacent to its power generation source, could have benefits to the developers, power plant owners, and surrounding community. These benefits stem from (1) securing power for stable and long-term operation, and (2) sharing of resources and infrastructure for efficient development and operation. Key co-location benefits are:

- Reduced interconnection costs – In the case that the power grid is congested upstream and/or downstream of the generation source, connecting a data center closer to the main source of power could reduce the interconnection upgrades and costs associated with connecting a large load consumer to the grid.
- Workforce availability – Energy communities often have an experienced workforce to ensure continued operations and therefore have the potential to support new development opportunities. The C-LEAP communities in particular are targeting job growth and sustainment opportunities.
- Site suitability – Nuclear reactors tend to have stricter siting criteria than data centers, such that areas where power plants may be constructed will be low risk for siting a data center.
- Power stability – Nuclear reactors provide high-capacity factor power, usually in large capacity that would minimize grid disturbances to achieve the needed high-capacity factor operation expected from data centers. Locating nearby a stable power supplier with sufficient capacity, such as a nuclear reactor would be advantageous to the expected reliability of data centers by their customers (>99% capacity factor).

However, planning simultaneous deployment of a nuclear power plant and a data center could face challenges stemming from:

- Mismatched development timelines. See Deployment Timeline section for more detail.
- Difficulty purchasing enough power near-term to enable operation. This is influenced by the generation and transmission capacity and planned retirement dates of existing generators.
- Difficulty establishing commitment to the development project from various stakeholders and agreeing to terms with the utility to enable connection to the grid. PPAs are difficult to execute with the intersection of regulation, utility interests, generation owner interests, community interests, and developer interests impacting the success of agreements.

## Feasibility of Partnership Agreements

To understand the feasibility of partnerships between existing power providers and data center developers, it is important to understand the regulatory pathways in the local power market. The regulatory pathways are strongly influenced by the local legislation and community interests. In

this study, the feasibility of common partnership types is considered through a study of regulation and local initiatives to accelerate project development of this kind.

A major theoretical benefit of co-locating a data center next to a major generation source is the potential for a BTM connection. However, the high-capacity demand data centers require has not been seen in successful BTM applications using existing power generating sources. BTM applications are typically for smaller, supplemental power sources. Because of the scale of the needed capacity (10s-100s of MW) and the capacity factor demands of data centers (>99%), BTM connections likely still require back-up grid connection. This grid connection could impose major grid-upgrade requirements and resulting rate payer risks. To date, the Federal Energy Regulatory Commission (FERC) has rejected interconnection agreements between nuclear power plants and data centers that attempt to avoid interconnection upgrade costs (Reference 46). However, FERC is conducting a review of BTM connections of this type to provide future guidance (Reference 49). There is potential for BTM connections to be realized in the future through new rulemaking, but assurances cannot be made ahead of regulatory review. In cases where BTM cannot be achieved, more typical PPAs are formed instead.

Regulated markets, like Montana, Utah, and Colorado are likely to have fewer options available for PPAs as compared to an unregulated market. However, there may be partnership opportunities enabled by evolving local regulations (Reference 44). For example, Utah passed Senate Bill (SB) 132 to enable data center developers to seek alternative electric service independent of the local electric utility in the case that the utility cannot provide electric service to the developer with sufficient capacity. Regulations such as SB 132 indicate both that Utah is willing to work with developers to accelerate projects and the future regulatory landscape in the region is shifting to ease burden.

Because of the rapidly evolving nature of data center partnerships and regulation, understanding and tracking partnership structures under development today could inform communities on what may or may not work for attracting capital investment and development. Stakeholders and regulators are working to keep up with changes in industry. Examples of recent data center and power project partnerships are listed below.

- AWS and Talen Energy attempted to solidify an interconnection security agreement (ISA) for a newly constructed data center to connect BTM to the Susquehanna Nuclear Power Plant to avoid required interconnection upgrade costs (Reference 46). FERC on two occasions of review, rejected the ISA for BTM connection between AWS and Talen Energy (Reference 49). FERC cited insufficient engineering judgement to the investigation of consequences of BTM connection impact on the grid. BTM connections aim to avoid grid interconnection, but to maintain the high capacity and reliability required by data centers, they will likely need to be connected to the grid anyways (Reference 47).

- Meta and Constellation have signed a PPA for the purchase of 1,121 MW of nuclear energy for 20 years (Reference 50).
- Microsoft agreed to pay a premium for power from Constellation through a 20-year PPA (with a cap) to incentivize major equipment replacement and relicensing of existing nuclear power plant Three Mile Island 1, now Crane Clean Energy Center (References 51, 52, 53).

Given the lack of precedent for successful BTM partnerships between data centers and existing generation sources, the anticipated operational, regulatory, and economic benefits remain theoretical rather than proven. While the electric power industry has experience handling large loads through traditional FTM interconnections, there are still significant uncertainties with entirely BTM connections. The communities should continue to monitor the ongoing FERC decisions and case studies discussed in this section to determine the potential for leveraging the results of this study to market future BTM opportunities to potential data center developers.

## DEPLOYMENT TIMELINES

An important aspect of nuclear reactor and data center deployment is understanding the time to first power and operation for each of the technologies. Deployment timelines help to illustrate possible pathways to these milestones, beginning from initial feasibility studies and finishing with the start of operations. It is important to note that these timelines can vary substantially and can be impacted by various risks and opportunities throughout the project timeline. The following sections serve to illustrate generic deployment timelines which can help inform possible deployment scenarios for data centers and power generation assets.

### Deploying Data Centers

There are a variety of considerations that can inform the decision to deploy a data center including available power, continuity of power generation, and the size of a data center. These factors can impact the timeline to deployment of data center facilities, whether that includes a single data center or a larger data center campus. The size of a data center significantly impacts the amount of time required for deployment and the overall use case based on the scale up of required equipment. Table 6 summarizes typical data center sizes and their associated use cases.

**Table 6. General Data Center Sizes and Use Cases (Reference 56)**

<b>Data Center Size</b>	<b>Range</b>	<b>Typical Use Case</b>
Micro Data Center	<1 MW	Support Specific Entity or Project
Small to Medium Data Center	1 – 5 MW	Service Providers Separate from Data Center
Large Data Center <sup>(1)</sup>	10-50+ MW	Data Center Campus, Separate from Service Provider

Notes:

1. Hyperscale data centers represent the upper end of the large data center power consumption range provided in this table (~100+ MW).

This section details a general timeline based on the assumption that a large data center is pursued, substantiated by the current average size of data centers in the U.S. (approximately 40 MW) (Reference 73).

Key activities, durations, and risks/opportunities were determined for a large/hyperscale data center deployment through engagement with subject matter experts (SMEs) and research using publicly available, independent sources identified in the input tables. Table 7 summarizes the major activities, expected durations, and the basis for the duration. This timeline specifically considers time to commissioning the first building, although additional buildings could be constructed as additional power becomes available after the initial timeline (i.e., building out a larger data center).

**Table 7. Large Data Center Timeline Inputs**

<b>Phase</b>	<b>Duration/Range (months)</b>	<b>Key Activities</b>	<b>Basis</b>
Feasibility	3	Define the needs, site selection feasibility considering connectivity to fiber and transmission, land, and cooling capabilities.	References 54, 55, 56
Permitting	12	Environmental permits, load interconnection process, zoning and building permits.	
Engineering Design	4	Engineering and designing of the data center, infrastructure preparation.	
Procurement	5	Equipment sourcing, including long lead electrical equipment.	
Construction and Commissioning	18 - 24	Clear land, foundations, physical structure, cooling systems, power, servers, testing and commissioning.	
<b>TOTAL</b>	<b>3 years<sup>(1)</sup></b>		

Notes:

1. Note that the total duration is not an aggregate of the various activity durations as many of these activities occur simultaneously.

The durations detailed in Table 7 are subject to project risks and opportunities. Construction of data centers can be streamlined using modular construction, in which portions of the data center are fabricated off site, and then standardized modules are pre-assembled and transported on site for the final assembly (Reference 57). This can enable greater flexibility compared to traditional construction, enabling quicker deployments and scaling of the total data center size as necessitated. As companies and investors continue to grow their data center needs, modular deployment can also enable further expansion and flexibility compared to a traditional data center build. Additional key risks and opportunities for data center deployment are included in Table 8. Note that these risks are likely to impact the schedule for data center deployment, but also the overall cost of deployment. There may also be opportunities to reduce the risks given additional capital investment.

**Table 8. Key Data Center Deployment Risks and Opportunities**

<b>Schedule Category Impact</b>	<b>Title</b>	<b>Description</b>
Risk with Potential Impact to Entire Project	Grid Interconnection Point	The point of grid interconnection will alter the amount of time needed for permitting and interconnection applications, whether the interconnection be pursued BTM or FTM.
	Power Availability	The size of the data center may be driven by the excess power available from the current coal plants and may ultimately lead to project delays or cancellations if no power is available to support data center deployment.
	Water Availability	The availability of water to support cooling the data centers may limit deployment or require air-cooled design solutions if there is not enough excess water available in the area. This would include the risk that the water rights of currently operating power generation sources were unable to be transferred to the data center due to sustained operations or other permitting issues.
	Land Availability and Viability	Sufficient land must be available for siting a data center. Additionally, enough land must be available for all required components needed to support construction.

**Table 8. Key Data Center Deployment Risks and Opportunities**

<b>Schedule Category Impact</b>	<b>Title</b>	<b>Description</b>
Permitting	BTM Connection	<i>Opportunity</i> – Connection of the data center to the grid BTM, as discussed in previous sections, may help to streamline the interconnection process.
	Grid Upgrades	Additional time may be needed if grid upgrades are deemed necessary during the interconnection studies.
	Load Interconnection	Load interconnection timelines have seen a drastic increase in duration due to the sheer volume of loads requesting power from the grid and the availability of excess generation to support these requests. This volume of requests may continue to lead to delays in the load interconnection process, leading to longer permitting timelines.
	Fiber Availability	The proximity of the data center to local fiber networks and ability to connect to the existing network will likely impact the timeline. Construction of additional fiber lines to support data center deployment may be needed depending on the distance from the proposed facility.
Procurement	Long Lead Electrical Equipment Procurement	Should network or grid upgrades be required to support the addition of the data center to the grid, procurement durations for the electrical equipment will likely impact the timeline.
	Vendor Procurement Slot	<i>Opportunity</i> – Depending on the chosen data center developer, the developer may already have an agreement with data center equipment vendors for a procurement slot. Such vendor procurement slots may be leveraged for electrical infrastructure and data center procurements to facilitate a more rapid deployment.
Construction	Temporary Power	<i>Opportunity</i> – Power via a temporary power source (i.e., turbine generators, reciprocating generators, etc.) could allow the data center to come online prior to a grid connection.
	Existing Infrastructure	<i>Opportunity</i> – Should the data center be built adjacent to an existing generating facility, existing electrical infrastructure (i.e., the substation) may be leveraged, assuming that the current generating facility will no longer require use of the equipment.
	Craft Availability	Dependent on the timing of the data center deployment with other, parallel activities (i.e., alternate generation deployment, current generation retirement), there may be a shortage of craft available to support construction of the data center.

## Continuity of Power Generation

An alternative generating source may be required to meet a data center's baseload power generation requirement depending on the available generating capacity and retirement plans associated with the existing generating assets. Deployment of alternative, continuous generating technologies could also help to alleviate other grid resources from needing to supplement the power of current coal resources and may be able to help maintain grid interconnection rights for the alternative source. More intermittent generating technologies, such as solar and wind, would likely be unable to supplement the baseload power and reliability requirements of data centers, but could be coupled with other continuous technologies such as battery energy storage systems to mitigate these concerns.

### ***Nuclear Power***

Nuclear power is a viable generation option that could be deployed to maintain the baseload generation of retiring facilities and/or provide additional capacity to the grid or to large loads such as data centers. Several advanced nuclear first movers are refining deployment and construction timelines, which will be important to understanding what the time to first power. Some of the advanced nuclear first-movers include X-energy, with the Xe-100 reactor design, and TerraPower, with the Natrium reactor design. Long Mott Generating Station, a four-unit Xe-100 SMR facility, has an estimated operation date of the early 2030's, proposing an approximately 4-year construction and commissioning timeline beginning in 2026 (Reference 58). Similarly, the TerraPower Natrium Reactor began construction in 2024 and is expected to be operational by the early 2030s (Reference 59). Subsequent nuclear deployments are forecasted to take around 10 years to first power, due to the additional time needed for feasibility studies, design, interconnection, licensing, and procurement.

### ***Natural Gas***

Natural gas fueled power generation is another viable option that could be deployed in a rapid manner to serve as a source of baseload generation. Natural gas power deployment is relatively well understood but deployment timelines may vary based on the size of the project and location (e.g., accessibility of natural gas resources in the area). Additional feasibility studies would need to be considered before natural gas is further pursued in any of the communities, which would include the climate of the area of interest. Natural gas plants are unique in that they are susceptible to possible climate curtailments due to fuel delivery risks in colder weather. This resiliency risk has improved in recent years but should be considered further in deployment feasibility assessments (Reference 60).

Recent deployments and announcements of natural gas plants include those from Tri-State Generation and NWE. Tri-State announced plans to construct a 307-MW natural gas plant in

Moffat County in 2025, with plans to have the plant online and operational by 2029, indicating an approximately 4-year construction timeline (Reference 61). Similarly, NWE recently commissioned the Yellowstone Generating Station, a 175 MW natural gas plant, which was constructed in about 2-years and came online in 2024 (Reference 62). A typical commercial natural gas deployment is likely to take approximately 6 years to achieve first power when considering the additional time needed for feasibility studies, permitting, procurement, interconnection, and potential natural gas pipeline tie in.

### ***General Timelines***

Table 9 contains details on the general deployment timelines for natural gas and advanced nuclear deployment, including key activities, and key risks and opportunities which may impact the overall timeline for deployment of these technologies. This table includes a general timeline duration for both technologies, to bound further analysis completed in this study, but it is understood that nuclear and natural gas deployment could take less or more time depending on the technology and the size of the generating asset.

There are several location, technology, and time dependent risks and opportunities that could impact deployment timelines. It should be noted that as of this report, there is a high demand for gas turbines, with procurement timelines predicted between 3 and 7 years (References 70, 71). Should a natural gas plant be pursued, this may have an impact on the overall duration, while little impact is expected on combined cycle plants.

The nuclear deployment timeline in Table 9 incorporates conservative estimates regarding the starting point of development and experience level of advanced nuclear developers. This timeline assumes a starting point of initial feasibility studies and includes contingency to address schedule risks inherent in first-of-a-kind deployments. As developers gain experience deploying advanced nuclear technologies, schedule precision and accuracy will improve. Additionally, there may be changes to the overall nuclear power timeline given NRC commitments to reducing permitting timelines, which may significantly reduce the overall time for permitting a nuclear power plant in the future (Reference 66). Overall, the activities, activity durations, and milestones that form the nuclear deployment timeline will ultimately depend on the selected technology and characteristics of the proposed site. Additional investigation and timeline refinement is required as the details of a particular nuclear project are better defined.

Table 9. Alternative Technology Timelines

Technology	General Timeline Deployment	Key Activities	Key Risks	Key Opportunities	Basis
Natural Gas	~6 years	<ul style="list-style-type: none"> <li>• Permitting</li> <li>• Interconnection</li> <li>• Equipment Procurement</li> <li>• Pipeline Construction and Tie-In (if/as necessary depending on existing infrastructure)</li> <li>• Construction</li> <li>• Commissioning</li> </ul>	<ul style="list-style-type: none"> <li>• Natural gas pipeline availability and proximity to desired plant location</li> <li>• Procurement duration increases due to vendor wait times</li> <li>• Climate in the area may impact the plant's reliability and overall feasibility</li> <li>• Necessary grid upgrades to support deployment</li> </ul>	<ul style="list-style-type: none"> <li>• Leveraging existing coal plant infrastructure to decrease procurement needs</li> </ul>	References 63, 64, 65, and 66
Advanced Nuclear	~10 years	<ul style="list-style-type: none"> <li>• Feasibility</li> <li>• Design</li> <li>• Licensing</li> <li>• Interconnection</li> <li>• Procurement/Fuel Procurement</li> <li>• Construction</li> <li>• Operator Training</li> <li>• Fueling</li> <li>• Commissioning</li> </ul>	<ul style="list-style-type: none"> <li>• Fuel procurement supply chain is still under development for many advanced reactors</li> <li>• Safety related equipment procurement may be delayed based on vendor wait times</li> <li>• Many advanced reactors are currently first of a kind construction that is not yet well understood</li> </ul>	<ul style="list-style-type: none"> <li>• Pre-Application engagement with regulators to understand key areas of focus</li> <li>• Early Site Permits (ESPs), to gain approval from the NRC to build a nuclear reactor on a specified site, independent of the nuclear vendor</li> <li>• NRC updated review estimates for applications show increased timelines</li> </ul>	References 66, 67, 68, and 69

## Technology Useful Life and Deployment Timelines

Regardless of what generating asset is chosen to supplement the data center’s baseload capacity, there is also a useful life (i.e., lifespan) associated with each of the technologies. Understanding how the overall time to first power and subsequent lifespan vary by technology can be useful for planning and determining which generating assets would best support data center deployment and sustainment, as well as meet the ultimate goals of a utility and community for their generating portfolios. It may also be useful to understanding the evolving landscape of resources in the communities, and how near-term deployments may impact local grid availability as utilities look to building new technologies.

Several key factors contribute to the typical lifespan of the various generating technologies, including safety requirements, material limits, environmental conditions, and overall component durability. Table 10 includes a comparison of typical lifespans for various generating technologies. Note that these lifespan durations are based on the average commercial generation sizes for each technology.

**Table 10. Typical / Expected Technology Useful Life**

	<b>Wind</b>	<b>Solar</b>	<b>Natural Gas</b>	<b>Nuclear<sup>(1)</sup></b>
Typical Lifespan	30 years (Reference 72)	25-35 years (Reference 74)	40-45 years (Reference 75)	40-80 years (Reference 76)

Notes:

1. The lifetime for nuclear technologies is based on existing commercial LLWRs.

## COMMON INSIGHTS

The ability to secure near-term power and subsequent sustainment of power generation in the region through deployment of new power generating assets is unique to each C-LEAP community. Recommendations for approach and strategy should be specific to the goals and priorities of each community. The circumstances surrounding the unused capacity and continued operation or retirement of the existing coal facilities drive the possible opportunities for how each community might approach future development. Shared recommendations are limited to:

- Engage with the local utility to confirm the presence/absence of excess capacity
- Gauge community interest/ability to deploy regulatory or financial incentives to attract nuclear and/or data center development

## ECONOMIC IMPACT ASSESSMENT

The purpose of the economic impact assessment, performed by energy economists from INL, was to quantify the effects of nuclear reactor and data center operations and construction on the Colorado, Utah, and Montana C-LEAP communities. The assessment utilized input-output models to assess employment, revenue, value added (gross domestic product), and labor income generated from new economic activities. For nuclear power, revenue was calculated based on electricity generation, while data center revenue was derived from existing economic evaluations.

Economic impacts for data center and nuclear construction were only assessed as a single scenario which could be applied to all three geographic areas with similar accuracy. The annual operations impacts for data centers and nuclear facilities were performed for all locations within the three states. The following county clusters were used to define the economic impact region for each state:

- **Colorado:** Moffat, Routt, Rio Blanco, and Garfield Counties
- **Utah:** Carbon, Emery, Grand, and San Juan Counties
- **Montana:** Treasure, Rosebud, and Yellowstone Counties

The full economic impact assessments for Colorado, Montana, and Utah are available in Appendix A, Appendix B, and Appendix C, respectively.

## METHODOLOGY

An input-output model was utilized to quantify the economic impacts of nuclear reactor and data center operations scenarios. Input-output models are developed by integrating regional economic data with industry-level transaction data for a specific period, typically one year. By applying mathematical formulas, the impact of new economic activity observed in a particular industry can be traced as it permeates other industries throughout the region. These inter-industry transactions create opportunities for increased revenue, job creation, and income growth. Such models can either be calculated manually or processed using advanced applications available from multiple software developers. The model employed in this assessment was produced using the Impact Analysis for Planning (IMPLAN) input-output modeling application.

Input-output model results are driven by three primary factors: employment, revenue, and labor income. For this analysis, revenue from electricity generation was calculated using annual MWh multiplied by the wholesale price of electricity, an approach that more accurately reflects the value added by the generating station. Wholesale electricity prices were sourced from the EIA (Reference 78). Retail electricity prices were not used for revenue estimation to avoid overstating

the value of the generating station, considering additional value is created during the transmission and distribution process performed at the utility level.

Employee compensation for both data centers and the nuclear reactor scenarios is based on the default values in the most recent IMPLAN datasets without adjustment. Employment numbers for the nuclear reactor and data center scenarios were determined through a meta-analysis of news reports and previous economic impact studies.

The selection of nuclear reactor options was based on the availability of data necessary for the operationalization of the input-output model. Various public reports from reactor vendors have provided employment estimates for SMRs. The vendors currently include NuScale Power (Reference 86), X-energy (Reference 84), and TerraPower (Reference 87). These vendors have published or announced employment estimates that enhance the accuracy of model results. Accurate employment and wage information are critical components for effective input-output modeling.

Economic impacts are separated into the following four categories:

- **Facility Operations Impact:** Otherwise known as the “Direct Impact.” These values are based on facility operations which include employment, labor costs, and wholesale revenue from electricity produced by the generating facilities or annual operations in the case of a data center.
- **Supply Chain Impacts:** Otherwise known as “Indirect Impacts.” The result of supply chain activity between the generating stations or a data center and suppliers of goods and services within the region.
- **Community Impact:** New economic activity caused by households spending income earned directly or indirectly from generating station or data center operations. These are otherwise known as “Induced Impacts.”
- **Total Impact:** The combination of all three impact categories.

Figure 4 illustrates what is included when estimating the total economic impact of operating data centers or nuclear reactors.

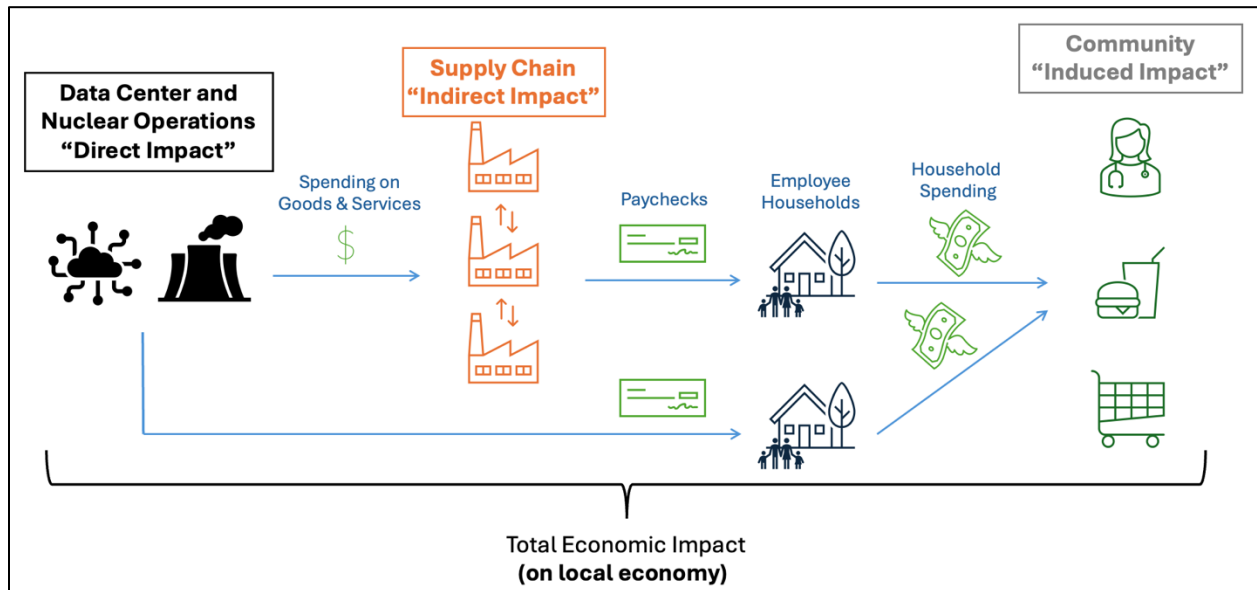


Figure 4. Economic Impacts Model Scope

## RESULTS

### Employment

Large nuclear reactors typically operate in pairs, benefiting from economies of scale in both construction and operation. Analyzing 16 different GW-scale nuclear facilities a GW-scale reactor requires about 0.54 employees per megawatt electric (MWe) (Reference 80). SMR developers are planning on using slightly fewer employees per MWe than what is observed for LLWRs. These reactors are expected to have around 0.40 employees per MWe. Table 11 provides information about the expected number of employees based on publicly released information from SMR developers.

Table 11. SMR Employment and Installed Capacity Data

Plant Configuration	Xe-100 1, 4-pack	Sodium	NuScale 6	NuScale 12	Xe-100 3, 4-packs
Employment (No. of Employees)	96	250	193	270	212
Plant Capacity (MWe)	320	345-500	462	924	960
Emp/ (MW)	0.30	0.72	0.42	0.29	0.22
MWh/Emp	27,100	11,200	19,400	27,800	36,800

Data center reports were examined to identify the number of workers required per square foot of facility space, yielding an average value of 15 employees per 100,000 square feet. This also equates to around one employee per MW of electricity use, on average. It was not very common to find data center information that reported electricity use as well as employment. Table 12 shows the variety of data that was accumulated to evaluate the size, electricity consumption, and employment for data centers.

**Table 12. Data Center Comparison Facilities**

<b>Company</b>	<b>Data Center Name</b>	<b>Status</b>	<b>Location</b>	<b>Reported Sq. Ft.</b>	<b>Reported Electricity Use (MWe)</b>	<b>MWe/ Sq. Ft.</b>	<b>Reported Operations Jobs</b>	<b>Operations Jobs/ Sq. Ft.</b>
Stack	NVA01A	Operating	Ashburn, VA	180,000	17	0.00009	—	—
Stack	NVA02A	Operating	Manassas, VA	227,000	40	0.00017	—	—
Stack	NVA02B	Operating	Manassas, VA	227,000	40	0.00017	—	—
Stack	NVA02C	Operating	Manassas, VA	15,000	2	0.00013	—	—
Stack	NVA02D	Operating	Manassas, VA	280,000	36	0.00012	—	—
Stack	NVA02E	Operating	Manassas, VA	280,000	36	0.00012	—	—
Stack	NVA05	Operating	Manassas, VA	262,000	36	0.00013	—	—
Stack	NVA06	Operating	Leesburg, VA	620,000	72	0.00011	—	—
Point One	(Unknown)	Announced	Richmond, VA	3,250,000	600	0.00018	—	—
Cloud HQ	CloudHQ MDC1	Announced	Manassas, VA	599,198	84	0.00014	—	—
Evo Switch	EvoSwitch Manassas (WDC1)	Operating	Manassas, VA	235,000	20	0.00008	—	—
Iron Mountain	Iron Mountain Data Centers VA-1	Operating	Manassas, VA	168,000	12	0.00007	—	—
Iron Mountain	Iron Mountain Data Centers VA-2	Operating	Manassas, VA	221,500	36	0.00016	—	—
Cloud HQ	CloudHQ MCC4	Announced	Manassas, VA	382,538	60	0.00015	—	—
Digital Realty	(Unknown)	Operating	Ashburn, VA	206,100	20	0.00009	—	—
Switch	(Unknown)	Operating	Grand Rapids, MI	225,000	110	0.00048	26	0.000116
5C Data Centers	(Unknown)	Announced	Springfield, OH	214,000	200	0.00093	100	0.000467

**Table 12. Data Center Comparison Facilities**

<b>Company</b>	<b>Data Center Name</b>	<b>Status</b>	<b>Location</b>	<b>Reported Sq. Ft.</b>	<b>Reported Electricity Use (MWe)</b>	<b>MWe/ Sq. Ft.</b>	<b>Reported Operations Jobs</b>	<b>Operations Jobs/ Sq. Ft.</b>
Microsoft	Quincy	Operating	Quincy, WA	800,000	—	—	50	0.000063
Meta	(Unknown)	Announced	Richland Parish, LA	4,000,000	—	—	500	0.000125
Meta	(Unknown)	Announced	Aiken County, SC	715,000	—	—	100	0.00014
(Unknown)	Crusoe	Announced	Abilene, Texas	998,000	—	—	100	0.00010
Meta	(Unknown)	Announced	Montgomery, AL	715,000	—	—	100	0.00014
(Unknown)	(Unknown)	Announced	Hanover County, VA	257,176	—	—	28	0.00010
<b>Average</b>						<b>0.000155</b>		<b>0.000157</b>

## Revenue

Nuclear power plant revenue was calculated considering electricity generation using annual MWh multiplied by wholesale electricity prices from the U.S. EIA (Reference 78). Based on EIA data, the average wholesale U.S. price of electricity was \$62.02/MWh. Using this method better reflects the generating station's value compared to full retail prices that an end use consumer would typically pay. Retail electricity prices were not used to avoid overstating the plant's value, as they include additional value from transmission and distribution activities.

Data center revenue values were derived from existing economic impact evaluations (References 79, 83). Economic output per worker calculations were then applied to the 1-GW data center scenario, showing an average revenue of \$1,295,000 per worker. Actual revenue figures are proprietary and can stem from hosting services, cloud computing, data storage, managed services, and co-location services. These revenue streams involve various pricing models, customer bases, and service levels, making revenue estimation complex.

## Construction Impacts

Economic impact analysis is a crucial tool for understanding the socioeconomic benefits associated with large-scale construction projects. This report delves into the economic impacts of constructing nuclear power plants and data centers, focusing on the various stages of construction. By examining employment numbers, community spending, and supply chain activities, this analysis aims to provide a comprehensive overview of how these projects contribute to the local economy. Construction-related economic impacts were estimated for a 1,200 MWe LWR and a 500 MWe SMR. A 275,000-square-foot data center was used to represent construction impacts for data centers.

The most recent nuclear power plant construction project completed in the U.S. was Plant Vogtle in Georgia, where two AP1000 reactors were built. Bechtel reported that peak construction employment reached 9,000 workers (Reference 77). As more nuclear construction projects are completed, additional estimates will be available to help understand construction timelines and the employment numbers by year. The cost of construction is also part of the construction economic impact equation. The construction cost inputs for the economic impact model were created using the National Renewable Energy Laboratory (NREL) Annual Technology Baseline database (Reference 85).

Table 13 shows the values associated with an LWR and SMR construction that were used to estimate the construction impact. The "Local Spend" amount is a combination of labor costs and any expected equipment and construction materials that could come from local sources. As future nuclear construction projects are completed, the assumptions used in this model could be

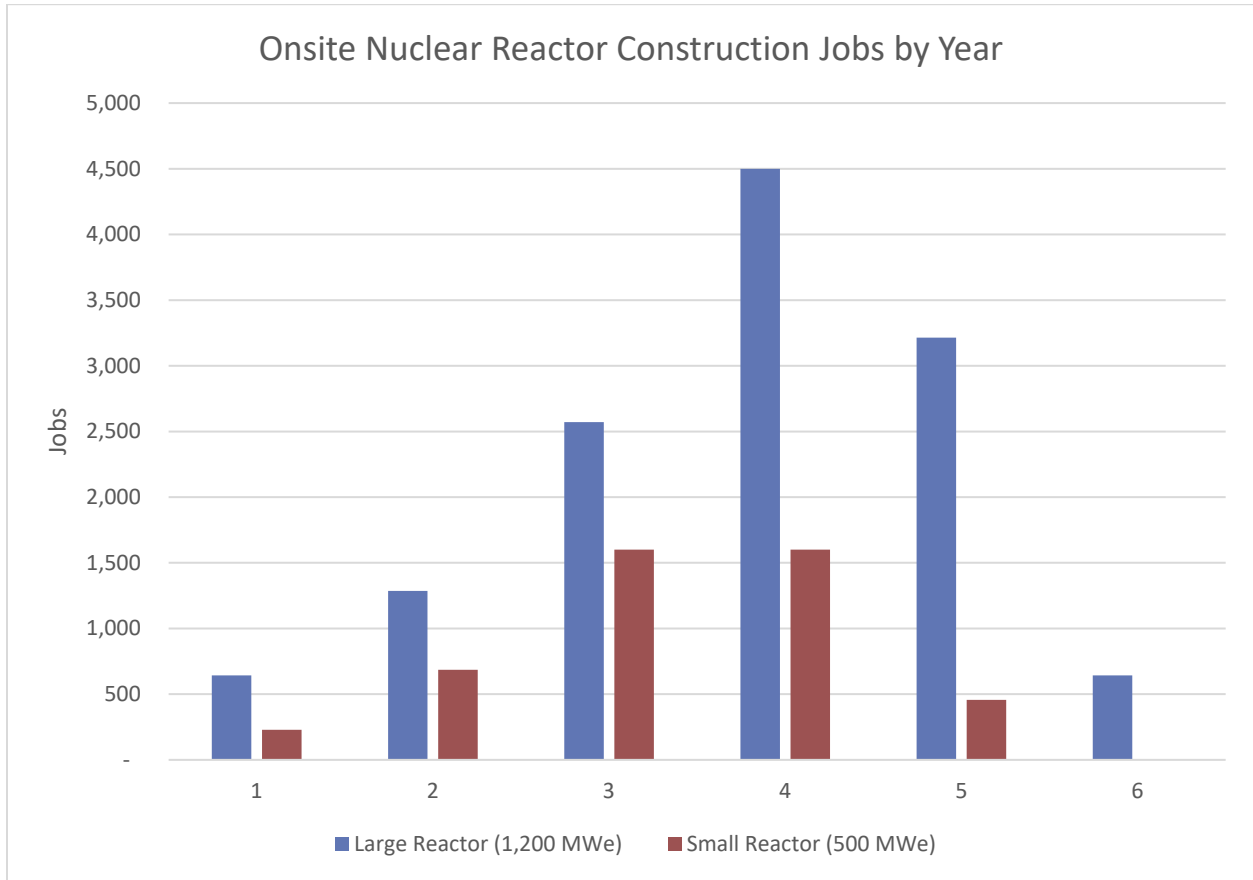
modified to reflect actual outcomes, which could improve the accuracy of construction-related economic impact modeling efforts.

*Table 13. Large and Small Reactor Cost Estimations*

<b>Reactor Type</b>	<b>MWe</b>	<b>Overnight Capital Cost (OCC)</b>	<b>Total Local Spend</b>	<b>Local Equipment &amp; Materials</b>	<b>Local Labor Cost</b>	<b>Peak Construction Employment</b>
Large	1,200	\$8,748,960,000	\$4,286,000,000	\$1,057,000,000	\$3,229,000,000	4,500
Small	500	\$4,825,000,000	\$1,731,000,000	\$583,000,000	\$1,148,000,000	1,600

The location of the construction project will also influence the size of the potential economic impact. If the construction location is very rural, it is more likely that construction resources would have to come from outside the region, which would reduce the local economic impact. Only one location scenario was used for this analysis, but the results could reasonably be applied to all three locations.

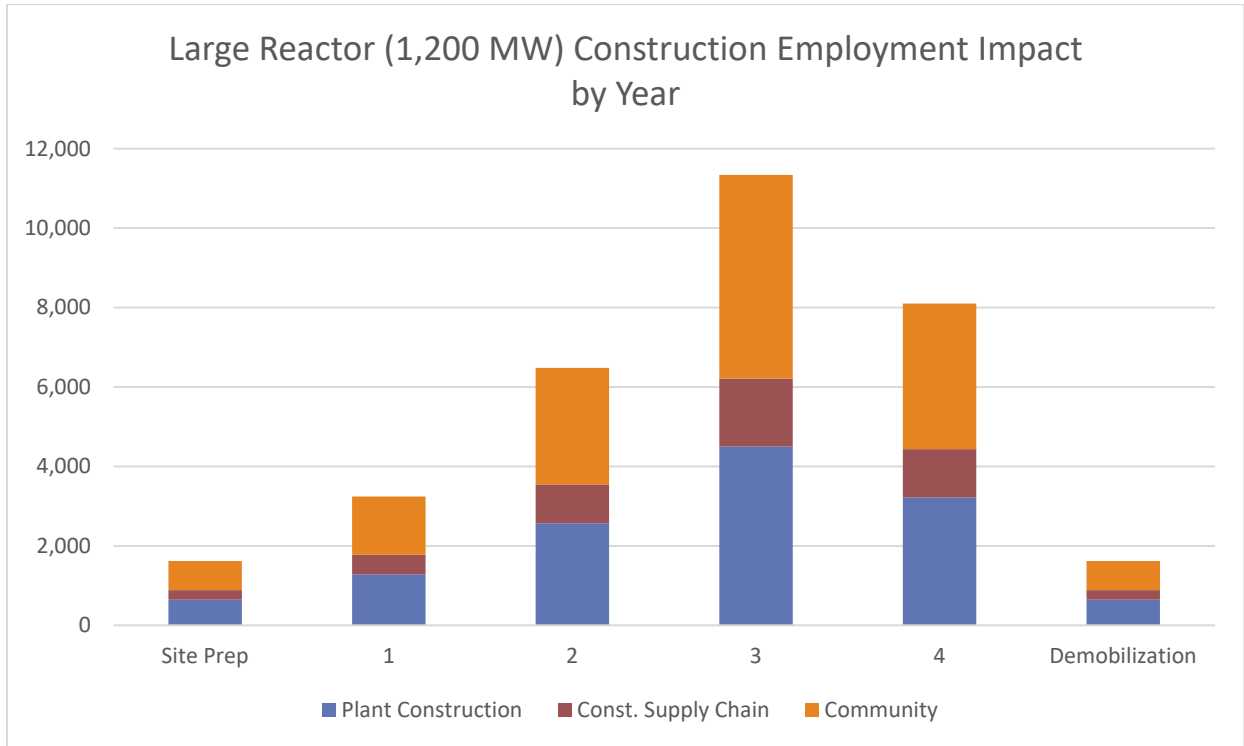
The onsite construction-related employment forecasts by year are available in Figure 5. Based on reports by Bechtel and TerraPower, peak employment for a single LWR and an SMR could support up to 4,500 and 1,600 construction workers, respectively (References 77, 87).



**Figure 5.** Onsite Nuclear Reactor Construction Jobs by Year

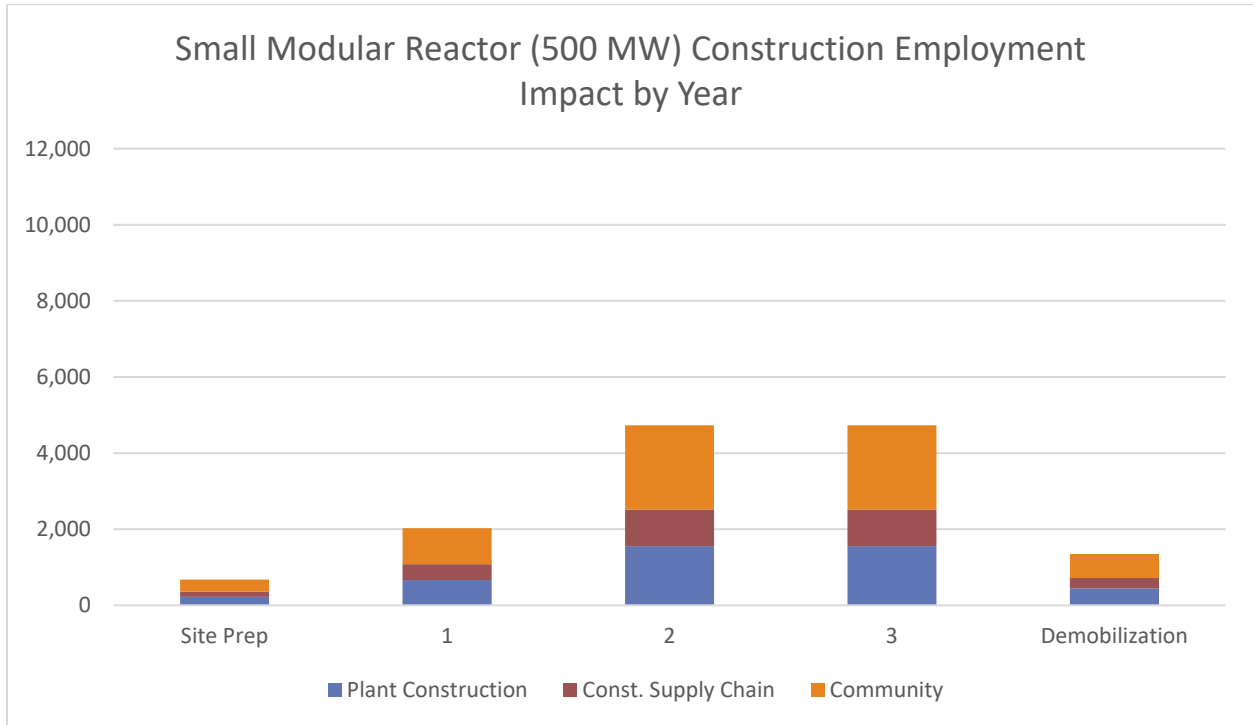
The peak construction estimates were used to approximate the distribution of construction employment across a 4-year construction period for an LWR that included an additional year before and after for site preparation and demobilization. Construction time is assumed to be reduced by 1 year for an SMR. In both cases, construction time is based on Nth-of-a-kind builds.

Construction-related economic activity would create additional jobs within the local construction supply chain and at local businesses where employee spending would take place. In the case of a large 1,200-MWe reactor, during peak construction, a total of more than 11,300 jobs could be created, as seen in Figure 6. The LWR construction effort does allow for a higher number of construction workers and higher level of impact per MW of installed capacity due to more onsite construction efforts compared to what is expected for SMR construction projects where some components could be assembled offsite.



**Figure 6.** Large Reactor Construction Employment Impact

In the case of an SMR, construction-related impacts are expected to create or sustain more than 4,700 jobs. It is possible that nearly 1,000 jobs could be created among the supply-chain-related businesses that support construction efforts. During peak construction, an additional 2,200 jobs could be created or sustained at businesses where employees would typically spend their paychecks. Detailed employment impacts for construction activities are illustrated in Figure 7.



**Figure 7. SMR Construction Employment Impact**

Mangum Economics conducted an economic impact analysis for a proposed data center campus in Hanover County, VA (Reference 83). The report suggested the construction of a 257,000-square-foot data center facility would support 550 construction jobs over a 2-year period. An additional 190 jobs would be created by new construction-related supply-chain activity and community spending. Combined, the total employment impact reaches 740 workers. The report also suggested the total pay and benefits from the workers is more than \$47.2 million. Mangum also provides an estimated total output value that exceeds \$140.1 million. Typically, total output represents industry sales or revenue. In the case of construction, it would represent the value of required construction materials including equipment purchases that occur in the region. Based on the analysis of data center data in the Employment section, a data center of around 257,000 square feet would require around 43 MW of power to operate. Table 14 provides the results of the Mangum Economics study.

**Table 14. Data Center Construction Economic Impact**

<b>Impact Type</b>	<b>Jobs</b>	<b>Pay &amp; Benefits (millions)</b>	<b>Output (millions)</b>
Direct Construction Impact	550	\$37.3	\$115.7
Supply Chain and Community Spending	190	\$9.9	\$33.4
Total Economic Activity	740	\$47.2	\$149.1

Appendices A, B, and C of this report include specific economic impact estimates for the Colorado, Montana, and Utah communities, respectively.

## **FINANCIAL AND REGULATORY INSTRUMENT INVESTIGATION**

Attracting investment into large infrastructure projects such as nuclear power plants or data centers is a long and complex process. These multi-billion-dollar projects require coordination on a community, state, and federal level. The decision to select a specific site may hinge on financial incentives, likelihood of legal challenges, and needs of the nuclear power plant owner or data center company involved. Subsequently, communities will only play a small part in driving this selection process. None the less, communities can take steps that have a material impact on site sections and attracting investment. This section discusses potential actions communities could take to attract both nuclear power projects and data centers (both together or independently). Some programmatic incentives can include (but are not limited to):

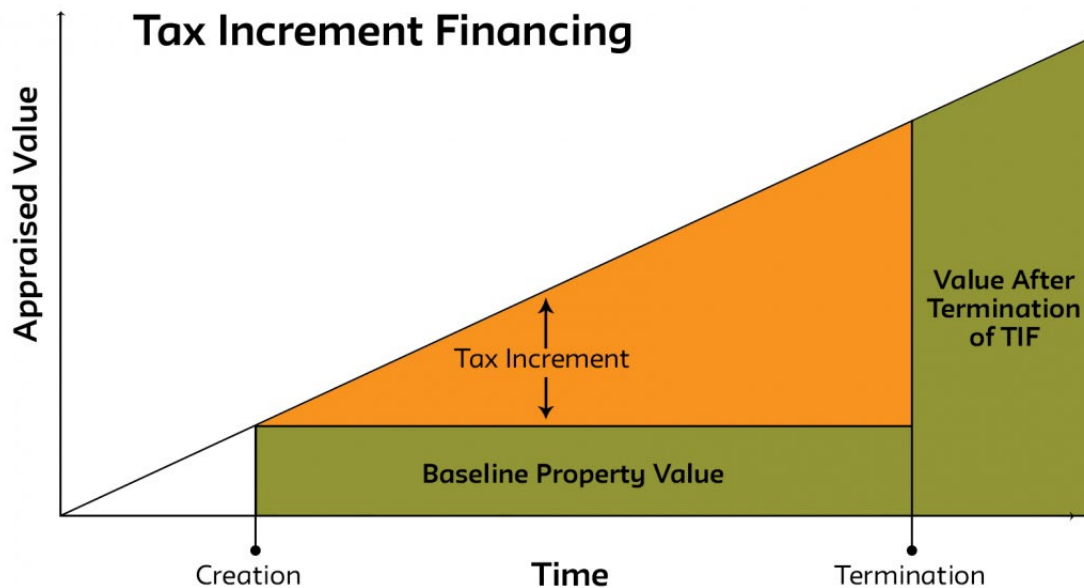
- Tax increment financing (TIF)
- Property and other tax credits
- Bonds for specific development costs
- Early site feasibility and permitting
- Reducing other regulatory hurdles that bottleneck development projects regarding:
  - PPAs
  - Environmental permitting
  - Tariffs

A few examples of these types of incentive programs and their intent are discussed herein.

## INCREMENTAL TAX CREDITS

TIF is a method used by local governments to drive economic development by financing the initial costs of a project with future tax revenue generated by the development it spurs. (Reference 88). The increment (difference between base and tax on increased property value) can then be allocated for specific projects.

This is done in a series of steps. The area flagged for development, such as for nuclear power plants or data centers, would be designated a TIF district by the local government, which effectively “freezes” the tax revenue generated from that area at its current rate. A specific timeframe is defined during which all base tax revenue is frozen, after which the TIF district is terminated. During the defined timeframe, all money generated from the area at the current rate continues to go into the general tax revenue fund, but any additional revenue beyond that amount would go into separate funds to help cover initial project costs. After termination, the surrounding districts still capture the increased property taxes, which rise due to the area's new development. This is illustrated graphically in Figure 8.



**Figure 8.** TIF Illustrative Example (Reference 88)

The value of TIF is that it helps project developers recover the initial costs associated with project development at an accelerated pace. A general premise of project finance is that the sooner a firm can recoup initial costs, the more likely their project is to be profitable. This unique taxing approach enables developers to offset large upfront costs while still allowing the tax base to benefit from the increased taxes in the long run. However, an important caveat to note is the scale of the TIF versus the size of the project. In some instances, the TIF may only be able to

raise a small amount of money relative to the project size and therefore have a much smaller impact. In the case of nuclear power plants and data centers, this is likely to be the case. This means TIF is still an effective tool that can be used, but it will not be a standalone solution and would likely still require other incentives at the state or federal level. As an example: in Wisconsin, new bills have been passed to grant exception to the state's cap on TIF tax, as long as the new project costs are attributed to data centers (Reference 93).

## EARLY SITE FEASIBILITY STUDIES

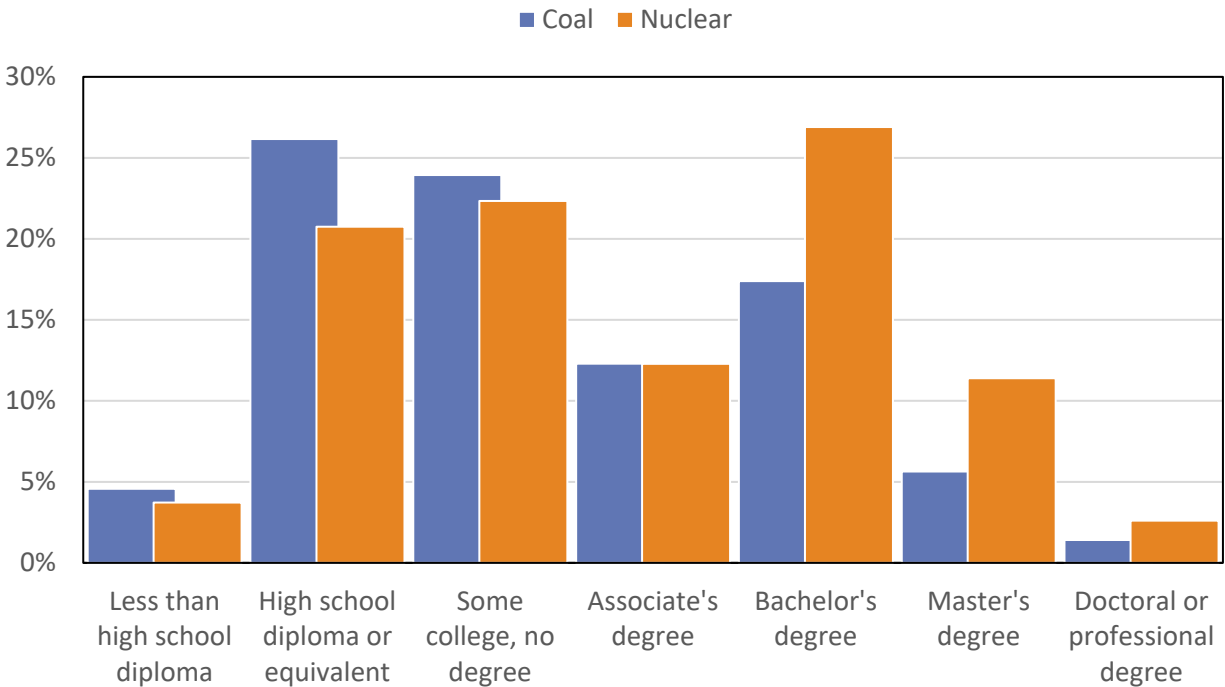
Site feasibility studies are included herein. These can be leveraged in the development of an ESP or other site permits for data centers.

Another method local municipalities could use to attract these projects is to perform early site studies that would highlight the suitability of potential sites for a given project type. This could include feasibility studies, community impact assessments, environmental site assessments, and planning studies. Which study a community would pursue would largely depend on the project and location.

For example, in Colstrip, Montana, the state economic development organization, carried out a feasibility study to determine the viability of facilities that would test and train on capturing flue gases from smokestacks. The community funded the work through a grant from the U.S. Department of Agriculture and a second grant from the Montana Coal Board (Reference 90).

Another example of such an early site study from an economic impact standpoint was carried out for the Coronado Generation Station in St. Johns, Arizona. The study identified the impacts on jobs, labor income, value added (i.e., new economic activity), and economic output for a combination of project outcomes (Reference 91). The study shed light on the potential increase in jobs from the closure of a coal plant followed by the development of a nuclear power plant. It also highlighted the potential gap in educational differences between job types at each generation station and provided valuable information for the surrounding communities that could be used to prepare for and train a changing workforce. Figure 9 highlights an example of the educational attainment results from this study.

## Educational Attainment by Plant Type



**Figure 9.** Examples of Results from Early Site Studies (Reference 91)

These studies generate value by demonstrating to developers that the community is interested in the project and willing to take action to ensure its success. In the decision-making process, more data helps developers make more informed decisions, which these studies facilitate. This early involvement is also likely to encourage higher levels of project acceptance and local support for the project. From a financial standpoint, many of these studies would be required before the project starts, which means the community is also easing the financial burden of the project for the potential developer. However, it should be noted that it is still only a fraction of the costs associated with mega projects like large nuclear power plants or data centers.

## TARIFFS

Tariff structures that can enable data centers to purchase local power are unique to each region and can be a significant regulatory hurdle. Local government can balance the interests of the community, traditional rate payers, and those of developers looking to invest in the region by customizing tariff structure around data center development (Reference 89). The Public Utilities Commission of Ohio (PUCO) approved a tariff structure requiring data center customers to pay a minimum of 85% of their subscribed electricity usage- regardless of actual consumption – for up to 12 years (Reference 92). The new tariff structure enables the lifting of American Electric

Power (AEP) Ohio's (local utility) moratorium on new service agreements in Central Ohio by developing a payment structure that protects other ratepayers from the cost of grid expansion due to the data center and other provisions. Tariff modification can minimize risks of stranded assets caused by large power customers backing out of deals to purchase power from major utility infrastructure investment.

## **SUMMARY OF RESULTS AND POTENTIAL NEXT STEPS**

The Colorado, Montana, and Utah Nuclear and Data Center Feasibility Study and Business Case effort identified important feasibility considerations to inform community planning. Results of the four sub-studies provide information needed to make decisions regarding nuclear and/or data center deployment and facilitate conversations with potential partners. The findings are intended to provide insight into the business case opportunities and challenges that require additional investigation should communities decide to continue to pursue nuclear and/or data center deployment.

The intent is that Colorado, Montana, and Utah communities can leverage results from the four sub-studies and the community-specific business cases to engage directly with nuclear and data center developers as well as existing coal plant owners to further explore opportunities. Communities will need to work with developers and/or existing coal plant owners to confirm assumptions in this report and conduct more detailed studies to inform project-specific decisions (e.g., site location, data center sizing, nuclear technology selection, etc.). Additionally, different nuclear and data center developers (i.e., parties responsible for site permitting/licensing, construction and ultimate deployment of a project) are likely to have different priorities; the relative weight of each factor in decision making is informed by their mission and business objectives (Reference 24). The communities should also continue to monitor on-going industry reviews (e.g., FERC's rulemaking review for BTM connections) to ensure the results of this study are presented to developers in the most recent and informed context.

Table 15 details the business case drivers considered with generally applicable insights regarding potential nuclear and data center deployment opportunities and challenges. Appendices A, B, and C provide community specific business cases as well as community specific recommendations to Colorado, Montana, and Utah communities, respectively.

**Table 15. Business Case Drivers with Opportunities/Challenges**

Driver	Data Center Development Opportunity	Advanced Reactor Development Opportunity	Data Center Development Challenges	Advanced Reactor Development Challenges
<b>Continuity and Availability of Power</b>				
Available Capacity of Existing Coal Plant	Existing power plants with excess available capacity (i.e., low capacity factor) may be leveraged to support operation of new data centers.	Future / planned retirement of existing coal plants can serve as a bridge and provide reliable power until advanced reactors can be deployed.	If the existing plant is overleveraged (i.e., high capacity factor), data centers may not be able to connect due to lack of available capacity.	If coal plant retirement is not planned, it may be difficult to drive near-term generation development interest, especially if region is resource constrained (e.g. low available water, workforce already occupied).
Available Capacity of Existing Transmission System for New Large Loads	<p>Interconnection infrastructure may have excess capacity, which would make interconnection anywhere along the major transmission line in connection to the existing coal plant advantageous.</p> <p>The grid will be more stable and reliable in the region of existing coal plants. Coal plants are highly stable sources of power due to their large inertia. Data centers require high reliability, typically maintaining a capacity factor &gt;99%.</p>	Near-term coal plant retirements may decrease transmission line congestion and enable new resources to connect. There may also be an opportunity to leverage existing interconnection agreements / transmission connection infrastructure if deployed adjacent to the exiting coal plant.	Transmission lines near coal plants are not guaranteed to have available capacity. In the case of large data center projects (100 MW), interconnection is likely to incur higher grid upgrade costs wherever they connect compared to smaller projects.	All new power generation projects have to compete with other projects to connect to the grid. Long-term operation of existing coal plants would delay opportunities to connect to the grid due to high congestion.

**Table 15. Business Case Drivers with Opportunities/Challenges**

Driver	Data Center Development Opportunity	Advanced Reactor Development Opportunity	Data Center Development Challenges	Advanced Reactor Development Challenges
Retirement Date Compatibility with Deployment	Coal plants planned for long-term operation are good candidates for supplying data centers with sufficient electrical service to meet their high capacity and reliability needs.	Coal plants with retirement dates predicted years in advance may be compatible with bridging to nuclear. Nuclear power projects take a long time to deploy, and bridge technologies enable continued power delivery while those projects are underway.	Coal plants with near term retirement dates preclude data center development that would be reliant on that power source.	Coal plants with near-term retirement dates cannot serve as a bridge technology for advanced nuclear development projects. Additionally, coal plants without planned retirement do not inspire the strategic planning of replacement technologies at the end of the current asset's life.
<b>Co-Location</b>				
Availability of Interconnection Infrastructure	Co-located data center could be future guaranteed customer of new capacity without congesting other transmission lines.	Co-location enhances efficiency by maximizing the use of existing infrastructure and land. High-capacity transmission lines connect existing power plants to the larger grid.	Existing large capacity power plants in the west often supply power far distances to major cities. Locating a data center near a metropolitan area, rather than nearby the generation source, is a priority for some developers. Data center developers may experience the same grid benefits and context far from the power plant.	N/A
Utility Position on Large Load Off-takers	PPAs between the data center and electricity producer ensure long term power availability and can allow for lower electricity costs due to commitment to purchase power. The electric power industry has decades of experience connecting large loads FTM, but there is uncertainty with BTM configurations as they have yet to be proven in practice.		Whether PPAs are an option is dependent on utility and energy regulations. The utility may not be quick to enable major grid changes to support new projects.	

**Table 15. Business Case Drivers with Opportunities/Challenges**

<b>Driver</b>	<b>Data Center Development Opportunity</b>	<b>Advanced Reactor Development Opportunity</b>	<b>Data Center Development Challenges</b>	<b>Advanced Reactor Development Challenges</b>
State and Local Energy Regulations	State and local posture on development of data centers and/or advanced nuclear could impact in either direction. Regulatory hurdles experienced by developers are dependent on ongoing first-of-a-kind agreements and new regulations. Rulings regarding the regulation of BTM partnership agreements between large loads and existing generation have yet to be issued at the state or federal level. These rulings could present prohibitive challenges or open up additional opportunities for partnerships.			
Site Suitability	Siting criteria for power plants is stricter than that of data center (especially earth-quake activity). Sites suitable for power plants are likely suitable for data centers.	See individual siting assessments	See individual siting assessments	See individual siting assessments
Workforce Availability	Energy communities are seeking opportunities to ensure their people have jobs. Staffing a data center should not be difficult in these regions.	Energy communities are seeking opportunities to ensure their people have jobs. Adding advanced reactor to the energy mix would provide long-term job stability in the region to an already primed energy community.	N/A	Advanced reactors require similar or more staff than the existing coal power plant. If the coal power plant continues to operate, the workforce may otherwise be occupied.

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### **Montana Appendix**

To be included in Revision 1.

### **Utah Appendix**

To be included in Revision 1.

## **Appendix A – Moffat and Routt Colorado Community-Specific Business Case**

The following appendix content includes the Colorado community-specific business cases for Moffat and Routt Counties. This appendix includes discussions on the siting feasibility, economic impact, and power source criteria evaluated specific to the Colorado communities included in the C-LEAP application as well as recommended next steps.

The near-term retirement of the Craig and Hayden Stations by the end of 2028 presents the need for a near-term plan to address the concerns of Moffat County and Routt County residents. A data center and/or nuclear power plant could provide employment relief and an economic boost. The site feasibility study found that siting a data center is feasible in Craig, Hayden, and the majority of the remaining area in Moffat and Routt Counties. The siting feasibility study found that siting a nuclear power plant could be feasible, but identified feasibility flags, most notably streamflow requirements in Craig, and hazard proximity in Hayden (i.e., Yampa Valley Regional Airport). Additionally, there are nuclear siting feasibility flags in the remaining areas of Moffat and Routt Counties related to slope, protected lands, and landslide risk. These flags have the potential to increase cost and/or risk associated with nuclear deployment and require additional investigation. These flags may not all be exclusionary and solutions for addressing them or reducing their applicability may exist through the utilization of existing resources (e.g., water rights).

Based on the results of the power source study, Moffat and Routt Counties have been identified as communities that should prioritize securing power first to address the near-term challenges of local coal plant retirements and to secure power for future data center development. In this context, securing power refers to all actions related to building new generation sources and/or determining if new energy projects in the region can support local data centers.

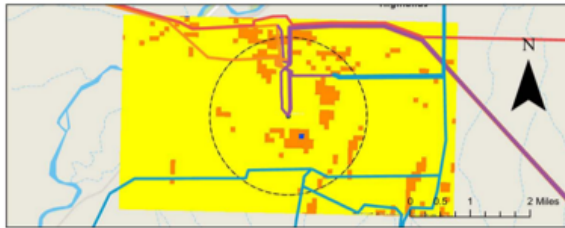
### **SITE FEASIBILITY RESULTS AND INSIGHTS**

There is land in Colorado within Routt and Moffat Counties that is suitable for nuclear power plants. However, there are several nuclear siting flags that will need to be investigated in more detail before any particular sites, technologies, or cooling strategies are selected. Nuclear siting constraints in Colorado are primarily driven by the topographic, hydrologic, and environmental restrictions of the region. Much of the western half of the state is occupied by the Rocky Mountains, while much of the eastern half has limited access to cooling water from a series of reservoirs in central Colorado. The Rocky Mountains present restrictions according to maximum requirements for the grading of slopes, the susceptibility to landslide risks, and the prevalence of protected lands, including a number of national forests and parks. Additionally, as is common near mountain ranges, there are a number of fault lines in central and southwestern Colorado.

From a population standpoint, the majority of the state is suitable for development, exceptions being the major population centers in and surrounding Denver and Colorado Springs, and scattered communities in western Colorado. There are additionally, a number of military installations and airports that could present locational restrictions for nuclear development, primarily in western and central Colorado. Given these siting requirements and restrictions, without additional accommodations to address the identified siting concerns, opportunities for nuclear development in Colorado may be limited to specific locations within the state, especially for large light-water reactors.

Lowering the cooling-water requirement for SMRs expands the viability of nuclear development in eastern Colorado. Additionally, the higher slope threshold expands viability in Moffat, Delta, and Rio Blanco Counties. Despite this change in requirements for SMRs, the viability of counties in the west remains limited. However, the viability in the west is expanded when considering air-cooled SMRs – which have no restrictions related to cooling water – particularly for Moffat County, which sees a notable boost in suitable land. Additionally, considering air-cooled SMRs enables the majority of eastern Colorado to be made viable. The higher slope threshold for SMRs slightly expands the viability of nuclear development in Routt County, but even with the higher threshold, the slope flag, protected lands, and landslide risk still make nuclear development challenging.

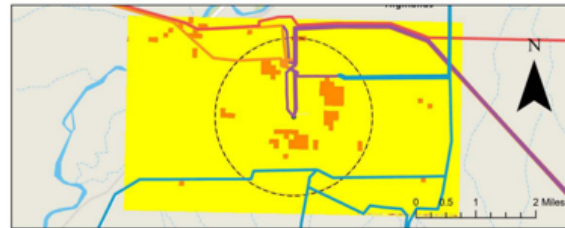
When looking specifically at the Craig (Figure 10) and Hayden (Figure 11) communities, the nuclear feasibility flags are less restrictive than they appear to be for surrounding counties. These communities are far less restricted by the slope, protected lands, and landslide risk siting flags; however, streamflow requirements continue to be the primary siting flag for Craig, while proximity to hazards (i.e., Yampa Valley Regional Airport) is the most notable siting flag for Hayden. There are additional siting flags such as wetlands/open water and 100-year floodplain risk areas that are presented in Figure 10 and Figure 11, but these only appear to be a minor concern in Hayden. Since the streamflow requirement only considers make-up water sourced from existing natural water sources, the streamflow requirement in Craig could be overcome if the water rights from the operating Craig Station are transferred to a future nuclear developer, or if air-cooled technology is pursued. The hazard proximity siting flag for Hayden may be considered exclusionary, but future discussions with nuclear developers will be able to determine if the hazards siting flag is overly conservative for certain reactor designs.



**Large Water-Cooled Nuclear Power Plant**

Siting Flags:

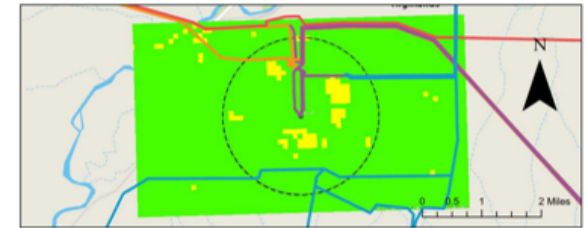
- Streamflow (<130,000 gpm)
- Wetlands/Open Water
- Slope (>12% grade)



**Small Water-Cooled Nuclear Power Plant**

Siting Flags:

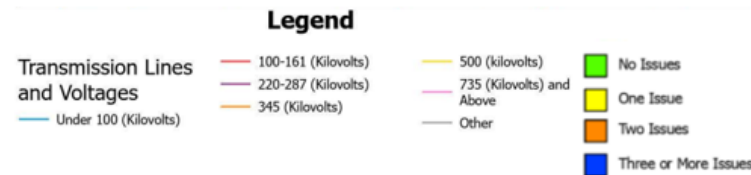
- Streamflow (<36,000 gpm)
- Wetlands/Open Water
- Slope (>18% grade)



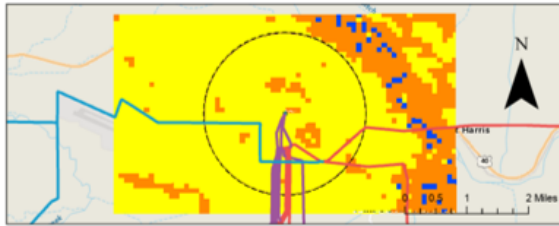
**Small Air-Cooled Nuclear Power Plant**

Siting Flags:

- Wetlands/Open Water
- Slope (>18% grade)



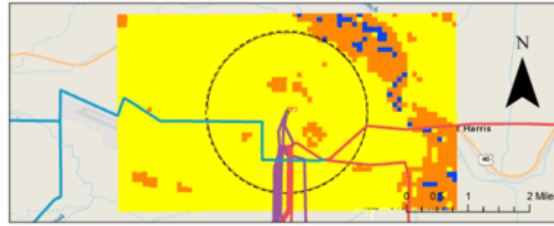
*Figure 10. Craig Nuclear Siting Map*



**Large Water-Cooled Nuclear Power Plant**

Siting Flags:

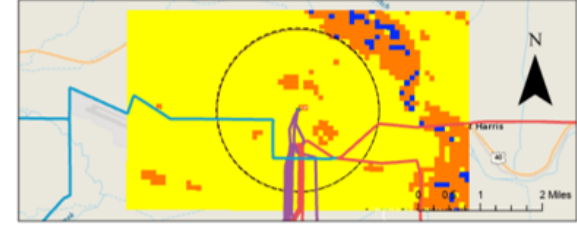
- Wetlands/Open Waters
- Slope (>12% grade)
- Floodplain (100-year Risk Areas)
- Proximity to Hazards (Airport)



**Small Water-Cooled Nuclear Power Plant**

Siting Flags:

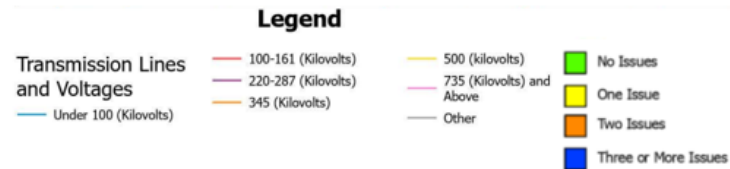
- Wetlands/Open Waters
- Slope (>18% grade)
- Floodplain (100-year Risk Areas)
- Proximity to Hazards (Airport)



**Small Air-Cooled Nuclear Power Plant**

Siting Flags:

- Wetlands/Open Water
- Slope (>18% grade)
- Floodplain (100-year Risk Areas)
- Proximity to Hazards (Airport)



*Figure 11. Hayden Nuclear Siting Map*

Given the much less restrictive siting criteria for data centers, especially related to cooling water requirements, the majority of Colorado is suitable for data center development. The primary barriers to siting a data center in Colorado are landslide risks, and to a lesser extent, terrain slope. However, the maximum allowable slope grading required for a data center is more relaxed than for nuclear reactors, which opens up significantly more land in western Colorado. Due to these considerations, data center development is primarily only restricted by the risk of landslides in scattered regions throughout western Colorado.

Figure 12 presents a higher-level view of the data center and nuclear siting results across the entirety of Colorado State and Moffat and Routt County. This perspective visualizes the previously discussed data center and nuclear site feasibility results. In the state and county images, the green-colored regions represent locations where a data center and nuclear reactor could both be supported, while the orange-colored regions are locations that could only support a data center. Regions that remain uncolored are not able to support either a data center or a nuclear reactor of any type. Images are presented for each combination of data center and nuclear reactor technology (e.g., large light-water reactor, small water-cooled reactor, and small air-cooled reactor).

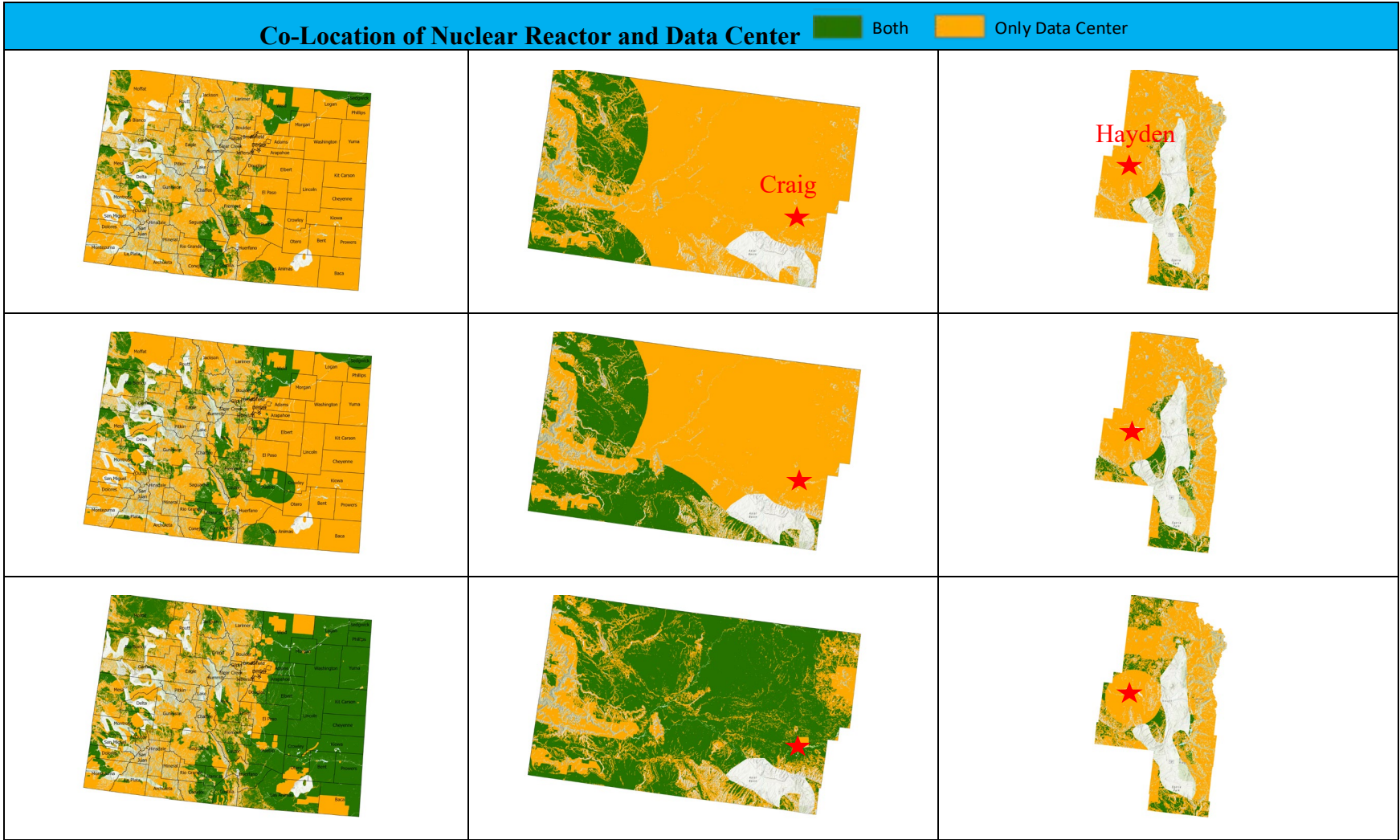


Figure 12. Colorado, Moffat, and Routt Counties Co-location Maps

The majority of the existing data centers, and consequentially, the intersection of the available fiber optic networks within Colorado, are located in the Denver area. The fiber optic corridors travel in all four cardinal directions through the rest of the state. However, the existing fiber-optic infrastructure does not pass nearby the Craig and Hayden Stations. Figure 13 presents a comprehensive state-level view of the data center features investigated in the siting study, including the actual siting results, the existing major fiber optic network, and the percent of land available per county.

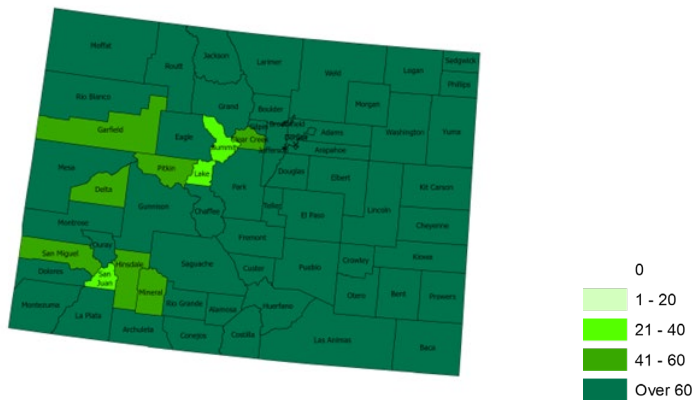
## Data Center (e.g., Large Hyperscale)



Composite Map



Basemap



Percent of Land Available Per County

Figure 13. Colorado Data Center Siting Map

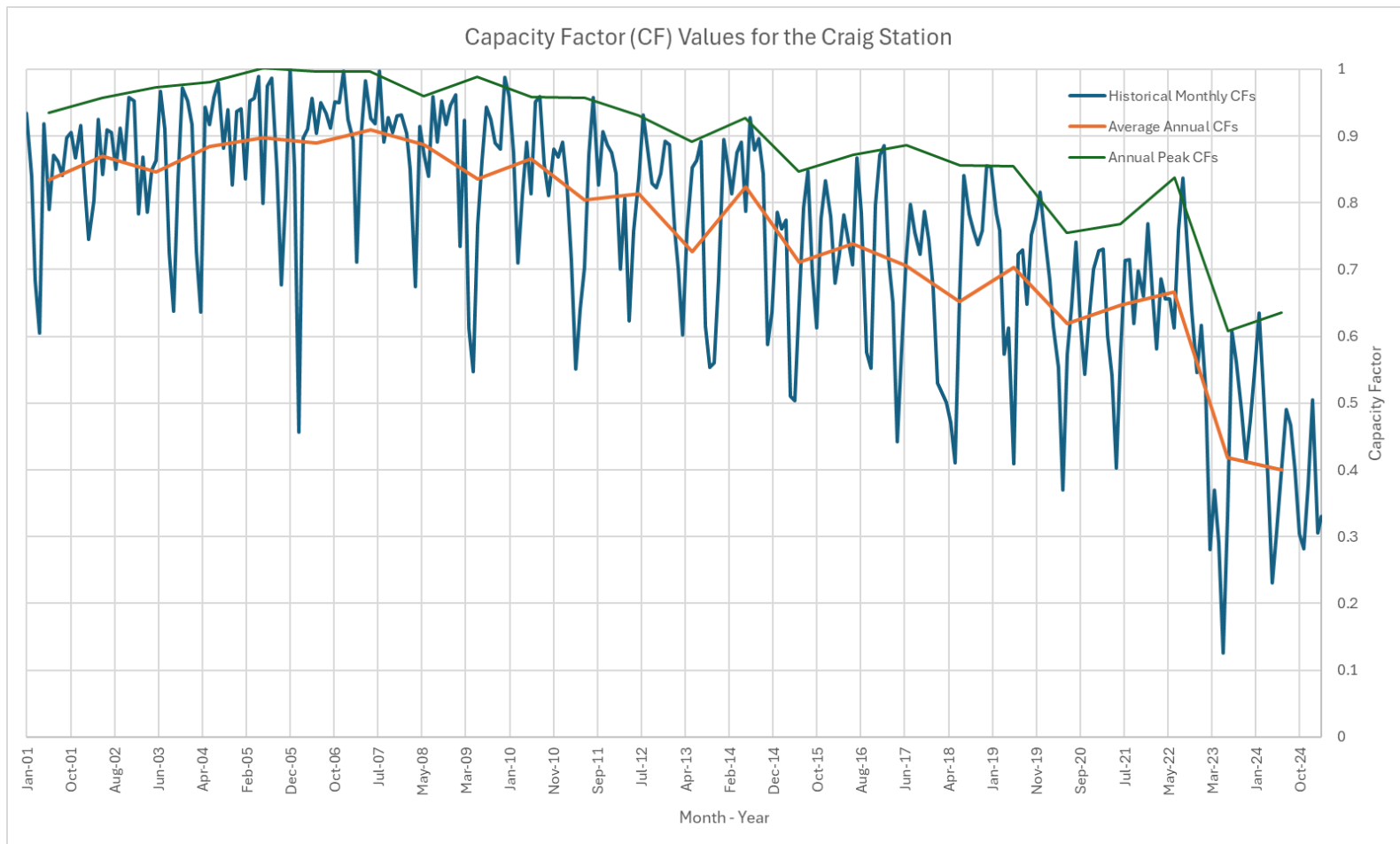
## **POWER SOURCE RESULTS AND INSIGHTS**

This section includes Colorado specific insights from the power source study.

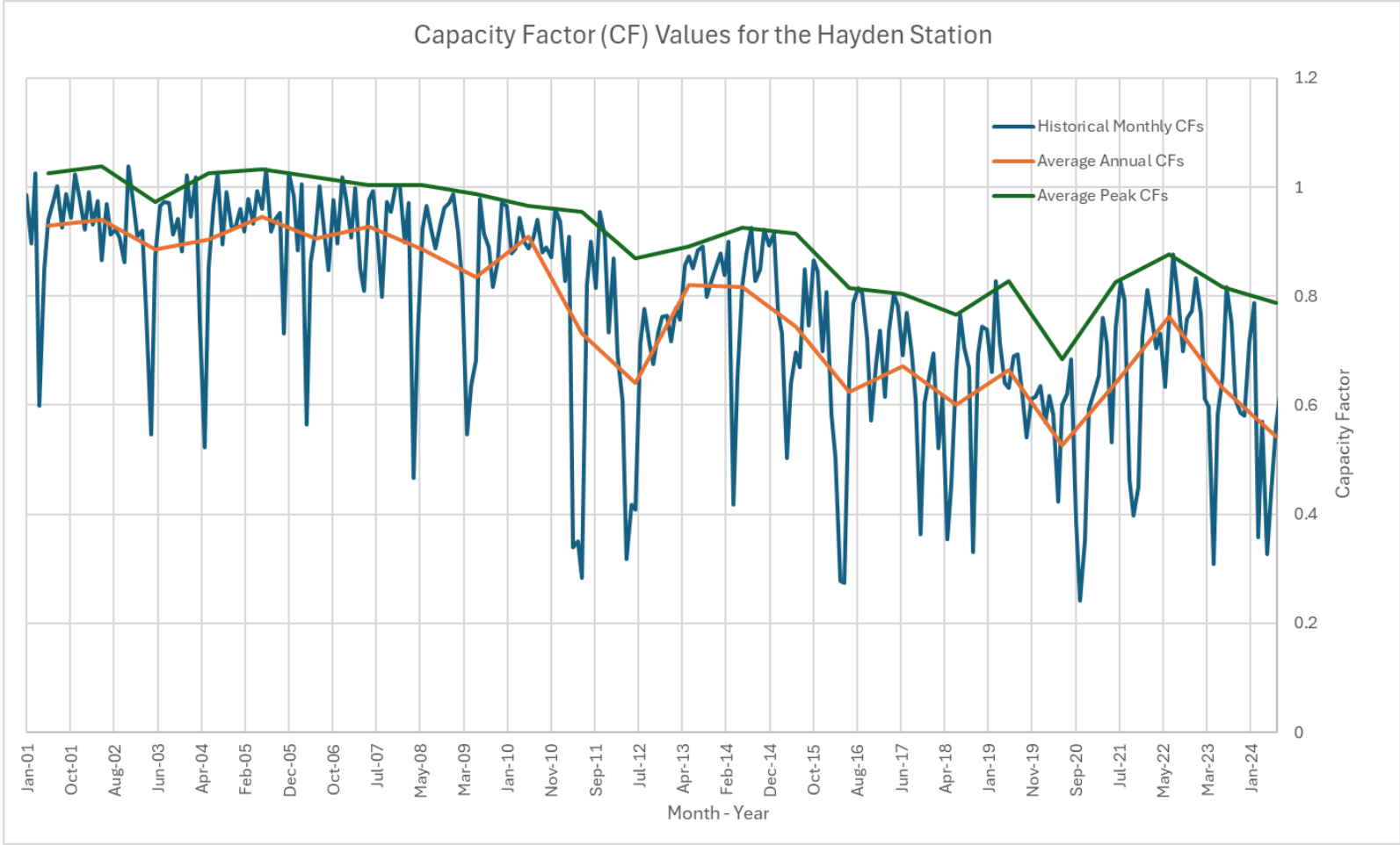
### **Generation and Transmission Capacity**

While the near-term and definite retirements of all units at the Craig and Hayden Stations by 2028 imply that an investigation into the generation and transmission capacity in their communities is not necessary, one was conducted for the purposes of this study and to inform future deployments.

The Craig and Hayden Stations are located in close geographic proximity to each other; however, they are majority-owned by different entities, support distinct transmission systems, and are dispatched according to separate balancing authorities. Although the two coal plants differ in how they are owned and governed, both plants show the same general trend of decreasing capacity factor (i.e., increasing theoretical available generation capacity). The monthly capacity factors from January 2001 to March 2025 for the Craig and Hayden Stations are presented in Figure 14 and Figure 15, respectively, below.



**Figure 14.** Craig Station Monthly Capacity Factor Values (Jan 2001- Mar 2025)

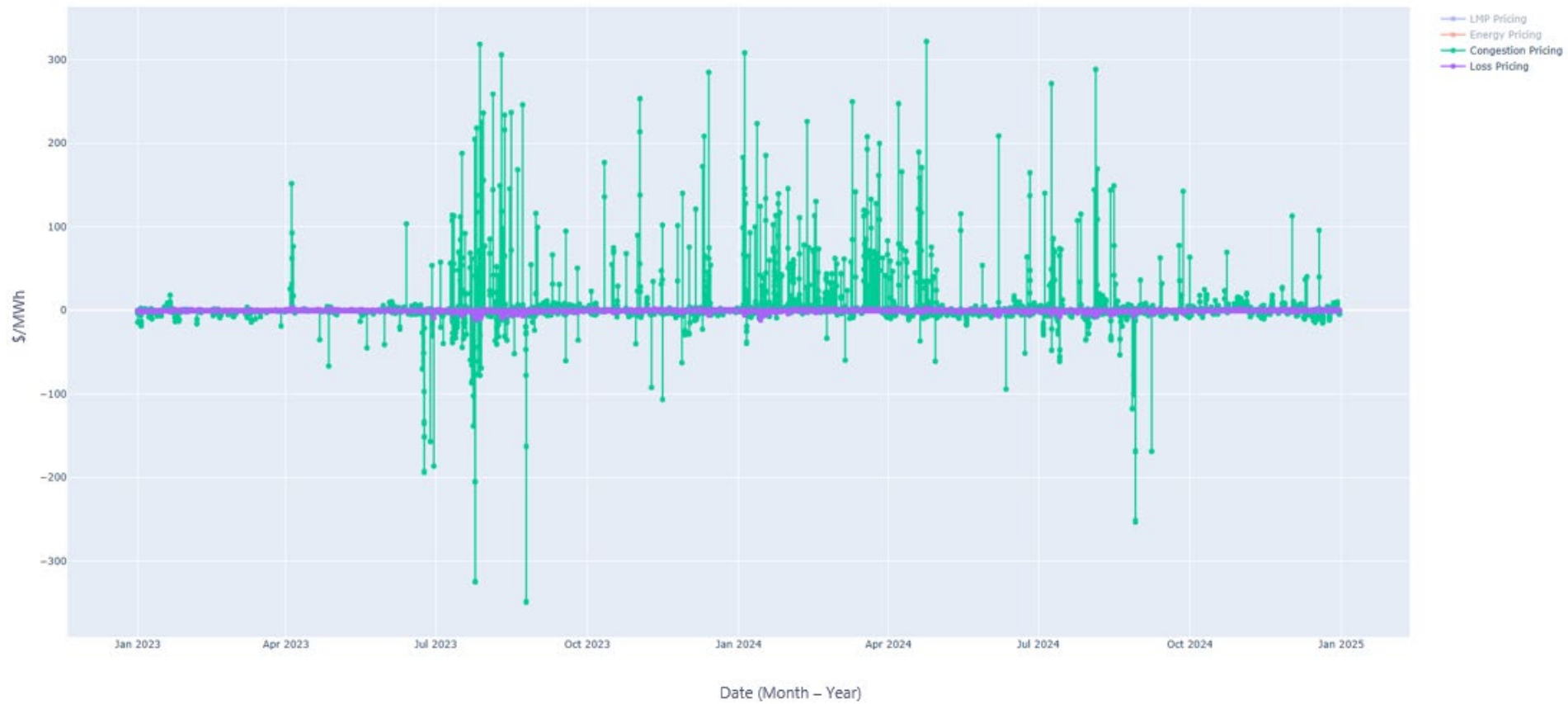


**Figure 15.** Hayden Station Monthly Capacity Factor Values (Jan 2001- Mar 2025)

As Figure 14 and Figure 15 show, the decreasing trend in capacity factor has been more profound for the Craig Station than it has been for the Hayden Station. Considering the difference in rated capacities of the two stations – 1285 MW for Craig and 441 MW for Hayden (Reference 9) – this would indicate that if retirement dates were ignored, the Craig community would be better suited for hosting a data center and eventual data center campus, based on available power alone.

The LMP history of Craig and Hayden tell a slightly different story than the capacity factor data and is more reflective of the fact that the two stations serve different transmission systems. As Figure 16 and Figure 17 show, over the past two years, both stations have shown a large number of instances – on a per hour basis – where congestion pricing was significant, with the Craig Station having more than double the number of instances than the Hayden Station. LMP congestion pricing data suggests that the transmission networks around both coal plants are frequently constrained, with Craig more so than Hayden, since any deviation from \$0/MWh indicates congestion/constrain on the local grid.

Craig 2023-2024 Nodes Pricing (1hr)



**Figure 16.** Craig Station Congestion Pricing Values per Hour (Jan 2023 – Dec 2024)

Hayden 2023-2024 Nodes Pricing (1hr)



**Figure 17.** Hayden Station Congestion Pricing Values per Hour (Apr 2023 – Dec 2024)

The transmission systems of Craig and Hayden exhibit different trends with congestion pricing. The instances of extreme deviation from \$0/MWh (i.e., deviations > \$50/MWh) for Craig were dominated by positive congestion pricing values, indicating that its transmission system is import-constrained. The instances of extreme deviation for Hayden were dominated by negative congestion pricing values, indicating that its transmission system is frequently export-constrained.

The conclusions from the capacity factor data and LMP congestion pricing data for the Hayden Station are aligned. The congestion pricing data shows Hayden is more export-constrained, implying that within the Hayden transmission system, there is a surplus amount of cheap generation available to meet demand, therefore prices are lowered to ramp-down the output from comparatively expensive generators – like Hayden. This data is consistent with the steadily decreasing capacity factors, suggesting that over time as more cheap generation has been added to the transmission system around Hayden, the output from Hayden has decreased.

The capacity factor and LMP congestion pricing data for Craig can appear contradictory. From a high level, decreasing capacity factors should correspond to a significant number of negative congestion pricing instances. This data contradiction suggests there is not a simple cause and effect explanation for the Craig Station's operational history. Instead, there is likely a combination of factors/situations, that together, could explain the data collected on the Craig Station. Some of the factors could potentially include:

- The baseload generation of the Craig Station has decreased, but it remains available as a peaking resource to relieve congestion downstream of a transmission bottleneck.
- LMP congestion prices are not high enough or frequent enough to justify ramping-up the output of Craig, so the congestion is being relieved by some other downstream resource.
- Other external constraints (e.g., degraded equipment performance or environmental restrictions) are limiting the ability of the Craig Station to output more power when demand calls for it.

Regardless of the potential factors that could be causing misalignment in conclusions for the Craig Station, the congestion pricing data does indicate that the transmission system in this area is import-constrained, and therefore struggles to bring in cheaper generation from elsewhere.

It is important to note that due to the near-term closure of all units at both stations, the conclusions about available generation and transmission capacity in these communities will likely change based on the local utilities' plans to replace the output of the two stations. The communities should inquire directly with the utilities to determine how adding large loads (e.g., data centers) or new generators (e.g., advanced nuclear) would impact the utilities' resource planning.

## Co-location and Partnership with Data Centers

Northwest Colorado falls within a regulated energy market, such that physical PPAs are restricted, and consumers are expected to purchase power from the utility rather than participating in a competitive market (Reference 94). Virtual PPAs, for the long-term purchase of power at a controlled price, are permissible in both regulated and deregulated markets. A consumer can continue to buy power from a local utility through a virtual PPA contract structure (Reference 95). Virtual PPAs are popular for data centers to reduce cost of electricity. However, interconnection to the grid for the transmission of power from the utility is expected; this agreement does not enable BTM connection.

Colorado's legislature has been active in developing legislation relating to the deployment of data centers. Colorado legislature has put forth bill SB 25-280 to incentivize data center development by reducing grid connection regulatory hurdles, but these have not passed due to opposition from various groups (Reference 96, 97). Opposition argued that the legislation does not properly balance incentives for data centers with protection for Colorado communities (environmental, electricity rates, etc.) (Reference 98). Discussions in opposition to data center development incentives indicate there may be challenges to gaining state acceptance and support for new development.

In contrast, Colorado has been successful in passing legislation to encourage deployment of nuclear reactors. House Bill (HB) 25-1040 was signed into law in late March 2025. This bill designates nuclear energy as clean energy, thereby allowing utilities to credit nuclear energy projects as clean energy and take advantage of the accompanying financial assistance programs.

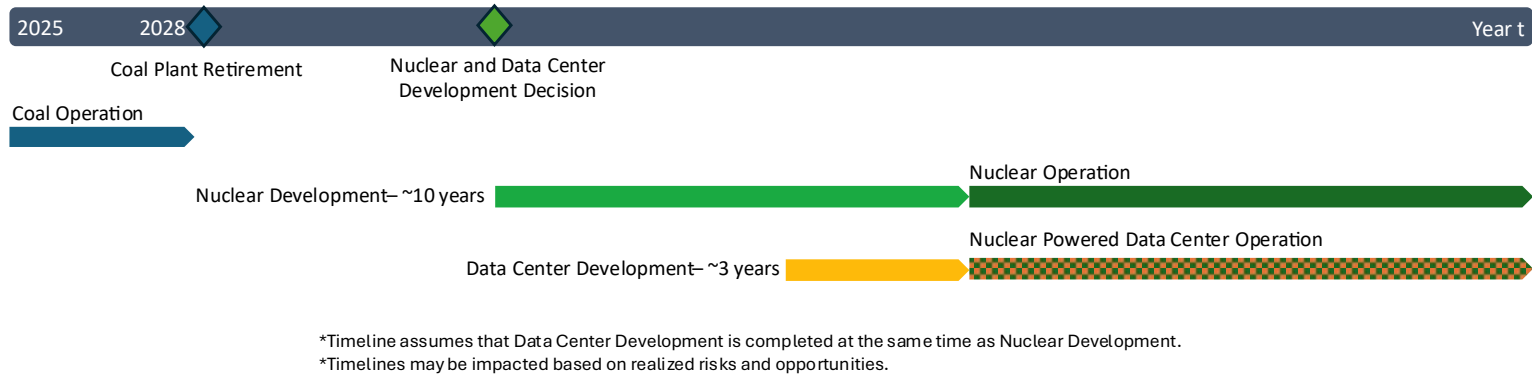
## Possible Deployment Timelines

Due to the near-term retirement dates at Craig and Hayden Stations, deployment of a data center in Northwest Colorado would require an alternative generation source to supply power. Although the feasibility of nuclear power in Colorado is water-constrained, there are possible avenues for nuclear deployment via the transfer of water rights from the current coal plants, or by the implementation of an air-cooled nuclear power plant. A natural gas plant could also enable deployment of a new generating facility sooner, offsetting some of the lost baseload generation while also creating a pathway for data center deployment and possible nuclear deployment in the future. Deployment of either of these generating types would support and enable subsequent data center deployment and timelines for both options are included in Figure 18 and Figure 19.

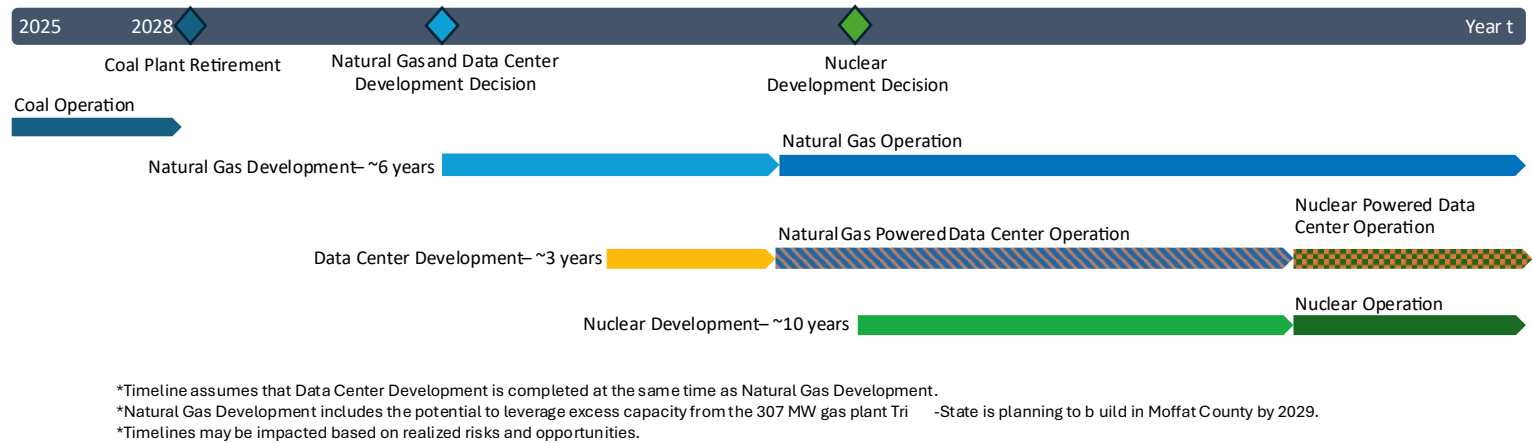
There are several key assumptions that influence the possible deployment timelines, including:

- **Existing infrastructure and permits can be leveraged.** The timeline assumes that existing electrical infrastructure from the existing coal plant, as well as any water permits and other permits, can be leveraged and transferred to the alternative generating source being deployed.

- **Availability of craft.** In the timelines, data center development occurs in parallel with the development of the alternative generating source. Data center development may occur later based on the availability of craft in the area but would still require the alternative generating source to be completed at the same time that the data center is completed.
- **Additional generating assets.** The timelines primarily focus on the availability of generation to support data center development, although additional generating assets may be warranted based on future generating needs or utility portfolio diversification. This can occur at any time in the timelines but is not included in the current views.
- **Confirmation of other available capacity.** These timelines assume that no additional capacity is available at other nearby generating facilities following retirement of the existing stations to support a data center. If power is available, data center deployment could start earlier.



**Figure 18. Colorado Nuclear Deployment Timeline**



**Figure 19. Colorado Natural Gas Deployment Timeline**

The deployment of a data center in Colorado requires alternative generation to be available based on the planned retirements of the existing coal station. Following a successful initial deployment of an alternative generating source, a data center could also be deployed and supported by the new asset. Any additional capacity, whether it be through additional nuclear deployment or alternative generating assets, could begin at any point in the timelines above, but are chosen in the provided timeline scenario to occur after initial development of generating assets for simplicity. Similarly, data center development could begin at any time, so long as power was available for the data center once it was constructed. Data center deployment is not a critical component of the alternative generation decision but could be used as a tool to draw potential nuclear developers to the area for deployment.

## ECONOMIC IMPACT RESULTS AND INSIGHTS

This section contains the Colorado economic impact report prepared and reviewed by economists at INL that details the economic impacts specific to the Colorado communities.

### Employment

Total employment for nuclear power plants ranges from 323 jobs for a 300-MWe SMR to nearly 1,500 jobs for a LWR. The largest share of economic impact was the result of reactor operations followed by community-spending-related job creation. Data centers produce a different distribution of impact. The largest share of impacts is the results of induced supply chain activity that supports data center operations. Close to 60% of the total employment impact for data centers comes from supply chain activity compared to 30% for nuclear reactors.

Data center (DC) operations could create or sustain as much as 4,500 jobs in the case of a 1 GW facility. Smaller 50-MW data centers would create or sustain around 226 total jobs in the local economy. Based on a review of existing data centers, on average, there is an almost-one-to-one ratio for the number of jobs and MWs required to operate data center facilities. Detailed employment impacts can be found in Table 16. In this table, the numbers assigned to each Scenario (e.g., 900, 1200, etc.) refer to the electric generating capacity of the nuclear reactor (i.e., for LWR or SMR scenarios) or the power consumption of the data center (i.e., for DC scenarios).

**Table 16. Colorado Employment Impacts**

<b>Employment Impact</b>				
<b>Scenario</b>	<b>Operations</b>	<b>Supply Chain</b>	<b>Community</b>	<b>Total</b>
LWR 1200	648	389	424	1,461
SMR 900	358	292	322	972
SMR 500	199	162	179	540
SMR 300	119	97	107	323
DC 1000	1,011	2,690	812	4,513
DC 500	505	1,345	406	2,256
DC 300	303	807	244	1,354
DC 100	101	269	81	451
DC 50	51	134	41	226

### **Labor Income**

Labor income, which includes wages, salaries, benefits, and employment taxes, provides a significant boost to local economies. Again, the supply chain impact associated with data center operations results in a very large labor income impact. The labor income impact of a 1-GW data center is estimated to be 2.5 times higher than what could be expected from a 900-MWe SMR and 1.9 times higher than an LWR. The largest data center scenario is estimated to have a total labor income impact of nearly \$382 million with \$194 million coming from facility operations. An LWR should have an impact of just over \$200 million. A 300-MWe SMR would have an impact of more than \$50 million. Detailed labor income impacts are available in Table 17.

**Table 17. Colorado Labor Income Impacts**

<b>Labor Income Impact (\$Millions)</b>				
<b>Scenario</b>	<b>Operations</b>	<b>Supply Chain</b>	<b>Community</b>	<b>Total</b>
LWR 1200	\$146.0	\$34.1	\$22.0	\$202.2
SMR 900	\$111.1	\$25.6	\$16.7	\$153.4
SMR 500	\$61.7	\$14.2	\$9.3	\$85.2
SMR 300	\$37.0	\$8.5	\$5.6	\$51.1
DC 1000	\$194.4	\$145.3	\$42.2	\$381.9
DC 500	\$97.2	\$72.6	\$21.1	\$190.9
DC 300	\$58.3	\$43.6	\$12.7	\$114.6
DC 100	\$19.4	\$14.5	\$4.2	\$38.2
DC 50	\$9.7	\$7.3	\$2.1	\$19.1

## Value Added

Value-added impacts are the most similar to the region’s contribution to gross domestic product. Many of the value-added impacts for service-based industries come from labor income, as workers convert knowledge and skills into revenue for the data center or nuclear reactor. In the case of nuclear reactor operations, around 40% of the value-added impact comes from labor income. For data centers, labor income makes up around 50% of the value-added impact. Total value-added impacts for the nuclear reactor scenarios ranged from nearly \$126 million to \$504 million. Data center value-added impacts started at almost \$38 million for a 50-MW facility to \$755 million for a 1,000 MW facility.

Detailed value-added impacts are available in Table 18.

*Table 18. Colorado Value-added Impacts.*

Value-Added Impact (\$Millions)				
Scenario	Operations	Supply Chain	Community	Total
LWR 1200	\$379.3	\$76.3	\$48.6	\$504.2
SMR 900	\$286.1	\$57.2	\$36.9	\$380.1
SMR 500	\$158.9	\$31.8	\$20.5	\$211.2
SMR 300	\$95.4	\$19.1	\$12.3	\$126.7
DC 1000	\$406.9	\$255.0	\$93.1	\$755.1
DC 500	\$203.5	\$127.5	\$46.5	\$377.5
DC 300	\$122.1	\$76.5	\$27.9	\$226.5
DC 100	\$40.7	\$25.5	\$9.3	\$75.5
DC 50	\$20.3	\$12.8	\$4.7	\$37.8

## Output

The operations output impact is equivalent to sales of electricity for the nuclear facility or sales of data center services. Additional spending on goods and services provides revenue for businesses and creates an output impact within the locally available supply chain. The last portion of output impacts comes from community-related spending from employees of the power plant or data center combined with supply chain employee spending. The values associated with total output impact range from \$213 million to nearly \$850 million for the nuclear reactor scenarios. Data center total output impacts fall between \$96 million for a 50 MW facility to more than \$1.9 billion for the 1,000-MW facility. Unlike the employment impacts, the largest share of data center impacts is from operations-related activity followed by supply chain, then community impacts.

Detailed nuclear reactor and data center output impacts are available in Table 19.

**Table 19. Colorado Output Impacts**

<b>Total Output Impact (\$Millions)</b>				
<b>Scenario</b>	<b>Operations</b>	<b>Supply Chain</b>	<b>Community</b>	<b>Total</b>
LWR 1200	\$601.8	\$171.1	\$76.8	\$849.6
SMR 900	\$451.3	\$128.3	\$58.2	\$637.9
SMR 500	\$250.7	\$71.3	\$32.4	\$354.4
SMR 300	\$150.4	\$42.8	\$19.4	\$212.6
DC 1000	\$1,309.7	\$471.3	\$147.1	\$1,928.0
DC 500	\$654.8	\$235.7	\$73.5	\$964.0
DC 300	\$392.9	\$141.4	\$44.1	\$578.4
DC 100	\$131.0	\$47.1	\$14.7	\$192.8
DC 50	\$65.5	\$23.6	\$7.4	\$96.4

## CONCLUSIONS

The near-term and non-negotiable retirement dates of all five units at the Craig and Hayden Stations by 2028 offer little to no flexibility with leveraging excess generation to enable data center deployment. Additionally, a data center developer would not be incentivized to locate in the two Colorado communities without having long-term power secured, even though the siting assessment indicates both communities are suitable for hosting a data center. Therefore, data center deployment without the utilization of bridging technology is not considered viable. However, Tri-State Generation & Transmission – the majority owner of the Craig Station – has recently published the results of extensive modeling work for potential energy-mix portfolios to replace the output of the retiring coal plants in their 2023 Electric Resource Plan (ERP) Phase II (Reference 102), and they have indicated their preferred portfolio includes a 307 MW natural gas plant with hydrogen-blend capability that would be located in Moffat County, among other resources. If this portfolio is pursued by Tri-State, it offers a potential source of bridging power for data centers prior to the deployment of nuclear. Xcel Energy – the majority owner of Hayden Station – has yet to reach this same level of new resource modeling so a similar conclusion cannot be reached for Hayden at this time.

While data centers would provide some relief to the closure of the Craig and Hayden Stations and would potentially provide incentive for advanced nuclear developers to locate in Moffat and Routt Counties, the emphasis of the Colorado communities has been to assess the technical feasibility and viability of advanced nuclear deployment. According to the siting assessment, Moffat County is well positioned for advanced nuclear deployment, with the only constraint

being water availability. While Craig could host an air-cooled SMR immediately, a transfer of the existing water rights of the Craig Station could allow for deployment of alternate advanced nuclear technologies. While the exact amount of water rights owned by the existing coal plant is unknown, Colorado legislature has implemented recent policies (SB 24-197) that prevent the water rights of the utilities from being abandoned following closure of their coal assets. This allows utilities to retain their water rights through 2050 as they explore alternative generating technologies and may enable transferring of water rights in the future once new nuclear technologies are commercially available (Reference 103). Alternatively, Hayden Station is not constrained by water availability but instead by its close proximity to the Yampa Valley Regional Airport. The Hayden Station is less than two miles from this airport and such close proximity may present undue challenges related to licensing and engineered safety features. While there are other locations in Routt County that are feasible for advanced nuclear deployment, not being able to leverage the existing infrastructure of the Hayden Station may make nuclear deployment in this community challenging.

The challenges and opportunities of each nuclear and data center business case driver for the Colorado communities are presented in Table 20 below. This table summarizes how the conclusions from the siting study, power source study, and economic impact study relate back to each component of the business cases.

**Table 20. Colorado Nuclear and Data Center Business Case Drivers**

<b>Driver</b>	<b>Nuclear Challenge or Opportunity</b>	<b>Data Center Challenge or Opportunity</b>
Available Capacity of Existing Coal Plant	<p style="text-align: center;"><b>Opportunity</b></p> <p>The near-term retirement dates of the Craig and Hayden coal plants leave two communities eager to bring in new local generation.</p>	<p style="text-align: center;"><b>Challenge</b></p> <p>The excess capacity cannot be used to support data center operations due to the near-term retirement dates and data center deployment timelines.</p>
Available Capacity of Existing Transmission System for New Large Loads	<p style="text-align: center;"><b>Challenge</b></p> <p>Future transmission capacity is uncertain given status of resource planning activities outlined in Tri-State’s 2023 ERP Phase II preferred portfolio and Xcel’s 2024 JTS plan. Nuclear was not selected to meet near term needs but could be considered in future resource plans.</p>	<p style="text-align: center;"><b>Challenge</b></p> <p>Tri-State and Xcel considered load growth as part of resource planning. However, the proportion of load growth attributed to new large loads/data centers is not specified. Close coordination with Tri-State and Xcel would be required should there be demand from a data center before additional generation comes online.</p>

**Table 20. Colorado Nuclear and Data Center Business Case Drivers**

<b>Driver</b>	<b>Nuclear Challenge or Opportunity</b>	<b>Data Center Challenge or Opportunity</b>
Retirement Date Compatibility with Deployment	<p style="text-align: center;"><b>Opportunity / Challenge</b></p> <p>Coal plant retirement prior to nuclear being deployed could allow for reuse of the coal plants' transmission infrastructure, potentially reducing costs and interconnection delays.</p> <p>Colorado SB 24-197 protects the water rights of utilities from being abandoned until 2050 following closure of their generation assets. This protection will preserve an asset that the communities could leverage to attract nuclear developers.</p> <p>Additionally, the existing coal plant workforce could be trained to support nuclear operations. However, extended time between coal plant retirement and nuclear power plant operations could introduce challenges.</p>	<p style="text-align: center;"><b>Challenge</b></p> <p>The retirement dates are finalized and likely too near-term to incentivize a data center developer to locate in Craig and Hayden with the promise of a consistent supply of power from the coal plants.</p>
Utility Position on Large Load Off-takers	<p style="text-align: center;"><b>Challenge</b></p> <p>Xcel indicated a desire to leverage renewable investment and production tax credits to secure the generation assets necessary to replace the output of retiring units and meet growing demand driven by large load customers. The goal is to accomplish this prior to sunset of the tax credits so long-term energy projects have not been prioritized.</p> <p>Tri-State's ERP Phase II plan only considers resource addition in the near-term (i.e., prior to 2031).</p>	<p style="text-align: center;"><b>Opportunity</b></p> <p>Utilities will be seeking large customer loads to protect existing ratepayers from having to cover all the costs of the expensive new generation being added to replace the output of the Craig and Hayden Stations.</p>
State and Local Energy Regulations	<p style="text-align: center;"><b>Opportunity</b></p> <p>HB 25-1040 was signed into law in late March 2025, designating nuclear energy as clean energy, thereby allowing utilities to credit nuclear energy projects as clean energy and take advantage of the accompanying financial assistance programs.</p>	<p style="text-align: center;"><b>Challenge</b></p> <p>Colorado SB 25-280, which would have offered sales and income tax credits to incentivize investments in data centers and upgrades to electric transmission infrastructure, was introduced in April 2025 but failed to pass into law in May 2025.</p>

**Table 20. Colorado Nuclear and Data Center Business Case Drivers**

Driver	Nuclear Challenge or Opportunity	Data Center Challenge or Opportunity
Site Suitability and Co-location Feasibility	<p style="text-align: center;"><b>Opportunity / Challenge</b></p> <p>The siting study identified nuclear feasibility flags for both Colorado communities, particularly related to water availability in Craig and hazards proximity in Hayden. These flags will have to be further considered in discussions with interested developers to assess their level of applicability.</p>	<p style="text-align: center;"><b>Opportunity</b></p> <p>Siting a data center is feasible in both Craig and Hayden.</p>
Economic Impact	<p style="text-align: center;"><b>Opportunity</b></p> <p>Nuclear reactors could create between 300-1,500 new jobs depending on the size of the reactor (300 MW SMR compared to 1200 MW LLWR).</p>	<p style="text-align: center;"><b>Opportunity</b></p> <p>Large data centers (1 GW) could create a substantial amount of jobs, particularly due to the large supply chain impact a data center would have. Smaller data centers would create comparatively fewer jobs, with a 50 MW data center creating approximately 226 total jobs.</p>

## NEXT STEPS

While the Craig and Hayden communities should both prioritize securing power in the near-term, the next steps that each community should take are dependent on the characteristics of each location, including the results of each investigation presented in the previous sections. The communities should consider the following topics and specific questions during future conversations with potential nuclear and/or data center developers. These focused conversations will help the communities determine which of the possible deployment roadmaps are the most appropriate.

### Craig

Announced resource plans of the local utility in Craig have indicated an opportunity to secure near-term power to support data center development, while still affording the ability to pursue long-term power solutions such as nuclear. The Craig community can focus on the questions/topics in the following sections to explore near-term power opportunities while still driving forward discussions with interested nuclear developers.

### ***Securing Near-Term Power for Data Center Operations***

In regard to exploring the natural gas-powered data center operation roadmap, the Craig community should leverage the results of this study to engage with the local utility (i.e., Tri-State

Generation & Transmission Association) to determine if deployment of a data center in Craig could be supported following implementation of the planned projects in Tri-State's 2023 ERP Phase II (Reference 99). The communities should specifically inquire about information to answer the following questions:

- How much reserve is built into Tri-State's new portfolio of energy projects?
- Did the resource planning that determined the amount and mix of new energy projects consider the addition of large load customers (e.g., data centers), specifically in Craig?
- Will there be any excess generation capacity from the 307 MW gas plant that Tri-State is building in Moffat County that could be consumed by a large load customer, or will additional gas-powered bridging capacity be needed?

The above questions are primarily intended to better understand the future availability of power according to announced plans for building new generation and are therefore dependent on engaging with the utility who is planning said future development.

### ***Securing Long-Term Nuclear Power***

The following are considerations that the community and interested developers – who may or may not be the local utility – should make regarding building new generation (e.g., nuclear or an additional gas plant) in Craig:

- Interested developers should consider the current and future transmission capacity/congestion in the region during site selection and evaluation of deployment timing. Interested developers could engage directly with Tri-State to assess the expected congestion impact of Tri-State's planned energy projects or consult directly with the Western Area Power Administration – Rocky Mountain Region, the balancing authority, for insights into projected system-wide capacity and congestion
  - Expected congestion of the local transmission system will impact siting of nuclear reactors as new generation should be strategically located to relieve congestion, not add to it.
  - Tri-State's planned energy projects, and accompanying infrastructure upgrades, will likely impact the historical congestion of the region and may unlock additional transmission capacity or make nuclear deployment in Craig less preferred (assuming a large load customer like a data center does not accompany it).
- Interested developers should inquire about the possibility of leveraging existing assets (e.g., transmission/interconnection access and water rights) to enable future nuclear development.

- Developers – if not the local utility – could consider purchasing the existing Craig site and existing interconnection rights to streamline the process of future interconnection.
- Using the water rights previously held by the Craig Station would allow for a wider variety of nuclear technologies to be supported in Craig and the surrounding Moffat County area. SB 24-197 protects the industrial water rights held by Tri-State from being abandoned through 2050 following closure of the Craig Station. According to the Colorado Division of Water Resources, Tri-State was decreed a conditional water right of 60 cubic feet per second (CFS) in 1975, with 44.93 CFS of that being decreed absolute by 1981 (Reference 100). Additionally, Tri-State may own other water rights that could also be transferable.
- Craig community representatives interfacing with interested developers should inquire about the developers’ perspective on the relative impact existing versus prospective large load customers have on the developers’ decision making.
  - This is meant to determine how developers weigh existing large load customers versus the promise of future customers to identify the need/benefit of building up a data center industry prior to nuclear being commercially deployable.

These considerations will enable focused discussions between community members and interested developers. The community members will be able to direct the interested developers such that they are aware of conditions in Craig that would have to be accounted for in nuclear development. These considerations will also inform interested developers on the appropriate entities they should continue to interface with if they decide to pursue nuclear development in Colorado.

### ***Additional Useful Information***

To provide additional context, Tri-State’s 2023 ERP Phase II preferred portfolio was formally approved by the Colorado Public Utilities Commission (CPUC) on August 26, 2025 (Reference 101). This portfolio represents Tri-State’s plans across their entire service territory, including but not limited to Craig and Moffat County. The plan includes:

- 1,350 MW of renewable, hybrid, and standalone short-term storage resources.
- A 307 MW natural gas plant with hydrogen-blend capability located in Moffat County.
- Replacement of five combustion turbines at the JM Shafer Station, bringing the station’s nameplate capacity to 281 MW.

The details of Tri-State’s 2023 ERP Phase II plan (Reference 99) outlined above only reflect near-term measures (i.e. through 2031) to replace the output of Tri-State’s retiring coal assets and do not preclude additional generation from being needed in the future. Colorado utilities are

required to submit ERPs every four years to reassess future resource needs. The absence of nuclear from Tri-State's 2023 ERP Phase II does not indicate that Tri-State has dismissed nuclear as a long-term power solution, but only that nuclear has not been publicly announced as part of their near-term solution to meet power demands following closure of their coal assets. This is consistent with the status of commercially available new nuclear technologies. Although not part of the immediate solution, nuclear generation – whether deployed by Tri-State or an independent developer – remains a potential future opportunity for Craig.

## Hayden

The results of the earlier investigations for the Hayden community are distinct from those of the Craig community. Therefore, the next steps that the Hayden community should take differ slightly from those defined for Craig. The Hayden community can focus on these questions/topics to confirm the availability of power and drive future discussions with developers to focus on the opportunities and potential concerns of data center and/or nuclear development in Hayden that are identified in this study.

### ***Securing Near-Term Power for Data Center Operations***

Hayden should first continue to engage with the local utility (i.e., Xcel Energy) to determine their plan for building any new generation locally in Hayden. Xcel's "Just Transition Solicitation" (JTS) indicates that they intend to take actions to incentivize new energy development specifically in Hayden. The Hayden community should inquire with Xcel about what those incentives may look like and how the community can support these efforts. Additionally, early statements from Xcel indicate that some of the planned new generation may be gas-powered. Hayden should inquire about securing and deploying a gas plant within the community similar to Tri-State's plans for Moffat County. These actions are specifically related to securing the power necessary to incentivize data center development according to already announced plans. The results of the data center siting study for Hayden indicate that Hayden is suitable for hosting a data center; continued discussions with Xcel will determine if additional power (e.g., gas-powered bridging capacity) or if the newly planned energy projects would be able to support a data center. Additionally, historical congestion has not indicated a transmission congestion concern related to importing power; however, interested data center developers should focus on potential future impacts on congestion if new generation is not built locally in Hayden. To summarize, the following actions should be taken to facilitate the deployment of a data center:

1. Inquire about actions to incentivize new energy projects being built locally in Hayden (including the possibility of a gas plant).

2. Inquire about the percentage of load growth that Xcel is attributing to data centers and if the new energy projects will be capable of supporting a data center located in Hayden.
  - a. Additional renewables may be able to support the increased load from a data center during peak production periods, but Hayden should inquire about the system's capabilities of meeting the reliability and power supply requirements necessary to support continuous data center operations.
3. Determine if additional gas-powered bridging capacity would be needed to support a data center.
4. Investigate expected future transmission congestion according to the closure of the Hayden Station and deployment of new generation in Xcel's service territory, specifically how this will impact the feasibility of locating a data center in Hayden.

These actions will directly inform the Hayden community's path forward, specifically regarding whether Xcel's near-term plans will be able to support a data center in Hayden or if additional bridging capacity would need to be deployed.

### ***Securing Long-Term Nuclear Power***

In future discussions with interested nuclear developers, the results of the Hayden siting study should be the primary focus. Hayden should drive discussions with nuclear developers by focusing on the following questions and topics:

- How exclusionary is Hayden's proximity to the Yampa Valley Regional Airport for nuclear development?
  - Engage with nuclear technology vendors to understand the Emergency Planning Zone (EPZ) for their particular design. Smaller EPZs may reduce the challenge with siting near hazards like the regional airport.
- Emphasize that there are locations in the surrounding Routt County that are otherwise suitable for nuclear development.
- How would not being able to leverage the existing transmission/interconnection rights of the Hayden Station impact nuclear development siting decisions?
  - If a nuclear reactor is unable to be deployed on or near the existing Hayden site, would developers consider locating elsewhere in Routt County?
- Hayden community representatives interfacing with interested developers should inquire about the developers' perspective on the relative impact existing versus prospective large load customers have on the developers' decision making.

- This is meant to determine how developers weigh existing large load customers versus the promise of future customers to identify the need/benefit of building up a data center industry prior to nuclear being commercially deployable.

These questions will help clarify the feasibility flag of proximity to the Yampa Valley Regional Airport identified in the siting study and confirm how impactful not being able to site directly in Hayden would be for interested developers.

### ***Additional Useful Information***

The Hayden Station is operated by a different utility (i.e., Xcel Energy) than the Craig Station (i.e., Tri-State). While Tri-State's 2023 ERP Phase II Implementation Plan was recently approved by the CPUC, only Phase 1 of Xcel Energy's JTS ERP was approved by the CPUC on August 27, 2025. Early objectives of this JTS indicate a plan to construct more than 6,000 MW of new generation in the Xcel service territory. The JTS also establishes a more flexible process for adding new capacity to respond to future load growth (Reference 102).

## **Appendix B – Rosebud and Treasure Montana Community-Specific Business Case**

Community specific business case to be included in Revision 1.

## **Appendix C – Emery and Carbon Utah Community-Specific Business Case**

Community specific business case to be included in Revision 1.